

passenger trips. Following the BART strike in September, 1997, AC Transit transbay ridership increased substantially, and has stabilized in recent months at a higher level than before the strike. The expected growth in passenger trips, however, has not been reassessed, and the 9,000 to 12,000 additional trips represent a smaller proportion of the revised current ridership. Therefore, expected growth between 1997 and 2010 yields a growth rate of 80% to 110%./82/

AC Transit's growth estimate assumes that the additional capacity BART will gain with smaller headways will consist primarily of trains traveling on the Dublin/Pleasanton Line. This would mean that a large portion of transbay travel demand growth to the northern part of AC Transit's service area could not be directly accommodated by BART. However, BART's *Short Range Transit Plan* suggests that it will be able to accommodate more transbay demand growth than AC Transit predicts. Therefore, a total cumulative growth rate of 80% was assumed over the next 13 years for AC Transit rather than the larger rate. This corresponds to an annual growth of approximately 4.6%. Currently, there are no plans to increase the number of buses or transbay bus runs in the future. Continued growth in demand may prompt a reevaluation of the service provided.

An 80% increase in cumulative passenger trips during the p.m. peak hour would increase the current 83% average load factor to 150%. If all eastbound transbay buses were equally loaded, a load factor of 150% would translate to approximately 23 standees per bus. Because the arrival of passengers to the Transbay Transit Terminal is not likely to be evenly distributed throughout the p.m. peak hour, and because each transbay bus represents a particular bus line that may capture more or less ridership demand than other lines, the passenger loads are unlikely to be the same on each transbay p.m. peak hour bus. Although 23 standees per vehicle can be accommodated, the variable passenger loading suggests that the demand for particular buses during the p.m. peak hour may exceed capacity, while other lines may experience a demand slightly less than capacity. The 295 p.m. peak hour eastbound project-related person trips would contribute an additional 5%, increasing the load factor to 157%, a significant contribution to cumulative impacts on AC Transit. Such a load factor indicates an average of 26 standees per bus, if all eastbound p.m. peak hour buses were equally loaded. Mitigation Measure E.44 in Section VI.E, Mitigation Measures: Transportation, may help to reduce this cumulative impact.

SamTrans

SamTrans is not expected to experience any substantial increases in ridership in the near future. With the planned BART-to-San Francisco International Airport extension, SamTrans plans to revise its bus route system to provide new feeder bus routes to serve the new BART stations. Furthermore, the MUNI Metro Extensions to the Caltrain terminal and to the Caltrain Bayshore Station, would make Caltrain more accessible as a transit mode. Consequently, BART and Caltrain would be expected to carry the vast majority of the additional growth in San Francisco-Peninsula transit ridership.

Golden Gate Transit

The Golden Gate Bridge, Highway and Transportation District Short Range Transit Plan (FY 1996/1997 to 2005/2006)/83/ estimates a 0.68% annual increase in bus ridership between 1997 and 2006, which is higher than the no growth estimated for travel between the North Bay and San

- Francisco by the MTC model. Because on average only 70% of current capacity is used on Golden Gate Transit buses during the p.m. peak hour, the 0.68% annual growth in cumulative ridership, including Mission Bay-generated trips, is estimated to increase the average p.m. peak hour load factor to 85%, assuming capacity remains the same. Not all GGT bus routes have the same passenger loads during the p.m. peak hour, with some carrying more passengers than others. It is assumed that the future allocation of buses to routes and the establishment of future bus route headways could be done by GGT in such a manner that the average future cumulative load factor of 85% would be redistributed without exceeding 100% on any given bus route.

Ferry Services

Golden Gate Transit anticipates ferry ridership to increase at a greater annual rate of 2.28% during the same time period. This annual growth rate was chosen as an appropriate (conservative) value for analysis of Mission Bay development./84/ The expected 2.28% annual increase in ferry ridership extended to the year 2015 corresponds to a 50% increase in current ridership. The estimated ridership growth would increase the commute-direction load factor of the Larkspur Ferry to 75% of capacity, and would increase the commute direction of the Sausalito Ferry to 44% of capacity. As stated in note p. in Table V.E.13, a new, 325-seat ferry boat is expected to be added to the Larkspur Ferry service in the fall of 1998. Even if capacity were not increased by year 2015, the ferries could easily accommodate the estimated 50 persons generated by the project that would be leaving San Francisco on ferries during the p.m. peak hour. The lower existing load factors on the reverse-commute direction ferries could also easily accommodate the 25 people traveling from the North Bay to Mission Bay during the p.m. peak hour.

- No project-related trips were assigned to private ferries such as the Blue & Gold Fleet, Vallejo Baylink, Oakland/Alameda, and Harbor Bay ferries. The private ferry service between the North Bay and San Francisco supplements that provided by Golden Gate Transit. The private ferry service between the Ferry Building and the East Bay supplements the transit options provided by AC Transit and BART. All of the private ferries have unused passenger capacity during the p.m. peak hour, such that any shifts from Golden Gate Transit buses to the Blue & Gold Fleet's Tiburon ferry, for example, would be accommodated./85/

San Francisco Municipal Railway

Mission Bay Project Impacts

Although MUNI provides service to all areas of San Francisco, the types of MUNI service provided to each area is different. Due to relative availability of MUNI Metro versus MUNI bus lines in different areas within San Francisco, service to the northeast, northwest, southeast and southwest quadrants of the City were analyzed separately. These quadrants are defined by the MUNI

screenlines described in Setting, above, at the end of the "Local Transit Facilities/Services" section, and shown in Figure V.E.6. The extension of light rail on Third Street through the Project Area is also anticipated to influence the relative number of MUNI passengers that would choose between the bus and Metro systems. The allocation of MUNI Metro and bus trips to each City quadrant was based on the relative level of service and coverage each offered to individuals traveling to/from these areas. Based on this evaluation, the relative number of passengers in each quadrant choosing MUNI bus or MUNI Metro was determined.

MUNI buses are expected to carry about 1,790 passengers to and from Mission Bay during the p.m. peak hour, while MUNI Metro is anticipated to carry approximately 4,670 Mission Bay passengers during the same time period. The larger proportion of Metro users is attributable to the combination of the expected origin/destinations of Mission Bay project patrons, and the relative accessibility of MUNI Metro vs. MUNI buses within Mission Bay.

During the p.m. peak hour, it was estimated that about 860 passengers would use MUNI buses to reach Mission Bay, and approximately 930 passengers would travel outbound from the Project Area, using MUNI buses. The number of passengers that would ride MUNI Metro to Mission Bay during the p.m. peak hour would be about 1,810; and 2,860 passengers are estimated to leave the area during this time./86/ MUNI-only passengers make up about 65 % of the projected load resulting from Project Area growth. The remaining project-related growth on MUNI would consist of travelers using MUNI to access BART, SamTrans, Golden Gate Transit and other regional transit services.

The impact of Mission Bay project travelers on MUNI has been evaluated at four screenlines, subdivided into nine transit corridors. (See Figure V.E.6 for screenline locations.) These screenlines are intended to measure the movement of MUNI passengers from the greater downtown area to other areas of the City; they represent the majority of demand and service on MUNI in the peak hour. The MUNI screenlines have no relation to the regional traffic screenlines described previously. Table V.E.14 presents the existing and existing-plus-project aggregate passenger loads crossing each of these four screenlines during the p.m. peak hour,/87/ plus the amount of capacity used by these passengers. The table also lists the MUNI corridors and lines that combine to carry these loads across each screenline. It should be noted that the referenced MUNI planning-level capacities shown in Table V.E.14 assume an appreciable number of standees (somewhere between 60% and 80% of the number of seated passengers depending on the specific transit vehicle configuration), such that 100% capacity represents a vehicle that is heavily loaded.

The northwest screenline has the greatest number of existing passengers, with a current p.m. peak hour load of 7,550 riders; transit facilities at this screenline operate at 72% of capacity. The addition

TABLE V.E.14
EXISTING AND EXISTING-PLUS-PROJECT MUNI RIDERSHIP SUMMARY BY SCREENLINE
P.M. PEAK HOUR - PEAK DIRECTION

Screenline/a/	MUNI Routes	Existing Conditions			Existing-Plus-Project Conditions		
		Hourly Capacity /b/	Average Hourly Load /c/	Percent Capacity Used	Project Trips /d/	Average Hourly Load/e/	Percent Capacity Used
Northeast	15, 30, 30X, 45	3,400	2,250	66%	230	2,480	73%
	41, 42, 82X	1,750	900	51%	150	1,030	59%
	<i>Subtotal</i>	<i>5,150</i>	<i>3,150</i>	<i>61%</i>	<i>380</i>	<i>3,510</i>	<i>68%</i>
Northwest	38, 38L, 38AX, 38BX	2,800	2,000	71%	50	2,050	73%
	1, 1AX, 1BX, 2, 3, 4, 5, 21, 22, 31, 31AX, 31BX	7,700	5,550	72%	90	5,620	73%
	<i>Subtotal</i>	<i>10,500</i>	<i>7,550</i>	<i>72%</i>	<i>140</i>	<i>7,670</i>	<i>73%</i>
Southwest	K, L (MMX), M, N	6,800	4,900	72%	290	5,190	76%
	6, 7, 71, F	1,400	1,100	79%	50	1,150	82%
	<i>Subtotal</i>	<i>8,200</i>	<i>6,000</i>	<i>73%</i>	<i>340</i>	<i>6,340</i>	<i>77%</i>
Southeast	J, 9	1,700	1,250	74%	140	1,390	82%
	15	850	350	41%	300	650	76%
	14, 14X	1,500	950	63%	120	1,070	71%
	<i>Subtotal</i>	<i>4,050</i>	<i>2,550</i>	<i>63%</i>	<i>560</i>	<i>3,110</i>	<i>77%</i>

Notes:

- See Figure V.E.6 for Screenline location.
- Capacity based on "San Francisco Municipal Railway, Ridership Projections to the Year 2015," April 25, 1997; revised May 5, 1997. It assumes an appreciable number of standees per vehicle (somewhere between 60% and 80% of the number of seated passengers, depending on the specific transit vehicle configuration) and may not include the effects of missed or late runs.
- Average load at maximum load point, based on MUNI's monitoring data, FY 1995-96.
- Estimated number of project trips that would cross the screenlines.
- Average load at maximum load point.

Source: Wilbur Smith Associates

of the projected 140 Mission Bay MUNI outbound riders would increase the maximum capacity utilization to 73%. The southwest screenline would become the most crowded screenline under existing-plus-project conditions. The addition of 340 Mission Bay outbound MUNI riders during the p.m. peak hour would increase the percent capacity used from 73% to 77%. The smallest growth but greatest crowding on this screenline would occur on the surface lines (6, 7, 71, and F), due to their relatively lower overall capacity.

The southeast screenline, being immediately adjacent to the Mission Bay Project Area, would be influenced the most by Mission Bay project development. The addition of 560 MUNI passengers would increase the average p.m. peak hour capacity use from 63% to 77%. Most MUNI bus lines expected to directly serve the Mission Bay Project Area would combine to provide the loads associated with the northeast screenline. The addition of the projected 380 outbound Mission Bay MUNI passengers to the current p.m. peak hour average load would yield a new average load of 3,680 passengers, increasing the percent of capacity used from 64% to 71%.

The macroscopic analysis provided by evaluating passenger loads aggregated at screenlines does not indicate that the additional passenger trips generated in Mission Bay would exceed MUNI's capacity in any of the transit corridors. The impact on individual lines that currently operate near capacity may require some adjustments in some MUNI services to and from the Mission Bay Project Area, such as increasing the frequency or number of cars on the MMX service. However, the existing-plus-project analysis describes a scenario assuming the project travel demand occurs all at once rather than over a period of 20 years or more. During the development period, MUNI's Third Street light rail project is assumed to be constructed and operating, providing additional service in the Project Area, as described below in the 2015 cumulative scenario. However, additional demand from cumulative growth would also occur, as described and analyzed below under "MUNI 2015 Cumulative Scenario."

It should also be noted that because MUNI mostly operates on rights of way shared with vehicular traffic, MUNI operation will be affected not only by transit demand, but traffic demand as well. Increased volumes of vehicular traffic in and near the Project Area would impede the movement of buses just as the flow of private vehicles is affected. MUNI operations would be affected most noticeably in very congested areas, marked by intersections functioning at LOS E or F.

The impact on demand for the UCSF shuttle bus service may require UCSF to increase capacity with more frequent service and, if necessary, additional buses to accommodate the longer route between San Francisco campuses with the addition of a Mission Bay stop, as well as to accommodate the additional patronage that would be generated by UCSF facilities at Mission Bay.

MUNI 2015 Cumulative Scenario

The transit infrastructure available in Mission Bay in 2015 would be different from that provided today. MUNI Metro Extension (MMX) light rail service will be provided from The Embarcadero and extend along King Street to the Caltrain terminal, operating at a six-minute frequency as an extension of the L-Taraval line. In addition, the Third Street light rail extension under the Initial Operating Segment (IOS) phase is assumed to be in place on Third Street and Fourth Street through the entire Project Area. (See "Light Rail Extensions," under "Changes to San Francisco Municipal Railway," above, for a discussion of the IOS phase of the Third Street Light Rail Project.) Under the IOS phase, light rail vehicles (LRVs) would operate along The Embarcadero, King Street, Fourth Street, Third Street and Bayshore Boulevard on a semi-exclusive alignment (except on the Peter Maloney Bridge), as an extension of the J-Church line, providing a base service of a one-car train every ten minutes each way, to be increased to one train every six minutes during the p.m. peak period.

The addition of the Metro light rail service would provide service to passengers traveling across the southwest screenline as well as those transferring to/from other regional transit modes (AC Transit, BART, Golden Gate Transit). The additional capacity provided by light rail service between the Project Area and downtown is estimated to improve the level of service offered to transit users in Mission Bay, directly serving employees and visitors of Mission Bay North. Mission Bay South would be served by the J-line extension of light rail service along Third Street. This transit service addition would improve transit opportunities for individuals traveling beyond the southeast screenline, as well as serve northbound passengers.

MUNI service currently offered by lines 15 and 32 would instead be provided by the L-Taraval line and the Third Street light rail J-Church line on some parts of their routes; thus, MUNI capacity in this area is not expected to increase by the total capacity provided on the new light rail lines. On the other hand, MUNI, in response to expected increases in Mission Bay transit demand, in accordance with the prior Mission Bay development plan, and consistent with the assumptions in the *Third Street Light Rail Project DEIS/DEIR*, plans to extend about 50% of the present 30-Stockton or 45-Union/Stockton trolley coaches south from their current terminus at the Caltrain terminal to somewhere in the vicinity of Third Street and 19th or 20th Streets. Similarly, MUNI would extend the 22-Fillmore into Mission Bay South via 16th and Third Streets to terminate at The Common. (See "Changes to San Francisco Municipal Railway [MUNI] System," under "Year 2015 Transportation System Assumptions," for a more detailed description of the proposed bus changes.) Therefore, the net capacity gain from the additional MUNI service would be substantially greater than the degree of service lost.

MUNI is currently considering a new street car service (E-Embarcadero) to be provided between Fisherman's Wharf and the Caltrain terminal at Fourth and King Streets. Because implementation of this new service is somewhat speculative in terms of hours of operation, headways and funding sources, the transportation analyses for the Mission Bay project have assumed conservatively that the E-Embarcadero line would not be in service in the year 2015.

Table V.E.15 shows the resulting effects of cumulative transit use on the 2015 MUNI network. The northeast screenline would operate at 112% of future capacity as a result of cumulative growth, even without the Mission Bay project. The highest passenger crowding would occur on the Kearny/Stockton corridor (routes 30, 30X, 45), which would be 123% of capacity. The project would contribute about 7% of the cumulative ridership in this corridor.

The southwest screenline would be essentially fully used (99%) by cumulative growth, including that from Mission Bay. Although the screenline as a whole and the two corridors evaluated show slightly fewer transit riders than their maximum planned capacity, individual lines may not have capacity to meet the demand. In some cases passengers would be able to choose a less crowded parallel transit line; in others, individual buses or Metro cars would crowd beyond normally acceptable levels.

The northwest screenline would have some capacity available (about 6%), although most of the routes would be closer to capacity (96%). The southeast screenline would have the lowest overall congestion (89%), although the J-Church line would be full (100%).

Table V.E.16 presents the effects of year 2015 cumulative transit use, including effects of the project, in the immediate vicinity of the Mission Bay Project Area for the four major routes serving the project. As the table indicates, the two trolley bus routes and southbound Third Street light rail service would operate at about 85% or less of their maximum capacity in the vicinity of Mission Bay in the p.m. peak hour. On the other hand, the combined L-Taraval and J-Church light rail service operating on King Street and The Embarcadero would be above its planned capacity (112%), as a result of cumulative growth (including that from the Mission Bay project which would contribute approximately 65% of the trips) resulting in a significant impact on the transit system.

The Third Street and the L-line light rail vehicles will operate on semi-exclusive rights-of-way, separated from potentially conflicting traffic on streets and roadways. However, vehicles from both of these MUNI lines will be required to obey signals, and yield to conflicting traffic movements at intersections. Thus, although MUNI rail service in the area would be less impacted by traffic congestion than MUNI buses, it would still experience some degree of congestion-related delays.

TABLE V.E.15
YEAR 2015 CUMULATIVE-PLUS-PROJECT MUNI RIDERSHIP SUMMARY BY SCREENLINE
P.M. PEAK HOUR - PEAK DIRECTION

Screenline/a/	Year 2015 MUNI Routes	Existing Conditions			Year 2015 Cumulative Conditions				
		Hourly Capacity/b/	Average Hourly Load/c/	Percent Capacity Used	Hourly Capacity/d/	Cumulative Trips w/out Project/e/	Project Trips/f/	Average Hourly Load/g/	Percent Capacity Used
Northeast	30, 30X, 45	3,400	2,250	66%	2,760	3,160	230	3,390	123%
	41, 42, 82X	1,750	900	51%	1,480	1,230	150	1,380	93%
	<i>Subtotal</i>	<i>5,150</i>	<i>3,150</i>	<i>61%</i>	<i>4,240</i>	<i>4,390</i>	<i>380</i>	<i>4,770</i>	<i>112%</i>
Northwest	38, 38L, 38AX, 38BX	2,800	2,000	71%	3,150	2,780	50	2,830	89%
	1, 1AX, 1BX, 2, 3, 4, 5, 21,	7,700	5,550	72%	8,150	7,750	90	7,840	96%
	22, 31, 31AX, 31BX	10,500	7,550	72%	11,300	10,530	140	10,670	94%
Southwest	<i>Subtotal</i>	<i>6,800</i>	<i>4,900</i>	<i>72%</i>	<i>7,140</i>	<i>6,830</i>	<i>290</i>	<i>7,120</i>	<i>100%</i>
	K, L (MMX), M, N	1,400	1,100	79%	1,610	1,530	50	1,580	98%
	6, 7, 71, F	8,200	6,000	73%	8,750	8,360	340	8,700	99%
Southeast	<i>Subtotal</i>	<i>1,700</i>	<i>1,250</i>	<i>74%</i>	<i>1,900</i>	<i>1,750</i>	<i>140</i>	<i>1,890</i>	<i>99%</i>
	J, 9	850	350	41%	1,190	460	300	760	64%
	15/J (3rd St. LRT)	1,500	950	63%	1,540	1,320	120	1,440	94%
	14, 14X	4,050	2,550	63%	4,630	3,530	560	4,090	88%
	<i>Subtotal</i>								

Notes:

- See Figure V.E.6 for Screenline location.
- Capacity based on "San Francisco Municipal Railway, Ridership Projections to the Year 2015," April 25, 1997; revised May 5, 1997. It assumes an appreciable number of standees per vehicle (somewhere between 60% and 80% of the number of seated passengers, depending on the specific transit vehicle configuration) and may not include the effects of missed or late runs.
- Average load at maximum load point, based on MUNI's monitoring data, FY 1995-96.
- Capacity includes elimination of bus routes 15, 32, and 81X, plus implementation of the L-Taraval and J-Church line extensions on the MMX and Third Street Light Rail Services.
- Estimated from MTC Model projections and preliminary load estimates from MUNI Third Street Light Rail Study.
- Estimated number of trips from the Mission Bay Project that would cross the screenlines.
- Average load at maximum load point.

Source: Wilbur Smith Associates

TABLE V.E.16
YEAR 2015 CUMULATIVE MUNI RIDERSHIP IN THE VICINITY OF THE MISSION BAY
PROJECT P.M. PEAK HOUR - PEAK DIRECTION

MUNI Route/a/	Hourly Capacity/b/	Cumulative Trips without Project/c/	Project Trips	Average Hourly Load/d/	Percent Capacity Used
22	470	240	100	340	72%
30	1,380	650	500	1,150	83%
MMX (L line), Third St. LRT (J line, northbound at King St. and The Embarcadero)	3,570	1,400	2,600	4,000	112%
MMX (L line), Third St. LRT (J line, southbound at King St. and The Embarcadero)	3,570	800	1,600	2,400	67%
Third St. LRT (southbound, at Mariposa St.)	1,190	700	300	1,000	84%
Third St. LRT (northbound, at Mariposa St.)	1,190	720	200	920	77%

Notes:

- Assumes route changes as described in text and shown in Figure V.E.10.
- Capacity based on "San Francisco Municipal Railway Ridership Projections to the Year 2015," April 25, 1997; revised May 5, 1997. It assumes an appreciable number of standees per vehicle (somewhere between 60% and 80% of the number of seated passengers, depending on the specific transit vehicle configuration) and may not include the effects of missed or late runs.
- Estimated from MTC model projections and preliminary load estimates from MUNI Third Street Light Rail *Project Travel Demand Forecasting Results, Draft Final Report*, Korve Engineering, September 8, 1997.
- Average load at maximum load point in the vicinity of the Mission Bay Project.

Source: Wilbur Smith Associates.

PARKING IMPACTS

Parking demand for the various land uses in the project was based on estimated auto traffic, vehicle occupancy rates, and parking turnover rates.^{88/} Parking turnover rates for short term parking were assumed to be six per space per day, except for theater uses, where an average *duration* of two hours was used. The parking demand calculations represent the number of spaces that would be required in order to accommodate all the vehicles anticipated to result from the project if the proposed parking supply was unconstrained. As part of its "transit first" policy, the City and County of San Francisco does not require that the supply of parking spaces equal the demand. Consequently, even though an

adequate number of spaces to meet Planning Code requirements is generally proposed to be permitted, it may not be sufficient to accommodate the actual demand. Therefore, individuals who would prefer to drive may use transit because the perceived convenience of driving is lessened by a shortage of parking. This shortage in proposed off-street parking is not considered a significant environmental effect because it implements a policy intended to reduce citywide traffic congestion and air quality effects. Even with a shortage of off-street parking, measures often are implemented that result in a more efficient use of the parking spaces provided. By promoting carpooling, allowing for the shared use of parking, and implementing pricing strategies designed to encourage short-term parking, the spaces provided for nonresidential use would likely be used by more individuals, be vacant for shorter periods of time, and attract drivers needing short-term parking.

Table V.E.17 summarizes the aggregate of estimates consistent with peak parking demand for project land uses and also provides a comparison with the parking standards detailed in the documents prepared for this project as well as the parking requirements identified in UCSF's Long Range Development Plan for the Mission Bay site.^{/89/} The Mission Bay project design documents identify the maximum number of parking spaces to be provided for development in the Mission Bay Redevelopment Areas.^{/90/} For this SEIR analysis, the research and development uses in the Project Area site were assumed to have a parking demand similar to that for office uses, although parking demand for research and development uses is generally less than for office uses. As shown, the demand analysis indicates a need for about 26,125 spaces compared with a maximum requirement of about 21,400 off-street spaces; therefore, the maximum off-street parking supply would be approximately 4,700 spaces less than the estimated peak demand.

- The demand analysis indicates a need for approximately 7,920 residential parking spaces, while a maximum of 6,090 spaces would be permitted, indicating a deficit of about 1,830 spaces. Approximately 18,210 commercial parking spaces are expected to be needed, of which about 40% would be needed for short-term use, while the remaining 60% would be needed for long-term use. This can be compared with a maximum permitted number of about 15,280 spaces, to yield a deficit of at least 2,930 spaces. Residential space comprises approximately 38% of the total shortfall of parking spaces, with the remaining 62% as a shortage of commercial parking.
- Some of the differences between the overall demand and the proposed maximum number of spaces to be provided are attributable to differences in parking rates used for some land uses; for example, the estimated demand per dwelling unit is about 1.3 parking spaces, while the maximum permitted would be 1 parking space per unit. The project proposes to provide one parking space per dwelling unit as called for in the design documents. The proposed number of off-street parking spaces to be built as part of the Mission Bay project would be less than the maximum number of spaces necessary to meet

TABLE V.E.17
PEAK PARKING DEMAND

Project Area	Land Use Type	Short-Term Demand	Long-Term Demand	Total Demand	Proposed Plan/a/
Mission Bay North	Retail	1,118	280	1,398	1,329
	Restaurant	329	220	549	450
	Residential	0	3,900	3,900	3,000
	Movie Theater	715	23	738	675
	<i>Subtotal</i>	<i>2,162</i>	<i>4,423</i>	<i>6,585</i>	<i>5,454</i>
Mission Bay South					
Central Subarea	Retail	592	148	740	361
	Hotel	0	83	83	31
	Residential	0	4,017	4,017	3,090
	<i>Subtotal</i>	<i>592</i>	<i>4,248</i>	<i>4,840</i>	<i>3,483</i>
East Subarea	Office	640	2,160	2,800	1,328
	Retail	238	60	298	142
	R&D	277	936	1,213	1328
	Large Retail	945	236	1,181	903
	<i>Subtotal</i>	<i>2,100</i>	<i>3,392</i>	<i>5,492</i>	<i>3,701</i>
West Subarea	Office	565	1,905	2,470	1,172
	Retail	82	21	103	12
	R&D	245	826	1,071	1,172
	Large Retail	1,073	268	1,341	1,076
	<i>Subtotal</i>	<i>1,965</i>	<i>3,020</i>	<i>4,985</i>	<i>3,433</i>
UCSF Subarea/b/	UCSF Site	395	3,803	4,198	5,300
	School	0	25	25	0
	<i>Subtotal</i>	<i>395</i>	<i>3,828</i>	<i>4,223</i>	<i>5,300</i>
Total Mission Bay North		2,162	4,423	6,585	5,454
Total Mission Bay South		5,052	14,488	19,540	15,917
TOTAL PROJECT		7,214	18,911	26,125	21,371

Note:

- Maximum number of parking spaces proposed in *Design Standards and Guidelines: Mission Bay*, Draft C, March 30, 1998, p. 45.
- UCSF parking would be phased with development of the UCSF site; the actual total number of spaces provided would depend on demand, taking into account use of transit and alternative transportation modes. Parking is proposed to be supplied at a ratio of 2 spaces per 1000 gsf, or a total of 5,300 spaces; as the use of transit and alternative transportation increases, fewer parking spaces may be provided.

Sources: Wilbur Smith Associates; San Francisco Redevelopment Agency, *Design Standards and Guidelines: Mission Bay*, Draft C, March 30, 1998; Memorandum from Eric Harrison, *Proposed Mission Bay Parking Standards*, Catellus Development; *UCSF Long Range Development Plan Final EIR*, State Clearinghouse No. 95123032, certified January 1997; UCSF Facsimile Communication from Kevin Beauchamp, Long Range Planner, UCSF Campus Planning, to Wilbur Smith Associates, June 9, 1997.

the estimated demand for all land uses except UCSF and Commercial Industrial space (assumed to be equally split between research and development and office).

UCSF has calculated its own parking demand as part of its Long Range Development Plan. Initially, to construct spaces for the Mission Bay site, UCSF would use a planning ratio of approximately two spaces per 1,000 gross square feet, yielding up to 5,300 spaces. (This ratio is comparable to about 1.6 to 1.7 spaces per 1,000 square feet of occupied space as defined by the City Planning Code). Construction of off-street parking within the UCSF site would be phased with UCSF development, taking into account the availability of expanded transit service in the area, and provision of alternative transportation modes. The LRDP FEIR estimated demand of 4,200 spaces, assuming full realization of UCSF's transportation management programs and expanded transit service in the area. Permanent structured parking would be developed based on then-current demand calculated from employee surveys and/or parking permit waiting lists. Fewer than 5,300 spaces may be constructed on the UCSF site if actual demand is consistent with the analysis contained in the LRDP FEIR. UCSF does not intend to develop off-street parking in excess of its demand.

The off-street parking supply that is planned as part of the Mission Bay project is intended to include all parking required by the design documents and the UCSF Long Range Development Plan as it relates to a major new UCSF site at Mission Bay. If the demand for parking spaces exceeds the supply provided by the project, drivers would seek available on-street parking in the Project Area. In order to encourage non-automobile mode choices, the amount of on-street parking in the Project Area would be minimal, especially during the morning and afternoon peak commute periods. (On-street parking on "internal," private streets is expected to be prohibited, as these streets would be primarily for driveway access or would be pedestrian-oriented streets.) The following streets are proposed to have on-street parking on both sides of the street during both the peak and off-peak periods:

- King Street, between Fifth and Berry Streets, westbound direction (about 30 spaces)
- Berry Street between Third and Fourth Streets, south side only (about 30 spaces)
- Owens Street between Fourth Street and North Common Street, north side only (about 60 spaces)
- Mission Bay Street (about 80 spaces)
- Mission Rock Street, between Fourth Street and Terry A. François Boulevard (about 70 spaces)
- Bay Mud Street (about 20 spaces)
- Rincon Street (about 120 spaces)

- North Common and South Common Streets, between Mission Bay Street and Terry François Boulevard (about 150 spaces)
- Illinois Street, between 16th and Mariposa Streets (about 60 spaces)

Fourth Street, between Owens and Mariposa Streets is proposed to have approximately 400 on-street parking spaces on both sides of the street during off-peak commute periods. During the morning and afternoon peak commute periods, parking on one side of the street would be prohibited to provide one additional travel lane.

Similarly, Berry Street is proposed to have about 30 on-street parking spaces between King and Fifth Streets on the south side during off-peak commute periods. Parking would be prohibited during peak commute periods to provide an additional eastbound travel lane.

Some existing on-street parking would also be lost because of project changes to the existing roadway configuration. The angled parking on Terry A. François Boulevard would be converted to parallel parking, resulting in a net loss of approximately 210 spaces. In addition, the following streets would also have some on-street parking eliminated:

- Mariposa Street (about 65 spaces)
- 16th Street (about 85 spaces)
- Berry Street, between Fourth and King Streets (about 70 spaces)
- Fourth Street, between King and Berry Streets (about 15 spaces)
- Fifth Street, between King and Berry Streets (about 15 spaces)
- Channel Street (about 70 spaces)/91/
- Sixth Street (about 180 spaces)

The total number of on-street parking spaces included with the project would be about 1,050 during the off-peak periods, 820 during peak commute periods, with parking prohibited on one side of Fourth Street between Owens and Mariposa Streets, and on Berry Street between King and Fifth Streets. About 710 spaces would be eliminated by the project, for a net gain of about 340 spaces. In addition, about 300 on-street parking spaces would be lost on Third Street in the Project Area, indicating that in the year 2015 the Project Area would have about 40 more on-street parking spaces than can be found in 1997. With the elimination of parking during the peak commute periods, there would be a net loss of about 190 spaces.

In addition, the project would remove approximately 30 off-street parking spaces at the golf driving range and about 40 spaces at the Bladium in Mission Bay South, and about 520 parking spaces from the block bounded by King, Third, Berry and Fourth Street (used by the China Basin Landing Center). Because the golf driving range facilities and the Bladium would be demolished with project development, the actual net loss of off-street parking would be the 520 spaces for China Basin Landing.

The planned number of on-street parking spaces—about 1,050 spaces—would accommodate about 25% of the excess parking demand, mostly in Mission Bay South, but would be small enough to discourage individuals from driving. On the other hand, because available parking in Mission Bay South would not meet demand, some drivers may seek available parking in surrounding neighborhoods, including Potrero Hill and Lower Potrero areas.

Most of the Project Area development adjacent to and near Lower Potrero and Potrero Hill would be research and development, UCSF, or office uses, which would cause spillover parking demand during the daytime, primarily during mid-morning and early afternoon periods. This increase in parking demand would likely spill over to streets with existing industrial and warehousing uses in the vicinity of the Project Area during those times, which could, in turn, increase demand for parking in nearby Potrero Hill residential areas. Residential streets on Potrero Hill near the Project Area do not now have parking restrictions; if none were established as Mission Bay is built out, some employees working in Mission Bay or in areas near Mission Bay could be willing to walk from Potrero Hill to their work place in order to use “free” parking, or in order to find available parking spaces. Commercial and industrial parking spillover into residential areas is not expected to be a substantial problem because parking demand in the residential areas in Potrero Hill would be highest at night, when the commercial/industrial parking demand is at its lowest. In addition, the parking demand was calculated assuming about 50% of the Commercial Industrial space in Mission Bay South would be in office uses. Because the parking demand for research and development uses is less than that for office uses, and research and development and UCSF uses are expected to predominate in Mission Bay South, the overall parking demand figure is likely to be conservatively high, suggesting that the proposed supply may be somewhat closer to demand. If parking demand is found to exceed supply in the Potrero Hill residential area, the City’s residential parking permit program could be expanded to include the area to help ensure availability of parking for local residents.

As shown in Table V.E.17, in Mission Bay North there would be an excess demand of approximately 1,130 parking spaces to which is added the 520 parking spaces lost by the China Basin Landing Center, for a total excess demand of about 1,650 parking spaces. Some drivers would look for parking in garages in the adjacent South of Market neighborhood while others may find MUNI transit more convenient and shift their mode of travel.

On days when sold-out events were scheduled at the Giants Ballpark, parking in South of Market and Mission Bay areas would be in great demand. Those arriving at Mission Bay in the afternoon or evening or on weekends after drivers have started arriving for the ballpark event would have difficulty parking on event days unless they have already-reserved parking, such as the spaces allocated to residential units.

PEDESTRIAN IMPACTS

Existing with Project Conditions

Pedestrian forecasts at the study locations were based on the mode split percentages for person-trips described in the "Project Analysis Methodology" section, above. The pedestrian trips would include not only those who walk to and from Mission Bay North and South, but also those who walk to transit. For most of the Mission Bay South land uses, walking to transit would not involve crossing to the north of China Basin Channel. But for those using Caltrain, there would be some who would walk and some who would take MUNI. To provide a conservatively large number of pedestrians, those who walk to the Caltrain terminal from Mission Bay South were all assumed to do so through the intersection of Fourth and King Streets, although many could instead cross the Channel on the proposed new pedestrian bridge at Fifth Street, avoiding Fourth and King Streets. It was assumed that all of the project person trips generated in Mission Bay North going to and from the Caltrain terminal also would walk through the intersection of Fourth and King Streets. Other pedestrians walking through the two study intersections, Third and King Streets and Fourth and King Streets, would be primarily those traveling to various sites in the Project Area or those walking directly to the MMX light rail line on King Street.

Pedestrians were distributed onto the street network using the assumptions for trip origin to the four quadrants of the City, described at the end of "Local Transit Facilities and Services" under "Existing Project Area Transportation Facilities," in the Setting section, above, and shown in combination with bicycle trips in Table V.E.18. The results of the pedestrian operations analysis with existing-plus-project pedestrian trips are presented in Table V.E.19. The level of service would remain the same at all eight crosswalks as under existing conditions (see Table V.E.4).

If a pedestrian bridge were to be built over China Basin Channel at Fifth Street, it would improve pedestrian circulation opportunities in Mission Bay. The bridge would be most beneficial to pedestrians traveling between Mission Bay North and Mission Bay South, as well as pedestrians wishing to travel between Mission Bay South and the Caltrain terminal or MUNI MMX stations on King Street.

**TABLE V.E.18
P.M. PEAK HOUR
PEDESTRIAN AND BICYCLE TRIPS**

San Francisco Origin/Destination	Total Walk/Other
Mission Bay North	
Northeast Quadrant	1,890
Northwest Quadrant	180
Southeast Quadrant	350
Southwest Quadrant	70
Mission Bay South	
Northeast Quadrant	1,360
Northwest Quadrant	430
Southeast Quadrant	1,130
Southwest Quadrant	120

Notes:

To be conservatively high for pedestrian and bicycle impact analysis purposes, this table assumes that all of the Walk/Other trips are either walk or bike trips, although some may be motorcycle or other non-vehicle trips.

This table includes both internal and external bicycle/pedestrian trips.

Source: Wilbur Smith Associates.

If a pedestrian bridge were not provided at Fifth Street, pedestrians would have to use the Lefty O'Doul (Third Street) Bridge or Peter Maloney (Fourth Street) Bridge to cross China Basin Channel. The additional walking distance would be approximately twice the block length between Fourth Street and Fifth Street, or 1,650 feet. At a walking pace of 4 feet per second, additional walk time would be approximately seven minutes.

Most of the sidewalks in Mission Bay are proposed to be 12 feet or greater in width. This width would meet city standards.^{/92/} The sidewalks on the Peter Maloney Bridge are proposed to be 9 feet wide. However, the proposed pedestrian bridge at Fifth Street would provide relief from potential problems that could be caused by the relatively narrow sidewalks on the Peter Maloney Bridge. All other sidewalks in Mission Bay are proposed to be at least 10 feet wide. Ten-foot-wide sidewalks are proposed for Mariposa Street, 16th Street, Berry Street, and for the three narrow connectors providing access between North Common Street and South Common Street, in the Central Subarea. Illinois Street is proposed to have 10.5-foot sidewalks, and Third Street is proposed to have 11-foot

**TABLE V.E.19
CROSSWALK OPERATIONS ANALYSIS - EXISTING + PROJECT VOLUMES**

Crosswalk Location	Time Period	Width (feet)	Walk Time	Volume (pph)/a/			Flow Rate (ppmpf) /b/	Flow Regime /c/
				Existing	Project	Existing + Proj		
Third Street/King Street								
Northside	4:30 - 5:30 PM	20	29.5%	45	93	138	0.18	Open
Southside	4:30 - 5:30 PM	20	20.5%	4	618	622	0.02	Open
Eastside	4:30 - 5:30 PM	20	14.5%	127	354	481	0.73	Unimpeded
Westside	4:30 - 5:30 PM	20	14.5%	47	563	610	0.27	Open
Fourth Street/King Street								
Northside	4:30 - 5:30 PM	20	45.5%	20	60	80	0.04	Open
Southside	4:30 - 5:30 PM	20	45.5%	20	202	222	0.04	Open
Eastside	4:30 - 5:30 PM	20	15.0%	72	456	528	0.40	Open
Westside	4:30 - 5:30 PM	30	15.0%	97	588	685	0.36	Open

Notes:

See Table V.E.4 for a description of existing conditions at these intersections.

Counts taken June 25, 1997.

Walk time for eastside and westside crosswalks assumed to be percent of green time.

a. pph = Pedestrians per hour.

b. ppmpf = Pedestrians per minute per foot of width.

c. Flow regimes are defined in Appendix Table D.17.

Source: Wilbur Smith Associates

sidewalks near the intersection of Owens Street. Although sidewalks on Illinois and Third Streets are expected to receive comparatively less pedestrian traffic than other sidewalks in the Project Area, the sidewalk widths on these streets may not be adequate to accommodate unusually high pedestrian traffic volumes, such as before and after large events in Pacific Bell Ballpark. During these times, pedestrians may spill over into traffic lanes.

No pedestrian improvements are proposed for Townsend Street except on the south side of the street between Third and Fourth Streets, as the remainder of Townsend Street is outside the Project Area. Pedestrian improvements are not proposed for the length of Seventh Street; the west side of the street is outside the Project Area, and the east side of the street is adjacent to the Caltrain railroad tracks.

A fence is proposed to be constructed adjacent to Seventh Street contiguous with the rail right-of-way between King Street and Mariposa Street to provide for pedestrian safety. There would be signalized, controlled crossings of the tracks along Seventh Street at Berry Street, at the extension of The Common, and at 16th Street.

The proposed realignment of the freight railroad tracks to 16th Street and Terry A. François Boulevard would intrude into the open space areas near the intersection of the two streets. The tracks are used once a month or less frequently, although the Port's *Waterfront Land Use Plan* calls for increased use in the future. Because freight activities are scheduled to occur late at night, between 1 a.m. and 4 a.m., they are not expected to create any pedestrian hazards. Railroad operations on this type of alignment in public street rights-of-way are typically limited to speeds of 5 to 10 miles per hour, further minimizing potential hazards.

Year 2015 Cumulative Pedestrian Conditions

To simulate future pedestrian volumes in the year 2015, the future land use changes in the vicinity were considered. The most likely change in pedestrian volumes at the study intersections would be growth in Caltrain ridership. It was assumed, conservatively, that the pedestrians at the intersection of King and Fourth Streets were walking to/from the Caltrain terminal. Thus the increase in the number of pedestrians at this intersection was assumed to be the same as the growth in Caltrain ridership. As described in the Transit Impacts subsection (under "Regional Carriers, 2015 Cumulative Scenario"), Caltrain ridership was assumed to grow at 2.4% per year. This growth rate was applied to existing pedestrian volumes to arrive at cumulative pedestrian volumes. At the intersection of Third and King Streets, half of the pedestrian volumes were assumed to be affiliated with Caltrain, so half the Caltrain growth rate was assumed.

Project volumes were added to the future cumulative volumes, and the level of service was calculated. The results are presented in Table V.E.20. The eastside and westside crosswalks at the intersection of Fourth and King Streets would worsen slightly, from Open to Unimpeded. (See Appendix Table D.17 for definitions of pedestrian flow descriptions.) However, "Unimpeded" is considered an acceptable level of service.

BICYCLE IMPACTS

Bicycle Forecasts

The Mission Bay Project Area is within easy bicycling distance (four to six miles) of a large portion of the City's residents. Travel time to the Project Area by bicycle would be competitive with MUNI,

TABLE V.E.20
CROSSWALK OPERATIONS ANALYSIS - CUMULATIVE WITH PROJECT VOLUMES

Crosswalk Location	Time Period	Width (feet)	Walk Time	Volume (pph)/a/		Existing + Proj	Flow Rate (ppmpf) /b/	Flow Regime /c/
				Existing	Project			
Third Street/King Street								
Northside	4:30 - 5:30 PM	20	20.5%	59	93	152	0.18	Open
Southside	4:30 - 5:30 PM	20	20.5%	5	618	623	0.02	Open
Eastside	4:30 - 5:30 PM	20	14.5%	165	354	519	0.73	Unimpeded
Westside	4:30 - 5:30 PM	20	14.5%	61	563	624	0.27	Open
Fourth Street/King Street								
Northside	4:30 - 5:30 PM	20	45.5%	32	60	92	0.04	Open
Southside	4:30 - 5:30 PM	20	45.5%	32	202	234	0.04	Open
Eastside	4:30 - 5:30 PM	20	15.0%	116	456	572	0.40	Unimpeded
Westside	4:30 - 5:30 PM	30	15.0%	156	588	744	0.36	Unimpeded

Notes:

Counts taken June 25, 1997.

Walk time for eastside and westside crosswalks assumed to be percent of green time.

a. pph = Pedestrians per hour.

b. ppmpf = Pedestrians per minute per foot of width.

c. Flow regimes are defined in Appendix Table D.17.

Source: Wilbur Smith Associates

especially for those who may not live on a MUNI Metro line or those who must make at least one transfer. Bicycling could be competitive with the automobile in terms of travel time, depending on the level of traffic congestion and how close one can park one's car. The actual mode share achieved by the bicycle to and from the project would depend on numerous factors, including travel distance; relative travel time and relative costs of other modes; topography of origin/destination areas; weather; amount and location of secure bicycle parking; and safety, directness, and ambiance of the bicycle travel routes.

Given the various transportation options available to the project, it is estimated that about 1,850 of the 33,500 p.m. peak hour person trips to and from the Mission Bay Project Area could be made by bicycle. Table V.E.18 quantifies the number of p.m. peak hour trips that could potentially be made by bicyclists or pedestrians./93/ The northeast and southeast quadrants of the City are the closest to

the Project Area and both are fairly well connected to the Project Area by the Bicycle Network in the *San Francisco Bicycle Plan* as well as the least constrained by the topography of San Francisco. Therefore, the bicycle is a more attractive mode for some bicyclists in these areas than either auto or transit would be, compared to bicyclists located in the northwest and southwest quadrants of the City./94/

Bike Routes in the Street Network

The proposed cross-sections of the streets within the Project Area were reviewed in the context of bicycle travel (see Appendix Figures D.2 and D.3). Fourth Street, a major north-south arterial, would be of particular importance to bicyclists after the Third Street Light Rail is constructed, since the new rail tracks would decrease the lane widths that bicycles must share with cars. Fourth Street, as currently planned, would be a designated Class III bicycle route and would have a curb lane 15 feet in width in each direction. During non-peak hours, this curb lane would be a parking lane, which would effectively provide the equivalent of a 7-foot bicycle lane. During peak hours, the curb lane would be a tow-away zone, resulting in the shared use of the curb lane by bike and autos. This width of 15 feet is adequate for a shared lane. Sixteenth Street would be a designated Class II bicycle route in the Project Area, with exclusive 6-foot bicycle lanes on both sides of the street, adjacent to a 12-foot vehicular traffic lane. This width would be more than adequate; most bike lanes in San Francisco are 5 to 6 feet wide./95/

North Common Street and South Common Street between Terry A. François Boulevard and Mission Bay Street would each have one 15-foot-wide traffic lane, to be shared by automobile and bicycle traffic (a designated Class III bicycle route) and would accommodate parking on the curb side. The project calls for Terry A. François Boulevard to be a designated Class II bicycle route for its entire length, with 6-foot-wide striped bicycle lanes on both sides of the street, and parallel curb parking.

Elsewhere in the Project Area, 11- or 12-foot-wide curb lanes are shown either without parking or adjacent to an 8-foot parking lane. On these streets, bicycles would have to share the curb lane with vehicular traffic, although the streets are not expected to, and would not be designed to, accommodate large volumes of bicycle traffic. On the proposed recreational bicycle path on the south side of the Channel, pedestrian and bicycle movements would be separated and delineated.

Bicycle safety concerns can arise whenever there is an increased potential for bicycle and auto conflicts, or when paved surfaces are uneven. Proposed bike routes in Mission Bay would use streets where freight rail tracks may occur (16th Street and Terry A. François Boulevard), but the rail tracks would not be immediately adjacent to the curb, and potential overlap with bicycle lanes would be

limited (see “Freight Rail Operation Changes” under “Year 2015 Transportation System Assumptions,” above). At the intersection of 16th Street and Terry A. François Boulevard, the southbound bicycle lane would cross the proposed freight rail tracks at an oblique angle; this southbound bicycle lane could be designed to use a portion of the adjacent public open space at that location to provide a more perpendicular crossing. Catellus intends to propose placement of advance warning signs for bicyclists indicating the presence of rail crossings in advance of oblique rail crossings./95a/ There would be no double right-turn lanes within the project area, which would avoid one source of inherent bicycle/vehicle conflicts.

- The Redevelopment Plan documents call for bicycle parking to be provided at a ratio of one bicycle parking space for every 20 off-street automobile parking spaces for residential, retail, commercial industrial, and commercial industrial/retail land uses. The maximum number of parking spaces allowed for the project (21,371) would be used to calculate the minimum bicycle parking supply, resulting in about 1,070 bicycle parking spaces. The *San Francisco Bicycle Plan* provides guidelines for bicycle parking implementation and design. These guidelines address issues of security and location as well as quantifying the number of spaces needed. Appendix Table D.18 details the number of bicycle parking spaces for various land uses, as suggested in *San Francisco Bicycle Plan* guidelines.
- The bicycle parking demand would be for about 2,300 spaces, resulting in a deficit of about 1,230 spaces throughout the Project Area. Some of the deficit could be met by residents parking their bicycles either in garages next to their automobiles or in their residences. Short-term demand could be satisfied by bicycle racks on sidewalks, particularly in neighborhood shopping areas and on the UCSF site.

IMPACT OF THE NEW GIANTS BALLPARK AT CHINA BASIN

As noted earlier in “Pacific Bell Park,” under “Year 2015 Transportation System Assumptions” in the Impacts subsection, there will be a new ballpark for the San Francisco Giants baseball team located at China Basin, south of King Street between Second and Third Streets across the street from Mission Bay North. The *San Francisco Giants Ballpark at China Basin EIR*, certified in June 1997, considered the transportation impacts of the ballpark in the context of cumulative future growth, including development in Mission Bay with a major new UCSF site./96/ The following discussion summarizes that analysis.

Events at the ballpark will not occur every day and when they occur, transportation impacts would be most severe prior to and at the conclusion of the games. About 80 to 85 baseball games will be

played during the April-through-September baseball season; about 13 of these games are expected to be played on weekday afternoons. Other non-baseball events may also be held when the Giants play out of town as well as at other times during the year. Events will be scheduled to avoid start times or end times that would generate substantial transportation demand during the weekday peak hour of the evening commute period, 4:30 to 5:30 p.m. The start times of the weekday afternoon games, dictated somewhat by Major League Baseball rules, and other special events will be planned to most likely end during the 3:30 to 4:30 p.m. period, and weeknight events will generally start at 7:30 p.m. Games and special events will also be held on weekend days. Transportation travel demands are less during these time periods than during the 4:30 to 5:30 p.m. peak weekday commute hour.

As noted in the Ballpark EIR, sellout events at the ballpark will generate substantial transportation demand. Attendance forecasts prepared by the Giants suggest that about 37% of the total number of games (about 30 games a year) would be sellouts, and there is also a potential for up to five sellout special events each year. The greatest impact would occur after weekday afternoon sellout events, during the 3:30 to 4:30 period when traffic, transit, and pedestrian flows exiting the ballpark area would coincide with the early commute period demand already on the transportation network before the peak commute hour. During this time period for a sellout ballgame, ballpark patrons would generate 10,125 new transit trips and 9,500 new auto trips. Similar demands would occur before and after weeknight and weekend sellout events.

The Ballpark EIR analyzed 66 intersections in the vicinity of the ballpark site and parking areas both north and south of China Basin Channel. Two cumulative scenarios were studied, one with ABAG *Projections '96* growth forecasts for the San Francisco Bay Area and another with growth forecasts augmented by a major new UCSF site in Mission Bay and by additional employment in the Mission Bay South area./97/ This second cumulative scenario included growth in the Mission Bay area that is similar to the development proposed by Catellus for Mission Bay South as analyzed in this Mission Bay SEIR. The results of the Ballpark EIR transportation analysis conducted for this second cumulative scenario showed that fans traveling to and from a sold-out or high-attendance ballgame (or other sold-out high-attendance event at the ballpark) would contribute to substantial congestion on local streets and on MUNI routes between the ballpark parking areas and regional transportation systems before and after the game or event./98/

Without mitigation, and under the cumulative scenario that included UCSF and additional employment in Mission Bay, about 35 intersections of the 66 studied would operate at LOS E or F following a weekday afternoon event ending at about 3:30 p.m., compared to 10 intersections that operated at LOS E or F during this hour in 1996. Of the 66 intersections analyzed in the Ballpark EIR, 27 were analyzed for this SEIR; 9 of the 27 common intersections currently operate at LOS E or F during the 4:30 to 5:30 p.m. peak hour in 1997, and 20 would operate at LOS E or F during the 3:30 to 4:30 p.m. hour after a game under future cumulative conditions which included UCSF and additional employment in Mission Bay. Before weeknight games, about 27 of the 66 intersections studied in the Ballpark EIR would operate at LOS E or F, 21 more than operated at unacceptable levels under 1996 existing conditions. Traffic on local streets in Mission Bay, including King Street, Third Street, Terry A. François Boulevard and Fourth Street south of the Channel, would be congested as ballpark fans leave parking areas, making it difficult for Mission Bay motorists to use those streets to access the area, both inbound and outbound.

Freeway ramps near ballpark parking, including those at Fifth and Bryant Streets, First and Harrison Streets, and Fourth and Harrison Streets, would have long queues of cars waiting to access the freeway after sellout and high-attendance games or events. These queues would contribute to afternoon congestion on days with weekday afternoon games, particularly as the peak commute period lengthens due to cumulative future employment growth in the City. Although for evening events motorists would be generally traveling toward San Francisco while commuters travel away from downtown, as the afternoon peak period expands, intersections leading to freeway ramps would remain congested beyond the 4:30 to 5:30 p.m. peak commute hour, and ballpark-bound traffic using those intersections to access parking sites would contribute to the congestion.

The analysis in the Giants Ballpark EIR assumed the existing street configuration in the Mission Bay Project Area because the development program for Mission Bay South had not yet been defined. The currently proposed internal roadway system for Mission Bay would substantially change the existing street pattern, particularly in Mission Bay South. The proposed plan includes a grid system of local collector streets, new major streets, plus improvements to existing major streets./99/ Because there would be added vehicular capacity, traffic conditions at several intersections within Mission Bay would be expected to operate at better levels of service than identified in the Ballpark EIR.

For example, the intersections of Third Street with 16th Street and with Mariposa Street, which would be operating at a LOS F under the existing street configuration, should improve, most likely to LOS E and possibly to LOS D. The improvement is expected because of street widenings, provision of additional turn lanes, the opening of a new four-lane Owens Street between Fourth Street and the Mariposa I-280 ramps, and, to a certain extent, the extension of Fourth Street parallel to Third Street. Similarly, the intersections of Mariposa Street with the I-280 on- and off-ramps would improve from LOS F to LOS E or possibly D, because of widening of Mariposa Street and the extension of Owens Street to directly connect with the I-280 ramps.

The analysis of cumulative impacts on MUNI service to and from the Mission Bay area in the Ballpark EIR showed a demand for additional light rail vehicles on the Metro Extension at King Street and on the proposed Third Street light rail line, or a demand for additional MUNI buses serving the Mission Bay Project Area. In particular, expected capacity on the Metro Extension and bus lines 30, 45 and 42 serving the South of Market area to Market Street would be exceeded by a combination of demand from growth in Mission Bay and from a sold-out event at the ballpark./100/ Mission Bay transit patrons would find jammed conditions on all of these MUNI facilities if they chose to travel immediately before or after an event at the ballpark. Caltrain would also be expected to serve large numbers of ballpark patrons; project travelers and other workers who use the train to commute to or from the Project Area and downtown San Francisco would find considerably more crowded conditions

after a weekday afternoon event or before a weeknight event at the ballpark than during the normal commute periods. Caltrain would have to add three to five additional cars to the early rush-hour trains to satisfy the increase in ridership from ballpark patrons leaving a weekday afternoon high-attendance ballpark or event./101/

These events would also generate parking demands ranging from 8,530 spaces for the weekday afternoon sellout game to 10,590 spaces for a weeknight game or event. The Giants will provide approximately 5,000 spaces on lands owned by the Port of San Francisco (for 9 years from completion of the parking improvements and opening of the ballpark)/102/ and Catellus Development Corporation (for 5 years, through 2005) immediately south of China Basin Channel. Any parking demand not satisfied by these 5,000 spaces will have to be served by the available on- and off-street parking (public and private) located within a 20-minute walk of the ballpark, mainly in the South of Market and South Beach areas. Many ballpark patrons would also attempt to use on-street parking in Mission Bay if longer term parking (longer than the one- to two-hour on-street limits generally established) were made available on any Mission Bay streets within a 15- to 20-minute walk of the ballpark. If no substantial number of parking spaces within a 15- to 20-minute walk-distance of the ballpark were available to baseball fans in the Mission Bay South area, some patrons would be willing to park in the surrounding residential areas, including Potrero Hill and Lower Potrero Hill areas. However, there are commercial/industrial areas west of Mission Bay North that are closer to the ballpark, and most ballpark patrons would find the residential areas too long a walk, beyond 25 minutes, so any parking intrusion into the Potrero Hill residential neighborhoods is likely to be minor.

No plan has been established to provide for ballpark parking after the Catellus and port lease terms have expired. It is possible that port properties could be made available for an extended period, or that experience will show that substantially less parking is needed due to transit accessibility, or that parking garages will be constructed at some location near the ballpark to serve all or a portion of the ballpark parking demand. For analysis purposes, the Ballpark EIR assumed that by 2015 a parking structure or structures had been constructed for up to 5,000 vehicles in an undetermined location south of the Channel. The Ballpark EIR also analyzed the effects of providing no parking south of the Channel in Variant B, concluding that traffic effects in the area near the ballpark would be less because fewer vehicles would be attracted to that location, that a portion of the parking demand would be met in parking facilities and on streets further than a 20-minute walk from the ballpark, and that there could be considerable additional demand for transit services in the Third Street light rail corridor as patrons located parking south of the Mission Bay Project Area close to the new light rail line.

Pedestrian flows before and, in particular, after ballgames will be intense, and will exceed the capacity of sidewalks on King Street in front of the ballpark and on Third Street and Fourth Street between King Street and the Giants parking lots south of the Channel. Without appropriate control measures, pedestrians could spill into the traffic lanes on these street segments and create added traffic congestion. Typical measures would include closing some traffic lanes to provide a wider area to pedestrians, installing fences and barricades clearly delineating the traffic and pedestrian areas, and providing sufficient parking control officers to manage the expected pedestrian and traffic flow surges.

To address the impacts summarized above, the Ballpark EIR proposed a mitigation program that defined measures to accommodate and better manage traffic flows, transit demands, and pedestrian volumes before and after ballgames. As events at the ballpark would not occur every day, and the size and nature of the events would vary, the mitigation program focused on measures that would provide flexibility in addressing the transportation demands of each event. As a result, the approach was to manage ballpark travel demand rather than constructing new roadway, transit, pedestrian, and parking facilities.

The mitigation program described in the Ballpark EIR included reallocations and rerouting of existing transit resources to provide service to and from the ballpark before and after events. Traffic demands would be accommodated through the application of the pre-game and post-game traffic routing plans. The routing plans were designed to prevent all traffic from using streets adjacent to the ballpark, to route non-ballpark related traffic away from the key routes to and from ballpark parking, and to provide ballpark related traffic with routes to and from the areas with available parking. A pedestrian circulation plan was provided to accommodate the peak flows of pedestrians near the ballpark. The plans for added transit service, traffic routing, and pedestrian control presented in the Ballpark EIR were identified as examples of the type of transportation improvement measures that could be implemented before and after ballgames.

The plan presented in the Ballpark EIR involved the closure for one hour before and after the games of King Street between Second and Third Street, and of Third Street between Fourth and King Streets, except for MUNI vehicles and pedestrians. It also included making Fourth Street one-way southbound between King and Third Streets prior to a game, and converting to a one-way northbound street after a game. Because the currently preferred alignment for MUNI's Third Street light rail extension/103/ calls for a bi-directional track alignment on the Peter Maloney (Fourth Street) Bridge, and not on the Lefty O'Doul (Third Street) Bridge as assumed in the Ballpark EIR, some of the proposed measures included in the illustrative plan would be infeasible and will have to be modified.

For example, rather than completely closing the Lefty O'Doul Bridge to automobile traffic, the three most westerly lanes could remain open to automobiles, in the southbound direction prior to a game and in the northbound direction after a game, while the rest of the bridge remains for pedestrians only. Similarly, two lanes on the Peter Maloney Bridge would be reserved for MUNI light rail operation, while the remaining third lane could be used by MUNI buses exclusively, or, most likely, shared with automobile traffic. These and other modifications to the overall mitigation program were expected, as it was impossible at the time that the EIR was completed to determine how streets and transit would ultimately be configured in the area around the ballpark site.

The Ballpark EIR determined that the actual measures to be implemented would be defined as part of a ballpark Transportation Management Plan (TMP) to be prepared by the Giants in coordination with a Ballpark Transportation Coordinating Committee (BTCC). This mitigation measure has been adopted and a coordinating committee is part of the ballpark project. The BTCC, which includes representatives of the key transportation agencies, UCSF, Catellus, other property owners, and neighborhood groups, will have the responsibility of implementing and managing the application of the measures defined in a ballpark TMP. As conditions governing transportation around the ballpark change over time, the BTCC would be responsible for refining and modifying the ballpark TMP to address those changing conditions. For example, when the ballpark opens in the year 2000, the Mission Bay project would be in its earliest phases of planned development, and the transportation network would be much as it is today. As phases of the Mission Bay project are implemented, new development and transportation infrastructure would be put in place. The ballpark TMP will need to be refined regularly to reflect this new development and the availability of the new transportation facilities.

Even with the application of the measures defined in the ballpark TMP, the travel demands associated with ballpark events would result in traffic delays and congestion on streets in and around the Mission Bay project. Transit facilities and services in the area would be crowded and subject to delays. Some pedestrian routes nearest the ballpark would also be crowded and difficult for non-ballpark pedestrians to use. The employees, residents, and visitors of the Mission Bay Project Area who choose to travel during the period before and after ballpark events would likely experience some degree of inconvenience and delay. For example, Mission Bay residents and employees who normally use MUNI to or from the area would find buses and Metro cars crowded and schedules could be temporarily changed to accommodate ballpark patrons. The traffic routing plan may require Mission Bay motorists to use routes different from their normal travel paths. In some cases, special measures may be required to allow these motorists to travel on street segments that would otherwise be closed to traffic.

Any parking that is open to the public within a 20-minute walk of the ballpark is likely to be used by ballpark patrons. Unless special controls or restrictions are applied, ballpark related parking could displace other parking activity. For example, access to waterfront land uses and activities might be diminished if ballpark patrons park in public parking on and along Terry A. François Boulevard. Further, traffic congestion on Terry A. François Boulevard due to the flow of vehicles in and out of the Giants parking lots could cause delays for those trying to access the waterfront. While the Ballpark EIR proposed measures to address these types of impacts, it will be the responsibility of the BTCC to ensure that the appropriate measures are implemented.

TRANSPORTATION ISSUES DURING BUILD-OUT

Phasing of New Transportation Facilities

The project includes construction of new streets, widening of some existing streets, modification of existing traffic signals and installation of new signals, and extension of existing 22 and 30/45 MUNI trolleybus lines into the Project Area./104/ If these transportation features were not developed at appropriate points during build-out of the project, transportation impacts could occur as growth in traffic and in demand for transit could exceed the capacity of available facilities. To reduce potential impacts to a less-than-significant level or to avoid them infrastructure, such as streets and traffic signals, is proposed to be installed in phases corresponding to building development phases.

Most of the circulation and transportation components of the project would be triggered by an “adjacency” concept. As each development phase is constructed, adjacent sidewalks, new streets or improvements to existing streets, driveways and curb cuts, and pedestrian pathways, as applicable, would be included. The developer of each phase would submit preliminary infrastructure plans to the Redevelopment Agency for review by the Redevelopment Agency and by appropriate City departments as coordinated by the Department of Public Works (see “Review Process for Proposed Phases,” under “Phasing of Construction of Infrastructure and Improvements in the Project Area,” Section III.B, Project Description, for additional information about the review process). Each preliminary infrastructure plan would show adjacent roadway and other transportation improvements, would include the types of land uses proposed and square footages of these uses, and would identify any major circulation improvements triggered by the amount of development proposed.

For major improvements such as extending Fourth Street and Owens Street, and for improvement of or addition of rail crossings proposed at Berry and Seventh Streets and at the new intersection of The Common with Seventh Street, installation would be triggered by an amount of development established based on expected p.m. peak hour vehicle trips generated by the project. These triggers

have been identified for the land uses analyzed in this SEIR based on the proposed square footage of project build-out. The triggers are described more fully in Section VI.E, Mitigation Measures: Transportation.

Existing Uses

During the period that the Project Area is being developed, some existing uses would remain for periods established in the Redevelopment Plans. Some of the existing uses would be permitted limited expansion for defined periods. Existing buildings might also be permitted to house different uses while other parts of the Project Area were being developed. These land uses would be different from those expected to be in place following full development of the Project Area in 2015.

Continuation of and limited expansion of existing uses would not be expected to cause significant increases in traffic volumes or transit demand compared to existing conditions described in the Setting section. Minor changes of use or expansions in existing buildings would not likely cause substantial changes in traffic patterns or increases in traffic volumes near the particular site.

Interim Uses and Interim Conditions

Interim Uses

Interim uses could include parking lots, structures incidental to environmental clean-up, construction-related temporary structures, retail and sales offices incidental to newly developed uses, open recreational uses, and truck parking. These uses would be allowed for up to 15 years, with 5-year extensions possible.

The transportation effects of most interim uses expected to be permitted in the Project Area would be less than those described for the project at full build-out. If changes to the circulation system, described above under “Changes to Circulation Patterns in Mission Bay” in the Impacts section and to MUNI service, described above under “Changes to San Francisco Municipal Railway (MUNI) System,” in the Impacts section assumed to be in place in the Project Area by 2015, have not been completed at a particular location, some interim uses such as truck parking might cause localized effects at a nearby intersection that might reduce existing levels of service, but would not likely degrade conditions below those presented in the impacts analysis for the project. Completion of the MUNI Third Street Light Rail project in about 2003 would provide additional transit capacity for employees and residents in the Project Area and could help to reduce potential traffic impacts.

● Among the interim uses would be surface parking lots for the Giants Ballpark planned for sites on Third Street and Fourth Streets and for the UCSF site in Mission Bay South. Under the UCSF Preliminary April 1998 Development Plan, during Phase I about 800 feet of Fourth Street would be improved, north of 16th Street, to its ultimate configuration to provide access to the first three structures and interim UCSF surface parking lots. The transportation effects of ballpark parking have been analyzed in the Giants Ballpark FEIR and are summarized above in "Impact of the New Giants Ballpark at China Basin."

If parking lots for commuters working in Nearby Areas were included in the interim uses or if the ballpark lots were made available for use by commuters, impacts would be directly related to the level of usage, which would in turn depend on the number of spaces permitted, and the cost and convenience for commuters. If interim commuter parking lots were to accommodate several thousand vehicles, and if the lots were convenient enough, based on the availability of transit from parking lots to businesses in the South of Market or downtown areas, for example, this interim use could cause substantial congestion during the p.m. peak at intersections in and around the Project Area that lead to regional access points. If commuter parking lots were established, they would not produce traffic volumes as great as would the project at buildout; insofar as planned intersection improvements, such as exclusive left turn lanes and new traffic signals, were not in place, traffic from the lots could cause localized reductions in service levels until improvements were carried out.

Although commuter parking areas could theoretically be established in the Project Area, the determination issued by the Zoning Administrator for the Port/Catellus ballpark parking permits use of these lots for ballpark parking only, not commuter use, and would need to be amended to make commuter use possible on those lots./105/ UCSF has indicated it does not intend to accommodate non-UCSF commuter parking.

Interim Conditions During Buildout Period

● Seismic retrofit of the San Francisco-Oakland Bay Bridge approaches is planned by Caltrans for the period from about 1999 to 2004./105a/ The capacity of the freeway approach to the Bay Bridge (I-80 eastbound) will be temporarily reduced and various on- and off-ramps may be closed for extended periods. Traffic congestion in the areas of the freeway ramps leading to the Bay Bridge, particularly those at Fifth and Bryant Streets and on Harrison Street at Essex and at First Street, is likely to be substantially greater than described in the Traffic Setting section, above, and could be greater than that analyzed for the 2015 cumulative conditions for some periods of the retrofit, depending on what facilities are closed or reduced. Any development that was completed and occupied in Mission Bay before 2003 would contribute to this extensive traffic congestion. It is possible that some downtown employees who commute between the City and the East Bay will shift to BART and AC Transit during this period, increasing crowding on these transit facilities. The retrofit would be completed several years before the 2015 analysis year; therefore, it would not affect the results of the transportation analysis for full build-out of the Project Area.

Temporary Uses

Other uses that may be established in the Project Area during the project development period include temporary uses such as fairs or carnivals, seasonal sales facilities like Christmas tree lots, and convention staging facilities. These uses would be permitted for no more than 90 days. They would not be expected to have long-term local or regional transportation impacts greater than those described for full development of the Project Area, although short-term, temporary congestion could occur. Any short-term traffic and/or transit congestion that might result from a fair in the Project Area, for example, would occur primarily during weekend and/or evening hours, because that is when most people would visit such an attraction. The traffic and transit congestion would be substantially less than that described for a sold-out ballgame or event at the San Francisco Giants Ballpark, summarized above, because the entire visitor population would not arrive at a fair or carnival at one time as they would for a ballgame. Based upon experience to date with temporary uses at Mission Bay, these uses are expected to be infrequent.

LOADING OPERATIONS

The demand for loading spaces in the Mission Bay project, including that for the UCSF site, was estimated based on the Planning Department's *Guidelines for Environmental Review: Transportation Impacts*, Appendix 7./106/ Daily truck trips generated per 1,000 gross square feet (gsf) were calculated based on the information in Table 7.1, then converted to hourly demand based on a 9-hour day and a 25-minute average stay. Average hourly demand was converted to a peak hour demand by multiplying it by 1.25, as specified in the *Guidelines*.

The estimated loading space demand was then compared with requirements in Section 152 of the City Planning Code. Table V.E.21 presents a summary of the estimated truck peak demand for loading spaces and a comparison with the minimum San Francisco Planning Code requirements. The loading space standards incorporated in the project's design documents pursuant to the Redevelopment Plans would be the same as the San Francisco Planning Code standards./107/ As shown in Table V.E.21, approximately 158 loading spaces are estimated to be needed in the peak period for freight delivery and service vehicle demand, which generally occurs between 10:00 a.m. and 1:00 p.m., compared with the design documents' minimum requirement for 106 loading spaces. The estimated loading space demand would be larger than the minimum number of loading spaces required for the Mission Bay North Subarea, and the East, West, and UCSF Subareas in Mission Bay South. If the loading demand is not met, trucks could temporarily double-park and partially block local streets while loading and unloading goods in the Project Area. In the Central Subarea, on the other hand, with housing, hotel, and retail uses, the estimated loading space demand would be less than the minimum

**TABLE V.E.21
WEEKDAY LOADING DEMAND AND SUPPLY**

Project Area	Land Use Type	Daily Truck Generation	Average Hour Loading Dock Space Demand	Peak Hour Loading Dock Space Demand	Minimum Planning Code/ Design For Development Requirement
Mission Bay North	Retail	190	9	11	11
	Restaurant	360	17	21	0
	Residential	90	4	5	14
	Movie Theater	34	3	4	1
	<i>Subtotal</i>	<i>674</i>	<i>33</i>	<i>41</i>	<i>26</i>
Mission Bay South Central Subarea	Retail	75	3	4	4
	Hotel	45	2	3	2
	Residential	93	4	5	22
	<i>Subtotal</i>	<i>213</i>	<i>9</i>	<i>12</i>	<i>28</i>
East Subarea	Office	310	14	18	8
	Retail	41	2	2	2
	R&D	310	14	18	8
	Large Retail	55	3	3	6
	<i>Subtotal</i>	<i>716</i>	<i>33</i>	<i>41</i>	<i>24</i>
West Subarea	Office	274	13	16	7
	Retail	10	0	1	0
	R&D	274	13	16	7
	Large Retail	68	3	4	6
	<i>Subtotal</i>	<i>626</i>	<i>29</i>	<i>37</i>	<i>20</i>
UCSF Subarea	UCSF Site	445	21	26	N/A
	School	10	0	1	N/A
	<i>Subtotal</i>	<i>455</i>	<i>21</i>	<i>27</i>	<i>N/A</i>
Total Mission Bay North		674	33	41	26
Total Mission Bay South		2,010	92	117	80
TOTAL PROJECT		2,684	125	158	106

Notes:

N/A = Not Applicable

The Planning Code and Redevelopment Plan loading requirements would not apply to the UCSF site or to the public school site.

Sources: Wilbur Smith Associates.

number of spaces required. Because any effects of unmet loading demand would be temporary inconveniences, any excess demand would not be a significant impact. The Redevelopment Plan design documents used to calculate expected loading supply establish a minimum number of loading spaces; more could be provided as part of individual development proposals.

RAIL FREIGHT OPERATIONS

The proposed project would not directly impact freight rail operations in terms of the ability to maintain service to existing users of the railroad. As described earlier in this section, under "Freight Rail Operation Changes" in "Changes to Circulation Pattern in Mission Bay" under "Year 2015 Transportation System Assumptions," the project proposes to relocate the existing railroad tracks near 16th Street, to follow 16th Street, Terry A. François Boulevard, and Illinois Street alignments. Trains would follow the public street right-of-way to connect with the existing trackage on Illinois Street south of the Project Area, to provide access to Pier 80 to the south. Freight train operations would be restricted to approximately the 1 a.m. to 4 a.m. time period, which would not substantially impact circulation in and through the Project Area.

If it became desirable to provide rail access to Piers 48 and 50 (Mission Rock Terminal), the proposed short trackage on Terry A. François Boulevard could be extended north, following the street's public right-of-way, to reach the piers./108/ Therefore, the reconfigured rail trackage would provide the same level of access for existing and recent former users as does the current configuration.

CONSTRUCTION IMPACTS

Construction of the project would occur in several phases. The duration of each phase would vary, depending on the type of development (e.g., residential, research and development laboratories) and on the amount of building space included in the phase. It is estimated that an average phase would require approximately 18 months to complete. Additional traffic (both trucks and autos) would be generated during all phases of construction. While the exact timing of construction for each is not available, the preliminary schedule provided by the project's construction management consultant shows that the most intense construction impact (in terms of number of workers and vehicles) would occur when the 500-room hotel is built./109/ Therefore, to ensure the most conservative approach, the data related to this construction stage are used in the analysis.

During the peak phase of construction of the hotel (i.e., the superstructure and finish phases), there would be approximately 200 workers and 145 vehicles (both trucks and autos) on-site each day. A

maximum of 125 one-way truck trips could occur on a single day. While daily truck traffic operation is expected to occur from 7:00 a.m. till 6:00 p.m. and would impede the flow of non-construction traffic on access streets and major haul routes, only 5% of that traffic would operate during the afternoon commute hours (between 4:00 p.m. and 6:00 p.m.). Most of the truck loading and unloading activities would occur within or adjacent to the development site and would have minimal impacts on adjacent streets.

The typical work shift for most construction workers would be from 7:00 a.m. to about 3:30 p.m. on weekdays; this work schedule would minimize the traffic impact on neighborhood streets during the typical afternoon commute hours. Further, because of the large amount of vacant land in the Project Area, construction worker vehicles would likely park near construction sites in the Project Area during most phases, and would not occupy parking spaces on neighborhood streets.

All project construction operations would include plans for the closure of traffic/parking lanes and sidewalks adjacent to construction sites./110/ The closure of sidewalks and parking lanes could last throughout the entire construction phase for each building or group of buildings (about 18 months). The location of lane closures would depend on the location of construction sites during different development phases. It is expected that no more than one traffic lane would be closed during construction of individual buildings in the Project Area, and closed traffic lanes would reopen during the afternoon peak period (after 4:00 p.m.). It is possible that more than one location in the Project Area could be under construction at any one time during the project development period. Thus, several parking lanes and sidewalks could be closed for construction at one time, causing temporary inconvenience for motorists and pedestrians.

While the exact routes that construction trucks would be using would depend on the location of individual construction sites, it is expected that Third Street and César Chavez Street would be the primary haul and access routes to or from San Francisco via U.S. 101. Trucks would use Third Street and the ramps at Mariposa Street to access I-280. From the East Bay, trucks would use the Fifth Street and Fourth Street ramps to arrive at the Project Area.

The construction of certain phases of the project would overlap with other construction activities in Nearby Areas, such as the San Francisco Giants Ballpark and the Third Street Light Rail project. The Giants Ballpark, to be located at King and Third Streets, is expected to be completed by the year 2000, while the Third Street Light Rail Extension is expected to be finished by the year 2003. If the first buildings to be built in the Project Area were located on Third Street north of China Basin Channel, some cumulative construction transportation effects could occur on Third Street. Construction management consultants for the various projects would be required to collaborate with

City Public Works and MUNI staff to establish construction schedules, staging areas, and access locations to minimize temporary traffic and transit impacts related to obstructed street rights-of-way; the Mission Bay Transportation Management Association described in Mitigation Measure E.46 in Section VI.E, Mitigation Measures: Transportation, could assist in coordinating construction traffic.

NOTES: Transportation and Circulation

1. San Francisco Planning Department, *Mission Bay Final Environmental Impact Report*, Planning Department File No. 86.505E, State Clearinghouse No. 86070113, Certified August 23, 1990, Volume Two, p. VI.E.1a.*
2. California Department of Transportation, Traffic survey files, 1996.
3. California Department of Transportation, Traffic survey files, 1996; and San Francisco County Transportation Authority, Congestion Management Plan (CMP) network annual monitoring reports, 1995.
4. San Francisco County Transportation Authority, Congestion Management Plan (CMP) network annual monitoring reports, 1995.
5. San Francisco County Transportation Authority, Congestion Management Plan (CMP) network annual monitoring reports, 1995.
6. California Department of Transportation, Traffic survey files, 1996.
7. California Department of Transportation, Traffic survey files, 1996.
8. California Department of Transportation, Traffic survey files, 1996.
9. California Department of Transportation, Traffic survey files, 1996.
10. The I-80/U.S. 101 "split" is the location where Interstate 80 ends in San Francisco and becomes U.S. 101. At that point, U.S. 101 turns north to the "Central Freeway," but the driver perceives the main freeway as a continuation of I-80 leading south for westbound drivers or leading east for northbound drivers on U.S. 101.
11. California Department of Transportation, Traffic survey files, 1996.
12. Caltrain Time Table and Information Guide, effective July 6, 1997 - January 3, 1998.
13. Peninsula Corridor Joint Powers Board, *Caltrain 20-Year Strategic Plan, Fiscal Year 1997/1998 to Fiscal Year 2016/2017*, October 1997.*
14. A one-way couplet is a pair of one-way streets that are parallel to and adjacent to each other.
15. SamTrans Bus System Route Map; SamTrans Service Time Tables, effective May 4, 1997.
16. Headways are the amounts of time between scheduled runs of a bus or rail line.

17. San Mateo County Transit District, *Short Range Transit Plan, FY 1995/96 - FY 2004/05*, September 1995.*
18. BART Service and Schedules, April 1997.
19. San Francisco Bay Area Rapid Transit District, *Short Range Transit Plan, July 1995 through June 2005, FY 1996-FY 2005*, September 14, 1995.*
20. BART uses these standards as a way to determine the quality of the service it provides to its customers. BART does not automatically add more cars or trains any time the standard is reached or exceeded.
21. AC Transit Transbay Route Map, April 1997.
22. Paul Bignardi, Associate Planner, AC Transit District, Technical Memorandum, October 3, 1997, and personal communication with Wilbur Smith Associates, December 5, 1997.*
23. Golden Gate Transit relocated its Civic Center bus service from Folsom Street, Howard Street and the Transbay Terminal to Mission Street in March, 1997.
24. Golden Gate Transit, Bus & Ferry Transit Guide, June 8 - September 6, 1997.
25. Maurice Palumbo, Senior Planner, Golden Gate Bridge, Highway, and Transportation District, Technical Memorandum to Wilbur Smith Associates, June 24, 1997.*
26. Blue & Gold Fleet Ferry Schedule No. 2; Red & White Fleet Ferry Schedule No. 154; Alameda/Oakland Ferry Schedule, effective May 19 through December 31, 1997; Vallejo Baylink Ferry Schedule; Jim Reed, Port Captain, Red & White Fleet, telephone conversation with Wilbur Smith Associates, November 20, 1997.
27. According to the City and County of San Francisco, *San Francisco General Plan*, Transportation Element, a "Major Arterial" is a "cross-town thoroughfare whose primary function is to link districts within the city and to distribute traffic from and to the freeways; these are routes generally of citywide significance; of varying capacity depending on the travel demand for the specific direction and adjacent land uses." p. I.4.35.*
28. According to the City and County of San Francisco, *San Francisco General Plan*, Transportation Element, "Secondary Arterials" are "primarily intra-district routes of varying capacity serving as collectors for the major thoroughfares; in some cases supplemental to the major arterial system." p. I.4.35.*
29. Note that the San Francisco Congestion Management Program (CMP) does not consider deficient those roadway segments that operate at LOS "E," or those that were already operating at LOS "F" when the baseline monitoring was conducted for the first CMP in 1991. For CEQA purposes, however, a change in intersection LOS from "D" to "E" or "F" is considered a significant impact.
30. Bridge tenders are on duty 24 hours a day because under Federal Drawbridge Operating Regulation, 33 CFR 117.149 China Basin, Mission Creek, a bridge tender must open both bridges "on signal if at least one hour advance notice is given."
31. Robert Peters, City and County of San Francisco, Department of Public Works, Bureau of Street and Sewer Repair, written communications to Wilbur Smith Associates, June 20, 1996.*

32. San Francisco Municipal Railway, Street and Transit Map, 1996; *Short-Range Transit Plan, July 1, 1995 - June 30, 2005*, October 15, 1995.
33. Peter Straus, Director of Service Planning, San Francisco Municipal Railway, personal communication to Wilbur Smith Associates, June 18, 1997.
34. Screenlines are hypothetical lines that would be crossed by persons traveling between two points. In particular, MUNI's percentages of capacity utilized were based on the total number of passengers crossing a screenline during the p.m. peak hour.
35. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, pp. III.95-III.99, and Table X.C.5, pp. A.105-A.106.
36. Pushkarev and Zupan, *Urban Space for Pedestrians*, MIT Press, 1975.*
37. San Francisco Board of Supervisors Resolution 225-97, adopted March 4, 1997.
38. Bill Harris, Santina & Thompson, Inc., personal communication with Wilbur Smith Associates, October 1, 1997.
39. Donald Miller, Hawk Engineers, Inc., written communication to Wilbur Smith Associates, July 8, 1997.
40. Bill Harris, Santina & Thompson, Inc., personal communication with Wilbur Smith Associates, October 1, 1997. Charles Mitchell, Chief Warfinger, Port of San Francisco, telephone conversation with EIP Associates, March 2, 1998.
41. Charles Mitchell, Chief Warfinger, Port of San Francisco, telephone conversation with EIP Associates, March 2, 1998.
42. The Metropolitan Transportation System is a regional network of freeways, major and secondary arterials, transit and recreational streets meeting criteria developed by the Metropolitan Transportation Commission as part of the Regional Transportation Plan. City and County of San Francisco, Planning Department, *San Francisco General Plan*, Transportation Element, Table 1: Classification of Elements in Vehicular Circulation Plan, p. I.4.35.
43. The project to extend Caltrain to downtown has been delayed because the San Francisco Board of Supervisors voted, in July 1997, not to complete the environmental impact report. See discussion in Section V.E, Transportation, "Caltrain San Francisco Downtown Extension Project" for more information.
44. San Francisco Bay Conservation and Development Commission, *San Francisco Bay Plan*, January 1969, as amended, p. 25.*
45. 1990 FEIR, Volume II, p. VI.E.49.*
46. San Francisco Bay Conservation and Development Commission Resolution 96-06, May 8, 1996.
47. City and County of San Francisco, *San Francisco General Plan*, Transportation Element, City Planning Commission Resolution 13907, July 6, 1995.*

48. 1990 FEIR, Volume II, p. VI.E.45, citing City and County of San Francisco, *San Francisco General Plan*, Transportation Element.*
49. The San Francisco Bicycle Plan was prepared by the Department of Parking and Traffic and was adopted by the San Francisco Board of Supervisors in Resolution 225-97, March 4, 1997.
50. Port of San Francisco, *Waterfront Land Use Plan*, adopted June 24, 1997, pp. 34, 44, 45, 60.*
51. The specific iterative technique used in the MTC origin/destination trip tables adjustment is known as a *Fratar* process. It adjusts the number of trips in each geographic area within the model individually by applying specified "production" or "origin" and "attraction" or "destination" growth factors to each trip table. Since the application of the origin factors affects the total number of trips destined to a geographic area and vice versa, the factoring process is repeated several times, in order to converge on a reasonable solution which, to the extent possible, preserves the already estimated totals for both origins and destinations for each geographic area.
52. As discussed in Appendix C., Business Activity, Employment, Housing, and Population, under "SEIR Cumulative Growth Scenario Compared to *Projections '98*," ABAG's latest growth forecast for San Francisco includes employment increases similar to those in the updated San Francisco cumulative growth estimates and includes a slightly slower growth in households than was assumed in the San Francisco cumulative growth estimates. To the extent that the population growth forecast used for this SEIR is higher than *Projections '98*, the resulting transportation and related effects (air quality, transportation, noise) are greater than if *Projections '98* forecasts were used, providing a more conservative result. *Projections '98* was published in December 1997, and so was not available in time to use in the transportation analysis.
53. Similarly, EIRs under preparation for other projects included in the revised San Francisco projections may assume more buildout for the particular project that is the subject of the EIR, to ensure a conservative analysis of impacts. However, outside of the project that is the subject of the EIR, each EIR is using consistent assumptions about growth in the rest of the City.
54. Catellus is initiating the necessary steps to obtain approvals from the Peninsula Corridor Joint Powers Board (Caltrain) and the State of California Public Utilities Commission for this crossing.
55. San Francisco Board of Supervisors Resolution 225-97, March 4, 1997.
56. San Francisco Bay Conservation and Development Commission, Permit No. 4-97 granting the Port of San Francisco permission to construct a shed in China Basin, August 25, 1997.
57. David Knadle, Director, Construction Services, Catellus Development Corporation, personal communication with Wilbur Smith Associates, December 10, 1997.
58. Caltrans, *Central Freeway Replacement Project Draft Environmental Assessment*, April 1997.
59. Although results in the Project Transportation Study area would not be substantially different with either of the Caltrans alternatives for the Central Freeway, the updated MTC regional level demand model used in the transportation analysis of this project assumes that Alternative 1A/B would be built.
60. The updated MTC regional travel demand model used in the transportation analysis of this project assumed that Alternative 1A/B would be built. However, because both freeway replacement alternatives would follow the same path, with the only difference being the touchdown point and the type of crossing of Market Street near Octavia Street, which is located about two miles away from the

Project Area, it is not expected that traffic conditions in the project's study area would be substantially different if Alternative 8B were to be built.

61. Michael Chronbach, Transit Planner, San Francisco Municipal Railway, telephone conversation with Wilbur Smith Associates, February 6, 1998.
62. Changes to the 9X, 9AX, and 9BX bus routes would occur outside the project's study area and would not affect Mission Bay-related transit demand or supply. See *Third Street Light Rail Project - Detailed Definition of Alternatives - Working Paper #3*, City and County of San Francisco Public Transportation Commission Municipal Railway, September 1997, for a more complete description of proposed bus operating plans related to the MUNI Third Street Light Rail Project.
63. Peter Straus, Director of Service Planning, San Francisco Municipal Railway, facsimile to Wilbur Smith Associates, July 17, 1997, and letters to Paul Deutsch, San Francisco Planning Department, August 29 and October 17, 1997.
64. Carmen Clark, Executive Director, S.F. Transportation Authority, telephone conversation with EIP Associates, August 19, 1997.
- 64a. San Francisco Planning Department and Federal Transit Administration, *Third Street Light Rail Project DEIS/DEIR*, State Clearinghouse #96102097, Planning Department File No. 96.281E, April 3, 1998, pp. 2-8 to 2-12 and 3-7.
65. The San Francisco Board of Supervisors voted on July 21, 1997, not to conduct additional work to complete the Draft EIS/EIR.
66. San Francisco Bay Area Rapid Transit District, *Short Range Transit Plan, July 1996 through June 2006*, September 26, 1996.
67. San Mateo County Transit, *FY 1995/96-FY 2004/05 Short Range Transit Plan*, September/October, 1995, p.4-4.
68. City and County of San Francisco Planning Department, *San Francisco Giants Ballpark Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, p. IV.197.*
69. Caltrain District 4 and Metropolitan Transportation Commission, *Bay Bridge Traffic Survey Series*, April 1996.
70. The local traffic analysis directed southbound traffic to Third Street at Mariposa Street in order to provide a worst-case analysis for this main thoroughfare, and to determine whether capacity would be adequate. As the level of service would remain at D or better at Third and Mariposa Streets, it is not expected that the number of vehicles that might use Minnesota Street to travel southbound in the p.m. peak hour would be large enough to cause a significant change in traffic conditions. However, some vehicular trips were assigned to Minnesota Street in a separate analysis, to provide a conservative assumption for impacts. The traffic analysis results are also provided for this assumption.
71. Transit trips to the Peninsula and South Bay comprise about 6% of the total trips to/from Mission Bay in the p.m. peak hour.

72. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, p. IV.197.*
73. Bay Area Rapid Transit District, *BART Short Range Transit Plan*, July 1995 through June 2005, September 1995.
74. Paul Bignardi, Associate Planner, AC Transit, telephone conversation with Wilbur Smith Associates, December 5, 1997.
75. Bay Area Transit Information Webpage: www.transitinfo.org
76. Maurice Palumbo, Senior Transit Planner, Golden Gate Bridge, Highway and Transportation District, facsimile to José Farrán, Wilbur Smith Associates, June 24, 1997.
77. Peninsula Corridor Joint Powers Board, *Caltrain San Francisco Downtown Extension Project Draft EIS/EIR*, State Clearinghouse No. 95063004, March 1997.
78. Peninsula Corridor Joint Powers Board, *Caltrain 20-Year Strategic Plan, FY 1997/98 to 2016/17*, October 1997.
79. Daryl Maxey, Chief Engineer, Peninsula Corridor Joint Powers Board, estimated future train schedules, October 1997.
80. Bay Area Rapid Transit District, *San Francisco Bay Area Rapid Transit Short Range Transit Plan, FY 1996-2005*, September 1995.
81. AC Transit District, *AC Transit Draft Transbay Comprehensive Service Plan*, February 1997.
82. Paul Bignardi, Associate Planner, AC Transit, telephone conversation with Wilbur Smith Associates, December 5, 1997.
83. *Golden Gate Bridge, Highway and Transportation District Short Range Transit Plan*, September 1995.
84. Maurice Palumbo, Senior Planner, Golden Gate Bridge, Highway and Transportation District, Technical Memorandum, June 24, 1997.
85. Jim Reed, Port Captain, Red & White Fleet, telephone conversation with Wilbur Smith Associates, November 20, 1997.
86. San Francisco Planning Department, *Guidelines for Environmental Review: Transportation Impacts*, July 1991.*
87. Ridership data for the p.m. peak hour study period was assumed to comprise 60% of the ridership data provided by MUNI for the two-hour p.m. peak period (4 p.m. to 6 p.m.).
88. San Francisco Planning Department, *Guidelines for Environmental Review: Transportation Impacts*, July 1991.*

89. San Francisco Redevelopment Agency, *Design Standards and Guidelines, Mission Bay*, Draft C, prepared by Catellus Development Corporation; as adopted by the Mission Bay Citizens Advisory Committee on December 11, 1997, revised March 30, 1998, p. 45. University of California San Francisco, *1996 Long Range Development Plan*, Adopted January 1997, p. 211.
90. The design documents for Mission Bay North and South include provisions to modify the maximum parking limits for some uses based on parking demand studies to be conducted after buildings are occupied. San Francisco Redevelopment Agency, *Design Standards and Guidelines, Mission Bay*, Draft C, prepared by Catellus Development Corporation; as adopted by the Mission Bay Citizens Advisory Committee on December 11, 1997, revised March 30, 1998, p. 45.
91. Although, on-street parking would be eliminated on Channel Street, the existing 50-space parking area leased by the Mission Creek Harbor Association from the Port of San Francisco would remain.
92. San Francisco Bureau of Engineering, Department of Public Works Standard Plan, Dwg 55.017 Rev.2, Section at Standard San Francisco Curb Ramp. The ramp requirement establishes a standard sidewalk width of about 10.5 feet for a six-inch curb.
93. Based on results of a survey made at the De Young Museum, "Visitor Survey," December, 1996.
94. Although non-auto, non-transit trips are more likely means of traveling between Mission Bay and other parts of the northeast and southeast quadrants of the City, the proportion of bicycle trips to walk trips would be less in the northeast and southeast quadrants than in the northwest and southwest quadrants. This is because one is more likely to bike than walk from the southwest quadrant to Mission Bay, but someone living in the southeast quadrant is more likely to bike or walk (rather than drive or take transit) than is someone living in the northwest or southwest areas of the City.
95. The policy of the San Francisco Department of Parking and Traffic for bicycle lane widths is to recommend a minimum of 5 feet if there is no on-street parking and a minimum of a 6-foot bicycle lane and 8-foot parking lane if there is on-street parking. Required minimum widths are 4 feet without on-street parking and 5 feet with on-street parking.
- 95a. Eric Harrison, Project Manager, Catellus Development Corporation, telephone conversation with Wilbur Smith Associates, August 4, 1998.
96. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, pp. IV.108-IV.110.*
97. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, pp. IV.108-IV.110. Note that neither cumulative future scenario included the revised growth forecast for San Francisco County prepared for this SEIR or other San Francisco EIRs now in preparation.*
98. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, Volume Two, pp. IV.166-IV.172 and IV.183-IV.200.*
99. See "Changes to Circulation Pattern in Mission Bay: Traffic Circulation" in "Year 2015 Transportation System Assumptions" in the Impacts subsection for a more detailed description of the Mission Bay circulation plan.

100. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, Volume Two, pp. IV.183 - IV.185.*
101. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, Volume Two, p. IV.197.*
102. Lease between City and County of San Francisco and China Basin Ballpark Company, LLC, as approved by the San Francisco Board of Supervisors, Resolution 880-97, September 22, 1997.
103. See more detailed descriptions of the MUNI Third Street light rail proposal in Section V.E, Transportation: Impacts, under "Changes to San Francisco Municipal Railway (MUNI) System."
104. It is assumed that the MUNI Metro Third Street Light Rail Project would be in place in about 2003 and would serve any uses in the Project Area.
105. Robert Passmore, Zoning Administrator, San Francisco Planning Department, letter to Douglas Wong, Executive Director, Port of San Francisco, and Don Parker, Senior Vice President, Catellus Development Corporation, September 4, 1997. See particularly p. 7 of 10.
- 105a. Arvind Joshi, Caltrans, telephone conversation with Wilbur Smith Associates, August 14, 1998.
106. San Francisco Planning Department, *Guidelines for Environmental Review, Transportation Impacts*, July 1991, Appendix 7.*
107. San Francisco Redevelopment Agency, *Design Standards and Guidelines, Mission Bay*, Draft C, prepared by Catellus Development Corporation; as adopted by the Mission Bay Citizens Advisory Committee on December 11, 1997, revised March 30, 1998, p. 46. Note that these standards were also used to establish likely loading requirements for the UCSF site because no loading standards were established in the UCSF LRDP. San Francisco Planning Code Section 152 requirements for residential loading were used for Mission Bay residential, because no standards were included in the Design Standards document.*
108. Pier 64 is listed in the *Waterfront Land Use Plan* as condemned and is not proposed for any industrial use that might need rail access.
109. Dean Browning, Senior Project Sponsor, Charles Pankow Builders, Ltd., facsimile to Eric Harrison, Project Manager, Catellus Development Corporation, April 3, 1997.
110. Dean Browning, Senior Project Sponsor, Charles Pankow Builders, Ltd., facsimile to Eric Harrison, Project Manager, Catellus Development Corporation, April 3, 1997.

* A copy of this report is on file for public review at the Office of Environmental Review, Planning Department, 1660 Mission Street, San Francisco.

F. AIR QUALITY

This section describes the environmental setting and impacts for air quality. The Setting subsection includes a summary of the climate in the Project Area; federal, state, and regional air quality standards; and existing air quality data and emissions for the San Francisco Bay Area for both “criteria air pollutants”/1/ and “toxic air contaminants.” The impact analysis focuses on expected emissions of criteria air pollutants and toxic air contaminants from stationary and mobile sources in the Project Area and from cumulative development.

Criteria air pollutants refer to a group of pollutants for which regulatory agencies have adopted federal, state, or regional ambient air quality standards and pollution reduction plans. Criteria air pollutants include ozone, carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), small-diameter particulate matter (PM₁₀), and lead./2/

Toxic air contaminants refer to a category of air pollutants that pose a present or potential hazard to human health, but which have more localized impacts than criteria air pollutants. Some toxic air contaminant sources are regulated with emission- and risk-based regulations at the federal, state, and local levels. There are more than 700 toxic air contaminants recognized by different regulatory agencies. This Air Quality section is concerned with routinely emitted toxic air contaminants. Possible emissions of biohazardous materials and radioactive substances (which are not typically considered toxic air contaminants), and nonroutine releases of hazardous chemicals, are discussed in “Hazard Assessment” in Appendix H.

The air quality analysis in the 1990 FEIR has been updated for this SEIR based on the revised traffic analysis. In addition, an expanded discussion of toxic air contaminants is presented. A Glossary appears at the end of this section, and the endnotes for this section begin on p. V.F.45.

SETTING

CLIMATE

Regional Climate

The San Francisco Bay Area’s regional meteorological conditions are dominated by the semi-permanent high pressure area in the eastern Pacific Ocean, which is in large part responsible for the warm, dry summers and cool, wet winters. This pressure system is also responsible for the westerly winds that tend to transport air pollutants inland. The marine layer typically extends from the ground

surface to an elevation of 2,000 feet. The mean maximum summer temperature is 71.5 degrees Fahrenheit; the annual mean temperature is 57.2 degrees Fahrenheit./3/

Regionwide elevated temperature inversions, caused when a layer of cool air is suspended between warm air layers above and below, are common in late summer and fall. In the absence of wind to transport pollutants out of the region, air pollution concentrations will rise during an inversion. These inversions can last for extended periods of time and, when combined with strong sunlight, can produce the worst-case conditions for ozone generation and smog formation. Ozone is formed by a series of chemical reactions between reactive organic gases (ROG) and oxides of nitrogen (NO_x). Surface inversions, formed on winter nights when surface air cools faster than the air above it, are also common in many parts of the Bay Area. When surface inversions coincide with low, surface wind speed conditions, air pollutants disperse less readily and concentrations rise. In general, the potential for air pollution problems in the Project Area is greatest during fall and winter when winds are light and inversion heights are low.

The global climate, and perhaps regional climate, is changing due to the enhanced greenhouse effect. The greenhouse effect is the warming of the atmosphere due to the trapping of infrared radiation from the sun, and this effect is being enhanced by humankind's burning of fossil fuels./4/

Wind Patterns

Wind patterns are an important element of climate because they affect air pollution dispersion and transport. High winds tend to cause an increase in dispersion and dilution of emissions. Stable conditions, where wind speed is low and an inversion (thermal boundary layer preventing upward escape of pollutants) is present, tend to trap air pollutants near their source of emissions. Therefore, understanding the wind directions and speeds in the Project Area is important to understanding the transport and fate of air pollutants.

In the Project Area, the generally prevailing wind direction is westerly during most of the year. Therefore, pollutants from the Project Area tend to disperse and move out to the Bay, away from receptors. Four wind directions comprise the greatest frequency of occurrence as well as the majority of strong wind flow; these are northwest, west-northwest, west, and west-southwest winds./5/ Wind direction may vary considerably in the Project Area due to the surrounding topography. Wind direction during the day may be predominantly westerly, and may shift at night to predominantly easterly, thereby transporting pollutants from the east towards downtown San Francisco and the Project Area. These types of changes in wind patterns are common occurrences in San Francisco. Calm conditions occur about 2% of the time.

Meteorological data are currently not collected within the Project Area. A more accurate classification of existing wind patterns in the Project Area would require on-site meteorological monitoring. While there are meteorological stations at sites in Nearby Areas, these sites may not be representative of conditions in Mission Bay because of variations in topography and the location of tall buildings near the monitoring sites. Turbulence created by large buildings can alter localized wind patterns. Construction of tall buildings may also alter localized wind patterns from conditions that were previously recorded at the old Federal Building (a source of meteorological data for the area).

REGULATORY FRAMEWORK

Criteria Air Pollutants

Air quality is regulated at the federal, state, and local levels. A series of laws and regulations has been designed to provide a basis for air pollutant control efforts. The major control efforts focus on criteria air pollutants, pollutants for which ambient standards have been established.

Based on the authority of the federal Clean Air Act, as amended, and the California Clean Air Act, federal and state regulatory agencies set upper limits on the airborne concentrations of ozone, carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and small-diameter particulate matter (PM₁₀). Federal and state standards for these pollutants are presented in Table V.F.1. Such upper limits or “ambient air quality standards” are designed to protect segments of the population most susceptible to the pollutants’ adverse effects (e.g., the very young, the elderly, people weak from illness or disease, or persons doing heavy work or exercise). The potential human health effects of these air pollutants are presented in Table V.F.2. The Bay Area Air Quality Management District (BAAQMD) is primarily responsible for planning, implementing, and enforcing federal and state ambient standards in the Bay Area. Current plans for air quality improvement include the Ozone and Carbon Monoxide Attainment/Maintenance Plans/6/,/7/, which address federal requirements/8/, and BAAQMD’s 1997 Clean Air Plan./9/

Criteria pollutants are described briefly below. They include ozone (and its precursors, reactive organic gases and oxides of nitrogen), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and small-diameter particulate matter (PM₁₀).

TABLE V.F.1 ●
FEDERAL AND STATE AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standard/a/	Federal Standard/b/
Ozone	1-hour	0.09 ppm	0.12 ppm
Carbon Monoxide	1-hour	20.00 ppm	35.00 ppm
	8-hour	9.00 ppm	9.00 ppm
Nitrogen Dioxide	1-hour	0.25 ppm	—
	Annual Average	—	0.053 ppm
Sulfur Dioxide	1-hour	0.25 ppm	—
	3-hour	—	1,300 $\mu\text{g}/\text{m}^3$
	24-hour	0.04 ppm	365 $\mu\text{g}/\text{m}^3$
	Annual Average	—	80 $\mu\text{g}/\text{m}^3$
Particulate Matter (PM_{10})	24-hour	50 $\mu\text{g}/\text{m}^3$	150 $\mu\text{g}/\text{m}^3$
	Annual Geometric Mean	30 $\mu\text{g}/\text{m}^3$	—
	Annual Arithmetic Mean	—	50 $\mu\text{g}/\text{m}^3$
Lead	30-Day Average	1.5 $\mu\text{g}/\text{m}^3$	—
	Calendar Quarter	—	1.5 $\mu\text{g}/\text{m}^3$

Notes:

ppm = parts per million by volume

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

— = No standard in this category

- California standards for ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and particulate matter (PM_{10}) are values that are not to be exceeded.
- National standards, other than for ozone and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The ozone standard is "not exceeded" when the expected number of days per calendar year with maximum hourly average concentration above the standard is equal to or less than one.

Source: EIP Associates.

Ozone

Ozone is a secondary pollutant which forms from the interaction of ROG and NO_x in the presence of sunlight. Motor vehicles are the primary source of ROG and NO_x in the Bay Area. Ozone standards have been violated most often in the Santa Clara, Livermore, and Diablo Valleys because local topography and meteorological conditions favor the buildup of ozone and its precursors.

TABLE V.F.2 ●
HEALTH EFFECTS SUMMARY OF THE MAJOR CRITERIA AIR POLLUTANTS

Air Pollutant	Adverse Effects
Ozone	Eye irritation. Respiratory function impairment.
Carbon Monoxide	Impairment of oxygen transport in the bloodstream, increase of carboxyhemoglobin. Aggravation of cardiovascular disease. Impairment of central nervous system function. Fatigue, headache, confusion and dizziness. Can be fatal in the case of very high concentrations in enclosed places.
Nitrogen Dioxide	Risk of acute and chronic respiratory illness.
Sulfur Dioxide	Aggravation of chronic obstruction lung disease. Increased risk of acute and chronic respiratory illness.
Particulate Matter (PM ₁₀)	Increased risk of chronic respiratory illness with long exposure. Altered lung function in children. With SO ₂ , may produce acute illness.
Particulate Matter (PM _{2.5})	May be inhaled and possibly lodge in and/or irritate the lungs. Same adverse effects as PM ₁₀ .
Lead	Gastrointestinal and central nervous system effects in adults. Anoxeria, vomiting, malaise, convulsions, and possibly, permanent brain damage, in children.

Source: Bay Area Air Quality Management District Air Quality Handbook, 1993; Zannetti, Paolo, *Air Pollution Modeling*, 1990; The Merck Index, 10th ed., 1983.

Carbon Monoxide

In 1995, about 65% of the carbon monoxide (CO) in the Bay Area was generated by motor vehicles./10/ The one-hour and eight-hour CO standards have been occasionally exceeded in San Francisco, San Jose, and Vallejo, which are areas with high traffic volumes and frequent surface inversions during the winter months. Compliance strategies include stricter motor vehicle emission limits statewide, with local biannual motor vehicle inspection/maintenance and transportation control measures.

Particulate Matter

Particulate levels in the Bay Area are low near the coast. Levels increase with distance inland and reach their highest levels in dry, sheltered valleys, such as the Santa Clara, Diablo, and Livermore Valleys. The largest human-caused sources are motor vehicle travel over paved and unpaved roads, demolition and construction activities, and agricultural operations and burning. Natural sources (i.e., wind-raised dust) are also significant. Particulate standards refer to particulates that are small enough to be inhaled (i.e., PM₁₀, those less than 10 microns in diameter) or PM_{2.5}, those less than 2.5

microns in diameter./11/ The state ambient air quality standards for PM₁₀ are exceeded regularly in the Bay Area.

Nitrogen Dioxide

The major sources of nitrogen oxides (NO_x) are vehicular, residential, and commercial fuel combustion. Concentrations of nitrogen dioxide (NO₂), the most abundant form of ambient NO_x, are highest in the South Bay. No NO₂ standard violations have been measured at any monitoring station in the Bay Area since the early 1980's.

Sulfur Dioxide

Burning of high sulfur fuels for activities such as electricity generation, petroleum refining, and shipping is the major source of sulfur dioxide (SO₂). The highest levels of SO₂ are recorded by monitoring stations located in a relatively narrow crescent along the Bay shore of northern Contra Costa County, where major petroleum refineries are located. The SO₂ standard is currently being met throughout the Bay Area.

Lead

The Bay Area is in attainment for both the federal lead standard of 1.5 micrograms per cubic meter (based on a calendar quarter averaging time) and state lead standard of 1.5 micrograms per cubic meter (based on a 30-day average). Lead concentrations have dropped substantially since the introduction of unleaded gasoline. In the last 15 monitoring years, ambient concentrations have not approached the lead standards, and no violations have been reported. The highest concentration recorded in 1996 was 0.48 microgram per cubic meter, approximately one-third of the standard.

Toxic Air Contaminants

Historically, air quality laws and regulations have concentrated on "criteria" pollutants, which are emitted by numerous types of industries, automobiles, and other sources. Over the last decade, the importance of specific, highly toxic pollutants, which often cause cancer, has been realized. These pollutants are called "toxic air contaminants" under California law.

To define toxic air contaminants more specifically, they comprise a category of air pollutants that may cause or contribute to an increase in mortality or serious illness, or that may pose a present or potential hazard to human health. Unlike criteria pollutants, there are no regional ambient standards

for toxic air contaminants; stationary sources of toxic air contaminants are regulated through standards and risk reduction strategies implemented at the sources of emissions. This is primarily due to the localized adverse health impacts caused by toxic air contaminant emissions.

Fundamentals of Risk Assessment

Adverse health impacts from toxic air contaminants are often described in terms of risk. There are four distinct steps to risk assessment: hazard identification, exposure assessment, toxicological assessment, and risk characterization. Hazard identification means determining the compounds of concern. Exposure assessment involves calculating (typically using a computer model) the emission and dispersion of the compounds of concern. Toxicological assessment means gathering the most recent toxicity data for the compounds of concern. Risk characterization roughly means summing up the risks. (Risk assessments are discussed in greater detail under “Toxic Air Contaminants” in Appendix E.)

Toxic air contaminant risks can be chronic (resulting from long-term toxic air contaminant exposure) or acute (resulting from short-term exposure). Chronic health effects can include cancer and noncancer effects. Cancer risk is expressed as an increased risk for an individual or an increase in the number of cancer cases per 1 million persons in a population. Typically, increased cancer risk is expressed in terms of the chance of developing cancer over a lifetime, such as a 10-in-1-million increased risk for an individual.^{/12/} Risk assessments use the term maximally exposed individual (MEI), which is the hypothetical person near a facility who would receive the maximum exposure to toxic air contaminants from the facility (calculated for a resident and for an off-site employee). A residential MEI would be assumed to reside at the MEI location all day, every day, between 30-70 years depending on the risk assessment guidelines being used.^{/13/} An occupational MEI would be assumed to work normal work hours (week days only) at the location for a number of years more typical of employees. More information about how MEIs are determined is provided under “Exposure Assessment” under “Toxic Air Contaminants” in Appendix E.

Noncancer risks are generally not described in terms of cases per million persons in a population. Instead, noncancer risks are described in terms of a “hazard index.” A hazard index compares the maximum exposure an individual is likely to experience to an exposure level considered to be protective of human health. The hazard index is a numerical value derived by dividing the maximum possible exposure by the acceptable exposure. If the hazard index is greater than or equal to 1 (i.e., if the possible exposure exceeds safe levels), adverse health effects could occur.

Regulatory Requirements for Stationary Sources of Toxic Air Contaminants

Key points of federal, state, and regional programs regarding toxic air contaminants are discussed below. "Toxic Air Contaminants" in Appendix E provides additional detail.

Federal Regulations

At the federal level, Title III of the federal 1990 Clean Air Act Amendments regulates certain toxic air contaminants referred to as "hazardous air pollutants." Title III sets forth Maximum Achievable Control Technology (MACT) standards to reduce hazardous air pollutants from specific source categories.^{14/} The U.S. EPA is responsible for developing and enforcing the MACT standards to reduce hazardous air pollutant emissions from specific types of industry source classifications.^{15/} This technology-based approach will eventually address the control and/or reduction of risk from urban area sources after an affected industry has complied with the MACT standards. Title III of the Clean Air Act, as amended, Section 112(r), also addresses risk management concerning the accidental release of extremely hazardous chemicals.

State Regulations

California has taken a different approach to regulating toxic air contaminant emissions from stationary sources than the federal government has. California's approach is risk based, whereas the federal approach is technology based. California's Air Toxics "Hot Spots" Information and Assessment Act of 1987 (also referred to as Assembly Bill 2588) requires facilities (defined as any structure associated with emissions or potential emissions of toxic air contaminants) to quantify their emissions and, if necessary, assess the health risks attributable to these emissions.^{16/} ("Hot Spots" refers to the localized impacts associated with toxic air contaminant emissions.) This program has resulted in substantial reductions in toxic air contaminant emissions throughout the state.

One part of the "Hot Spots" Act deals with the identification of toxic air contaminants and generic ways to reduce their emissions. Based on the information collected under the Air Toxics "Hot Spots" Act and through research and evaluation, the Air Resources Board (ARB) identifies what compounds should be considered toxic air contaminants. ARB has identified over 729 toxic air contaminants (including the 189 federal hazardous air pollutants) as part of the "Hot Spots" Act. After ARB identifies specific toxic air contaminants and evaluates their health effects, ARB may develop measures to control toxic air contaminants from stationary sources. These measures are called Air Toxics Control Measures, and may include control technologies or changes in processes.

Another part of the “Hot Spots” Act deals with individual facilities. The essentials of the “Hot Spots” Act process for an individual facility are as follows: Certain facilities must submit emissions inventory plans, followed by reports describing emissions of toxic air contaminants. Air quality management districts review these reports and prioritize facilities into high, medium, and low priority categories. A “high priority designation” means that a facility requires a comprehensive, facility-wide health risk assessment./17/ If the air district decides the health risks warrant notification of the public, the facility is required to notify its neighbors (for example, through public meetings and direct mail).

If the air district determines that the health risk assessment shows a significant risk associated with the facility’s emissions, the operator must develop a plan that will reduce emissions so that risks are below the significant risk level within five years./18/ The five-year period may be shortened if the air district finds that the facility’s emissions pose an unreasonable health risk or that it is technically feasible and economically practicable to achieve the result earlier./19/ The five-year period may also be extended by an additional five years, if the air district finds that the actions necessary are not technically feasible or would impose an unreasonable economic burden, and the health risk is not unreasonable./20/

The Air Toxics Hot Spots Act was originally intended to assess health impacts associated with emissions from existing facilities,/21/ but recent amendments make the law applicable to new facilities./22/ If a new facility falls outside the local air management district’s permit process, then it must submit an emissions inventory plan and report to the district under the “Hot Spots” Act,/23/ and it must file quadrennial emissions inventory updates.

If an existing or new facility shows that its health risks fall below significance criteria set by the air district, then it may become exempt from further reporting under the Act./24/ But, even if a facility has achieved exempt status, a change in operations or surrounding conditions may make the facility subject to “Hot Spots” Act reporting requirements. Examples of changes in operations that may require additional reporting are: 1) increasing the emissions of a listed substance by more than 100% of the previously reported level, and 2) emitting a listed substance not included in the previous emissions inventory./25/ A key change in circumstances that may require additional reporting is when a sensitive receptor has been established or constructed within 500 meters of the facility after the facility became exempt./26/,/27/ An exempt facility is only required to submit an emissions inventory update for such changes in operations or circumstances if the air district sends the facility a notice requesting an update./28/ This procedure is usually only invoked by the BAAQMD in response to a complaint from the public./29/

Local Programs

At the local and regional level, air quality management districts carry out a number of activities related to toxic air contaminants. In the San Francisco Bay Area, the Bay Area Air Quality Management District (BAAQMD) implements the state's Air Toxics Hot Spots program. BAAQMD may use the inventory compiled under the Air Toxics Hot Spots program to identify sources that pose a substantial risk and adopt a source-specific rule to control emissions from a particular class of stationary sources.^{/30/} BAAQMD also evaluates new facilities for air toxics through its trigger mechanism and its permit program, both of which are discussed below. BAAQMD's "Risk Management Policy" may require that a risk assessment be performed for a facility or that controls be installed for emissions of toxic air contaminants. BAAQMD may also, possibly, deny a permit.^{/31/}

BAAQMD Trigger Mechanism

BAAQMD's trigger mechanism is a means of reviewing the potential toxic air contaminant emissions from a facility to determine if further assessment is required.^{/32/} State law provides a mechanism for cities and counties to identify to BAAQMD projects that may emit toxic air contaminants. Cities and counties are prohibited from issuing final certificates of occupancy for such projects unless the applicants demonstrate compliance with air district permitting requirements.^{/33/} The process is as follows. Local building departments instruct applicants for building permits to contact BAAQMD. When applicants contact BAAQMD, BAAQMD staff request information regarding the types of chemicals to be used, and their potential air emissions.^{/34/} BAAQMD staff compare these potential emissions to "trigger levels" for toxic air contaminants (see Table V.F.6, under "Potential Emissions From the Proposed Project" in the Impacts subsection). Trigger levels roughly represent a (worst case) 1-in-1-million cancer risk or hazard index greater than 1 for a hypothetical maximally exposed individual under worst case conditions. For those toxic air contaminants where toxicology data are unavailable or limited, BAAQMD does not provide trigger levels.

If a facility requiring a building permit would emit any compound above its trigger level, then BAAQMD proceeds to perform, or have the applicant perform, a risk screening analysis. A risk screening analysis uses a simple computer model and worst-case assumptions to conservatively estimate the risk from a project. A risk screening analysis relies on information regarding stack parameters (e.g., height, diameter, flowrate, gas exit temperature); building dimensions; building ventilation; zoning; and distances to the property line and sensitive receptors.^{/35/} BAAQMD staff review this information, and sometimes require a formal risk assessment; a formal assessment uses more specific data and assumptions.

Permit Program

For facilities that must obtain a permit to operate from BAAQMD, BAAQMD's normal permitting procedures require air toxics risk screening analyses. Where an operating permit is required, BAAQMD's position is that an individual facility includes all stationary emissions sources as part of an identifiable business located on a contiguous parcel operated by a single entity./36/ Based on this approach, the proposed UCSF site could be considered one facility by BAAQMD staff, if a UCSF activity were to require an operating permit.

For facilities with an estimated cancer risk greater than 1 in 1 million for the maximally exposed individual, or a ground level concentration in excess of relevant non-cancer effect criteria for the MEI, BAAQMD will require that toxics best available control technology (TBACT) be applied to facility sources. In most cases, BAAQMD will not grant a permit to a facility with a cancer risk greater than 10 in 1 million or an excessive non-cancer health risk. BAAQMD may, within its discretion, approve permits for facilities with risks that exceed these thresholds, assuming that TBACT would be used.

Some types of facilities, including research and teaching laboratories, are ordinarily exempt from obtaining a permit to operate from BAAQMD because their emissions of individual toxic air contaminants typically do not exceed trigger levels./37/ However, a facility (including laboratory facilities) would be required to obtain a BAAQMD permit if it has the potential to emit toxic air contaminants greater than the trigger levels described above, unless it could establish to the satisfaction of BAAQMD that the emissions would pass a risk screening analysis./38/ Thus, if a facility's potential emissions exceed trigger levels (i.e., if adverse health effects could occur), BAAQMD could require the facility to perform a risk assessment.

School Siting Criteria

State laws regulate toxic air contaminant emissions and related risks from exposure from a facility. State laws also require air pollution control districts to prepare and distribute a public notice prior to approving an application for a permit to construct or modify an existing source that emits toxic air contaminants, regardless of quantity, if it is within 1,000 feet of a school./39/ In determining whether or not to grant the permit, the Air Pollution Control Officer is required to take the public's comments into consideration. To enable this to happen, the facility seeking the permit is required to notify the affected public and to receive input from the public on steps that could be taken to minimize risk impacts. The Air Pollution Control Officer also has the authority at any time to take action to address a reasonably foreseeable threat of a toxic air contaminant release from a source

within 1,000 feet of the boundary of a school, if the release would violate emissions limits. These actions could include issuing an order to prevent the release, if required to prevent or minimize injury./40/

State law also requires consideration of health and safety risks through the school site selection process. A school district may not approve a school site acquisition unless, among other things, the lead agency preparing the environmental impact report or negative declaration for the school has consulted with the air quality management district to identify facilities with potentially hazardous air emissions within one-fourth mile of the school site. The district must make a written finding that either there are no such facilities or that the health risks from the facilities would not pose an actual or potential health risk to students or staff./41/

Regulatory Requirements for Mobile Sources of Toxic Air Contaminants

Vehicles emit toxic air contaminants, including benzene, polycyclic aromatic hydrocarbons, and formaldehyde. Currently, there is no regulatory guidance or scientific consensus for estimating risks from mobile sources. Modeling toxic air contaminant emissions from mobile sources is rarely undertaken due to its difficulty and complexity. There are no control requirements for toxic air contaminant emissions from mobile sources, except for lead,/42/ but as new fuels are developed or other measures are implemented to reduce criteria pollutants, it is likely that toxic air contaminant emissions will decrease. Emissions control measures for mobile sources have typically focused on vehicle emissions and fuel efficiency standards, and recently on reformulation of fuels.

REGIONAL AND LOCAL AIR QUALITY

Criteria Air Pollutants

The BAAQMD has compiled inventories and projections of CO, ROG, NO₂, SO₂, and PM₁₀ emissions for the major pollutant sources in the Bay Area for the years 1995, 2000, and 2010. Table V.F.3 presents a summary of the emissions inventory and trends of air pollutants for the Bay Area. The substantial reductions apparent in the ROG and CO emissions from 1995 to 2000 are attributed to the stringent emission controls that have been or will be imposed on motor vehicles and stationary sources. PM₁₀ is forecasted to increase, mostly due to the growth in motor vehicle travel foreseen for the Bay Area. SO₂ is also forecasted to increase. The BAAQMD emissions projections assume the following:

TABLE V.F.3
BAY AREA CRITERIA POLLUTANT EMISSIONS INVENTORY AND PROJECTIONS
(Tons/Day - Annual Average)

	<u>CO</u>	<u>ROG/a/</u>	<u>NO₂</u>	<u>SO₂</u>	<u>PM₁₀/b/</u>
1995					
Total Emissions	2,425	535	454	102	462
Motor Vehicle Emissions	1,598	242	200	10	321
(Motor Vehicles' Percent of Total)	(66%)	(45%)	(44%)	(10%)	(70%)
2000					
Total Emissions	1,963	464	441	107	501
Motor Vehicle Emissions	1,108	166	171	10	355
(Motor Vehicles' Percent of Total)	(56%)	(36%)	(39%)	(9%)	(71%)
2010					
Total Emissions	1,600	406	449	115	582
Motor Vehicle Emissions	697	88	161	12	427
(Motor Vehicles' Percent of Total)	(44%)	(22%)	(36%)	(10%)	(73%)

Notes:

- a. Reactive organic gases (excluding emissions from natural vegetation).
- b. Including entrained road dust. (Projections are based on the Base Year 1990 Air District Emission Inventory.)

Source: Bay Area Air Quality Management District and Association of Bay Area Governments, *Improving Air Quality Through Local Plans & Programs*, October 1994.

- Population, housing, employment, economic growth, and land use will increase as regionally forecast./43/
- Cars will become cleaner, as required by California regulations.
- The recently improved "Smog Check" program will continue.
- Controls on industry and business will continue.
- Current transportation control measures will continue.

Both the federal Clean Air Act and the California Clean Air Act require that the State Air Resources Board designate as "nonattainment areas" portions of the state where federal or state ambient air quality standards are not met. The nine-county San Francisco Bay Area Air Basin has a history of recorded violations of federal and state ambient air quality standards for ozone, carbon monoxide, and PM₁₀. Since the early 1970's, substantial progress has been made toward controlling these pollutants.

In 1995, the U.S. Environmental Protection Agency (U.S. EPA) designated the Bay Area as an attainment area for the federal ozone standard/44/ and is considering a request for a similar designation for the federal CO standard. However, U.S. EPA recently redesignated the Bay Area as nonattainment for ozone because of violations of the standard in 1995 and 1996. The California Air Resources Board has designated the Bay Area as an attainment area for the state CO standard. Occasional violations of state ozone and PM₁₀ standards still persist, however, and although further air quality improvement is anticipated, attainment of state standards for these pollutants is not expected within the current 20-year planning horizon. In summary, the Bay Area is not in attainment for ozone under federal and state standards, and not in attainment of state PM₁₀ standards.

BAAQMD operates monitoring stations at 10 Arkansas Street at the foot of Potrero Hill, about a mile southwest of the Project Area, and at 939 Ellis Street, about 2 miles northwest of the Project Area. Appendix Table E.1 summarizes the most recent five years of available data. The following conclusions can be drawn from these data: ozone, CO, and NO₂ levels near the monitoring stations have not exceeded federal or state standards for the past five years; PM₁₀ levels near the monitoring stations occasionally exceed the state 24-hour standard, but not the federal standard.

Toxic Air Contaminants

Regional

In the Bay, BAAQMD reports that the background cancer risk from the combined emissions of toxic air contaminants from stationary and mobile sources is approximately 303 in 1 million over a lifetime in downtown San Francisco./45/,/46/ Ambient levels of toxic air contaminants in air are reasonably consistent throughout the Bay Area. Other factors (e.g., genetic predisposition, diet, use of tobacco products, and exposure to sunlight) affect the total cancer risk each individual experiences. Roughly one in three individuals contracts cancer within his or her lifetime./47/ This corresponds to a total risk of about 333,000 cancer cases for every 1 million persons. As indicated above, approximately 300 of these 333,000 cases can be attributed to toxic air contaminant exposure in ambient air.

Local

BAAQMD measures ambient levels of toxic air contaminants at a number of monitoring stations. Table E.2 in Appendix E summarizes 1996 monitoring data for selected toxic air contaminant concentration levels at 10 Arkansas Street, near the Project Area. The largest mean concentrations of toxic air contaminants were observed for toluene, meta/para-xylene, methylene chloride, and benzene. Toluene and benzene are usually associated with automobile emissions. These data represent the

combined emissions of toxic air contaminants from various emission sources, including stationary and mobile sources.

Currently, the Project Area is industrial in nature and is occupied by warehouses, concrete and gravel processing facilities, truck terminals, light manufacturing, and a few auto body shops. Typical toxic air contaminant emissions from such sources include crystalline silica, chromium, and isocyanates. Emissions inventory data from these facilities are unavailable.

Residential receptors are not located adjacent to existing stationary sources of toxic air contaminants in the Project Area. Residences near the Project Area include houseboats in the Channel, live/work units near the intersection of 18th and Minnesota Streets, and residences near Tennessee and 18th Streets and several blocks south of this intersection. Since risk decreases with distance from the sources of toxic air contaminants, it is likely that nearby residents are not currently substantially affected by emissions from Project Area sources.

IMPACTS

STANDARDS OF SIGNIFICANCE

A project would have a significant effect on the environment with respect to air quality if it would violate any ambient air quality standard or contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations, or permeate its vicinity with objectionable odors.

BAAQMD has established thresholds for assessment of project impacts on air quality that are commonly employed in determining the significance under CEQA of most air quality impacts. In its CEQA Guidelines, BAAQMD sets forth different standards of significance and different methodologies for evaluating projects and plans (defined below). While the Mission Bay project has aspects of both a plan and a project, its size, scope, and two Redevelopment Plans make it more like a plan. This section, however, describes both project-related and plan-related standards of significance.

Criteria Air Pollutants

To evaluate criteria air pollutants on a project level, construction-related emissions are typically considered less than significant if appropriate mitigation is employed to minimize particulate emissions. For operational impacts, emissions of 80 pounds per day of reactive organic gases,

nitrogen oxides, and inhalable particulates are considered significant. Carbon monoxide (CO) emissions are considered in the context of roadside concentrations, since CO is a local pollutant that does not readily disperse. CO concentrations are measured against the state standard (which is more stringent than the federal standard).

To evaluate criteria pollutants using a plan-level analysis, in accordance with the BAAQMD CEQA Guidelines, plans would have a less than significant impact if the following can be demonstrated over the planning period:/48/

- populations growth for the jurisdiction will not exceed the values included in the current *Clean Air Plan*, and
- the rate of increase in vehicle miles traveled for the jurisdiction is equal to or lower than the rate of increase in population.

For example, the BAAQMD CEQA Guidelines use these tests to determine whether a General Plan is consistent with the BAAQMD's *Clean Air Plan*.

Toxic Air Contaminants

BAAQMD's CEQA Guidelines address the significance of toxic air contaminant emissions. For the CEQA analysis of a development project, BAAQMD recommends that any project with the potential to expose sensitive receptors (including residences) or the general public to substantial levels of toxic air contaminants would be deemed to have a significant impact./49/,/50/ Generally, BAAQMD uses the term "project" to refer to a single facility. Proposed development projects that have the potential to expose the public to toxic air contaminants in excess of the following thresholds would be considered to have a significant air quality impact. These thresholds are, in part, based on California's Proposition 65 reporting requirements for chemicals known or suspected to cause cancer./51/

- Probability of contracting cancer exceeds 10 in 1 million for the maximally exposed individual (MEI)./52/
- Ground-level concentrations of noncarcinogenic toxic air contaminants would result in a hazard index greater than 1 for the maximally exposed individual.

These criteria refer to incremental risk of the proposed project.

In contrast to a project-level analysis, for the CEQA analysis of a local plan, BAAQMD does not recommend specific risk thresholds as standards of significance. Rather, the significance test is qualitative./53/ BAAQMD recommends that buffer zones be established around existing and

proposed land uses that would emit toxic air contaminants to ensure that the impact is less than significant./54/ BAAQMD includes general plans, redevelopment plans, general plan amendments, and specific area plans, in its definition of local plans./55/

CRITERIA AIR POLLUTANTS

Methodology

Regional Air Quality

Mobile Sources

For the project-level analysis, the URBEMIS, version 5, computer model (URBEMIS5) was used to assess regional air quality impacts that would result from the project-related traffic. URBEMIS5 was developed by the California Air Resources Board as a planning tool to help assess the impacts of proposed projects. URBEMIS5 utilizes the EMFAC7F1.1 emission factors to assess the pollutants which would be generated by vehicle trips associated with the project land uses. Trip generation numbers were developed for each of the land use categories, and average trip lengths were also calculated from each of the project subareas. The default values recommended by the BAAQMD CEQA Guidelines for percentages of cold starts and trip speed were also utilized in this analysis. All pollutants were analyzed under summer temperature conditions using a temperature of 75 degrees Fahrenheit except carbon monoxide, which was analyzed under winter temperature conditions at 50 degrees Fahrenheit.

Stationary Sources

Emissions from stationary sources were estimated using standard emission factors from the U.S. EPA.

Local Carbon Monoxide Concentrations

For the “project”-level analysis, Caltrans’ CALINE4 program was used to model local CO impacts. The CALINE4 model was used according to the Caltrans guidelines (“*CO Protocol*”)./56/ Emission factors recommended by the BAAQMD CEQA Guidelines were used. More detail on CO analysis methods is presented in Appendix E.

For the purpose of this analysis, CO concentrations were modeled under "worst-case" conditions at all of the intersections. Under worst-case conditions, receptors are placed in locations of maximum exposure, and a stable atmospheric environment is assumed in which dispersion of CO concentrations is minimal. The receptors were sited according to *CO Protocol* recommendations: for one-hour CO levels, receptors were located at 5 meters (16 feet) from the near edges of the nearest travel lanes; for eight-hour CO levels, at 7 meters (23 feet) from the near edges of the nearest travel lanes. If sensitive receptors were located at these minimum setback distances, they would experience the theoretical, projected maximum CO concentrations. Since CO levels fall off rapidly as distance from the intersection increases, sensitive receptors located at greater setback distances would experience much lower CO levels. At most of the modeled CO receptors, only the nearest surface streets were included because of their dominant influence on local CO levels.

Analysis of Plan Impacts

To perform a plan-level analysis, the population estimates for the Mission Bay plan were compared to the population assumptions in the 1997 *Clean Air Plan* (CAP). The Mission Bay population assumptions are based on the San Francisco cumulative growth scenario/57/ while the 1997 CAP population assumptions are based on ABAG *Projections '96*.

Regional Air Quality Impacts

Mobile Sources

For the "project"-level analysis, Table V.F.4 shows the BAAQMD's significance thresholds for the evaluation of the ozone precursors, particulate matter, and the threshold for further analysis of carbon monoxide. The primary source of these pollutants during project "operation" would be vehicular emissions from new traffic associated with development of the Project Area. The project's average daily emissions were estimated using vehicular emissions factors from the California Air Resources Board's computer model (EMFAC7F1.1) combined with estimated vehicular miles traveled for trips associated with the project's land uses.

As Table V.F.4 shows, vehicular emissions of ROG, NO_x, and PM₁₀ would exceed the 80 pound-per-day (lb/day) significance threshold. Emissions of ROG, NO_x, and PM₁₀ would be more than ten times greater than their respective thresholds. Maximum development under the proposed project would have a potentially significant impact to ozone, since the Bay Area is not in attainment under applicable ozone standards. The project would also have a significant regional impact in terms of

**TABLE V.F.4
ESTIMATED VEHICULAR EMISSIONS FROM PROJECT-RELATED TRAFFIC
AT BUILD-OUT (2015)**

Pollutant	BAAQMD Significance Threshold (lb/day)	Estimated Vehicular Emissions in 2015 (lb/day)
Reactive Organic Compounds/a/	80	865
Nitrogen Oxides/a/	80	1,324
Particulate Matter/a/	80	1,968
Carbon Monoxide/b/	550	12,228

Notes:

- a. The BAAQMD regards this amount of emissions as a threshold of significance for a regional impact.
- b. For carbon monoxide, the BAAQMD does not regard 550 lb/day as a threshold of significance, but rather, an indicator to perform micro-scale analysis.

Source: EIP Associates. Estimates are results of modeling using the California Air Resources Board's URBEMIS version 5 model.

PM₁₀ emissions. Because CO emissions would be more than 550 lb/day, micro-scale analysis of CO concentrations at the intersection level is appropriate, as provided below.

Mitigation Measure F.1 would require implementation of measures to decrease vehicle trips as discussed in this SEIR (see "Traffic Impacts" in Section V.E, Transportation: Impacts). Even if these trip reduction measures are imposed upon the project, they would not reduce vehicle emissions of ROG, NO_x, and PM₁₀ below the respective BAAQMD significance thresholds, because the projected emissions are so far above the thresholds. The effectiveness of transportation control measures is too limited to achieve such reductions./58/ Therefore, the vehicular emissions, specifically of ROG, NO_x, and PM₁₀ from maximum development of the Project Area would be an unavoidable significant air quality impact.

Stationary Sources

For the “project”-level analysis, project development would include new facilities and stationary equipment such as boilers, chillers, emergency generators, and possibly a cogeneration plant (within the UCSF portion of the Project Area). This equipment would generate criteria air pollutants, such as CO, SO₂, PM₁₀; ozone precursors (ROGs and NO_x); and toxic air contaminants. The primary source of these emissions would be the combustion of fossil fuels, either natural gas or diesel oil. The nature and extent of the emissions from these sources is not known at this time, as it depends upon the number, type, and rated capacity of the units installed and the efficacy of control equipment. Many of the new buildings in the Project Area would rely on electricity from a utility company for supply of power for heating and cooling. Some buildings would possess individual boilers, emergency generators, and chillers. Annual operational energy consumption was tabulated in the Initial Study (see Appendix A, Table A.2).

The source categories with the largest natural gas consumption would be UCSF and the Commercial Industrial uses. This natural gas consumption is largely attributable to boilers and emergency generators. The actual consumption rate and resulting emissions would vary widely depending on the type of equipment installed. No specific consumption rates are available for proposed Commercial Industrial development, but UCSF rates may be comparable to other future individual development. For example, if UCSF installs small commercial boilers equipped with low NO_x burners in individual buildings, the potential emissions increase per year would be 2.34 tons of VOCs, 16.6 tons of CO, 10.5 tons of NO_x, 0.4 ton of SO_x, and 2.8 tons of PM₁₀.^{/59/} However, if UCSF installs a central cogeneration plant rated at 148 million British Thermal Units (BTU) per hour, the potential emissions increase per year, before control, would be 0.9 ton of VOCs, 24.6 tons of CO, 49.9 tons of NO_x, 0.4 ton of SO_x, and 1.9 tons of PM₁₀.^{/60/} Diesel-fired emergency standby engines on the UCSF site could contribute additional yearly emissions of 7.2 tons of VOCs, 16.4 tons of CO, 75.5 tons of NO_x, 1.1 tons of SO_x, and 5.2 tons of PM₁₀. Actual emissions may be reduced through the use of Best Available Control Technology, as explained below.

Installation of new equipment would be subject to BAAQMD’s New Source Review (NSR) rule which is intended to ensure that the Bay Area achieves compliance with all National Ambient Air Quality Standards and to prevent further deterioration of air quality. Under NSR, equipment with emissions over 10 pounds per day of VOCs, CO, NO_x, SO₂, or PM₁₀ would be required to install Best Available Control Technology (BACT).^{/61/} Installation of BACT would substantially reduce the potential emissions. In addition to the provisions of BACT, emissions offsets would be required for emissions of ozone precursors over 15 tons per year.^{/62/} While pollutants emitted by the stationary equipment could potentially interfere with the attainment of regional and local air quality standards,

the NSR rule accounts for cumulative pollutant increases through the use of emission offsets and BACT. Therefore, emission increases from new stationary sources are accounted for in the BAAQMD's ozone attainment plan through the NSR rule. Compliance with the BAAQMD's NSR rule would substantially reduce emissions and result in a less than significant impact from stationary source emissions of criteria air pollutants.

Local Carbon Monoxide Concentrations

For the project-level analysis, thirteen intersections were chosen to represent a combination of specific sensitive land uses in the Project Area, based on a visual survey. Figure V.F.1 shows the locations of the intersections modeled in and near the Project Area. The intersection of Mariposa and De Haro Streets is adjacent to a church. Possible residential receptors were identified at 4 of the 13 intersections modeled: Bryant and Second Streets, Harrison and Second Streets, Third and Townsend Streets, and Harrison and Fremont Streets.

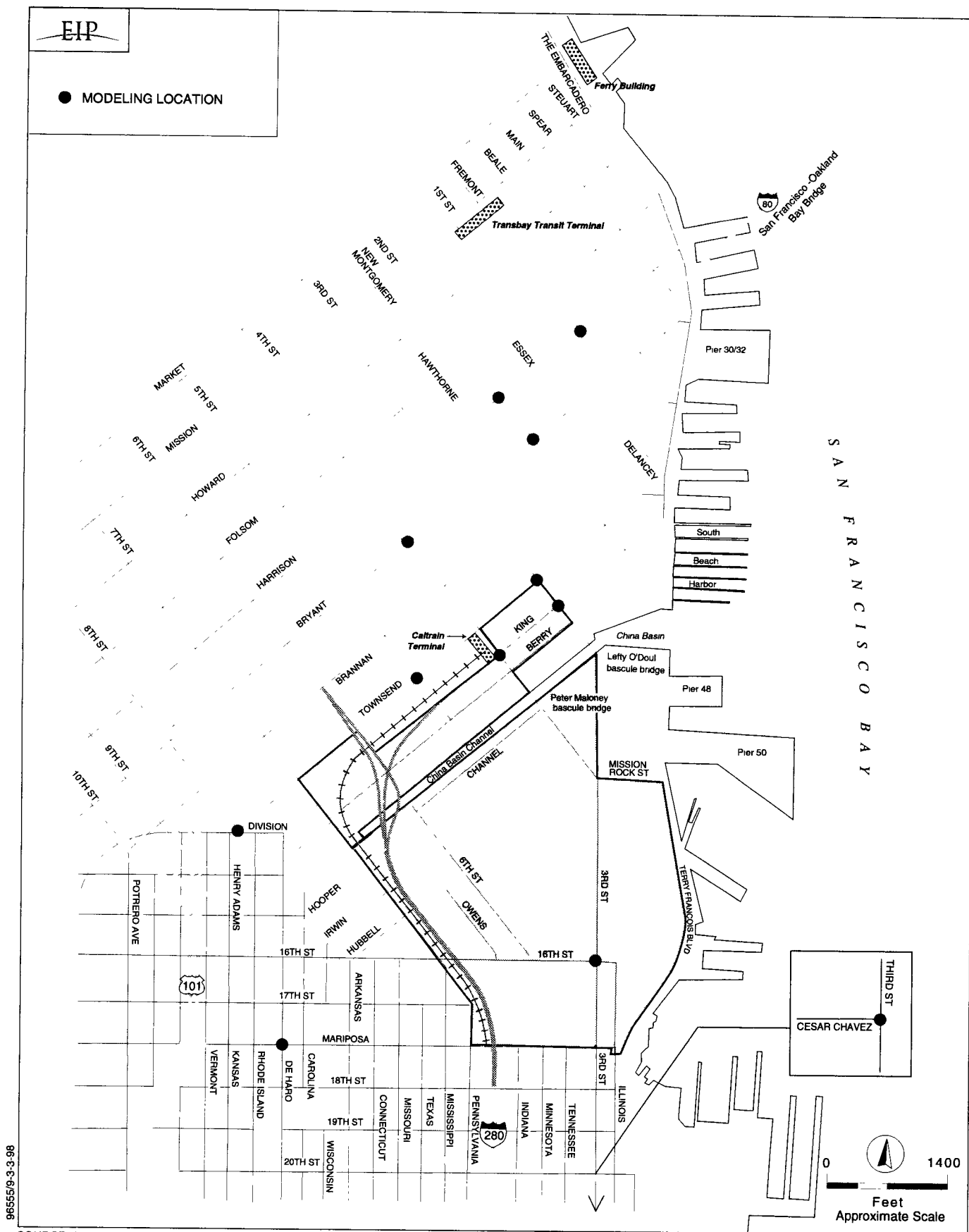
Traffic information for the following four scenarios, as calculated by the project transportation consultants, was used to estimate the local CO concentration impacts:

- Existing (1997)
- Existing with Project
- Cumulative without Project (2015)
- Cumulative with Project (2015)

Existing traffic conditions were modeled using current traffic volume information for the selected intersections. The future cumulative scenario was analyzed for the year 2015, both with and without the project development, using employment estimates, and corresponding traffic estimates for proposed development plans and other areas of the City.

Total CO concentrations were obtained by adding regional background levels to the local CO concentrations estimated using the CALINE4 model. Background CO levels were determined by applying the methodologies specified in the *BAAQMD CEQA Guidelines*.

The BAAQMD considers local CO concentrations to be significant if they exceed state or federal ambient standards. Project or cumulative sources would contribute significantly to these impacts if they produced measurable increases in CO levels at places where CO standards would be exceeded./63/ Worst-case one-hour and eight-hour average CO concentrations were estimated, as shown in Table V.F.5.



96555/9-3-3-98

SOURCE: EIP Associates

MISSION BAY SUBSEQUENT EIR
FIGURE V.F.1 SELECTED INTERSECTIONS FOR MODELING
OF LOCAL CARBON MONOXIDE CONCENTRATIONS

TABLE V.F.5
ESTIMATED EXISTING AND FUTURE LOCAL CARBON MONOXIDE CONCENTRATIONS AT SELECTED
INTERSECTIONS IN AND NEAR THE PROJECT AREA

Intersection (Streets)	One-Hour Total CO Concentration (ppm)/a/				Eight-Hour Total CO Concentration (ppm)/b/			
	2015		2015		2015		2015	
	Existing 1997	Existing with Project	Cumulative without Project/c/	Cumulative with Project/c/	Existing 1997	Existing with Project	Cumulative without Project/c/	Cumulative with Project/c/
Second and Harrison	14.5	17.0	8.1	8.8	8.8	10.2	5.0	5.5
Harrison and Fremont	12.4	13.3	7.0	7.5	7.4	8.2	4.5	4.8
Mariposa and De Haro	8.4	8.6	5.5	5.6	5.4	5.6	3.7	3.7
Third and 16th	14.4	21.9	8.6	11.0	8.1	12.0	5.1	6.3
Third and César Chavez	15.3	21.5	8.9	10.5	8.7	12.0	5.5	6.2
Third and King	20.5	29.1	10.6	13.6	11.3	15.0	6.2	7.6
Third and Townsend	19.2	26.8	10.5	12.1	10.0	13.4	6.0	6.6
Fourth and Bryant	14.2	16.0	7.8	8.3	8.6	9.5	4.9	5.3
Fourth and King	19.4	25.6	9.4	12.1	10.5	13.1	5.6	6.9
Eighth and Townsend	11.1	20.1	6.6	9.9	6.8	11.2	4.2	5.4
Second and Bryant	12.0	16.6	7.6	8.9	7.4	9.7	4.7	5.6
Seventh and Townsend	16.5	23.0	9.6	10.1	9.1	11.9	5.6	5.6
Fifth and King	18.6	22.6	9.5	10.8	10.0	11.9	5.5	6.1

Notes:

- a. The state one-hour standard is 20 ppm; the federal one-hour standard is 35 ppm.
b. The state and federal eight-hour standard is 9 ppm.
c. Estimated CO concentrations in 2015 are generally lower due to emission controls (i.e., cleaner cars) in the future.

☐ = State and federal standard exceeded

☐ = State standard exceeded

Source: EIP Associates.

Existing Conditions

Existing emission factors (1997) and traffic data were used to prepare modeling estimates, which show that violations of the state and federal CO standards now occur from traffic under existing conditions.

Under existing conditions, 1 of the 13 intersections modeled violated the state's one-hour CO standard of 20 ppm/64/. No violations of the federal CO standard (35 ppm) were indicated. The intersection of Third and King Streets showed the highest concentration at 20.5 ppm. The remaining ten intersections had CO concentration values ranging from 8.4 ppm to 19.4 ppm, all of which are below state and federal standards. The lowest CO concentration was estimated at the intersection of Mariposa and De Haro Streets, near a sensitive receptor (church).

Carbon monoxide concentrations at 5 of the 13 modeled intersections were estimated to violate the eight-hour state and federal standards of 9 ppm. The highest concentration (11.3 ppm) was at the intersection of Third and King Streets. The lowest concentration (5.4 ppm) was estimated at the Mariposa and De Haro Streets intersection.

Existing-with-Project Conditions

The existing-with-project analysis evaluated potential impacts using the hypothetical assumption that instantaneous project development would occur in 1997 in order to compare project air quality effects with the existing setting, as called for in CEQA./65/,/66/ Using emission factors for the existing vehicle fleet and projected increased traffic levels associated with the Mission Bay project development, violations of the one-hour and/or eight-hour air quality standards would result at almost all of the intersections studied. However, full build-out is not likely to occur until after the year 2015, when, due to implementation of anticipated stringent CO controls (i.e., cleaner cars), emissions would be considerably less; therefore, anticipated exceedances of CO standard are expected to be eliminated (see discussion in "Cumulative Conditions with Project, Year 2015," below).

In this hypothetical situation, one-hour violations of the state standard (i.e., concentrations above 20 ppm) were estimated to occur at 8 of the 13 intersections in the study, ranging in concentration from 20.1 ppm to 29.1 ppm. The highest concentration was modeled at the intersection of Third and King Streets. The intersection of Mariposa and De Haro experienced the lowest concentration at 8.6 ppm.

Under these hypothetical circumstances, violations of the state and federal eight-hour CO standards (9 ppm) would occur at 11 of the 13 intersections modeled. Concentrations at the intersections of

Harrison and Fremont Streets and Mariposa and De Haro did not exceed the standard. The highest value (15.0 ppm) was estimated at the intersection of Third and King Streets.

Cumulative Conditions without Project, Year 2015

For the future cumulative growth conditions without the project, all of the intersections modeled would be below the state and federal standards for one-hour and eight-hour exposures. For one-hour worst-case exposure concentrations, the values ranged from 5.5 ppm to 10.6 ppm. The highest one-hour concentration was estimated at the intersection of Third and King Streets. The lowest concentration was at the Mariposa and De Haro Streets intersection.

Estimated worst-case eight-hour exposure concentrations ranged 3.7 ppm to 6.2 ppm, with the intersection of Third and King Streets having a concentration of 6.2 ppm. The lowest concentration was projected at the intersection of Mariposa and De Haro Streets.

Cumulative Conditions with Project, Year 2015

As indicated by the analysis, no violations of the state and/or federal one-hour or eight-hour CO standards at any of the intersections modeled would be anticipated for the Cumulative-with-Project scenario. For one-hour estimates, values ranged from 5.6 ppm to 13.6 ppm, well below the 20 ppm state standard. As in the other scenarios, the highest concentration was estimated at the Third and King Streets intersection and the lowest at the intersection of Mariposa and De Haro Streets.

Estimated eight-hour CO concentrations were also below the state and federal standards of 9 ppm. Values ranged from 3.7 ppm (Mariposa and De Haro Streets) to 7.6 ppm (Third and King Streets).

Although there would continue to be large project-related traffic volume increases and low vehicular travel speeds in the Project Area, their adverse effects on CO levels would be offset by the stringent vehicular CO emission controls expected to be implemented over the next 20 years.^{67/} In general, in both 1997 and 2015, one-hour and eight-hour CO concentrations would increase with the addition of traffic associated with the project. In general, CO concentrations at all of the intersections were shown to decrease in 2015, compared to 1997 levels.

Mission Bay Project with Giants Ballpark, Year 2015

The modeling results discussed above already take into account cumulative traffic, but they do not specifically model cumulative traffic with the Mission Bay project and traffic from an event at the Giants Ballpark at the p.m. peak hour. The Giants Ballpark EIR contains a cumulative transportation

and air quality analysis, including UCSF/Mission Bay development with ballpark traffic added/68/, and that analysis is incorporated by reference and summarized below.

Modeling results for CO concentrations in the Giants Ballpark EIR indicate that no violations of the state and federal CO standards would occur in the Cumulative with Project, year 2015 conditions./69/

Plan-Level Analysis

As described above under "Standards of Significance" the plan-level analysis has two components: a population projection component and a vehicle miles traveled component. First, the Mission Bay North Redevelopment Plan and the Mission Bay South Redevelopment Plan would cause a significant air quality impact if the population growth would exceed the population growth assumptions in the current *Clean Air Plan* (CAP). The population assumptions for the Mission Bay project are presented in Section V.C, Business Activity, Employment, Housing, and Population. These were compared to the assumptions in the 1997 CAP, which relied upon ABAG *Projections '96* projections. Appendix Table E.3 shows the comparison; the San Francisco cumulative growth scenario used for Mission Bay is higher than the CAP population assumptions.

It should be noted that the 1997 Clean Air Plan is based on ABAG *Projections '96* which were recently updated by ABAG *Projections '98*. *Projections '98* have population estimates which are more consistent with those used in the project analysis (see Appendix Table C.9 for a comparison). The CAP will be updated in 2000 and will most likely use updated population estimates. Therefore, the inconsistency between the plans may only occur on a short-term basis.

The second test is whether the rate of increase in vehicle miles traveled for the jurisdiction is equal to or lower than the rate of increase in population. Because the project would include land uses which could attract regional trips, vehicle miles traveled could increase at a higher rate than the projected increase in population. However, such an increase might be minimized by the provisions and mitigation measures that promote transit use. In addition, the *General Plan* discourages automobile use and encourages alternative transportation, which is consistent with the types of Transportation Control Measures called for in the *'97 Clean Air Plan*.

Because the population assumptions for Mission Bay exceed those presented in the 1997 CAP and VMT could increase at a higher rate than the projected population increase, the plan would have a significant air quality impact./70/

Although not part of current plan-level analysis methodologies, another consideration is potential contribution of greenhouse gases. The project would result in greenhouse gases from stationary and mobile sources which would contribute to the atmospheric concentrations. The exact nature and extent of these emissions can not be accurately quantified at this time because it is dependent upon the nature of stationary equipment installed, fuel combustion rates, and emission increases of greenhouse gases from mobile sources. Because climate change occurs on a global level, the emission increases associated with this project would not be expected to significantly alter the atmospheric concentrations. Although greenhouse gases are attributable to the project, these emissions are only a small portion of emissions associated with national and global development.

Air Pollutant Emissions from Demolition and Construction Activities

Demolition and construction activities can generate emissions that impact air quality. Of concern are PM_{10} emissions.

The SEIR analysis of project construction impacts follows BAAQMD recommendations in focusing effort on the development of effective and comprehensive PM_{10} control measures rather than the detailed quantification of emissions, primarily because the mitigation measures, if adopted, would reduce temporary construction air quality impacts to insignificant levels./71/ The BAAQMD does not consider construction emissions of CO and ozone precursors significant, because they have already been included in the District's regional planning inventories and are not expected to impede regional attainment or maintenance of air quality standards.

Demolition and excavation activities, construction vehicle travel on unpaved ground, and wind blowing over exposed earth surfaces would generate PM_{10} . Such emissions and the resultant ambient concentrations near construction sites would be very sensitive to local meteorology and topography, to variations in soil silt and moisture content, and to the intensity of equipment use. Such emissions could be as high as 51 lb/acre/day for each construction site. Calculation of construction-related PM_{10} is shown in Appendix E. These emissions could lead to violations of federal and state ambient PM_{10} standards at nearby sensitive receptors, particularly the existing and proposed residential uses north, south, and west of the Project Area, unless a BAAQMD-approved program of mitigation measures were imposed. Emissions leading to violation of federal and state ambient PM_{10} standards during construction would be a significant impact; Mitigation Measure F.2 in Section VI.F, Mitigation Measures: Air Quality, would address this impact. With proper control, PM_{10} emissions would be reduced substantially. The use of water as a dust suppressant can reduce particulate emissions by as much as 90% when applied properly in a diligent manner./72/ The effectiveness of the control depends on a number of factors including frequency of watering, percentage of silt, and wind speed.

TOXIC AIR CONTAMINANTS

The Mission Bay project includes both Redevelopment Plans and a somewhat detailed proposed land use development program. The land use development program as proposed by Catellus and the Redevelopment Agency sets forth certain land uses, including enumerated limits on square footage by use, height zones that in turn would influence stack heights and locations of potential sensitive receptors within the Project Area. While the Mission Bay project has aspects of a local plan and aspects of a project, its size, scope, and two Redevelopment Plans make it more like a plan in terms of the BAAQMD CEQA Guidelines. Information about the specific characteristics of Project Area toxic air contaminant sources is not available at the level of detail necessary to support a quantitative analysis of risk, as would be needed to use BAAQMD's project-level significance criteria. It is therefore more appropriate to evaluate the potential toxic air contaminants impact qualitatively in terms of buffer zones.

Under the BAAQMD CEQA Guidelines, a project with a significant air quality impact automatically would be deemed to have a significant cumulative air quality impact. The BAAQMD CEQA Guidelines do not specifically address the manner in which the cumulative impact of a local plan should be assessed with other adjacent development.

Locations of Future Sensitive Receptors

The BAAQMD CEQA Guidelines define sensitive receptors for toxic air contaminant impact analysis to include residences, schools, and child care facilities.^{73/} Several proposed land use designations would include these uses, as described in greater detail in "Proposed Land Uses" in Section III.B, Project Description. Residences would be located on at least a portion of each large block in Mission Bay North and on each large block in the Central Subarea of Mission Bay South, with the exception of the hotel block. Commercial Industrial uses and UCSF would be located to the south of The Common. A public school would be located somewhere within the UCSF Subarea. Before the final decision regarding the location of the proposed school is made, the location would be reviewed using the criteria described under "School Siting Criteria" in the Setting section, above. These criteria include consideration of toxic air contaminant emissions sources.

Local-serving child care facilities could be located throughout the Project Area, with the exception of the Mission Bay Open Space and Mission Bay Public Facilities land use designations. Local-serving child care facilities would be allowed as principal uses within the Mission Bay North Retail, Mission Bay South Retail, Hotel, and Commercial Industrial/Retail land use designations. In addition, local-serving child care facilities would be allowed as secondary uses within the Mission Bay Residential

and Commercial Industrial land use designations. UCSF plans to have child care facilities within its site. Local-serving child care facilities would provide less than 24-hour care for children of residents and employees in the surrounding neighborhood. Non-local-serving child care facilities would not be permitted under the proposed Redevelopment Plans.

Existing residential receptors near the Project Area are expected to remain. These include houseboats in the Channel, live/work units near the intersection of 18th and Minnesota Streets, and residences near Tennessee and 18th Streets and several blocks south on Minnesota Street. Other existing sensitive receptors are Potrero Hill Middle School students located at 19th and De Haro Streets, about six blocks southwest of the Project Area.

Potential Emissions from the Proposed Project

Under the proposed project, toxic air contaminants would be released from various sources in the Project Area, including stationary sources and mobile sources. Toxic air contaminants could also be released during construction, as addressed under "Contaminated Soils" at the end of this section and in "Previously Unidentified Subsurface Hazards Encountered During Construction," in Section V.J, Contaminated Soils and Groundwater: Impacts.

Stationary Sources

Expected Types of Toxic Air Contaminant Emissions

Routine emissions of toxic air contaminants would be generated by several types of stationary sources in the Project Area, including boilers and emergency generators, research and development facilities, light industrial operations, and retail operations. With the exception of the uses planned by UCSF, the proposed businesses/74/ that would be located in the Project Area can be described and analyzed only in general terms and by industry type, because specific uses have not been identified. Therefore, the potential future operations and resulting emissions of these businesses can only be described in terms of industry profiles rather than in detail on a use-specific basis. Of the uses that would be allowed under the Redevelopment Plans, light industrial, research and development, and various service businesses (dry cleaning, automobile service station, printing shop, newspaper publication, blueprinting shop, sign-painting, sheet metal fabrication) would have the greatest potential to emit toxic air contaminants, based on the types and quantities of hazardous materials they may handle. These uses would be allowed within the Commercial Industrial, Commercial Industrial/Retail, and UCSF land use designations. (The types and quantities of hazardous materials associated with UCSF

and Commercial Industrial Uses are discussed in “Hazardous Materials Use, Storage, and Disposal” under Section V.I, Health and Safety: Impacts.)

Examples of the types of toxic air contaminants that could be used by facilities in the Commercial Industrial, Commercial Industrial/Retail, and UCSF land use designations are provided in Table V.F.6 along with trigger levels established by the BAAQMD for some of the substances. As explained in the Setting, above, trigger levels are the emission rates (pounds per year) that would most likely result in cancer risk levels below 1 in 1 million or a hazard index less than 1 under worst case conditions. Facilities that emit toxic air contaminants at rates above these trigger levels are required to evaluate the risks they pose. For those toxic air contaminants where toxicology data are unavailable or limited, BAAQMD does not provide trigger levels.

In addition to toxic air contaminant emissions associated with chemicals used in research and development facilities, toxic air contaminant emissions would also result from operation of utility equipment, such as boilers and emergency back-up generators. Toxic air contaminants of potential concern from the combustion of natural gas in boilers and diesel fuel in generators are benzene, polycyclic aromatic hydrocarbons, and formaldehyde. Other small businesses that have the potential to emit toxic air contaminants may be located in the Project Area. Of these, dry cleaning facilities that emit perchloroethylene would be of concern. Perchloroethylene is a highly toxic chemical carcinogen.

Expected Risks from Toxic Air Contaminant Emissions

While the types of uses that would occupy the Project Area have been identified, the future occupants of the Project Area are unknown, except for UCSF. Therefore, project-related stationary sources cannot be described in detail at this time. Without specific information on the types of pollutants, how these pollutants would be emitted (e.g., stack locations and parameters), locations of receptors, and meteorological conditions, it is impossible to quantify the resulting risk from the stationary sources of the various types of facilities that could be located in the Project Area. (See “Toxic Air Contaminants—Fundamentals of Risk Assessment” in Appendix E for an explanation of the steps needed to quantify the potential risks.)

Individual Facilities Within the Mission Bay Project—Illustrations of Risks from Similar Facilities

Although quantitatively estimating the risks posed by all project-related stationary sources is infeasible, a description of some specific facilities and their risks attributable to toxic air contaminant emissions is instructive in understanding the nature of potential risks associated with the project.

TABLE V.F.6
EXAMPLES OF POSSIBLE PROJECT-RELATED
TOXIC AIR CONTAMINANT EMISSIONS AND
THEIR BAAQMD TRIGGER LEVELS

Chemical	BAAQMD Trigger Level (lb/yr) /c/
Acetone /a,b/	--
Acetonitrile /b/	0.67
Alkanes and Alkenes /a/	--
Ammonia /b/	19,300
Arsine /b/	--
Benzene /a,b/	6.7
Benzyl Chloride /b/	2,320
Butane /a/	--
2-Butanol /b/	137,000
Butenes /a/	--
t-butylbenzene /a/	--
Butyraldehyde /a/	--
Carbon tetrachloride /b/	4.6
Chlorobenzene /a/	13,500
Chloroform /a,b/	36
Chloromethane /a/	--
Cyclopentane /a/	--
Dichlorosilane /b/	--
Ethylbenzene /a/	193,000
Formaldehyde /a,b/	33
Formic Acid /a/	--
Glutaraldehyde /a,b/	328
Heptane /a/	--
Hexanal /a/	--
n-Hexane /a,b/	83,000
Hydrazine /b/	0.039
Hydrobromic Acid /b/	4,630
Hydrochloric Acid /a/	1,350
Hydrofluoric Acid /b/	1,140
Isopentane /a/	--
Isopropanol /a,b/	444,000
(Continued)	

TABLE V.F.6 (Continued)

Chemical	BAAQMD Trigger Level (lb/yr) /c/
Mercury /b/	57.9
Methane /a/	--
Methanol /a,b/	120,000
Methylene Chloride /a,b/	190
n-Methylpyrrolidone /b/	183,000
Nitric Acid /a/	2,340
Nitrobenzene /b/	328
Pentane /a/	--
Phenol /b/	8,690
Piperidine /a/	--
Pyridine /a/	--
Toluene /a,b/	38,600
Trichloroacetic Acid /a/	--
1,1,1-Trichloroethane /a/	61,800
Trichlorofluoromethane /a/	--
Valeraldehyde /a/	--
Xylenes /a,b/	57,900

Note: "--" means that trigger levels have not been specified for these compounds.

Sources:

- a. University of California, San Francisco, *Assessment of Environmental Impacts for the University of California, San Francisco: Phase III, Health Risk Assessment*, prepared by Radian Corporation, August 31, 1989, pp.5-9.
- b. City of Emeryville, *Health Risk Assessment and Wind Tunnel Modeling: Chiron Development Plan*, prepared by Environmental Science Associates, February 1995 (revised April 1995), p.7.
- c. BAAQMD Rules and Regulations, Table 2-1-316, "Toxic Air Contaminant Trigger Levels," June 1995; Bay Area Air Quality Management District, *BACT/TBACT Workbook: Guidelines for Best Available Control Technology including Best Available Control Technology for Toxics (TBACT)*, Appendix B, Tables 2-5-1 and 2-5-2 (revised May 25, 1994), 1995.

Because a new UCSF site would be located within the Project Area, it is anticipated that many of the research and development activities in the Commercial Industrial areas would be related to health sciences or biotechnology. Health risks posed by existing UCSF facilities and other life science operations illustrate a range of possible health risks that could result from project operations. In addition, because of the Project Area's proximity to Silicon Valley, semiconductor and computer research and development operations could locate in the Project Area; therefore, health risks from similar high-tech facilities could illustrate the nature of potential project-related impacts. Risks from other UCSF sites and from other industrial facilities are discussed below for illustrative purposes.

University of California San Francisco. In 1989, UCSF completed an assessment of toxic air contaminant emissions from its Parnassus Heights site, and seven other satellite facilities, entitled *Assessment of Environmental Impacts for the University of California, San Francisco.*^{/75/} For the Parnassus site assessment, a survey of laboratory and fume hood uses identified all the major groups of chemicals by amounts estimated to be released to the air or into the sewers. Based on the survey, representative low-level, mid-level, and high-level emission sources (including 35 laboratory hood vents) were sampled for three eight-hour periods. At the same time, seven ambient air samples were taken from two to five blocks away from Parnassus. In addition to the laboratory vents, other sources of toxic air contaminant emissions included general building exhaust, hospital patient care hood vents, a medical waste incinerator, and two sterilizers. Toxic air contaminants included 1,4-dioxane, formaldehyde, chlorinated hydrocarbons, and benzene. Next, a health risk assessment modeled each source for total risk and cancer burden at 55 receptors to identify the maximally exposed individual (MEI). The model was then rerun with that MEI receptor specified. The study estimated that the calculated risk to the MEI from the five sources was 14 in 1 million. The most significant emissions were from the two sterilizers using ethylene oxide without controls (estimated risk of 9 in 1 million) and the incinerator (estimated risk of 3 in 1 million). The study concluded that, with controls on the sterilizers providing a 98% reduction in ethylene oxide concentrations, the cancer risk would drop from 14 in 1 million to 5 in 1 million.^{/76/} The portion of risk attributed directly to laboratory-related toxic air contaminants was estimated to be 0.48 in 1 million.

Currently, the sterilizers have been controlled to a 99.9% reduction in accordance with BAAQMD requirements, and the medical waste incinerator has been permanently shut down, bringing the risk from patient care, laboratory, and general building emissions to an estimated 2 in 1 million.^{/77/} However, the 1989 study did not model emissions from the then existing power plant and emergency generators at Parnassus, because they were not considered to be a major source of toxic air contaminants. A 1993 health risk assessment for the proposed new central utilities plant concluded that operation of the cogeneration facility (recently completed) and existing emergency generators would have a total risk of 5 in 1 million. Because the MEIs in the two health risk assessments are on

opposite sides of the Parnassus site, the theoretical cumulative total risk from the entire Parnassus site would be less than 7 in 1 million. The divergence between the locations suggest that the actual combined risk of all UCSF Parnassus site emissions is much lower than 7 in 1 million. This more recent study estimated the risk attributable directly to laboratory-related toxic air contaminants to be 0.54 in 1 million./78/

UCSF also conducted health risk assessments at its Laurel Heights site for the conversion of about 280,000 gross square feet (sq. ft.) into School of Pharmacy laboratories (no longer proposed), and at Mount Zion Medical Center for the addition of about 640,000 gross sq. ft. to the 450,000 gross sq. ft. Medical Center. Sensitive receptors at Laurel Heights included residences on three sides of the site, and a child care center across California Street. Because of the site's location and topography, the MEI was considered to be directly adjacent to, and above, the building emissions sources, resulting in a total risk estimate of 8 in 1 million. Emissions from laboratory and general building sources were estimated to each contribute about one-half of the risk./79/ At Mount Zion, there are a number of sensitive receptors in the area including residences and schools; however, the risk assessment focused on patient care in the main hospital. The total risk was estimated to be 5 in 1 million at full build-out in 2010. Laboratory sources were estimated to contribute about 2 in 1 million of the total. Currently, the total risk is estimated to be 4 in 1 million, of which the laboratory-source risk is estimated to be 1.5 in 1 million./80/

Although it is difficult to generalize about health risks without knowing precise locations and toxic air contaminant concentrations, emissions at the UCSF site would likely be comparable to those at the Parnassus Heights site, because the UCSF site in Mission Bay is a large site with a similar proximity to potential sensitive receptors. The *UCSF Long Range Development Plan FEIR* estimates that increased cancer risk from toxic air contaminant emissions from a central cogeneration plant or utility plant would be 5 in 1 million and from other general building emissions would be substantially lower than 10 in 1 million./81/ Toxic air contaminant emissions for the Mission Bay UCSF site were estimated in the *UCSF Long Range Development Plan FEIR* to be below UCSF significance thresholds. Although UCSF would not be subject to BAAQMD's "trigger" analysis because it would not obtain local building permits, UCSF intends to keep within the 10-in-1-million emissions standard and a hazard index of less than 1. UCSF would work with BAAQMD, as necessary, to keep site risks below BAAQMD, as necessary, thresholds of significance.

Commercial Industrial Uses. An example of the type of life science-related research and development that could locate in Commercial Industrial and Commercial Industrial/Retail areas within the project is Chiron Corporation's facility in Emeryville, California. A health risk assessment prepared for Chiron's Emeryville campus indicated that that facility emits toxic air contaminants from

boilers, laboratory fume hoods, and chemical storage tanks./82/ These sources emit benzene, chloroform, 1,4-dioxane, formaldehyde, and isopropanol, among other toxic air contaminants. The health risk assessment for an expansion of the Chiron facility estimated that the maximum cancer risk would be 0.25 in 1 million, with an acute noncancer hazard index of 0.15 and a chronic noncancer hazard index of about 0.21. All of these levels are well below BAAQMD's Risk Management Policy thresholds.

Although it is difficult to generalize about health risks without knowing the location of receptors and the types, emission characteristics, and concentrations of toxic air contaminants, the distances between receptors and sources on the Chiron campus are comparable to the distances between receptors and sites located within the Project Area. It is conceivable, therefore, that a number of facilities similar to Chiron could locate in the Project Area without individually posing significant health risks to area residents. Building massing and configuring information, along with source strength and location data, would be required to estimate more accurately the dispersion of toxic air contaminants and their potential effects on nearby residents and employees in the Project Area.

Although life science research and development would be expected to occupy most Commercial Industrial space, it is also possible that semiconductor research and development could be located in the Project Area. In addition to the types of chemicals found in life science-related facilities, semiconductor research and development would potentially emit several other types of toxic air contaminants. These include various organometallic compounds, fluorine gas, and chlorinated solvents. Since these operations would not likely be involved in large-scale manufacturing of semiconductors or related components, the potential for emission of large amounts of toxic air contaminants would be smaller than that of large-scale production and manufacturing plants.

The Santa Barbara Research Corporation, a major electronic/aerospace research and development facility in Santa Barbara County, could be representative of toxic air contaminant emissions and receptor distances in the Project Area, if "high tech" or semiconductor research and development were to dominate Commercial Industrial uses, instead of research and development related to the life sciences. According to a health risk assessment of the facility, the cancer risk was estimated to be 2 in 1 million./83/ Toxic air contaminant emissions from this facility include various solvents and metals. Solvents included trichloroethylene, isopropyl alcohol, and xylene. Metals responsible for most of the risk were chromium and lead. These risk assessment results probably exemplify worse case emissions from Project Area facilities because of the types of chemicals handled at the Santa Barbara Research Corporation facility. As with the Mission Bay project, residential receptors are located at distances across the streets adjacent to the Santa Barbara facility's property boundary (within 100 feet). There are currently live/work units approximately a block away from the

Commercial Industrial land use in the southern portion of the Project Area, and there are numerous residential receptors in the Potrero Hill area several blocks south of the southern edge of the Project Area. However, to infer any quantitative conclusions about the project from the results of health risk assessments at other facilities would require assuming that the same types and quantities of toxic air contaminant emissions would undergo similar dispersion patterns in the Project Area, which may or may not be the case.

Retail Uses. Along with Commercial Industrial operations, such as biotechnology, semiconductor, and multimedia or software research and development operations, commercial retail facilities are proposed. Of these commercial operations, dry cleaning facilities with on-site plants are of particular concern. Toxic air contaminant emissions, in the form of perchloroethylene (tetra chloroethylene), are associated with these facilities. In the Bay Area, dry cleaning facilities are now required to use the best available control technology on toxic air contaminant emissions; however, risks to receptors immediately adjacent to these types of operations may be substantial and considered significant; Mitigation Measure F.5, in Section VI.F, Mitigation Measures: Air Quality addresses this impact./84/ Although future new emissions control and product technologies may help reduce the risk posed by these operations, it is impossible to predict these reductions at this time.

Evaluation Processes for the Above Uses

As explained in the Setting, facilities required to obtain a permit to operate from BAAQMD are reviewed by the BAAQMD regarding emissions of toxic air contaminants and, if appropriate, must go through the risk screening procedure./85/ In addition, facilities emitting toxic air contaminants not otherwise subject to permitting are still required to undergo BAAQMD scrutiny,/86/ because building permit applicants are referred to BAAQMD.

Although certain types of uses, such as certain research laboratories, are exempt from BAAQMD permit requirements (see below), these uses would be referred to BAAQMD through the building permit process. BAAQMD would review information it receives to determine whether the facility is subject to the trigger analysis and, possibly, permitting.

Focusing on research and development uses, research laboratories of less than 25,000 sq. ft. in a building or less than 50 fume hoods are exempt from BAAQMD permits, provided that they use "Responsible Laboratory Management Practices."/87/ Responsible Laboratory Management Practices focus on preventing the escape of volatile toxic air contaminants during procedures, waste storage, and disposal./88/ UCSF's teaching laboratories would be exempt from BAAQMD permitting./89/

Project facilities that would require a permit from BAAQMD (either due to a specific source rule or because of the trigger mechanism process) would be subject to a screening-level risk assessment by BAAQMD. Under BAAQMD's risk management policy, permits to construct and operate would ordinarily be denied to facilities whose risks were estimated at above 10-in-1-million cancer risk or a hazard index greater than 1. Therefore, the BAAQMD review process would be an effective check to reduce the potential risks from most facilities. Although it is not certain that any individual facility would cause a significant impact, Mitigation Measure F.3 in Section VI.F, Mitigation Measures: Air Quality, would ensure that all facilities contact BAAQMD for evaluation.

Turning from the facility approval phase to the operational phase, the Air Toxics "Hot Spots" Information and Assessment Act allows BAAQMD to require a facility that has shown its risk to be less than significant to submit an emissions inventory update, if there are certain types of changes in operations or surrounding conditions, as discussed above in the Setting.^{90/} A key change in circumstances that requires reevaluation is when a sensitive receptor has been established or constructed within 500 meters (1,640 feet or about one-third of a mile) of the facility.

For example, if a child care center or a school were to locate within 1,640 feet of a previously exempted facility that emits toxic air contaminants, BAAQMD may request an updated emissions inventory from the facility, following receipt of notice from BAAQMD of the presence of such sensitive receptor.^{91/}

If, after evaluating potential risks to a proposed child care facility or school, BAAQMD were to determine that the facility's emissions would create significant risks to the center or school, the emissions source would be required to prepare and implement a plan for reducing these risks to a less-than-significant level, generally within five years.^{92/}

Combined Risk of Individual Facilities Within the Mission Bay Project Area

Under the BAAQMD's Risk Management Policy, BAAQMD ordinarily would issue permits to a facility with estimated risks below the thresholds (1-in-1-million cancer risk and acute and chronic non-cancer hazard indices less than 1) or to a facility with a cancer risk between 1 in 1 million and 10 in 1 million, with TBACT required. It is conceivable that the risk from multiple facilities could combine to produce a cancer risk greater than 10 in 1 million and/or a hazard index of 1, even though risk assessments for individual facilities may have risk levels below significance thresholds. For instance, two or more facilities located next to one another, each with cancer risks less than 10 in 1 million from their toxic air contaminant emissions, may produce a combined cancer risk greater than 10 in 1 million for a particular MEI. The same can be true for noncancer health risks, i.e.,

individual hazard indices could be less than 1, but especially if MEIs are close together, a combined hazard index could be greater than 1.

The issue of risk from multiple facilities is not addressed through the permitting requirements of BAAQMD, nor are there any established significance thresholds for such combined risks. BAAQMD takes a facility-by-facility approach. No federal, state, or local program requires assessment of combined risks from multiple facilities/^{93/}, although the Air Toxics Hot Spots Program seeks to build the database for examining risks beyond individual facilities. As discussed above and in “Regulatory Framework” in the Setting section, the ARB and BAAQMD use the information compiled under the Hot Spots program to identify areas of concern and high-risk stationary sources. Once a high-risk source is identified, an air toxic control measure or source specific rule may be adopted to control the risk from a specific class of sources. In addition, the inventory information is used in the development of BAAQMD and state policies. Similarly, there are no quantitative guidelines regarding what level of risk is acceptable from combined facilities. Instead, BAAQMD relies on buffer zones for plans under which combined risks from multiple facilities can be anticipated. Accordingly, the combined health risks of individual industrial, research and development, service, and UCSF research uses cannot be quantified at this time and are instead evaluated against qualitative criteria./^{94/}

Buffers Between Uses Emitting Toxic Air Contaminants and Sensitive Receptors

The *BAAQMD CEQA Guidelines* provide for evaluating the significance of toxic air contaminant emissions from stationary sources in the Project Area by assessing whether sufficient buffers are present between toxic air contaminant sources and sensitive receptors. The Guidelines do not contain specific guidance regarding how to assess the adequacy of buffers. The overall Mission Bay land use program places the Commercial Industrial land use designations (the most likely locations for future toxic air contaminant emitters along with UCSF) in a partial ring around the UCSF site, to its east, south, and west, segregated from proposed residential designations. UCSF’s contribution to combined toxic air contaminant concentrations in the Project Area would be limited, because UCSF intends to limit toxic air contaminant emissions from stationary UCSF sources at the site to achieve exposures to a cancer risk of less than 10 in 1 million and acute and chronic non-cancer hazard indices of less than 1. Areas adjacent to the proposed Commercial Industrial designations on the west, south, and east (outside of the Project Area) are mostly zoned M-2 (Heavy Industrial), and existing uses are largely industrial and commercial with some live/work and residential uses. On the north, an area of proposed Commercial Industrial uses east of Third Street would be separated from proposed residential areas by The Common, providing about 200 feet of separation.

Residences

Residences would be located on each large block in Mission Bay North and on each large block in the Central Subarea of Mission Bay South, with the exception of the hotel block. The residences in Mission Bay North could be located near, above, or on top of retail uses that could include service businesses that emit air toxics, such as dry cleaners and automotive gasoline stations. Although many sources would be separated from receptors by streets or open space, no buffers can be assumed. However, individual facilities would be required to comply with BAAQMD permit standards, including the Risk Management Policy.

The closest residences to the Commercial Industrial and UCSF land use designations are those on the north side of The Common. The Common provides a buffer of approximately 200 feet. BAAQMD Guidelines do not indicate whether this buffer is sufficient.

Existing live/work and residential uses directly to the south of the Project Area would also be separated by about 200 feet from the nearest proposed future Commercial Industrial uses between Third Street and Illinois Street south to Mariposa Street. The bulk of the Commercial Industrial area is at least 400 feet north of Mariposa Street. The Commercial Industrial area that would extend to Mariposa Street is approximately 250 feet wide. The live/work and residential uses south of Mariposa are located in an M-2 (Heavy Industrial) zoning district, the least restrictive district in San Francisco. Some facilities emitting toxic air contaminants are likely to exist in that district now, and new facilities may locate in the area (outside the Project Area) subject to BAAQMD permitting requirements. The UCSF and Commercial Industrial areas would provide greater buffers to the existing live/work and residential uses in this area than the adjacent M-2 district.

Public School

A public school occupying a site of at least 2.2 acres would be located somewhere within the UCSF subarea. The specific site location has not been determined. The possibility that the public school site would be located directly adjacent to research laboratories cannot be ruled out. It could also be located directly across a street (i.e., Owens, Mariposa, or Third Street) from Commercial Industrial uses. Because the location has not yet been established, no buffer is provided in the Redevelopment Plans. The site selection for the proposed school, however, would be subject to the siting criteria described previously under "School Siting Criteria." Pursuant to this process, the school district must find that the zoning of the surrounding properties is compatible with schools in that it would not pose potential health or safety risks. Lead agencies considering whether to approve a new school site would also comply with CEQA requirements pertaining directly to schools./95/

The Potrero Middle School is more than 3,000 feet from the Project Area; therefore, it is assumed to be sufficiently far away to have an adequate buffer.

Child Care Facilities

Local-serving child care centers (or pre-schools) could be located throughout most of the Project Area, in the Mission Bay North Retail, Mission Bay South Retail, Commercial Industrial, Commercial Industrial/Retail, UCSF, Mission Bay Residential and Hotel land use designations. There are no constraints in the Redevelopment Plans, related documents, or UCSF Long Range Development Plan that require any buffer between child care centers (or pre-schools) and facilities that may emit toxic air contaminants. Therefore, no buffer can be assumed.

Conclusion

Notwithstanding the existing mechanisms to protect sensitive receptors, in the absence of specific data on proposed facilities, the Redevelopment Plans cannot be shown to provide sufficient buffers for residences or the child care centers, to separate them from potential sources of toxic air contaminant emissions within the Project Area. On the other hand, California law and BAAQMD rules provide various mechanisms designed to protect sensitive receptors, including school siting procedures, BAAQMD permit procedures, BAAQMD “trigger mechanism” review of toxic air contaminant emissions, and Air Toxics “Hot Spots” Information and Assessment Act provisions when a sensitive receptor locates within 500 meters (1,640 feet) of a source of toxic air contaminants.

In addition, combined emissions of toxic air contaminants from the stationary sources located at the UCSF site would not be expected to exceed the 10-in-1-million threshold. Accordingly, the combination of these factors suggests that adequate safeguards likely exist to address toxic air contaminant concentrations from stationary sources. However, because specific future facilities in the Project Area that could emit toxic air contaminants are unknown, combined toxic air contaminant concentrations cannot be modeled. Without the ability to predict future toxic air contaminant concentrations, and in the absence of specific standards of significance for risks from toxic air contaminants from combined facilities, the significance of this potential impact is unknown. However, to avoid underestimating the importance of the impact, this SEIR concludes that the potential for significant combined risks to individuals in certain locations cannot be ruled out, and therefore the impact could be significant. Mitigation Measure F.6 in Section VI.F, Mitigation Measures: Air Quality, addresses this impact.

Mobile Sources

Vehicle toxic air contaminant emissions would include such compounds as benzene, polycyclic aromatic hydrocarbons, and formaldehyde resulting from combustion of vehicle fuels and gasoline evaporation. Emissions from mobile sources are not typically included in health risk assessments. In fact, no authoritative body has developed a standard protocol for assessing risks from mobile sources.

Vehicles in and around the Project Area would cause exhaust and evaporative emissions containing toxic air contaminants (mostly benzene). There is no scientific consensus or regulatory guidance on the proper procedures to estimate risks from mobile sources. Although a standard protocol has not been developed to quantify the risk posed by mobile source emissions for the project, an illustrative example is provided here. Air monitoring data and local meteorological information were used in a limited study conducted in the Santa Barbara County Air Pollution Control District to assess the contribution of mobile source emissions to background risk levels.^{96/} The study concluded that risks from vehicle emissions of benzene at a typical busy intersection in downtown Santa Barbara was approximately 500-in-1-million cancer risk for a lifetime (70-year) exposure.

In addition to increased vehicle trips associated with traffic from the project, emissions from heavy equipment performing construction activities over the life of the development would also contribute to toxic air contaminant emissions. In particular, diesel exhaust contains polycyclic aromatic hydrocarbons and formaldehyde. People would be living in and around the Project Area during the build-out period. Detailed information on the phased development of residential units and on construction project scheduling and the numbers and types of equipment to be used is not yet available.

Because estimating the health risk posed by project-related mobile sources is infeasible, the significance of this impact is unknown. It is assumed, however, to be at least potentially significant.

● Mitigation Measure F.1 in Section VI.F, Mitigation Measures: Air Quality, addresses this impact.

Contaminated Soils

Although most of the construction would be above existing grade, some disturbance of the soil would be necessary for utilities access to construction projects on the site and subterranean parking on certain sites within the Project Area. Chemicals such as metals and some organic compounds have been detected in Project Area soils at varying concentrations. Excavation could result in the generation of dust-containing toxic air contaminants and adverse impacts on construction workers and the public. "Exposure from Construction Activities," under "Impacts During Project Development"

in Section V.J, Contaminated Soils and Groundwater: Impacts, discusses potential toxic air contaminant risks from excavation of contaminated soils in the Project Area.

Cumulative Impacts Regarding Toxic Air Contaminants

Foreseeable development in San Francisco and throughout the Bay Area would contribute to cumulative toxic air contaminant emissions and their resulting risks. Both stationary and mobile sources would contribute to these toxic air contaminant emissions. Only sources that would be relatively close to one another would be likely to directly result in any substantial cumulative exposure and risk because toxic air contaminant concentrations attenuate substantially with distance. However, all toxic air contaminant sources would likely contribute to ambient conditions in the Bay Area.

As discussed in “Regional and Local Air Quality” in the Setting section, existing ambient concentrations of toxic air contaminants pose a cancer risk of about 303 in 1 million./97/ Cumulative development, including project development, could increase this risk, but the magnitude of the possible increase cannot be estimated. A substantial portion of the risk results from benzene emissions associated with motor vehicles.

Federal and state agencies, including the U.S. Environmental Protection Agency and the California Air Resources Board, address toxic air emissions from mobile sources by adopting vehicle emissions standards and by controlling the composition of vehicle fuels. Recent changes in the composition of fuels sold in the Bay Area have substantially reduced the cancer risks posed by ambient levels of toxic air contaminants. Additional measures could reduce these risks further; however, none are assured at this time.

No authoritative regulatory body has adopted any standard to determine whether the risks posed by existing levels of toxic air contaminants should be considered acceptable and, in turn, whether possible increases in ambient risks could potentially be considered significant. However, under the BAAQMD CEQA Guidelines, a project with a significant air quality impact would automatically be deemed to have a significant cumulative air quality impact. As discussed above, the project could be considered by some to pose a significant environmental impact related to combined toxic air contaminant emissions. Because the project could, by itself, pose a significant impact, this SEIR assumes that the cumulative impact of the project could also be significant with respect to combined toxic air contaminant sources. All of the mitigation measures proposed to address project-related impacts, as identified in Section VI.F, Mitigation Measures: Air Quality, would also be effective in reducing this cumulative impact.

INTERIM USES

Interim uses in the Project Area could include parking lots or structures and truck parking activities, which could contribute to existing air emissions in San Francisco and the region.

The project at full build-out would have a significant unavoidable impact on regional air quality as discussed in "Regional Air Quality Impacts: Mobile Sources," above. Operation of the proposed interim uses would not cause a significant contribution to local carbon monoxide levels or to regional air quality, as their traffic volumes and related emissions would be substantially less than for the project at build-out.

The analysis of localized carbon monoxide effects for the project is based on an improved traffic circulation and signalization system in the Project Area that is included as part of the project infrastructure. If some of these infrastructure improvements were not made early because long-term project development phases had not reached a particular location, and permanent uses had not reached levels triggering new transportation infrastructure (see Section VI.E, Mitigation Measures: Transportation), traffic congestion from newly developed interim and temporary uses in the Project Area could occur at key intersections such as at Third and King Streets. This traffic congestion might cause temporary localized carbon monoxide emissions somewhat greater than those shown in the analysis for the proposed project until traffic improvements were provided, reducing congestion, or until a temporary use ended (see next subsection regarding temporary uses).

TEMPORARY USES AND EVENTS

Some temporary uses, such as fairs or carnivals, could attract large amounts of traffic that could cause localized congestion and could contribute temporarily to local carbon monoxide concentrations, particularly if they were to occur before traffic improvements were in place. If very successful, these temporary uses might occasionally attract a number of attendees similar to a sold-out event at the nearby 42,000-seat Giants Ballpark. Traffic patterns for these types of events are different than ballpark traffic, as trips are generally dispersed throughout the day with no single, substantial influx of traffic. Therefore, congestion for a very large temporary event would be less than the conditions analyzed in the Ballpark EIR and the potential for exceedance of the local CO standards would also be reduced. A fair or other temporary event attracting a 40,000 person crowd would be a rare occasion; no known event of this magnitude has occurred in the Project Area.

Parking and vehicle and pedestrian traffic on unpaved surfaces for temporary uses would generate dust which could be annoying to nearby land uses. As these events would be intermittent, the dust generation associated with these events would be less than significant.

GLOSSARY

The following is a list of definitions used to describe risk assessment issues and related emissions.

Toxic Air Contaminant: A designation of any air pollutant that can cause an increase in mortality or serious illness. Adverse health effects of toxic air contaminants may be acute (short term) or chronic (long term). Chronic effects may be carcinogenic (cancer-causing) or noncarcinogenic.

Cancer Risk: Usually expressed as the number of cancer cases predicted in a hypothetical population of one million individuals exposed to a toxic air contaminants. Residential exposure is typically assumed to be 24 hours a day for 30 years (based on U.S. EPA Risk Assessment Guidelines) or 70 years (based on Air Toxic "Hot Spots" Risk Assessment Guidelines), while occupational exposure is typically assumed to be much less.

Chronic Noncancer Health Risk: The expression of adverse health impact estimated from long-term exposure to toxic air contaminants. Typical impacts can be disease or damage to the respiratory system, central nervous system, and organs.

Acute Noncancer Health Risk: The expression of adverse health impacts associated with short-term (usually one-hour) exposure to a toxic air contaminant. Typical impacts may range from respiratory irritation or irritation of mucus membranes to central nervous system damage and death.

Hazard Index: Used to express noncarcinogenic risk from exposure to a toxic air contaminant. A hazard index (HI) is calculated by dividing the modeled receptor exposure concentration by an acceptable exposure concentration or reference level. Results greater than or equal to one may indicate an unacceptable exposure level.

Receptor: A hypothetical or actual physical location where a toxic air contaminant exposure is modeled.

Maximally Exposed Individual (MEI): A theoretical receptor that experiences the greatest risk as a result of toxic air contaminant exposure.

Risk Assessment: The quantification of adverse health impacts associated with exposure to a toxic air contaminant using computer modeling techniques. There are usually four distinct steps: hazard identification, exposure assessment, toxicological assessment, and risk characterization.

Trigger Level: Emissions levels specified by BAAQMD for purpose of initial screening of toxic air contaminants. If exceeded by a source, the source would be required to perform a risk screening analysis.

TBACT: "Toxics best available control technology," technologically feasible control equipment for toxic air contaminant emissions.

NOTES: Air Quality

1. National Ambient Air Quality Standards have been established for criteria pollutants, named for the "criteria" documents that justified their regulation.
2. "PM₁₀" refers to particulate matter less than 10 microns in diameter.
3. National Weather Service Data, 1961-1996.*
4. Intergovernmental Panel on Climate Change, *Climate Change 1995--The Science of Climate*. Report of the IPCC Working Group I. (Cambridge; New York: Cambridge University Press).
5. U.S. Weather Bureau data from observations atop the Old Federal Building at 50 United Nations Plaza during the years 1945-1950. Data were collected hourly, annually for 16 wind directions.*
- 6. Bay Area Air Quality Management District (BAAQMD), Final San Francisco Bay Area Redesignation Request and Maintenance Plan for National Ozone Standards, August 1993.*
- 7. BAAQMD, Final San Francisco Bay Area Attainment Contingency Plan for National Carbon Monoxide Standards, August 1993.*
8. In July 1997, the U.S. EPA promulgated new standards for both ozone and particulate matter. There may be legislative or legal changes to the new standards. The U.S. EPA's new ozone standard is 0.08 ppm averaged over eight hours, rather than the existing 0.12 ppm averaged over one hour. Under the new ozone standard, it will be much more difficult for the Bay Area to achieve compliance. The former particulate standards limited concentrations of particulate matter less than 10 microns in diameter (PM₁₀). Due to increased concern over smaller particulate matter being responsible for health impacts, the new standards limit concentrations of particulate matter 2.5 microns or less in diameter (PM_{2.5}). The new standard will be implemented in 2000 as the attainment status is being based on 1997, 1998, and 1999 monitoring data.
9. BAAQMD, 1997 Clean Air Plan, a supplement to the 1994 Clean Air Plan, 1997 (adopted December 17, 1997).*
10. BAAQMD, *1994 Clean Air Plan*, 1994.
11. In July 1997, the U.S. EPA promulgated new standards for both ozone and particulate matter. There may yet be changes to the new standards.
12. For instance, an increased risk of 10 excess cancer cases per 1 million persons exposed would mean that, for a hypothetical population of 1 million persons at the MEI location exposed to a specific toxic air contaminant concentration over a lifetime of 30 years (based on U.S. EPA Risk Assessment Guidelines) and 70 years (based on Air Toxic "Hot Spots" Risk Assessment Guidelines), 10 individuals could develop cancer. The cancer may be fatal or nonfatal.
13. 30 years is the standard default assumption presented in U.S. EPA's Risk Assessment Guidelines for Superfund Sites. 70 years is the default assumption presented in CAPCOA's Air Toxic "Hot Spots" Risk Assessment Guidelines. U.S. Environmental Protection Agency (USEPA). *Risk Assessment*

Guidance for Superfund. Volume I: Human Health Evaluation Manual. Supplemental Guidance. Standards for Default Exposure Factors. Office of Emergency and Remedial Response. March 25, 1991. CAPCOA Air Toxics "Hot Spots" Program, Revised 1992, Risk Assessment Guidelines. October 1993.

14. United States Code, Title 42, Section 7412(d).
15. United States Code, Title 42, Section 7412(d).
16. California Health and Safety Code, Sections 44340, 44341, 44360, 1997.
17. BAAQMD, Toxic Air Contaminant Control Program Annual Report 1995, Vol. 1, (body) p. 6, November 1996. California Health and Safety Code Section 44360, 1997.
18. California Health and Safety Code, Section 44391(a), 1997.*
19. California Health and Safety Code, Section 44391(b), 1997.*
20. California Health and Safety Code, Section 44391(c), 1997.*
21. The 1987 Air Toxics "Hot Spots" Information and Assessment Act required existing emitters of toxic air contaminants to submit reports regarding their emissions starting in 1988, 1989, and 1990. California Health and Safety Code, Sections 44320 (applicability), 44322 (implementation schedule), 1997.* Facilities were grouped based on total emissions of criteria pollutants, with the largest required to report in 1988. California Health and Safety Code, Section 44322(a), 1997.* The act requires facilities to update their reports every four years, unless they demonstrate that their risks have been reduced. California Health and Safety Code, Section 44344, 1997.* A facility that shows its "prioritization scores" for cancer and noncancer health effects to be equal to or less than one, becomes exempt, and is no longer required to report. California Health and Safety Code, section 44344.4(a), 1997.* A prioritization score of one is regarded as the significance threshold.
22. California Health and Safety Code, Section 44344.5, 1997.*
23. A new facility is not required to file an emissions plan and report if three conditions are met: The facility is subject to an air district program; the district determines that it has a less-than-significant risk; and the air district issues a permit authorizing construction or operation of the new facility. California Health and Safety Code, Section 44344.5(b), 1997.*
24. California Health and Safety Code, Section 44344.4, 1997.*
25. California Health and Safety Code, Section 44344.7(b)(1)-(2), 1997.*
26. California Health and Safety Code, Section 44344.7(a)(2), 1997.*
27. Significance criteria found in California Health and Safety Code, Section 44360, for establishing priority facilities include consideration of proximity to potential receptors, including, but not limited to, hospitals, schools, day care centers, work sites, and residences.
28. California Health and Safety Code, Section 44344.7(a), 1997.*
29. Brian Bateman, Air Toxics Supervisor, BAAQMD, telephone conversation with EIP Associates, March 12, 1998.

30. The air district must report on the status of such control measures, along with other information, in its annual report under the "Hot Spots" program. See California Health and Safety Code, Section 44363(a)(4).*
31. BAAQMD, "Risk Management Policy," May 9, 1991.*
32. Steve Hill, Air Quality Engineering Manager, BAAQMD, meeting with EIP Associates, OER, and Catellus, February 5, 1998.
33. California Government Code, Section 65850.2.
34. See BAAQMD Regulation 1, Rule 1-410 providing that a person responsible for emission of air contaminants must provide information to BAAQMD.
35. See "Request for Information: Risk Screening Analysis" in the BAAQMD Permit Handbook.*
36. BAAQMD Regulation 1, Rule 1-215, 1982.
37. BAAQMD, Regulation 2, Rule 1-113, Exemption, Sources and Operations, June 1995.*
38. BAAQMD Regulation 2, Rule 1-316, 1995.*
39. California Health and Safety Code, Article 1, Section 42301.6(a).*
40. California Health and Safety Code, Section 42301.7.*
41. California Education Code, Section 17213; Public Resources Code, Section 21151.4.
42. Lead was one of the first hazardous air pollutants to receive national attention in the 1970's. Since lead emissions can be extremely toxic, National Ambient Air Quality Standards were developed to reduce the public's exposure under the Clean Air Act. Therefore, lead has the dual distinction of being a criteria pollutant and a hazardous air pollutant/toxic air contaminant.
43. BAAQMD, '97 *Clean Air Plan*, Volume IV, Appendix G. Source Inventory Description, p. G-5; BAAQMD '97 *Clean Air Plan*, p. D-1.
44. BAAQMD, *Ozone and Carbon Monoxide Attainment/Maintenance Plan*, 1993.*
45. BAAQMD, *Toxic Air Contaminant Control Program Annual Report 1995*, Volume I, November 1996, p. 21.*
- 46. BAAQMD, *Toxic Air Contaminant Control Program Annual Report 1995*, Volume I, November 1996, p. 21.*
- 47. BAAQMD, *Toxic Air Contaminant Control Program Annual Report 1995*, Volume I, November 1996.*
48. BAAQMD, *BAAQMD CEQA Guidelines*, 1996, p. 21.*
49. BAAQMD, *BAAQMD CEQA Guidelines*, 1996, p. 17.*

50. This applies to receptors (e.g., residences, schools) locating near existing sources of toxic air contaminants, as well as sources of toxic air contaminants locating near existing receptors. *BAAQMD CEQA Guidelines*, 1996, p. 17.*
51. Steve Hill, Air Quality Engineering Manager, BAAQMD, meeting with EIP Associates, OER, and Catellus, February 5, 1998.
52. The maximally exposed individual (MEI) is the hypothetical person whose exposure to toxic air contaminants from a project results in the greater risk. For residential receptors, the MEI is assumed to live near the source all his or her life (assumed to be 30 years [based on U.S. EPA Risk Assessment Guidelines] or 70 years [based on Air Toxic "Hot Spots" Risk Assessment Guidelines]).
53. Henry Hilken, Senior Environmental Planner (one of the three principal authors of the BAAQMD's 1996 CEQA Guidelines), Bay Area Air Quality Management District, meeting with EIP Associates, OER, and Catellus, February 5, 1998.
54. BAAQMD, *BAAQMD CEQA Guidelines*, 1996, p. 22.*
55. BAAQMD, *BAAQMD CEQA Guidelines*, 1996, p. 22.*
56. Caltrans, *Transportation Project-Level Carbon Monoxide Protocol*, August 1995.*
57. Keyser Marston and Associates, Inc., "San Francisco Cumulative Growth Scenario for 2015," draft memorandum to Stan Muraoka, San Francisco Redevelopment Agency, August 27, 1997.*
58. See the BAAQMD's 1994 *Clean Air Plan* for a discussion of the effectiveness of individual transportation control measures.
59. Potential emissions were calculated using standard emission factors from U.S. EPA's AP-42, 5th ed., *Compilation of Air Pollutant Emission Factors*, Table 1.4-2, p. 1.4-4.*
60. A cogeneration plant at UCSF's major new site was previously addressed in the *UCSF Long Range Development Plan Final Environmental Impact Report*, State Clearinghouse No. 95123032, certified January 1997, pp. 356-357. Actual emissions from the cogeneration plant would be expected to be similar to emissions reported in the Parnassus Heights Central Utility Plant FEIR, pp. 101-105. University of California, San Francisco, Parnassus Heights Central Utilities Plant Project, Final Environmental Impact Report, January 5, 1994.
61. BAAQMD, Regulation 2, Rule 2-301, June 1995.*
62. UCSF anticipates that the cogeneration plant would have emissions similar to the plant operation at UCSF's Parnassus Heights site. The controlled emissions from Parnassus Heights are subject to a BAAQMD-site-specific annual emissions limit of 14.8 tons of NO_x per year. By complying with a similar emissions limit at the Mission Bay site, UCSF would remain below the emissions offsets threshold for NO_x.*
63. BAAQMD, *Bay Area Air Quality Management District CEQA Guidelines: Assessing the Air Quality Impacts*, April 1996, p. 15.*
64. An expression of concentration in parts per million (ppm).
65. As mentioned elsewhere in this document, build-out by 2015 is a conservative assumption.

66. Public Resources Code Section 21100 (d); State CEQA Guidelines Sections 15125 and 15126.
67. The emission factors are developed assuming existing regulations that control automobile emissions (such as reformulated gasoline, exhaust pipe emissions controls and regular smog checks for cars) continue in force and that the number of old, polluting vehicles in the regional fleet declines over time as drivers replace old cars with new ones.
68. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, Volume I, pp. IV.108-IV.10.
69. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, Volume I, p. IV.275.
70. BAAQMD, *BAAQMD CEQA Guidelines*, April 1996, p. 21.*
71. BAAQMD, *BAAQMD CEQA Guidelines: Assessing the Air Quality Impacts*, April 1996, p. 27.*
72. Thus particulate emissions could be reduced to 5.1 lb/acre/day.
73. "Sensitive receptors are children, the elderly, people with illnesses or others who are especially sensitive to the effects of air pollutants. Hospitals, schools, convalescent facilities, and residential areas are examples of facilities that house or attract sensitive receptors." BAAQMD, *BAAQMD CEQA Guidelines*, 1996, p. 9.*
74. The term "businesses" is used in this discussion to represent both businesses and other organizations (called institutions in the Redevelopment Plans).
75. Radian, *Assessment of Environmental Impacts for the University of California, San Francisco, Phases I-III*. (Final Report published August 31, 1989, in six volumes).*
76. Radian, *Assessment of Environmental Impacts for the University of California, San Francisco, Phase III, Health Risk Assessment*, August 31, 1989, pp. 5-5 - 5-14, and 8-2.*
77. BAAQMD, Dentistry Sterilizer, Source Air Permit, 1990; Moffitt Sterilizer Source Air Permit, 1990, certified June 1994; Department of Public Health, 1995 Medical Waste Application (which includes decommission of Pathological Waste Incinerator).
78. Radian, *Phase III Health Risk Assessment*, Table 7-7, and *Parnassus Heights Central Utilities Plant Project FEIR*, certified January 1994, pp. 107, 125, 126.
79. University of California San Francisco, *University of California San Francisco - Laurel Heights Final Environmental Impact Report*, certified May 1990, Appendix J, p. 6-5.
80. ENSR Consulting and Engineering, *Risk Assessment of the UC San Francisco-Mount Zion Hospital and Medical Center*, September 1989, p. 7-16.*
81. University of California San Francisco, *UCSF Long Range Development Plan Final Environmental Impact Report*, State Clearinghouse No. 95123032, certified January 1997, Volume II, p. 357.

82. Environmental Science Associates, *Health Risk Assessment and Wind Tunnel Modeling, Chiron Development Plan*, February 1995.
83. Risk Assessment Results for Santa Barbara Research Corporation, Main Building, Santa Barbara County Air Pollution Control District, 1996.*
84. CAPCOA Draft Industry wide Risk Assessment Guidelines, 1996.*
85. BAAQMD, Regulation 2, Rule 1-316, New or Modified Sources of Toxic Air Contaminants, June 1995 (requiring new or modified sources that emit one or more air toxic contaminant in quantities above the trigger levels, to obtain permits, unless the owner or operator of the source can demonstrate that the source would pass a risk screening analysis within 90 days of receipt of a request by the BAAQMD).
86. California Government Code, Section 65850.2(c).
87. BAAQMD, Regulation 2, Rule 1-113.2.12, Exemption, Sources and Operations, June 1995.
88. Responsible Laboratory Management Practices include all of the following: avoiding open container procedures where feasible, avoiding storage of volatile hazardous chemical wastes in open containers, training employees to minimize emissions of volatile toxic air contaminants, posting notices on fume hoods, monitoring fume hoods to assure proper face velocity, and forbidding evaporation as a means of disposing of hazardous chemical waste containing toxic air contaminants. BAAQMD, Regulation 2, Rule 1-224, Responsible Laboratory Management Practices, June 1995.
89. BAAQMD, Regulation 2, Rule 1-113.2.11, June 1995.*
90. California Health and Safety Code, Section 44344.7(a)(2), 1997.*
91. California Health and Safety Code, Section 44344.7, 1997.*
92. California Health and Safety Code, Section 44391(a), 1997.*
93. Steve Hill, Air Quality Engineering Manager, BAAQMD, meeting with EIP Associates, February 5, 1998.
94. Even though the impacts of toxic air contaminants are localized, it is possible that one or more uses in the Project Area may result in a combined risk for a hypothetical maximally exposed individual that exceeds BAAQMD thresholds for evaluating a project under CEQA. Nevertheless, this comparison is inappropriate, since the Mission Bay project falls under the category of a local plan.
95. Public Resources Code, Sections 21151.2, 21151.4, and 21151.8.
96. Santa Barbara County Air Pollution Control District, 1995 Air Toxics "Hot Spots" Annual Report, November 1996.
97. BAAQMD, *Toxic Air Contaminant Control Program Annual Report 1995*, Volume I, November 1996, p. 21.

* A copy of this report is on file for public review at the Office of Environmental Review, Planning Department, 1660 Mission Street, San Francisco.

G. NOISE AND VIBRATION

This section describes existing conditions and potential project impacts with regard to noise and vibration in and adjacent to the Project Area. The Setting subsection presents a discussion of noise and how it is measured and a discussion of vibration and how it is described. In addition, existing noise sources and levels are identified, potential existing vibration sources are identified, and applicable regulatory standards for noise and vibration are presented. The Impacts subsection analyzes potential future noise and vibration sources and levels in and adjacent to the Project Area.

The traffic noise analysis in the 1990 FEIR has been updated for this SEIR based on the revised traffic analysis. Other operational noise issues discussed in the 1990 FEIR have also changed as the proposed project has been revised; for example, the Caltrain terminal is no longer proposed to be moved to Seventh Street and the resulting noise impacts on houseboat residents discussed in the 1990 FEIR would no longer occur. Construction noise effects analyzed in the 1990 FEIR remain generally applicable and have been summarized in the Initial Study (Appendix A), under "Construction Noise."

The endnotes for this section begin on p. V.G.32.

SETTING

NOISE

This section describes what noise is and the terms used to express its measurement. In addition, existing sources of noise and applicable regulations for noise control are discussed.

Sound creates pressure differentials in air. These pressure levels are measured in decibels (dB)./1/ Each 3 dB increase or decrease in sound level represents a doubling or halving, respectively, of sound energy. Although decibels can describe the purely physical intensity of sound, they cannot accurately describe loudness as perceived by the human ear. The pitch or frequency of a sound must be taken into account when measuring human response to sound. For this reason, a frequency-dependent weighting system must be employed whenever sound is measured. These measurements are generally reported in A-weighted decibels (dBA). In general, a difference of 3 dB is noticeable to most people and a difference of 10 dB is perceived as a doubling of loudness. Appendix F provides additional information on noise measurements and human reactions to environmental noise.

Noise levels typically fluctuate over time. Several indicators have been developed to describe environmental noise. Two of the most commonly used indicators are L_{eq} and L_{dn} ./2/,/3/ L_{eq} is an

average of noise over a stated time period; L_{dn} is a 24-hour average which accounts for the greater sensitivity of most people to nighttime noise. Community Noise Equivalent Level (CNEL) is also a 24-hour average, like L_{dn} , but is further weighted for sensitivity to evening noise./4/ These and other indicators are used to describe noise from different sources in different locations. For example, L_{dn} and CNEL are often used to describe general community noise levels, as they provide average noise levels over the entire 24-hour day; in the analysis for the proposed project, L_{dn} is used to discuss traffic noise during the 24-hour day at residential uses. The L_{eq} over a one-hour period is used to describe the traffic noise near nonresidential sensitive receptors like churches and schools because most people would not stay in those locations for more than a few hours.

Noise levels from a particular source decline as distance to the listener increases. A commonly used rule of thumb is that for every doubling of distance from the source, the noise level is reduced by about 6 dB./5/ Noise levels are also reduced by intervening structures—generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dB./6/

EXISTING NOISE SOURCES AND NOISE LEVELS

Major noise sources in the Project Area and vicinity include motor vehicles on major thoroughfares and Interstate 280 (I-280); freight and passenger trains; freight loading and unloading; and heavy equipment and machinery operation. Noise in and around the Project Area can be characterized in terms of a relatively steady “background” noise level upon which “intrusive” noises—noise events that stand out clearly from the background noise—are superimposed. Background and intrusive noise are two distinct descriptors of the sound environment. Intrusive noise is responsible for much of the annoyance generated by noise sources. However, since intrusive noise is generally intermittent and short in duration, it generally does not contribute to long-term average noise levels upon which community noise standards are based. Background noise can have a wide range of averaging periods, from one-hour averages used to characterize peak-hour traffic noise to 24-hour averaging periods used to express overall community noise exposure. Appendix F provides a general discussion of what noise is and how it is described.

Background Noise

Traffic on I-280 and Third Street is the primary source of background noise in the Project Area. Activities such as machinery operations, diesel truck traffic, and freight loading and unloading contribute to the background noise level. Factors such as local meteorological conditions and geographic locations can help intensify or reduce the noise level at any given location.

Traffic Noise

The ambient noise within the Project Area is dominated by vehicular traffic, particularly flows on the major adjacent streets (i.e., Third Street, Fourth Street, and Mariposa Street). Noise from traffic-related activities (e.g., bus idling, bus/delivery truck back-up signals, vehicle queuing for parking) and from stationary equipment also contributes, to a lesser extent, to the ambient noise level.

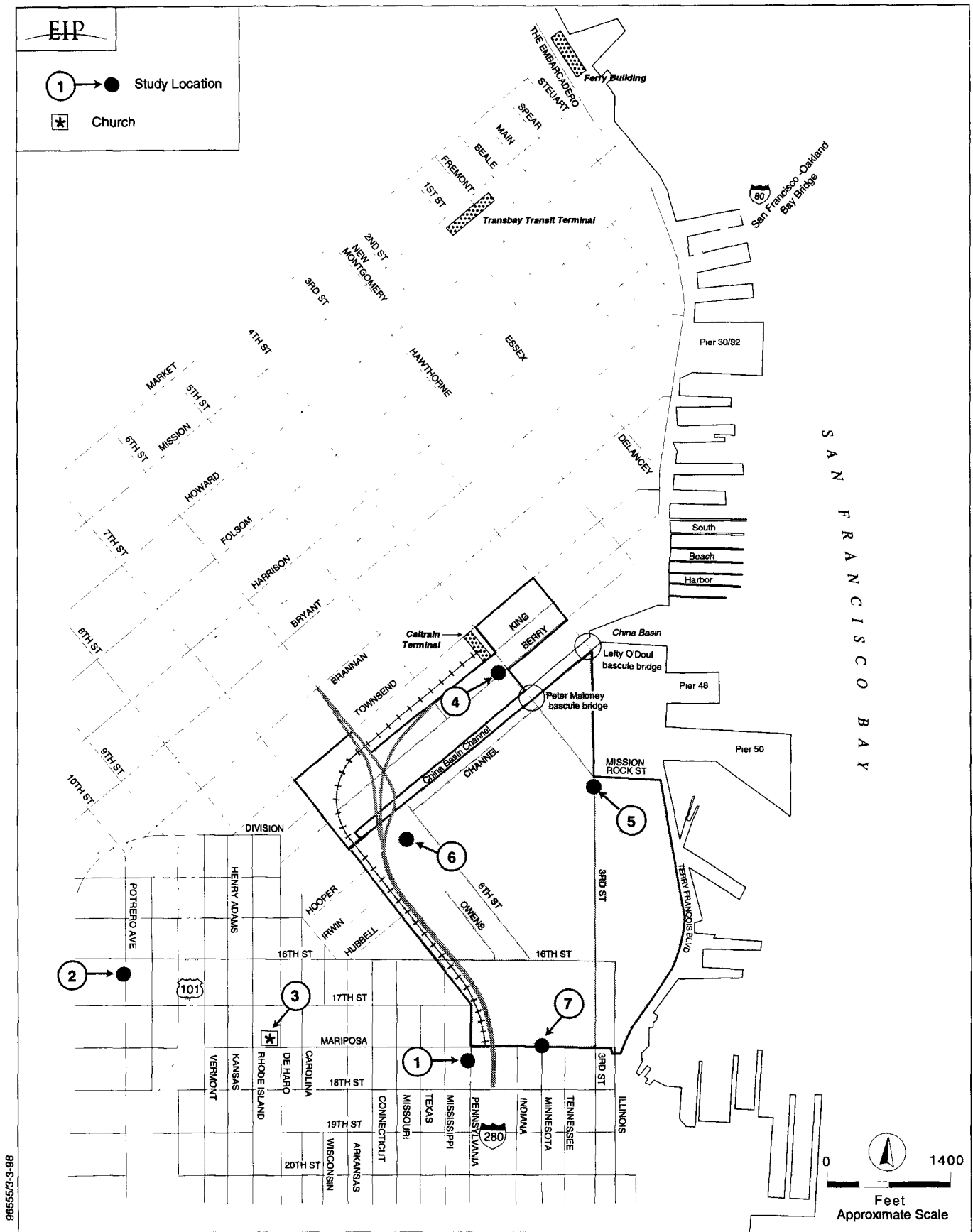
Short-term noise levels were monitored at locations in and near the Project Area. Traffic was counted during the short-term measurement periods to calibrate the SOUND32 traffic noise prediction computer model used for subsequent project and cumulative traffic noise modeling. Ambient noise measurement locations are identified in Figure V.G.1. Figure V.G.2 shows the seven locations selected for study. Appendix Table F.2 presents noise measurement field data for these seven study locations, which were used to calibrate the SOUND32 model. Table V.G.1 (in the Impacts subsection) presents the existing ambient noise levels based on SOUND32 modeling results. The field measurements of ambient noise levels conducted for the future intersection of The Common Streets with Owens Street at the circle were in the vicinity of the houseboats located in China Basin Channel. The model results for existing traffic noise at this intersection are representative of traffic noise on streets nearest the houseboats.

Intermittent Noise Sources

Caltrain

An additional existing source of noise within the proposed Project Area is the Caltrain commuter trains. The rail alignment generally follows Townsend Street from Fourth Street west to I-280, heading south parallel to the freeway in the Project Area. The Caltrain terminal is located south of the intersection of Townsend Street and Fourth Street, adjacent to the Project Area.

Although there is a considerable amount of noise associated with the operation of Caltrain, the noise generated is most likely less than that of automobile traffic carrying the equivalent number of commuters. Caltrain currently creates intermittent noise within the Project Area; there are currently no sensitive receptors in the Project Area near the Caltrain terminal and tracks under existing conditions. The houseboats at the west end of the Channel, adjacent to the Project Area, are close enough to the tracks for residents to notice trains and train whistles.



MISSION BAY SUBSEQUENT EIR
FIGURE V.G.2 NOISE STUDY LOCATIONS

San Francisco Giants Ballpark

A comprehensive analysis of traffic, crowd, and concert noise was conducted for the 1997 *San Francisco Giants Ballpark at China Basin EIR*.^{/7/} In that report, existing crowd noise levels were monitored at 3Com Park during Giants ballgames. Several sites near the new ballpark were monitored for two or three days to establish existing noise levels. Existing ambient noise levels at several locations in the Project Area near the ballpark were also estimated using computer modeling techniques.

Existing traffic noise levels on most streets near the residential receptors studied in the Giants Ballpark EIR were high enough (above 65 dBA) for the *San Francisco General Plan* Environmental Protection Element to discourage new residential developments unless substantial noise reduction features were included in their designs. The ballpark traffic increment, while small and relatively infrequent, could add to the level of annoyance of some residents on streets affected by ballpark traffic. Full capacity, amplified music concerts without noise controls at the ballpark could occur three times a year; other amplified music concerts are required to limit noise increases at residential sites to less than 3 dBA over the existing ambient noise levels.^{/8/} While not a regular activity, these concerts would increase noise levels at residential locations in the Project Area. Representative sites were studied in the San Francisco Giants Ballpark EIR and are discussed in the Impacts section below.

Basculer Bridges (Third and Fourth Streets)

The Lefty O'Doul and Peter Maloney Bridges at Third and Fourth Streets generate noise when the bridges are lifted. The frequency and duration of bridge openings varies depending on watercraft traffic in the Channel. Openings are tracked by the work shift hours of the operators. More bridge openings occur during the weekend and holiday shifts than during any other shift, followed by the night shifts (3:00 p.m. to 11:00 p.m.), day shifts (7:00 a.m. to 3:00 p.m.), and graveyard shifts (11:00 p.m. to 7:00 a.m.), respectively. Each bridge is opened approximately 45 times each month on holidays and weekends. An average of 21 bridge openings occur each month during the night shift. The average number of openings per month for the day shift is 19 times. During the graveyard shift, an average of 12 openings occur each month. Since the approximate time for opening and closing each bridge is five minutes, the contribution to background noise is considered insignificant.

NOISE-SENSITIVE USES

Certain types of land uses are considered more sensitive than others to higher noise levels. Schools, churches, libraries, hospitals, and nursing homes are generally more sensitive to noise than

commercial, office, and industrial uses. Residential land uses are also generally considered noise-sensitive uses because noise can disrupt sleep, conversation, reading, and similar activities that can occur at any time. Noise has been found to be especially disruptive in the evening and at night.

Sensitive Uses in the Project Area and Nearby Areas

There are currently no sensitive land uses in the Project Area. The areas around the project comprise a mix of industrial, commercial, and residential uses. The areas surrounding the Mission Bay Project Area have been broken down into nine Nearby Areas. Sensitive uses in these Nearby Areas have been identified and are discussed below.

Residential uses in three Nearby Areas, designated as North Potrero, Potrero Hill, and Lower Potrero, may also be impacted by noise from increased traffic associated with the project. In particular, the Potrero Hill area contains a residential neighborhood and a sensitive receptor—a church at the intersection of Mariposa and De Haro Streets. In addition, houseboats along the Channel are existing residences that may be affected by the project.

The Inner Mission, South Bayshore, Central Bayfront, and Showplace Square Nearby Areas do not currently contain sensitive receptors that would be affected by the project, although there are residential uses in most of these Nearby Areas.

REGULATORY FRAMEWORK

The following is a discussion of the San Francisco Noise Ordinance and adopted policies related to community noise.

San Francisco Noise Ordinance

The San Francisco Noise Ordinance regulates both construction noise and fixed-source noise. Sections 2907 and 2908 of the San Francisco Police Code regulate construction noise and provide that:

- Construction noise is limited to 85 dBA at 100 feet (ft.) from the equipment during daytime hours (7 a.m. to 8 p.m.). Impact tools are exempt provided that they are equipped with intake and exhaust mufflers.
- Nighttime construction (8 p.m. to 7 a.m.) that would increase ambient noise levels by 5 dBA or more is prohibited unless a permit is granted by the Director of Public Works.

Section 2909 regulates fixed-source noise such as mechanical noise from buildings, measured at the property line of the *affected* property, establishing maximum noise limits. The noise limits are established for zoning districts in which the affected property is located. In residential areas, generally noise levels are limited to 55 to 60 dBA during the day and 50 to 55 dBA during the night. In commercial areas, acceptable noise levels are 60 dBA at night and 70 dBA during the day. In industrial areas, 70 dBA is the established acceptable noise level any time.

A general provision in the ordinance permits the City to regulate unnecessary, excessive, or offensive noise that is annoying to most people. This provision, summarized below from Sections 2915 and 2901.11, generally prohibits excessive noise from a stationary source:

- Unnecessary, excessive or offensive noise which disturbs the peace or quiet of any neighborhood or which causes discomfort or annoyance of any reasonable person of normal sensitivity residing or working in the area is prohibited. A noise level which exceeds the ambient noise level by 5 dBA or more, as measured at an affected receptor's property line, is deemed a *prima facie* violation of the Ordinance.

Police Code Section 2915 allows the Chief of Police to consider other factors in determining whether a violation of the Police Code exists.

San Francisco General Plan

The *San Francisco General Plan* Environmental Protection Element includes a section on Transportation Noise, as cars, trucks, and buses are the major source of noise in San Francisco's dense urban setting. The Transportation Noise section contains objectives to reduce transportation noise and to promote land uses that are compatible with the existing noise environment. The Element includes a Land Use Compatibility Chart that suggests "satisfactory" exterior noise levels for various land uses. The maximum exterior L_{dn} considered "satisfactory, with no special noise insulation requirements" is 60 dBA for residential and transient lodging land uses, 65 dBA for schools and churches, and 70 dBA for office buildings. In areas where the 24-hour average noise levels exceed these values, the Environmental Protection Element suggests that a detailed analysis of noise reduction requirements be made and that noise insulation features be included in the design of new development. New residential uses are discouraged in the Element in areas with exterior L_{dn} values above 65 dBA unless noise insulation is included.

Title 24 of the California Code of Regulations (CCR) establishes an interior noise standard of 45 CNEL in new residential buildings (hotels, motels, and multi-unit dwellings) with all doors and windows closed. As noted in "Noise" in Section IV.B of the Initial Study (Appendix A), residential buildings in the Project Area would be subject to Title 24 interior noise requirements, and would need

to include noise insulation in most cases, based on existing exterior noise levels. While the Environmental Protection Element establishes the basic noise standards for San Francisco with respect to various land uses, it predates Title 24 requirements and is less stringent in many cases. Therefore, San Francisco relies on Title 24 requirements for the regulation of noise in new building construction.

VIBRATION

This section presents fundamentals of vibration, a regulatory framework for vibration, and information on existing sources of vibration in the Project Area.

Fundamentals of Vibration

Vibration is a trembling, quivering, or oscillating motion of the earth. It is similar to noise in that both are forms of energy that propagate through matter as waves. Vibration is transmitted in noise-like (compression) or ocean-like (transverse) waves through the earth.

There are several ways to categorize vibration sources. One way is to divide vibration into natural and artificial sources. Natural sources include earthquakes, volcanic eruptions, sea waves, and landslides. Artificial sources of vibration include explosions, machinery, traffic, trains, and construction equipment. Vibration sources can also be described as continuous, such as factory machinery, or transient, such as freight trains.

Like noise, vibrations can be described by amplitude and frequency. The vibration amplitude can be described in two ways: displacement and velocity. Particle displacement is the distance the soil particles travel from their original location, usually expressed in inches or millimeters. Particle velocity is the speed of the soil particles, usually expressed in inches per second or millimeters per second. Either peak particle velocity (PPV) or vibration decibels (VdB) can be used to describe vibration; VdB is used in the discussion below. It is a shorthand way of describing vibration using a logarithmic scale similar to the decibel scale.

Vibrations also vary in frequency, expressed as Hertz (Hz) or cycles per second. Typical construction vibrations fall within the 10 to 30 Hz range and usually cluster around 15 Hz. Traffic vibrations also generally range in frequencies from 10 to 30 Hz, with a majority of the frequencies found around 15 Hz.

Regulatory Framework

There are no adopted Federal Highway Administration (FHWA), state, or City and County of San Francisco standards for vibration. The Federal Transit Administration has established vibration impact criteria for evaluating the effects of proposed new transit systems, but these criteria are not adopted regulations./9/ One likely explanation for the lack of regulation in this area is that highway traffic and construction vibrations usually do not pose a threat to buildings and structures, and annoyance to people is no worse than other discomforts experienced from living near highways.

Existing Conditions

There are three common types of vibration sources that may be found in and around the Project Area: heavy truck and bus traffic, light and heavy rail operations, and construction equipment. Vibrations from these sources vary with pavement conditions. Pot holes, pavement joints, and differences in the settlement of pavement all increase vibration levels from traffic. Use of construction equipment, pile driving, pavement breaking, and demolition of structures generate among the highest construction vibrations.

Existing conditions in and around the Project Area include heavy truck and bus traffic. For rail operations, Caltrain and the Muni Metro Extension on King Street are sources of vibration. The freight rail line which uses part of the Caltrain trackage to 16th Street, travels on 16th Street to Terry A. François Boulevard in the Project Area, and then continues south to Pier 80 in Illinois Street, is used occasionally (about 15 times per year), and is not a major source of existing vibration. In addition, there are construction, demolition and pile driving activities in and around the Project Area, such as demolition by Caltrans of the I-280 Berry Street exit ramp.

IMPACTS

STANDARDS OF SIGNIFICANCE

San Francisco has no quantitative CEQA threshold for significance related to increases in noise levels. The San Francisco Noise Ordinance and the Environmental Protection Element Transportation Noise section described above in "Regulatory Framework" under "Noise" provide some guidance in evaluating noise effects from the project but do not provide specific legislated criteria for acceptable noise levels and are not adopted CEQA significance thresholds. In general, project increases in noise are modeled and presented quantitatively, but are evaluated qualitatively by asking the following questions:

- Would the increase in noise at any sensitive receptors be reasonably considered substantial?
- Would the increase in noise substantially affect the use and enjoyment of proximate areas or facilities?

Vibration impacts require a combined assessment of source (e.g., vehicle type), path (e.g., geological conditions), and receiver (e.g., building type) to evaluate severity. Although there is no CEQA threshold for significance related to vibration levels, ground-borne vibration can be disruptive to vibration-sensitive activity. A discussion of potential vibration impacts is provided later in this section. Under CEQA, a significant impact is defined as a substantial adverse environmental change.

NOISE ANALYSIS METHODOLOGY

Noise impacts from the proposed project would result from increases in traffic on local streets and near freeway on-ramps and off-ramps. Amplified music noise from events at the San Francisco Giants Ballpark, which is under construction across Third Street from Mission Bay North, could cause impacts on some new uses in the Project Area. The following discussion includes: 1) an explanation of the analysis methodologies used to estimate traffic noise; 2) results of the analysis of traffic noise using 24-hour day-night average (L_{dn}) levels outside residential receptors and one-hour L_{eq} levels outside nonresidential receptors; and 3) a summary of the analysis of music noise from a full-capacity rock concert at the Giants Ballpark as it could affect proposed uses in the Project Area. Traffic noise was analyzed for existing-plus-project conditions and for cumulative-plus-project conditions.

Quantitative and qualitative analyses were performed for noise sources. For vehicle traffic noise, analysis was performed using computer modeling techniques. A qualitative approach was used for sources such as rail transportation, lift bridges, and ballpark noise. All noise levels presented are ambient levels for locations on the outside of the modeled receptor sites. The interior noise levels would be reduced an average of 15 dB with windows open and 25 dB with windows closed./10/ This is the amount of reduction in decibels afforded by building walls and windows. For example, if the exterior noise level is 70 dBA, the interior noise level with windows open is 55 dBA. The increases in interior noise levels would be the same as the increases in exterior noise levels presented in this section. For example, if project-related traffic would cause a 3 dBA change in exterior noise levels, a 3 dBA change would be experienced indoors as well.

Traffic Noise

Noise from the motor vehicles traveling to/from the Project Area was modeled using the Caltrans SOUND32 computer model, an adaptation of the Federal Highway Administration's Highway Traffic

Noise Prediction Model (FHWA-RD-77-108). Noise measurements and traffic counts along one or two adjacent roadway segments, performed simultaneously, were used to calibrate the model.

Traffic noise levels were modeled at two locations near existing residential uses and an existing church. Traffic noise levels were also modeled at five intersections where traffic was projected to increase greatly as a result of project development. The seven study locations are shown in Figure V.G.2; each is near an ambient noise measurement location shown in Figure V.G.1. The locations were studied under the following four traffic scenarios from the transportation analysis:

- Existing: Existing traffic, not including project increases
- Existing-plus-project traffic
- Cumulative 2015: Cumulative growth in traffic to the year 2015 without the project
- Cumulative-plus-project traffic (2015)

The L_{dn} was used to evaluate traffic noise impacts for current residential study locations and study intersections because these uses often are, or may be in the future, occupied during an entire 24-hour period, and are sensitive at night (when the L_{dn} adds a 10 dBA penalty to ambient noise). The one-hour L_{eq} was used to evaluate the noise impact experienced at the church study location on Mariposa and De Haro Streets. The L_{eq} method was used for the church because of the type of use of the building. A one-hour L_{eq} more accurately reflects the impact experienced at a building which receives occasional use, as opposed to the 24-hour L_{dn} which is more appropriate for a building that is occupied for longer periods of time, such as a residence.

Ballgame Crowd Noise

An analysis of concert noise at the Giants Ballpark was performed for the *San Francisco Giants Ballpark at China Basin EIR* using the computer Environmental Noise Model (ENM).^{11/} The ENM incorporates the effects of topography, wind, and temperature gradients on noise propagation, when these issues are relevant to the analysis. The attenuative effects of the ballpark walls (as specified in the plan and section drawings provided by the ballpark project architect) and those of other nearby buildings were taken into account by the model. As described in the *San Francisco Giants Ballpark at China Basin EIR*, study locations were selected to address both existing land uses and the future land uses of projects such as Mission Bay. Later in the Impacts subsection, in “Ballpark Concert Noise” under “Intermittent Noise Source Impacts,” results are summarized for sites within the Mission Bay Project Area.

TRAFFIC NOISE IMPACTS

Due to development of the project, traffic noise would increase on streets in the vicinity of the Project Area. Increases in traffic are due to the proposed changes in land uses from either vacant or industrial use to higher-density commercial or industrial uses and high-density residential uses. In some cases, traffic volumes are projected to increase by 200% to 400% during the p.m. peak hour due to development of the Project Area. Traffic increases of this magnitude generally cause noticeable increases in ambient noise levels.

Existing Traffic Plus Project Traffic Noise

Two existing residential study locations (Pennsylvania Avenue south of Mariposa Street and Potrero Avenue south of 16th Street) were studied to assess the noise impacts associated with project-related traffic (see Figure V.G.2). These locations were selected because they would experience the most substantial traffic increases among the intersections studied in the transportation analysis; therefore, these two locations provided a conservative sample of effects on existing residential sites near the Project Area. A church on Mariposa Street, west of De Haro Street, was also studied to assess potential noise impacts due to project traffic increases. In addition, four other study locations (Berry Street west of Fourth Street, Third Street south of Mission Rock Street, the future Common Street roundabout south of the future location of Owens Street, and Mariposa Street west of Fourth Street) were analyzed to assess noise impacts on potential future noise-sensitive land uses that may result from project build-out.^{12/} There are currently no sensitive receptors at these four other study locations. Potential future noise-sensitive receptors include public open space, and child care facilities, schools, and other educational uses that may be in neighborhood-serving commercial areas.

Table V.G.1 summarizes the modeled noise levels from existing traffic, and from existing-plus-project traffic at the seven study locations, and shows the changes in noise levels due to project traffic. The existing-plus-project analysis uses a hypothetical scenario assuming instantaneous development of the project, in order to compare project traffic noise levels with existing noise at the locations studied.

As shown in Table V.G.1, project traffic would increase noise levels near one of the two existing residential locations studied—by 0.4 dBA L_{dn} . There would be no change at the Pennsylvania and Mariposa Streets location. The 0.4 dBA increase at Potrero and 16th Streets would not be perceptible (as an increase of less than 1.5 dB is generally not heard except in noise laboratory testing).

TABLE V.G.1
TRAFFIC NOISE LEVELS FOR EXISTING AND EXISTING-WITH-PROJECT
TRAFFIC VOLUMES

Location Number/a/	Study Location	Traffic Noise Source			Noise Level (dBA)		
		Street Modeled On	Near or At	Existing	With	Project Increase	
					Project		
					L _{dn} /b/		
1	Residential Location	Pennsylvania	Mariposa	58.8	58.8	0	
2	Residential Location	Potrero	16th St.	71.0	71.4	0.4	
3	Church (Sensitive Receptor)	Mariposa	De Haro	62.9	64.3	1.4	
4	Other Study Location /c/	Berry	Fourth St.	60.8	65.6	4.8	
5	Other Study Location /c/	Third	At Mission Rock	73.8	75.3	1.5	
6	Other Study Location /c/, /d/	Common Street (roundabout)	Near Owens	63.4	68.6	5.2	
7	Other Study Location /c/	Mariposa	Fourth Street	67.4	72.3	4.9	
3	Church (Sensitive Receptor)	Mariposa	Near De Haro	64.0	L _{eq} (1 hour)/b/		
					65.4	1.4	

Notes:

- Figure V.G.2 shows the locations of these sites.
- L_{dn} is the 24-hour average noise intensity with 10 dBA added to account for sensitivity to nighttime noise. L_{eq} is the average noise intensity during the one-hour analysis period.
- "Other study locations" are locations that do not currently have receptors but were studied to assess noise impacts on potential future noise-sensitive land uses.
- Field measurements were taken on Sixth Street, south of Channel Street, because this is the existing street closest to the proposed new intersection, and most existing Sixth Street traffic would be expected to shift to the new, extended Owens Street.

Source: EIP Associates.

With project traffic, traffic noise at Saint Gregory's Episcopal Church, on De Haro Street near Mariposa Street, would increase the L_{dn} by up to 1.4 dBA and the one-hour L_{eq} by 1.4 dBA. A 1.4 dBA increase in exterior traffic noise levels would not be noticeable to most churchgoers. The future interior noise levels would be less than 60.5 dBA due to sound level reductions from building walls, and would be unlikely to meaningfully or substantially impact the usefulness of the facility.

The four other study locations listed in Table V.G.1 show projected changes in traffic noise at locations within the Project Area. Increases at these other study locations would range from 1.5 to 5.2 dBA. These increases would alter interior and exterior noise levels equally. The 5.2 dBA increase would occur at The Common Streets roundabout near Owens Street. The future intersection of The Common Streets circle and Owens Street is the intersection nearest the houseboats. The houseboats would not be directly adjacent to the future intersection. The setback between the houseboats and Owens Street (the nearest street) would be greater than the existing distance between the houseboats and Channel Street, due to the proposed expanded open space along China Basin Channel. The houseboats would experience a smaller noise increase compared with the 5.2 dBA increase modeled for the receptor directly adjacent to the intersection in the existing-with-project and cumulative-with-project scenarios. The houseboats would be about five times the distance from the intersection as the modeled receptor; at this distance the noise increase from the intersection would generally be attenuated to background noise levels, as a doubling of distance corresponds to a 6 dB reduction in noise due to attenuation by distance. Therefore, there would be no noticeable change in noise levels at the houseboats due to project-related traffic. Berry Street near Fourth Street would experience an increase of about 4.8 dBA with project traffic increases. Three of the study locations are planned for residential uses, with neighborhood-serving retail uses permitted on the ground floor. These neighborhood-serving retail uses could include noise-sensitive receptors like small child-care facilities or small institutional uses. The study location on Mariposa Street west of Fourth Street is intended to assess traffic noise effects on the public open space proposed for the northwest corner of Mariposa and Fourth Streets. The exact traffic noise impact at these locations would vary depending on the proximity of new sensitive receptors to traffic noise sources and on the build-out schedule for the project.

Existing traffic noise levels at most of the study locations near residential receptors are high enough (above 65 dBA on the exterior of the building) for the *San Francisco General Plan* Environmental Protection Element to discourage new residential developments unless substantial noise reduction features are included in their designs. Newer residential buildings, such as those recently built in South Beach, are required to meet interior noise standards established in Title 24 of the California Code of Regulations and therefore include noise insulation based on existing noise levels at these sites (see "Noise" in Section IV.B of the Initial Study [Appendix A]). The future ambient exterior noise

levels with project traffic noise would range from about 65 to 75 dBA L_{dn} . The interior noise levels would be about 15 dBA less than exterior levels with windows open and 25 dBA less with windows closed. This reduction is due to attenuation afforded by building walls and windows. The exterior noise levels could be annoying to some residents on the streets studied and on other similarly noisy streets within the Project Area; the level of annoyance would depend on a number of factors, including whether or not the buildings in the affected residential areas contained sufficient noise insulation. While exterior noise levels may increase and result in a concomitant interior noise level increase, these increases would not be of the magnitude to substantially alter the exterior noise environment and would not cause a significant impact.

Cumulative (Year 2015) Traffic Noise

Table V.G.2 summarizes the modeled noise levels from existing, cumulative, and cumulative-plus-project traffic at seven noise analysis locations. The cumulative traffic analysis includes p.m. peak hour traffic increases associated with the project and other projected growth within San Francisco and in the Project Area. The p.m. peak hour traffic values were scaled to arrive at a total 24-hour traffic increase./13/

With cumulative growth in traffic alone in 2015, 24-hour traffic noise levels would increase by up to 0.6 dBA at the study locations analyzed. At the two residential locations there would be less than a 1 dBA increase due to cumulative traffic growth; this increase would not noticeably change noise levels. Cumulative traffic growth without project traffic in 2015 on streets near the three other study locations would not cause a substantial increase in traffic noise.

Project-induced traffic, when added to cumulative traffic in the year 2015, would add to the overall noise environment at the sites studied and at similar sites along main access routes in and near the Project Area. The cumulative-plus-project L_{dn} noise level would increase by 0.6 dBA at Potrero Avenue and 16th Street. No change would result at the Pennsylvania, south of Mariposa, residential study location because traffic from the Project Area would not be expected to use Pennsylvania Street south of Mariposa Street on a regular basis. Noise from traffic increases on Mariposa Street would not be noticeable at this residential study location.

Proposed project traffic plus cumulative traffic in 2015 would cause 24-hour L_{dn} noise levels to increase by up to 1.8 dBA at St. Gregory's Episcopal Church and other sensitive uses on Mariposa Street at De Haro Street, while the one-hour L_{eq} for p.m. peak hour traffic would increase by 1.6 dBA with project traffic. These increases in traffic noise would not be noticeable to most individuals and would not be expected to interrupt church activities.

TABLE V.G.2
PROJECT TRAFFIC NOISE LEVELS FOR CUMULATIVE TRAFFIC VOLUMES (YEAR 2015)

TABLE V.G.2 PROJECT TRAFFIC NOISE LEVELS FOR CUMULATIVE TRAFFIC VOLUMES (YEAR 2015)									
Location Number/a/	Study Location	Traffic Noise Source		Noise Level (dBA)				Impact Determination	
				Traffic Scenario		Cumulative Change			
				Existing	Cumulative without Project (2015)	Cumulative with Project (2015)	Project Increase over Cumulative Alone		
		Street Modeled On	Near	L _{dn} /b/					
1	Residential Location	Pennsylvania	Mariposa	58.8	58.8	58.8	0	0	0
2	Residential Location	Potrero	16th	71.0	71.6	71.6	0	0.6	0.6
3	Church (Sensitive Receptor)	Mariposa	De Haro	62.9	63.4	64.7	1.3	0.5	1.8
4	Other Study Location /c/	Berry	Fourth	60.8	60.8	65.6	4.8	0	4.8
5	Other Study Location /c/	Third	Mission Rock	73.8	73.7	75.8	2.1	-0.1	2.0
6	Other Study Location /c/, /d/	The Common	Owens	63.4	63.4	68.6	5.2	0	5.2
7	Other Study Location	Mariposa	Fourth Street	67.4	66.8	72.1	5.3	-0.6	4.7
				L _{eq} (1-hour) /b/					
3	Church (Sensitive Receptor)	Mariposa	De Haro	64.0	64.4	65.6	1.2	0.4	1.6

Notes:

a. Figure V.G.2 shows the location of these sites.

b. L_{dn} is the 24-hour average noise intensity with 10 dBA added to account for sensitivity to nighttime noise. L_{eq} is the average noise intensity during the one-hour analysis period.

c. Some locations do not currently have receptors but were studied to assess noise impacts on potential future noise-sensitive land uses.

d. Field measurements were taken on Sixth Street, south of Channel Street, because this is the existing street closest to the proposed new intersection, and most existing Sixth Street traffic would be expected to shift to the new, extended Owens Street.

Source: EIP Associates.

Notes:

- Figure V.G.2 shows the location of these sites.
- L_{dn} is the 24-hour average noise intensity with 10 dBA added to account for sensitivity to nighttime noise. L_{eq} is the average noise intensity during the one-hour analysis period.
- Some locations do not currently have receptors but were studied to assess noise impacts on potential future noise-sensitive land uses.
- Field measurements were taken on Sixth Street, south of Channel Street, because this is the existing street closest to the proposed new intersection, and most existing Sixth Street traffic would be expected to shift to the new, extended Owens Street.

Source: EIP Associates.

The L_{dn} at the other study locations would increase 2.0 to 5.2 dBA in 2015 with cumulative-plus-project traffic. The increase of 5.2 dBA at the roundabout on Common Street south of Owens Street, and the 4.8 dBA increase on Berry Street, west of Fourth Street, would be noticeable to most individuals if the increase occurred over a short period of time. However, these cumulative increases are expected to occur gradually over 15 to 20 years and would not be noticeable to most people. The response by new occupants of the Project Area would depend, in part, on the build-out schedule. Multi-unit residential buildings are required to include noise insulation under Title 24 of the California Code of Regulations (see "Regulatory Framework" under "Noise," above). The amount of insulation is based on ambient exterior noise levels existing at the time that the building permit is issued. If residential uses, or noise-sensitive uses such as a child-care center or educational facilities, were established relatively early in project build-out, when traffic noise was relatively low, an increase of 3 to 5 dBA over time would be noticeable and could be annoying to some people. While interior noise levels would be lower than exterior noise levels by about 25 dBA with windows closed, the increase in noise levels would be the same (2 dB to 5.2 dB), and this increase would be noticeable over time in residential buildings constructed early in the development program in part because the amount of noise insulation required by Title 24 of the California Code of Regulations would have been based on the earlier, quieter noise levels existing at the time that building was constructed. If the noise-sensitive uses were established in buildings built in late phases of project development, traffic-caused noise increases would have already occurred, and building noise insulation requirements in Title 24 would provide substantial attenuation, so that future interior noise increases would be substantially less than the cumulative-plus-project exterior L_{dn} change from 1997 to 2015 shown in Table V.G.2.

The intersection of Mariposa Street and the future Fourth Street realignment was studied to assess traffic noise effects on the proposed public open space adjacent to the northwest corner of this intersection. The change in the cumulative-plus-project noise level at this location would be 4.7 dBA. Because people would not be permanently located in the park, the resulting noise level and its effect on activities would be of greater interest than the change in the noise level. The resulting noise level would be 72.1 dBA and would be at a level for which construction of a park or playground would be discouraged by the *San Francisco General Plan* Environmental Protection Element without further study.^{14/} The resulting noise level may detract from some of the possible relatively quiet uses of the park, such as picnics or meditation. Other uses such as soccer, exercise, or other sporting activities would not be affected by the resulting noise level. The 72.1 dBA noise level was calculated using peak hour traffic volumes. Noise levels would be lower at off-peak hours and on weekends, when the open space would likely be more heavily used. While the predicted noise level may reduce the desirability of the open space for some activities at certain times of the day, it would not be expected to substantially alter the use of the open space and would not be considered a significant impact.

INTERMITTENT NOISE SOURCE IMPACTS

Ballpark Traffic Noise

The quantitative cumulative traffic noise analysis described above does not include San Francisco Giants Ballpark game day traffic. The San Francisco Giants Ballpark analysis included an estimate of cumulative impacts, when Mission Bay, UCSF, and ballpark traffic coincide. This estimate and analysis are summarized below. Traffic from sold-out events at the San Francisco Giants Ballpark, located across Third Street from Mission Bay North, would combine with cumulative future traffic from the Project Area and from the rest of the City and region on days when events are scheduled. Ballpark traffic noise was analyzed in the Ballpark EIR; relevant portions of that analysis are summarized here./15/ Ballpark traffic would increase noise levels in and near the Project Area primarily during the hour before and the hour after ballgames and events, when the majority of patrons are assumed to arrive at or leave parking areas near the ballpark. The Ballpark EIR analyzed a number of existing and proposed residential locations along expected traffic routes for ballpark traffic, and calculated the 24-hour average noise levels from that traffic./16/ The results of this analysis show that ballpark traffic would cause noise increases over existing and over cumulative 24-hour traffic noise levels of 1.8 dBA L_{dn} or less at the locations analyzed./17/ This increase alone would not be noticeable to most receptors.

Although the locations analyzed in the Ballpark EIR are not the same as those analyzed for this SEIR, the results indicate that the addition of ballpark traffic to the project and cumulative traffic noise from the Project Area would cause similar increases at locations in and near the Project Area. The greatest 24-hour average noise level increases from ballpark traffic were shown on Third Street, north of China Basin Channel./18/ If these increases also occurred in Third Street south of the Channel, noise levels at the intersection of Third and Mission Rock Streets could increase by about 9 dBA L_{dn} over existing exterior and interior levels with project, cumulative, and ballpark traffic. This change would be perceived as a nearly doubling of loudness if it occurred over a short period of time. The actual effect on Project Area residents and sensitive receptors that may locate on Third Street in Mission Bay South would depend in part on when buildings were built and occupied there; if traffic noise increases from Project Area and cumulative growth have already occurred before Third Street sites are built and occupied, the new buildings would have included noise insulation pursuant to Title 24 of the California Code of Regulations and interior noise levels would be attenuated.

The Ballpark EIR also analyzed one-hour L_{eq} noise levels at a few nonresidential locations, including at the church near Mariposa and De Haro Streets. Ballpark traffic alone would add about 5.4 dBA to existing noise levels at that location, during the period before a high-attendance weeknight ballgame

or event (6:30 - 7:30 p.m.).^{19/} In combination with cumulative growth in traffic including assumptions about growth from the Mission Bay Project Area with UCSF, the Ballpark EIR showed that traffic would cause noise levels to increase by up to 9.2 dBA if p.m. peak hour traffic volumes were to be the same at 6:30 p.m. as they are at 4:30 p.m.^{20/} This increase would be perceived as a nearly doubling in loudness and would be annoying to many church users when peak ballpark traffic coincided with church occupancy. Ballpark traffic would contribute about 5.5 dBA of the total 9.2 dBA increase. This analysis was prepared using preliminary traffic data for development in Mission Bay, and it included a conservative analysis which overestimated traffic growth on this segment of Mariposa Street west of the I-280 freeway ramps. The more detailed traffic analysis prepared for this SEIR has refined the traffic data. Therefore, the noise analysis for the SEIR shows a smaller noise increase on Mariposa Street at De Haro Street than was shown in the Ballpark EIR. If this p.m. peak hour traffic noise increase were combined with ballpark traffic noise increases, the result would be less than 9 dBA L_{dn} at the church location. The change would be noticed by some churchgoers, but would not be perceived as a doubling in loudness.

Ballgames and other events at the ballpark would not occur on a daily basis, and noise increases due to ballpark traffic would not occur throughout the year. Therefore, at most locations, ballpark traffic noise would not be considered a significant impact.

Caltrain

Caltrain trains would be expected to generate noise which would be noticeable to future residential receptors within the Project Area. The Caltrain terminal is outside the Project Area immediately to the north, at the southwest corner of Fourth and Townsend Streets. New residential receptors in the Project Area would be close to the terminal and tracks (within 100 feet in some locations in Mission Bay North). Weekday operating hours at the Caltrain terminal are from 5:00 a.m. to 10:00 p.m. The last train leaves the terminal at 10:00 p.m. on weekdays, with an additional train leaving San Francisco at midnight on Fridays. After night baseball games and other high-attendance nighttime events at the ballpark there may be an additional train leaving after 10:00 p.m. on nights other than Fridays. One train arrives at about midnight each night; all other arrivals are scheduled before 10:00 p.m. Caltrain currently operates 66 trains each weekday between San Jose and San Francisco.^{21/} Frequencies in the weekday peak periods vary between 5 and 30 minutes; in the off-peak periods, trains operate every 30 to 60 minutes.

Because there is only one late night train per week most weeks, the noise impact at night, when people are most sensitive to noise, would be limited. This train activity does not substantially affect the 24-hour average ambient noise levels weighted to account for nighttime noise sensitivity (L_{dn})

because there are no trains leaving after 10:00 p.m. on most nights and only one late night arrival. Therefore, new residential uses near the tracks would not experience an L_{dn} that would be substantially higher than the L_{dn} in similar residential areas. There are single-family homes and multi-family residential buildings within 100 feet of the tracks in other areas of the City and along the tracks on the Peninsula (e.g., in San Bruno along San Antonio Avenue; in Palo Alto across Alma Street; in Atherton where backyards of single-family homes are adjacent to the tracks; and in San Mateo where apartment buildings are immediately adjacent to the track right-of-way). The noise, while noticeable, would not be expected to disrupt daily activities at the new residential locations within the Project Area.

Third Street Light Rail

The extended light rail service under consideration by MUNI from King and Fourth Streets south to the Bayview Hunters Point and Visitacion Valley neighborhoods is proposed to travel on Fourth Street to Owens Street, on Owens Street to Third Street and then on Third Street south through the Project Area. Preliminary noise analyses for the Third Street Light Rail Project EIS/EIR indicate that the light rail trains would produce noise levels ranging from 58 to 60 dBA L_{dn} for a receptor at about 10 to 15 feet from the tracks./22/ Because existing noise levels along Third Street are relatively high (68 to 73 dBA L_{dn} at various locations on Third Street as shown in Appendix Table F.3), the addition of light rail traffic would not cause significant increases in noise exposure.

16th Street Freight Rail Track Rerouting

The proposed Mission Bay project would relocate the existing freight railroad tracks located in the vicinity of 16th and Mariposa Streets, which provide access to Pier 80. Currently, the railroad intersects 16th and Third Streets at a 45-degree angle. The railroad tracks would be relocated to coincide with the 16th Street realignment.

Trains bound for Pier 80 would travel east along 16th Street to Terry A. François Boulevard. Trains would then travel north on Terry A. François Boulevard and reverse direction to reach Illinois Street and continue on to Pier 80. Rail access could also be provided to reach Piers 48 and 50, if trackage were extended further north along the boulevard.

The existing freight rail tracks have been used infrequently in the last year./23/ Future use levels are unknown, and would depend on the amount of cargo generated by Pier 80 activity in the future that would be distributed by rail. Freight trains traveling along the 16th Street rail line would be expected to generate noise that would be noticeable to future residents within the Project Area. Freight trains

generally would be restricted to use of the main rail line after Caltrain passenger train operating hours, between the hours of 1:00 a.m. and 4 a.m.

Depending on the frequency of use of the freight line near residential land uses (lines to Piers 48 and 50), noise from the trains during the early morning hours may be noticeable and could be disruptive./24/

Bascule Bridge Openings

Noise measurements taken in the field near the Lefty O'Doul and Peter Maloney Bridges, associated with the opening and closing of the lift bridges, indicated that levels were not substantially different from background noise in the area. In addition, the China Basin Landing buildings are located along the Channel between Third and Fourth Streets. This massive structure acts as a noise barrier to potential receptors in Mission Bay North, between Third and Fourth Streets./25/ Potential noise from the bridge would be attenuated by distance between the lift mechanism and residential sites south of the Channel. Finally, the duration of the siren is very short and the total time for bridge openings is about five minutes. Therefore, noise associated with the bascule bridges would not be considered to significantly impact potential future noise-sensitive land uses in the Project Area.

Ballpark Concert Noise

Two concert scenarios at the proposed Giants Ballpark were analyzed quantitatively for noise effects in the Ballpark EIR: the first, a rock concert (special event) with a capacity crowd of up to 50,000; the second, a smaller concert with about 10,000 in attendance, seated in a limited portion of the ballpark with a stage located at the pitcher's mound and a fabric canopy over the infield area./26/

Full Capacity, Open Air Concert

In general, the maximum crowd-cheering noise level would be higher than the maximum music level, but the hourly crowd L_{eq} would be much less than the hourly music L_{eq} . Thus, music would be the dominant influence on the noise environment, with occasional interruption by crowd cheers.

Several locations within the Mission Bay Project Area were analyzed in the Ballpark EIR to assess effects of concerts on possible residential uses. Locations studied were the residential area between King and Berry Streets east of Fourth Street in Mission Bay North, the potential hotel and residential areas between Third and Fourth Streets north of Mission Rock Street, and the proposed residential area east of Third Street south of Mission Rock Street. These locations are listed in Table V.G.3,

**TABLE V.G.3
PROJECTED CONCERT NOISE LEVELS
FOR FULL CAPACITY, OPEN AIR EVENTS AT BALLPARK
(representative locations in Mission Bay)**

Location	Height /c/	Existing Weekend or Evening Hourly L_{eq}	Ballpark Music/a/ Noise Level (dBA)		Music Plus/a/ Crowd Noise (dBA)		Total Noise/b/ (dBA)	
			Hourly L_{eq}	Max. Level	Hourly L_{eq}	Max. Level	Hourly L_{eq}	Change in Hourly L_{eq}
Proposed Apartments between King and Berry Streets east of Fourth Street (ground, mid-, and top levels)	a	62	53	59	54	61	63	1
	b	60	53	59	54	61	61	1
	c	57	53	59	54	63	59	2
Mission Bay South between Third and Fourth Streets	a	63	69	75	69	75	70	7
	b	63	75	81	75	81	75	12
Mission Bay South along Terry A. François Blvd.	a	60	66	72	67	74	68	8
	b	60	71	77	71	78	72	12

Notes:

- “Ballpark Music Noise” and “Music plus Crowd Noise” calculate noise from concert music alone and for noise from music and the audience alone, without regard to any surrounding noise sources. “Maximum Level” is the maximum cheer or applause.
- Total noise adds music L_{eq} plus crowd noise L_{eq} to existing ambient noise. Note that dB cannot be added together using conventional arithmetic.
- Height “a” is approximately ground floor, height “b” is at approximately 60 feet, and height “c” is at approximately 130 feet of each multi-unit residential building.

Source: *San Francisco Giants Ballpark at China Basin EIR*, Table IV.F.4, p. IV.258; based on Wilson, Ihrig & Associates, Inc., *San Francisco Pacific Bell Park at China Basin Acoustical Analysis of Impacts from Stadium Noise*, February 1997.

which presents relevant data from the Ballpark EIR./27/ As shown in the table, upper stories of buildings in Mission Bay South that face the ballpark could experience increases in hourly L_{eq} of up to 12 dBA. Increases of this magnitude would be distinctly audible above background noise.

Concert and crowd noise from large music events would be noticeable and could be annoying to residents living in residential buildings near the ballpark in the Project Area. Some residents might find it difficult to sleep or might have their sleep disturbed as a result of a large music event.

Because large, amplified music events would be limited to three per year, with mitigation measures imposed requiring noise limits of no greater than a 3 dBA increase at the nearest residential receptor for additional concerts/28/, music noise from concerts would not be considered to be a significant impact on sensitive receptors in Mission Bay.

Small Concert Events

For small music events, music and crowd noise was added to existing noise levels for study locations near the ballpark in the Ballpark EIR./29/ At locations across the China Basin Channel from the ballpark in the Project Area where existing or planned new buildings would not block sound, one-hour average noise increases of 0 to 1 dBA could occur. While this level of noise increase normally would not be noticeable, because of the difference in character of crowd and music noise, it is possible that at some buildings in Mission Bay North, occasional cheers or applause might be noticeable at upper floors with windows open, depending on the sound-reducing qualities of the material used for the canopy in this scenario. The ballpark structure and other intervening buildings would block sound from small concert events at most Project Area locations. Small concert events would not cause significant noise impacts in the Project Area.

CONSTRUCTION NOISE

Construction noise, with the exception of pile driving, would have a short-term effect at each building location and therefore would not be considered a significant impact; pile-driving noise would be exceptionally loud and noticeable throughout the Project Area during build-out. Construction noise was previously examined in the 1990 FEIR; the impact of the proposed project would not substantially differ from that already analyzed, and no major new information about construction noise has come to light since the 1990 FEIR was certified. Compliance with the San Francisco Noise Ordinance would mitigate potential impacts. All development activity, including UCSF, would comply with the San Francisco Noise Ordinance. Construction noise effects and mitigation measures are summarized in "Noise" in Section IV.B of the Initial Study (Appendix A).

Construction pile driving would create a significant noise impact, addressed by Mitigation Measure G.1 in Section VI.G, Mitigation Measures: Noise.

OTHER POTENTIAL NOISE SOURCES

As mentioned in "South Beach," under "Existing Land Uses in Nearby Areas" in Section V.B, Land Use: Setting, there is a potential for maritime industrial or interim non-maritime industrial uses that could expand on Piers 48 and 50 on port property, immediately adjacent to the Project Area, to the northeast of Mission Bay South. Noise sources associated with industrial activities on these piers could contribute to background noise levels, although it is unlikely that residential or sensitive receptors would be adversely affected because of distance from the noise source (300 to 400 feet or more) and reduction in interior noise levels due to Title 24 construction standards.

Live-work uses may be intermixed with future residential land uses in the Project Area. Residential receptors near the live-work buildings may experience intermittent industrial-type noise. However, this type of noise and the proximity of residential receptors is not uncommon in the east side of the City. The noise level experienced by the residential receptors would be similar to that at upper-level residences where the retail facility below was a restaurant or similar somewhat noisy business. All new residential buildings would be built in compliance with Title 24 noise insulation standards which would minimize the impact of intrusive noise. The noise level generated by live-work facilities would not be expected to routinely disrupt daily activities at nearby residential receptors.

A new fire station is proposed to be located within a residential area in Mission Bay South and would have residential receptors on three sides. The sirens on fire trucks would cause intermittent noise at levels that would be annoying to some residents. At close range, without any intervening barriers, sirens can reach upwards of 90 dBA. This noise would be diminished inside the residential buildings by noise insulation. The frequency of the sirens would vary and would depend on the number of emergency responses per day. Similar fire stations within the City respond to as many as 30 calls per day. The location of a fire station within a residential area is not uncommon in San Francisco. Currently there are other fire stations (e.g., Station No. 28, the Telegraph Hill station located at 1814 Stockton, and Station No. 41, the Nob Hill station located at 1325 Leavenworth) located among housing units. While the intermittent noise levels may be annoying, they would not be expected to significantly change the community noise level or 24 hour L_{dn} .

INTERIM AND TEMPORARY USES

Interim and temporary uses generally would be expected to generate less traffic than is projected for full build-out; therefore, traffic noise levels in the Project Area would be less than predicted for cumulative (2015) plus project conditions. No significant traffic noise impacts were found under existing-plus-project or cumulative-plus-project conditions so no significant impacts would be expected from interim and temporary uses when traffic volumes would be less.

Some potential temporary uses such as fairs and carnivals could attract large amounts of traffic and could increase traffic noise levels on a short-term, localized and intermittent basis. However, traffic to these types of events would be dispersed throughout the day with no single, substantial influx of traffic. In addition, based on current experience, these events would be rare. This type of temporary traffic pattern would not substantially alter the traffic noise environment and therefore would not cause a significant traffic noise increase. Noise from stationary activities associated with temporary uses would be regulated by the City Noise Ordinance.

VIBRATION

The following section describes, in qualitative terms, the impacts of vibration from transportation sources and construction activities in the Project Area.

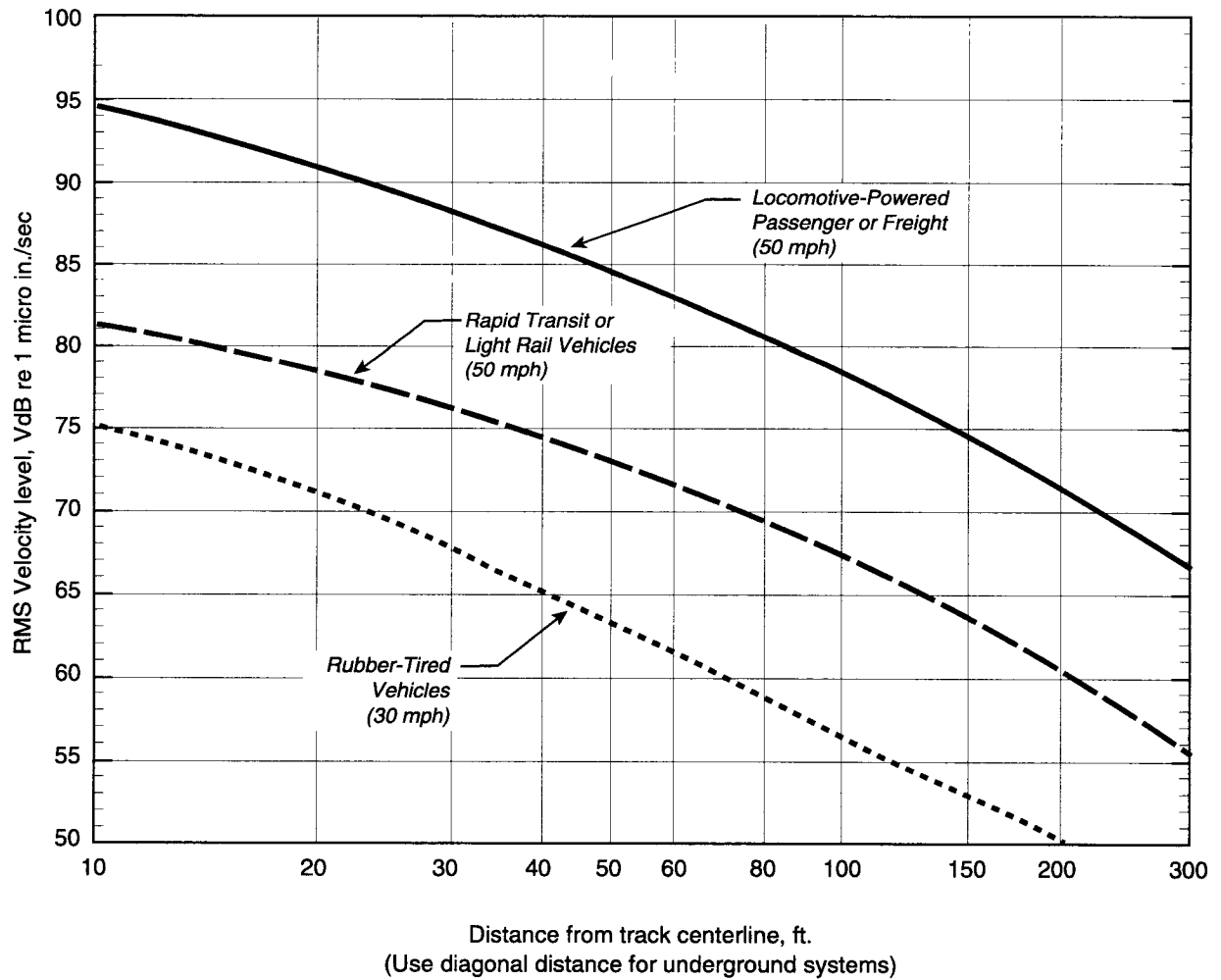
Transportation Vibration Sources

As shown in Figure V.G.3, vibration (VdB) drops off as distance increases from the source. A number of factors are responsible for the attenuation of vibration away from transportation sources. These include source, path, and receiver factors.

Vehicle type, speed, track type (for rail vehicles), or road conditions are considered source factors in the transmission of vibration. Trucks and buses typically cause less vibration than light and heavy rail vehicles.^{/30/} As vehicle speed increases, vibration effects also increase. Rough roadway surfaces increase vibration from heavy trucks and buses. The type of track also plays an important role in vibration from light and heavy rail vehicles; jointed rails cause more vibration than do welded rails, for example. Elevated structures can drastically reduce track vibration. On the other hand, worn track and damaged wheels can increase vibration.

Path factors are associated with the geologic conditions that vibration travels through. For instance, stiff clays will efficiently transmit vibration over greater distances than sand and unconsolidated fill.^{/31/} Depth to bedrock is also important; shallow bedrock less than 30 feet below the ground surface is likely to have efficient propagation of vibration. Depth to bedrock in the Project Area varies from 30 to more than 240 feet below ground surface. (See "Geology/Topography" in Section IV.B of the Initial Study [Appendix A].) In addition to geologic factors, the path that vibration must travel through a building is also important. In general, the heavier the building is, the greater the coupling loss, or effect of vibration. Wood-frame buildings, such as a residential structure, will respond to vibrations more easily than a large masonry building.^{/32/}

Finally, the receiver factor accounts for the dispersion, attenuation, or amplification of the vibration energy throughout a building. Vibration generally reduces in level as it propagates throughout a building. A 1 to 2 VdB per floor is usually assumed.^{/33/} Resonances of the building, particularly in the floor, may amplify the vibration, counteracting this attenuation. Therefore, depending on the structural properties of the building, vibration effects may cancel each other out, particularly in a wood-frame building.



SOURCE: Office of Planning, Federal Transit Administration, U.S. Department of Transportation, *Transit Noise and Vibration Impact Assessment Final Report*, April 1995, p. 10-3

MISSION BAY SUBSEQUENT EIR

FIGURE V.G.3 GENERALIZED GROUND SURFACE VIBRATION CURVES

Proposed project uses that could be affected by transportation vibration sources include new residential uses in buildings on streets adjacent to the proposed alignment of the new Third Street light rail tracks and adjacent to the Caltrain tracks. Most commercial uses in buildings adjacent to the light rail or heavy rail tracks would be less likely to be affected by vibration. However, sensitive and delicate instruments and equipment inside buildings used by research and development firms could be affected by light or heavy rail vibration. Research activities in buildings on the UCSF site located adjacent to 16th Street, where freight rail tracks are proposed to be realigned, and adjacent to Third Street where MUNI proposes new light rail service, could be affected by vibrations if they are using especially sensitive equipment.

Vibration is generally perceptible at levels above 65 VdB, and most people will be strongly annoyed by vibration levels at 85 VdB./34/ (See Appendix Figure F.1 for typical levels of ground-borne vibration.) Typical roadway vibrations from heavy trucks and buses are generally not noticeable under most conditions except when roads are rough or contain potholes, because they operate on rubber tires./35/

As presented in Table 5-18 of the *Draft Third Street Light Rail Project EIS/EIR*, the impact threshold for light rail vehicles on a wood-frame residence was established at 72 VdB, resulting in maximum impact distances in residential land use areas from ground-borne vibration ranging from 20 to 170 feet, without mitigation./36/ Most track segments, including those in the Project Area, have an impact distance of 100 feet for wood-frame residential buildings. According to the Draft EIS/EIR, mitigation measures such as modified suspensions on the trains and vibration control track systems would reduce the impact distance to 55 feet from the source./37/

The Mission Bay project would include multi-unit residential uses within 50 feet of the proposed light rail track along Third Street from North Common Street to Owens Street, and along Owens Street to Fourth Street and the Peter Malony Bridge. The *Third Street Light Rail Project DEIS/DEIR* analysis was prepared for small, wood-frame residential buildings that are more sensitive to vibration than are multi-story masonry buildings. The major buildings in the Project Area are expected to be built with pile-supported foundations that would attenuate vibration. Mat foundations are also likely to be used for some buildings where bedrock is shallow; mat foundations would be more susceptible to ground-borne vibrations than pile foundations but less than wood-frame buildings. If the residential structures on Third and Owens Streets south of the Channel were relatively large concrete construction on piles or spread-footing foundations similar to the residential buildings in South Beach on Townsend and Brannan Streets near The Embarcadero, the impact distance would be reduced to about 25 feet, according to the *Third Street Light Rail Project DEIS/DEIR*./38/ Under these conditions, significant vibration effects on adjacent residential uses would not be expected from light rail vehicles. If any of

the residential buildings along the proposed Third Street light rail alignment were to be small, wood-frame buildings, vibration from the light rail vehicles would be noticeable in those buildings and could be annoying to some residents; this type of residential building is not expected to be used in the Project Area on the light rail line, so no significant vibration effect would occur.

Most commercial and industrial buildings facing Third Street south of South Common Street, on the UCSF site and in research and development facilities on the east side of Third Street, would be expected to be in pile supported concrete construction that would attenuate vibration from the proposed light rail line to acceptable levels similar to the residential uses discussed above. Transit vehicle vibration impact criteria for typical commercial and industrial buildings with primarily daytime uses range from 75 VdB to 83 VdB./39/ The *Third Street Light Rail Project DEIS/DEIR* data indicate that vibration levels would range from 70 to 80 VdB at distances of 50 to 100 feet. These vibration levels would not exceed the transit impact criteria for commercial and industrial uses and therefore would not cause significant vibration impacts.

Vibration-sensitive equipment such as optical and electron microscopes in a building calls for a lower impact criterion of 65 VdB, according to the Federal Transportation Administration./40/ As the proposed light rail system could cause vibration levels over 70 VdB at distances of about 50 feet, some impact could occur to more sensitive uses in future buildings located immediately adjacent to Third Street in the Project Area, including those at the UCSF site, unless vibration-reducing measures were included in design and construction of buildings on Third Street or in foundations supporting the vibration-sensitive equipment. It is common for special equipment to be installed with vibration attenuation features in order to avoid disruption from occasional incidents such as loading dock activities in a building; such features would also serve to reduce any vibration from nearby light rail vehicles. Note that the vibration level reported does not account for attenuation due to building construction type; large concrete and steel buildings on pile foundations generally reduce vibration by about 10 VdB/41/, which would reduce the Third Street Light Rail Project vibration to acceptable levels for these sensitive uses without accounting for any measures included in building design, in equipment supports, or in light rail design. Therefore, impacts to vibration-sensitive equipment would be less than significant.

The other main vibration source in the Project Area would be heavy rail from Caltrain tracks in Mission Bay North from the Caltrain terminal and parallel to Seventh Street on the west boundary of the Project Area in Mission Bay South, and from the realigned freight rail tracks in 16th Street, Terry A. François Boulevard and Illinois Street. (Rubber-tire vehicles such as buses and trucks generally do not cause significant vibration effects because the tires and suspension absorb most of the vibration; vibration from these vehicles results mainly from potholes or bumps./42/) In the Project

Area, most residential land use areas are well over 200 feet from the Caltrain tracks, with the exception of residential land uses west of the intersection of Berry Street and Sixth Street. In this block of the Project Area, designated for Mission Bay North Retail land uses, residences may be located as close as 50 feet from the Caltrain tracks on upper stories of buildings. Caltrain is a heavy rail operation and therefore causes greater vibration than would the proposed Third Street light rail vehicles. Generalized ground surface vibration curves, shown in Figure V.G.3, would suggest that vibration could be 85 VdB at 50 feet if Caltrain were operating at 50 miles per hour. The Project Area block closest to the Caltrain tracks is one city block from the train station and the train speed would be less than 20 miles per hour; this reduces vibration by about 8 VdB./43/ In addition, vibration would be reduced by building foundations, would be further reduced by the expected building type (concrete on safe foundations) and by locating residences on upper stories, and would be increased by the jointed track typical of heavy rail tracks and by any worn wheels. The resulting vibration level would likely range from 70 to 75 VdB, depending on the specific nature of the soil and fill on that block. Since no details regarding building size and foundation type are available, the effects of vibration on these residences cannot be quantified, but might exceed the Federal Transit Authority vibration impact criterion of 72 VdB for frequent events (vibration events occurring more than 70 times per day) once Caltrain expands service to 86 trains per day./44/ Thus, it is possible that vibration could be a significant impact for buildings at this location. Mitigation Measure G.2 in Section VI.G, Mitigation Measures: Noise and Vibration, addresses this impact.

Caltrain tracks are located somewhat farther from development sites south of the Channel than from the retail and residential area adjacent to the tracks in Mission Bay North. Vibration impacts would attenuate with distance at these locations.

Freight rail tracks are proposed to be relocated from proposed development parcels south and north of 16th Street to the 16th Street right-of-way between the existing Caltrain tracks and Terry A. François Boulevard as part of the Mission Bay project. This heavy rail vibration source would be within 50 feet of the fronts of buildings located along 16th Street, including future buildings on the southern edge of the UCSF site. If research facilities in these buildings included sensitive equipment like that described above in the discussion of the Third Street Light Rail Project, vibrations from freight trains could impact that equipment unless vibration-reducing measures were included in building designs, or in the foundations supporting sensitive equipment typically included in equipment installation. The existing freight rail tracks, located near 16th Street, are used infrequently, and the use is generally limited to 1 a.m. to 4 a.m. (see "Rail Freight," in "Goods Movement," under "Existing Project Area Transportation Facilities" in Section V.E, Transportation: Setting). Freight trains move at low speeds of 5 to 10 miles per hour in this area, because of the large number of curves and the urban nature of

the area (see "Pedestrian Impacts," in Section V.E, Transportation: Impacts), substantially reducing vibration effects. Thus, rail freight use in 16th Street would not cause a significant vibration impact.

Construction Vibration Sources

Pile driving is potentially the greatest source of vibration generated from construction activities. As discussed in Appendix G, multi-story structures would most likely require pile driving for their foundations. There are essentially two types of pile drivers: vibratory and impact. A vibratory pile driver, which can operate at different frequencies, vibrates the pile into the ground. The continuous motion of vibratory pile driver may increase the resonance response (sympathetic vibrations in response to ground vibrations) of building structures. Impact pile drivers produce a high level of vibration for short periods (0.2 second) with sufficient time between impacts to allow a building's resonant effects to decay before the next vibration event./45/

Since much of the Project Area is unconsolidated fill, consisting of sand, rock, clay, debris and mud, it is difficult to quantify the vibration impacts of pile driving activities. Also, because of the irregularities of the fill, and difficulties of driving piles through areas of large rock deposits and heavy debris, holes are likely to be drilled for pile driving. This would tend to decrease vibration levels from subsequent pile driving at the source, since not as much energy would be required to drive or vibrate the piles into predrilled holes.

Due to the relatively large distances of over 100 feet and the vibration attenuating characteristics of the fill, it is unlikely that Nearby Areas would experience vibration impacts from pile driving activities. Inside some future buildings within the Project Area, vibration may have impacts on sensitive and delicate instruments and equipment. Many of these vibration-sensitive instruments would be found in buildings on the UCSF site and in buildings housing research and development uses in the commercial/industrial areas of Mission Bay South. These instruments include transmission and scanning electron microscopes, laser optical systems, magnetic resonance devices, and others.

Impacts to these especially sensitive instruments would depend on the proximity of pile driving activities and to what extent precautions have been taken to isolate this equipment from shock. Sensitive devices generally would incorporate design solutions to limit the effects of ordinary vibrations found in any commercial or industrial building, including the use of shock absorbing materials and independent suspension systems. Equipment could also be relocated to less vibration-prone areas of a building if vibration were found to interfere with use during nearby construction activities. Buildings may also be constructed with flexible elastomeric pads incorporated into their design to isolate the structure, or a part of the structure that would house sensitive equipment, from

transportation vibration effects, which would also provide attenuation from construction vibration. Because construction vibration effects on sensitive equipment would be a concern for future users of research buildings, rather than a physical impact on people or the environment, it could be an inconvenience but would not be a significant environmental effect./46/

Vibration Impact Conclusion

In the absence of site-specific soil vibration data; building design and location information; construction equipment type and operational details; sensitive instrument and equipment type, location, and isolation features; and regulatory standards; the impacts of vibration in and adjacent to the Project Area are difficult to quantify. In particular, it is possible that impacts would occur from pile driving activities next to existing and occupied structures in the Project Area. These impacts would be temporary and dependent on such factors as the location of the piles relative to existing structures, the time and energy required to drive the piles, the type of pile driver, the structural design of the building, and steps taken to isolate sensitive equipment from the effects of vibration. However, potential construction and transportation induced vibration sources would be known to developers prior to construction and occupancy of new buildings. It is therefore reasonable to assume that building design and construction and equipment installation would reduce vibration impacts to less-than-significant levels.

NOTES: Noise and Vibration

1. A decibel is the standard unit of sound amplitude, or loudness; decibels are measured on a logarithmic scale, similar to the scale used to measure earthquake intensity. A logarithmic scale is a non-linear scale; for decibels, each increase in 10 dB multiplies the previous value by 10. For example, 50 dBA is 10 times louder than 40 dBA, while 60 dBA is 100 times louder than 40 dBA.
2. L_{eq} , the equivalent steady-state sound level, is the average acoustic energy content of noise for a stated period of time. The L_{eq} of two different time-varying noise events are the same if the events deliver the same acoustic energy to the ear during exposure, no matter what time of the day or night they occur, unlike some other measurements that adjust for differences in noise sensitivity at night.
3. L_{dn} is a day-night average noise level, a 24-hour average L_{eq} ; it takes into account the greater sensitivity of persons to nighttime noise and adds 10 dBA to the noise level added during the hours of 10:00 p.m. to 7:00 a.m.
4. CNEL is a community noise equivalent level 24-hour average noise similar to L_{dn} but with an additional 5 dBA added during the hours of 7 p.m. to 10:00 p.m. to account for sensitivity to nighttime noise.
5. Minnesota Pollution Control Agency, *An Introduction to Sound Basics*, May 1983.

6. Federal Transit Administration, Transit Noise and Vibration Impact Assessment, DOT-T-95-16, April 1995, Table 6-10. Shielding provided by a row of buildings provided the gaps in the row of buildings is less than 1/3 of the length of the row.
7. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997.*
8. San Francisco Board of Supervisors, Resolution 701-97, July 31, 1997, adopting ground lease for China Basin Ballpark, Exhibit F, Improvement Measures, p. 3, Item 2 under "Concerts and Other Events."
9. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995.
10. U.S. Environmental Protection Agency, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, March 1974, Appendix B, Table 4.
11. The Environmental Noise Model is a comprehensive, commercially available computer model developed by RTA Software Pty, Ltd., Sidney, Australia, for predicting community noise.
12. Background noise measurements were taken at the intersection of Sixth and Channel Streets to approximate the future intersection of The Common Streets roundabout and Owens Street.
13. This analysis does not include the San Francisco Giants Ballpark game day traffic. The impact on the project area and surrounding locations from Giants Ballpark traffic was analyzed in the Giants Ballpark EIR and is summarized in a separate section below. The Giants Ballpark analysis included estimated traffic from the Mission Bay project; although those estimates were preliminary, the transportation noise analysis results in the Ballpark EIR are conservative and remain valid, generally consistent with Mission Bay SEIR results.
14. City and County of San Francisco, Planning Department, *San Francisco General Plan*, Environmental Protection Element, p. I.G.17.
15. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997.*
16. The 24-hour L_{dn} was used because residential land uses are sensitive to noise impacts during an entire 24-hour period.
17. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, Table IV.F.1, p. IV.246, and Table IV.F.2, p. IV.249.*
18. As no sensitive receptors or residential uses exist along Third Street south of the Channel, the Ballpark EIR did not analyze sites in this area for noise effects.
19. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, Table IV.F.1, p. IV.246.*

20. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, pp. IV.250-IV.251.*
21. Caltrain Time Table and Information Guide, effective July 6, 1997 - January 3, 1998.
22. City and County of San Francisco, Planning Department, *Third Street Light Rail Project Draft EIS/EIR*, Planning Department File No. 96.281E, State Clearinghouse No. 96102097, Sections 5.13.1 and 5.13.3.
23. Charles Mitchell, Chief Wharfinger, Port of San Francisco, telephone conversation with EIP Associates, March 2, 1998.
24. It is likely that residents would become more accustomed to freight rail noise if the frequency of use was relatively constant and regular and became part of the "background" noise for the area, similar to the noise of Caltrain passenger trains. People are generally more sensitive to intermittent intrusive noise sources that occur on an irregular basis; many people become accustomed to regular, more frequent noise sources that occur at the same time on a daily (or nightly) basis.
25. Potential noise from the bridge would be attenuated by distance between the lift mechanism and residential sites south of the Channel. There is a 6 dB reduction in noise for each doubling of distance.
26. Concert noise impacts are discussed in the *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, pp. IV.256-IV.261.*
27. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, Table IV.F.4, p. IV.258.*
28. San Francisco Board of Supervisors, Resolution 701-97, July 31, 1997, adopting ground lease for China Basin Ballpark, Exhibit F, Improvement Measures, p. 3, Item 2 under "Concerts and Other Events."
29. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, pp. IV.259-IV.261.*
30. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, pp. 7-5 to 7-6.
31. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, p. 7-10.
32. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, page 10-9.
33. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, p. 10-10.
34. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, p. 7-5 to 7-6.

35. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, pp. 7-1, 7-5 and 7-9.
36. City and County of San Francisco, Planning Department, *Third Street Light Rail Project Draft EIS/EIR*, Planning Department File No. 96.281E, State Clearinghouse No. 96102097, Section 5.13.3.*
37. City and County of San Francisco, Planning Department, *Third Street Light Rail Project Draft EIS/EIR* 2, Planning Department File No. 96.281E, State Clearinghouse No. 96102087, Section 5.13.3.*
38. City and County of San Francisco, Planning Department, *Third Street Light Rail Project Draft EIS/EIR*, Planning Department File No. 96.281E, State Clearinghouse No. 96102097, Table 5-18, note /b/.*
39. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, pp. 8-2 to 8-3 and Table 8-1.
40. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, pp. 8-2 to 8-3 and Table 8-1.
41. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, Table 10-1, pp. 10-6 and 10-7.
42. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, pp. 7-9 and 9-1 to 9-3.
43. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, publication DOT-T-95-16, April 1995, Table 10-1, "Adjustment Factors for Generalized Predictions of Ground-bourne Vibration and Noise," pp. 10-6 to 10-7.
44. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, Table 8-1, p. 8-3.
45. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, p. 12-11.
46. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995, p. 11-19.

* A copy of this report is on file for public review at the Office of Environmental Review, Planning Department, 1660 Mission Street, San Francisco.

H. SEISMICITY

This section provides the seismic information needed to evaluate potential seismic hazards for the Mission Bay project. This information has been updated from the 1990 FEIR for Mission Bay. The Geology & Seismicity section of the 1990 FEIR is incorporated herein by reference./1/ Relevant text is summarized briefly in Appendix G of this SEIR. The project now being considered would occupy approximately the same area as the project analyzed in the 1990 FEIR for Mission Bay./2/ Updated geologic and soils information is included in the Initial Study (Appendix A) and also appears in Appendix G of this SEIR. Terms that are used in this SEIR pertinent to San Francisco's geologic and seismic conditions are defined in the Glossary at the end of this section. The endnotes for this section begin on p. V.H.20.

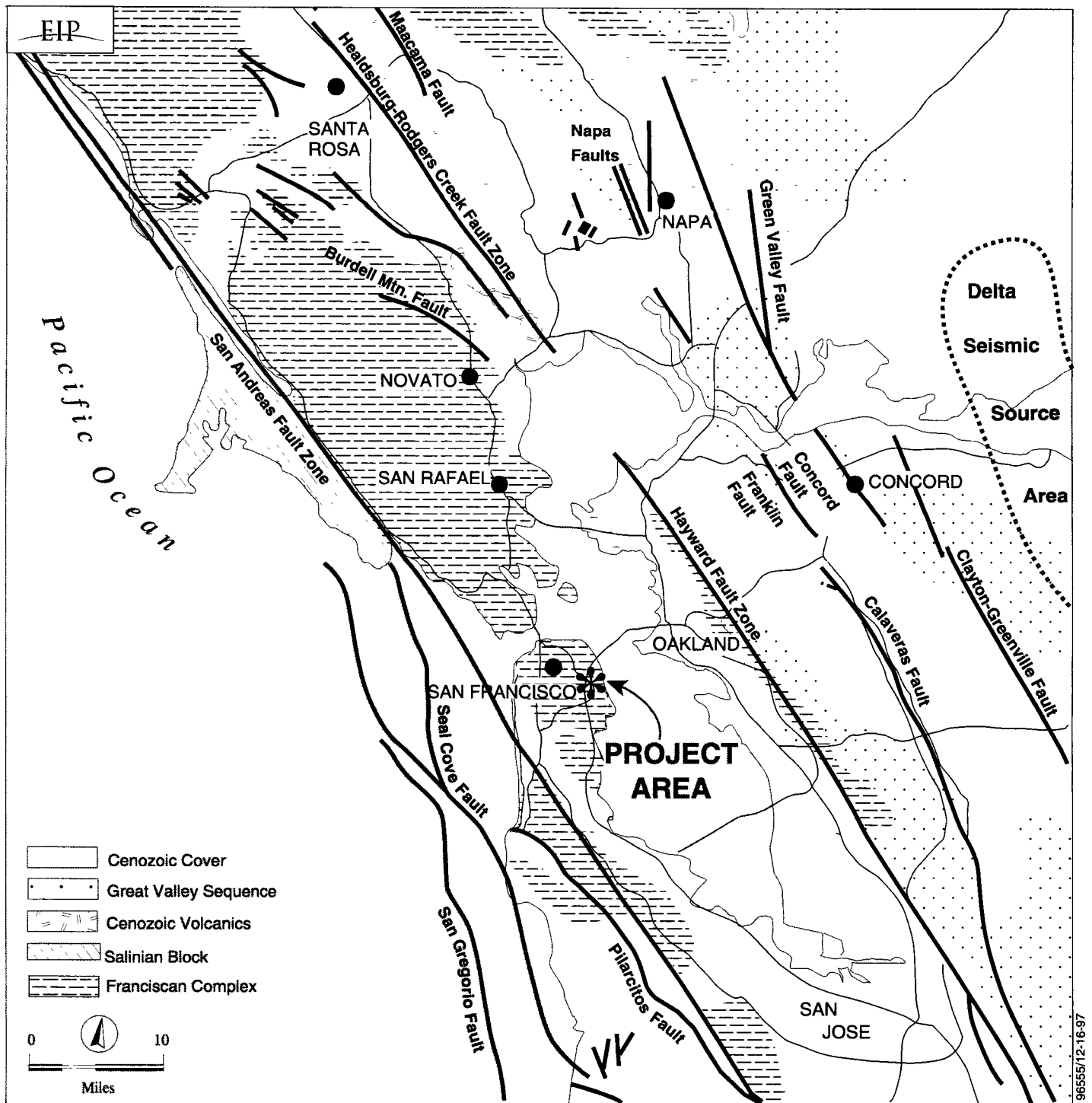
SETTING

REGIONAL CONDITIONS

Fault Activity

There are general conditions of location, composition, and engineering characteristics of geologic units (rock and sediment) that affect seismic design criteria for buildings constructed in San Francisco. Figure V.H.1 shows regional geologic and seismic conditions. The geology of San Francisco is dominated by the San Francisco Peninsula and North Coast segments of the San Andreas fault, the main trace of which divides ancient Franciscan assemblage sandstones, cherts, and shales northeast of the fault trace, from younger claystones, siltstones, and sandstones southwest of the fault trace. The Franciscan rocks are buried by a few feet to a few hundred feet of recent sediments, such as Bay Mud (defined in Glossary), dune sand, and river sand and gravel. These sediments form much of the present ground surface, but in most urban areas that surface has been altered by cuts or the addition of artificial fill. Static and seismic stability of the natural and artificial sediments varies considerably./3/

The Coast Ranges province, in which San Francisco is located, is one of the most active seismic regions in the United States, experiencing numerous low- and moderate-intensity earthquakes every year. About a dozen large-intensity and great earthquakes, causing deaths and property damage, have occurred during recorded history. The major fault zones in the San Andreas fault system (see below) are the sources of these earthquakes, and are likely to be the sources of future earthquakes affecting development in San Francisco, even though no known traces of active faults pass through the City./4/



MISSION BAY SUBSEQUENT EIR
FIGURE V.H.1 REGIONAL GEOLOGIC MAP

In discussing fault activity, it is necessary to introduce two descriptive terms, "moment magnitude" and "characteristic earthquake" (defined in Glossary).^{/5/} With the new information from studies of recent large earthquakes (e.g., 1989 Loma Prieta, 1994 Northridge, and 1995 Kobe), it has become necessary to define more precisely the seismic conditions in which planning and development occur, particularly in California. This has been accomplished largely through major revisions to the Uniform Building Code (1994 through 1997), the California Building Code (1995), and the San Francisco Building Code (1995). These specific terms increase the usefulness of the current building codes to people who design, construct, and inspect buildings to meet the standards of the codes. The increasing use of these terms in planning documents facilitates review by city and state agencies responsible for oversight of geotechnical and structural design issues.

The San Andreas, Seal Cove-San Gregorio, Hayward, and Calaveras fault zones (9 miles southwest, 20 miles west, 10 miles northeast, and 22 miles east of the Mission Bay Project Area, respectively) are historically active faults in the San Andreas fault system (i.e., active during the last 200 years). The San Francisco Peninsula segment of the San Andreas fault is capable of generating a characteristic earthquake of moment magnitude (M_w) 7.1; the Seal Cove-San Gregorio fault, M_w 7.3; the Hayward fault, M_w 7.1; and the Calaveras fault, M_w 6.8.^{/6/} Earthquakes of these magnitudes are sufficient to create horizontal ground accelerations (defined in Glossary) greater than 0.5g (50% of the acceleration of gravity) in bedrock or in unconsolidated sediments, which are severe enough to cause major damage to structures, foundations, and underground utility lines.^{/7/} For comparison, the earthquake of April 18, 1906, which ruptured the entire length of the San Andreas fault in the Bay Area, has been estimated at about M_w 7.8 (about M 8.3 on the Richter scale). The Loma Prieta earthquake of October 17, 1989, on the Southern Santa Cruz Mountains segment of the San Andreas fault, was measured at M_w 7.0 (Richter magnitude M 7.1). (Richter magnitude scale defined in Glossary.)

After the 1989 Loma Prieta earthquake, the U.S. Geological Survey estimated the probability of at least one major earthquake (Richter magnitude M 7 or greater) in the San Francisco Bay region within the 30-year period between 1990 and 2020 at about 67%. On the San Francisco Peninsula segment of the San Andreas fault, the probability that a large earthquake would occur in this time frame is estimated at about 23%.^{/8/}

Seismic Hazards

Groundshaking

The direct effects of seismically induced groundshaking result from a combination of surface (soil) conditions, the relative stiffness of subsurface geologic units, and the quality of construction at the

site. Seismic ground motions range from very low intensities which cannot be detected, except by specialized equipment, to high intensities which can cause buildings to be shaken apart and heavy objects to be thrown into the air. A single earthquake can create the entire range of effects, depending on the moment magnitude of the earthquake, a given site's distance from the source of the earthquake, the geologic conditions at the site, and the design of the buildings on the site. Generally, the intensity of groundshaking increases with proximity to the source of the earthquake, and ground motions tend to be amplified by the presence of a thick sequence of Bay Mud. However, given similar location and seismic energy output, vibrations would be least damaging at sites composed completely of bedrock (as in the northeast corner of the Project Area). Sites underlain by major thicknesses of sediments (such as the fill, Bay Mud, and marine clay beneath most of the Project Area) would experience more severe vibrational damage because of the sediments' tendency to deform to a greater degree than the bedrock./9/ For structures supported on sediments, the combination of ground deformation and susceptible building design (including foundation design) appears to determine the extent of damage, with well-constructed buildings founded on dense, undisturbed native deposits performing considerably better than moderately or poorly constructed buildings on unengineered fill. Pile-supported foundations that depend on firm sediments or bedrock for their support perform better during seismic vibration than structures supported on soft sediments./10/

Liquefaction and Earthquake-Induced Settlement

In San Francisco, the potential for liquefaction (defined in Glossary) poses a hazard in areas of old artificial fill for two reasons: lack of fill compaction, and lack of fill content control. Much of the old artificial fill was placed along the waterfront before modern engineering methods of compaction were developed or known to be needed. Essentially, any available material was dumped into the Bay at the shoreline until the new land surface was above high-tide level. The result was a loose, saturated deposit composed of irregular pockets of sand, gravel, rock, brick, lumber, or other disposed material. Only light structures could be supported on such material because almost any weight caused the fill to consolidate. The fill also settled under its own weight. During seismic groundshaking, vibration can cause this type of fill to settle or liquefy under certain conditions of saturation. Such conditions do not exist throughout all filled areas, but because there is no record of what was used for fill at most sites along the former shoreline, only site-specific geotechnical investigations can demonstrate the presence or absence of liquefiable material. The fill in the Project Area is loose material of this type, some of which is subject to liquefaction./11/

Tsunami and Seiche

Tsunami (defined in Glossary) are large sea waves generated by submarine earthquakes, or similar large-scale, short-duration phenomena, such as volcanic eruptions, that can cause considerable damage

to low-lying coastal areas. Seiches (defined in Glossary) are waves, also caused by large-scale, short-duration phenomena, that result from the oscillation of confined bodies of water, such as San Francisco Bay, that have the potential to damage low-lying coastal areas, although not as severely as tsunamis. The amount of damage caused by tsunami and seiches in the San Francisco Bay Area in historic times has been small, and there is little reliable data for local pre-historic events, but the potential for damage exists along all of the City's waterfront. Prior to the 1989 Loma Prieta earthquake, tsunamis and seiches had been considered phenomena associated only with earthquakes distant from the Bay Area (such as the 1964 Alaska earthquake which generated a tsunami that caused moderate damage around San Francisco Bay) because the mode of faulting along California's coast generally did not cause vertical disruptions of the sea floor./12/ The Loma Prieta earthquake did not cause a tsunami, but did create a 6-inch seiche effect in Monterey Bay, demonstrating that these phenomena can be associated with earthquakes on local faults./13/

PROJECT AREA CHARACTERISTICS

Geotechnical Investigations/14/

In 1995, geotechnical investigation of the Project Area was conducted by Treadwell & Rollo, Inc., Environmental and Geotechnical Consultants./15/ Field investigation included drilling or examining nearly 400 soil borings to depths greater than 240 feet below ground level, logging the borings during drilling, sampling and visually classifying material from the borings, and testing the in-place support capacity of the subsoils. Soil and groundwater conditions encountered during the drilling were recorded. Field and laboratory tests were performed to analyze such physical properties as moisture content, density, strength, compressibility, and corrosiveness. Project engineers used these technical data in formulating foundation and structural designs. Geo-seismic database and literature research provided information on local and regional geology and fault activity needed to formulate such design factors as foundation support, pile lengths, slabs-on-grade, earthwork (excavation and backfill), seismic considerations (soil profile, liquefaction, settlement), and corrosivity of soils.

Subsurface Conditions

Subsurface investigations by Treadwell & Rollo confirm that the site is underlain by fill, Bay Mud, alluvium, Old Bay Clay, colluvium, and Franciscan Bedrock. The sequence is described in Section 9, Geology and Topography, of the Initial Study for this SEIR (see Appendix A). Briefly, the sequence consists of less than 1 foot to more than 45 feet of loose artificial fill, irregularly distributed across the site, and underlain by 10 to 70 feet of soft, compressible, water-saturated, silty clay known as younger Bay Mud; a layer of sandy alluvium between 1 and about 30 feet thick; 1 to 40 feet of the

stiff, marine Old Bay Clay; and the Franciscan bedrock, the top of which is weathered and fractured (colluvium), at depths ranging from about 30 feet to about 130 feet below sea level./16/ The locations of old piles, driven to support roadways, buildings, storm drains, and sewer lines, are known along King Street (in Mission Bay North) and in the area west of Third Street (in Mission Bay South)./17/

Groundshaking

The Association of Bay Area Governments' computer models of the damage expected from major earthquakes on various segments of San Francisco Bay Area faults indicate that a M_w 7.1 earthquake on the Peninsula segment of the San Andreas fault would cause moderate structural damage (Modified Mercalli Intensity VIII, in Glossary) in the Project Area. Heavy structural damage (MM Intensity IX) would be caused by a M_w 7.1 earthquake that ruptured the entire length of the Hayward fault./18/

Liquefaction

The depth of the water table below the ground surface in the Project Area ranges from less than 1 foot in areas where railroad tracks remain in place, to as much as 18 feet in the area north of Mariposa Street, as revealed by numerous test borings. The presence of water in loose granular materials such as the unengineered fill by the Project Area produces conditions that could lead to liquefaction during seismic vibration./19/

REGULATORY FRAMEWORK

Seismic Hazard Zones

Two major pieces of state legislation regulate construction near active fault traces: the Alquist-Priolo Earthquake Fault Zoning Act./20/ and the Seismic Hazards Mapping Act./21/ The purpose of the Earthquake Fault Zoning Act is to reduce the hazards posed by surface rupture of a fault. The Project Area is not in an Alquist-Priolo Earthquake Fault Zone, and no earthquake fault zones are located near the Project Area./22/ Consequently, there is little likelihood of surface rupture of a fault within the Project Area.

The purpose of the Seismic Hazards Mapping Act is to provide safeguards to the public from the effects of strong groundshaking, liquefaction or other ground failure, and other hazards caused by local conditions during earthquakes. The Act requires the State Geologist to delineate the various seismic hazard zones and requires that "cities and counties, or other local permitting authority

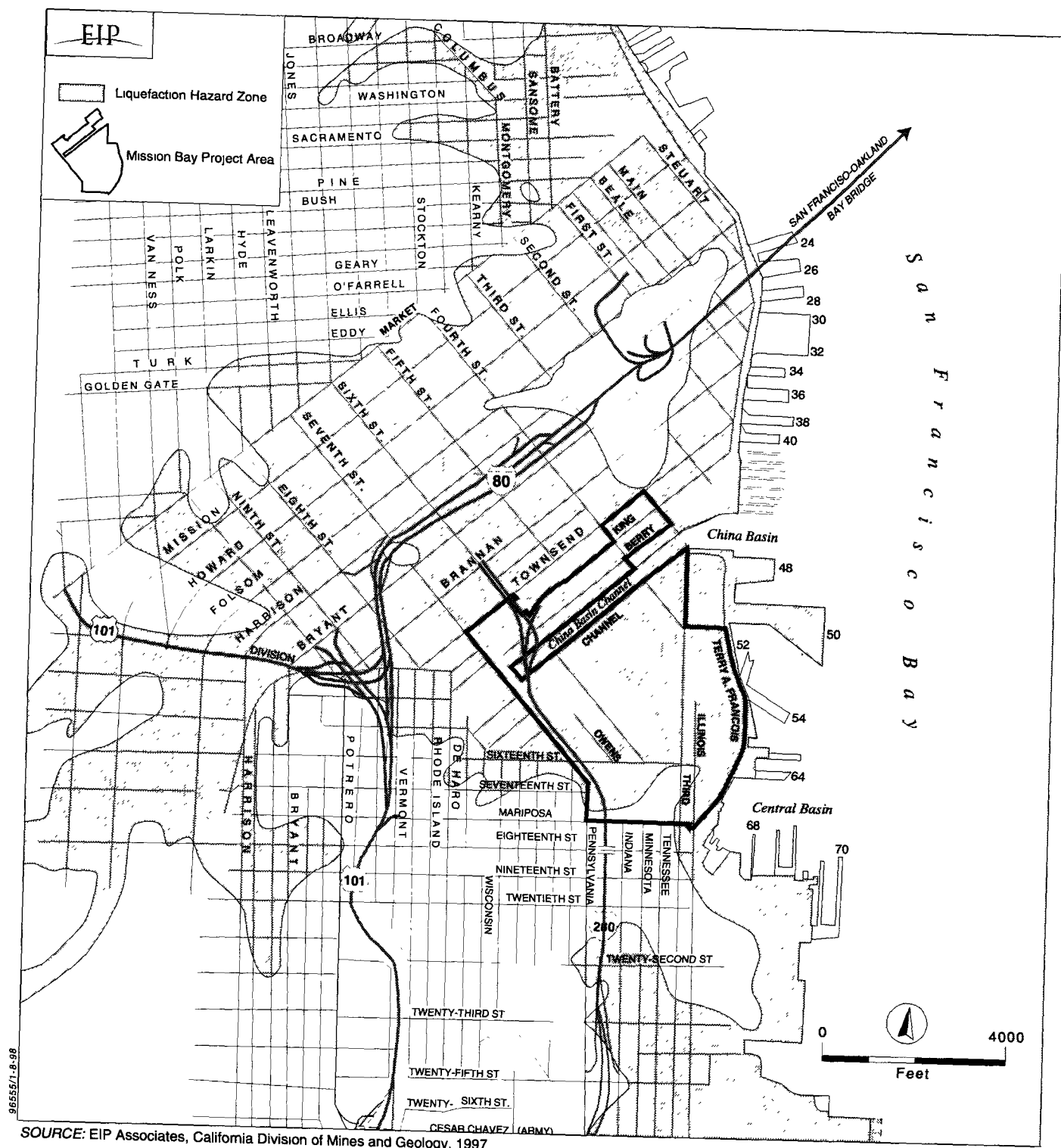
regulate certain development projects within the zones. [These agencies] must withhold the development permits for a site within the zone until a geotechnical evaluation is conducted and appropriate mitigation measures have been incorporated into development plans.”/23/ The Project Area is in a liquefaction hazard zone, as designated on the Seismic Hazard Zones Map, which covers most of San Francisco (see Figure V.H.2)./24/

Building Codes

The 1994 Uniform Building Code (UBC) is the basis of the current 1995 California Building Code (Title 24, California Code of Regulations, Part 2). The 1995 San Francisco Building Code is a modified version of the 1995 California Building Code, and contains more restrictive standards for structures in areas of San Francisco that are subject to failures from seismically induced groundshaking (structural damage, liquefaction, settlement). At the time the 1990 FEIR was certified, the then-current 1989 UBC was undergoing major revisions that would strengthen the code substantially, and eventually resulted in similar strengthening of the California and San Francisco codes. People on the Mission Bay Advisory Committee who were involved with the UBC update were aware that the Project Area needed geotechnical treatment beyond the requirements of the then-current San Francisco Building Code (see Appendix G). Five years later, the UBC had subsumed many of the concepts embodied in the recommendations of the members of the Advisory Committee. With the adoption of updated codes for California and San Francisco, the specific requirements formulated to address these structural issues became part of the regulatory framework in the 1995 San Francisco Building Code./25/

The Uniform Building Code continues to be updated, and the 1997 revisions, which reflect the latest technology in seismic design and construction, are in the process of being finalized. Adoption of comparable revisions to the California Building Code and the San Francisco Building Code normally would be expected to follow within several months. During the period between the finalization of the 1997 UBC revisions and the adoption of their respective codes by California and San Francisco, the 1997 UBC will contain some provisions which are more stringent than the 1995 San Francisco Code.

Much of the concern regarding seismic effects in the Project Area expressed in the 1990 FEIR grew out of concern that the then-current building codes might not be adequate to address the special conditions of a development the size and location of Mission Bay. As a result of the continued updating of building codes, all the major concerns related to structural design have been addressed satisfactorily as part of the standard regulations in the 1995 San Francisco Building Code, the 1995 California Building Code, or the 1997 Uniform Building Code. Such issues as emergency



preparedness, response, and recovery are not regulated by building codes, and are addressed in Section VI.H, Mitigation Measures: Seismicity, of this SEIR.

Community Safety Element

A revised version of the Community Safety Element of the *San Francisco General Plan* was adopted by the Planning Commission on April 27, 1997, and approved by the Board of Supervisors on August 11, 1997. The updated Element continues current policies that require new structures built in areas where site conditions could pose hazards, such as liquefaction or landslide, to be constructed in ways that reduce those hazards. Policy 2-1 is to “assure that new construction meets current structural and life safety standards.” Policy 2-3 is to “consider site soils conditions when reviewing projects in areas subject to liquefaction or slope instability.” Policy 2-9 is to “consider information about geologic hazards whenever City decisions that will influence land use, building density, building configuration or infrastructure are made.”/26/

To implement the life safety policies of the Community Safety Element, as well as the Seismic Hazard Mapping Act, engineers and inspectors at the Department of Building Inspection (DBI) work closely with a developer’s geotechnical team to ensure that all life safety issues related to seismic groundshaking are addressed by the special site investigations, and that appropriate recommendations are included in the geotechnical report. The recommendations are incorporated in the permit requirements for the proposed development. Each proposed development site is evaluated individually, based on its actual surface and subsurface conditions, without the use of preconceived development formulae./27/

University of California Policy on Seismic Safety

For the portion of the Mission Bay Project Area to be occupied by the University of California San Francisco, the University Policy on Seismic Safety would apply. In January 1995, this Policy was revised to require that all new University construction comply with the current seismic provisions of Title 24 of the California Code of Regulations (the California Building Code Standards) or local seismic requirements, whichever are most stringent./28/ Because the University Policy on Seismic Safety adopts the most stringent locally applicable code as its guidelines, the current San Francisco Building Code would be followed by the University in most situations. However, the 1997 revisions to the Uniform Building Code are in the process of being finalized. Adoption of similar revisions of the California Building Code and the San Francisco Building Code will follow, but these actions could take place several months apart. Between the adoptions of these two codes, the newer California Code will contain some provisions which are more stringent than the current (1995) San Francisco

Code. The most stringent code adopted at the time the University begins construction of a facility would be applied by the University to the construction of that facility. In addition, the University has adopted the mitigation measures from the 1990 FEIR dealing with emergency preparedness, response and recovery, which are not addressed by building codes, as part of each University construction project in the Project Area./29/

IMPACTS

STANDARDS OF SIGNIFICANCE

The City has no formally adopted significance standards for potential impacts related to geology and seismicity. However, projects are normally found to have a significant effect on the environment if they will cause substantial soil erosion or unstable ground conditions; or if they will expose substantial numbers of people or structures to major geologic or seismic hazards.

The 1990 FEIR analysis of potential seismic effects in the Project Area reflected the concern that the then-current building codes might not provide adequate protection from seismic forces for the special circumstances of a large development located in an area underlain by artificial fill and Bay mud. Since publication of the 1990 FEIR, building codes have been revised substantially, with the result that all the major concerns related to structural design in the Project Area have been addressed in all areas of concern in the 1995 San Francisco Building Code, the 1995 California Building Code, or the 1997 Uniform Building Code. This impact section begins with a brief examination of the relationship between the updated building codes and the currently proposed project. The remainder of the impact section focuses on the special circumstances related to groundshaking, liquefaction, tsunami and seiche inundation, and exposure of concentrated populations to seismic hazards in the Project Area.

RELATIONSHIP OF CURRENT BUILDING CODES TO THE PROPOSED PROJECT

The seismic safety provisions of the currently applicable San Francisco Building Code (1995 or future revisions) are required to be met for all construction in the Project Area under San Francisco's jurisdiction. As discussed earlier, University of California policy dictates that construction on land owned by the University would meet the San Francisco Building Code requirements voluntarily, or any more stringent provisions of the Uniform Building Code (1997 or future revisions). The provisions of the building codes pertain to the basic structure of each building, such as the foundation design and placement (discussed earlier under "Seismic Hazard Zones" in the Setting subsection), the building design and construction, and certain non-structural issues (such as wall-cladding anchorage),

special requirements for certain high-occupancy uses and emergency response facilities (hospitals, police and fire stations), and the way in which large or heavy equipment is secured.

Strict enforcement of seismic standards is the minimum requirement for development of the Project Area to reduce the chance of injury to people in or near the buildings during a major earthquake. The analysis assumes that the more stringent provisions of the 1997 Uniform Building Code will be adopted as part of the San Francisco Building Code prior to initial construction. Compliance with the 1997 Uniform Building Code provisions would reduce regulated hazards to an acceptable level.

GROUNDSHAKING

During the useful economic life of the project, it is probable that the Project Area will be subjected to at least one major earthquake which would create peak ground accelerations in excess of 0.5g throughout the Bay Area. Because the Project Area is underlain partly by thick deposits of Bay Mud and partly by bedrock at relatively shallow depths, sites within the Project Area will respond differently to these seismic vibrations. Based on the models developed by Treadwell & Rollo to analyze the dynamic response of the San Francisco Giants Ballpark site (on the north side of China Basin at King and Third Streets adjacent to Mission Bay North, which contains soil conditions similar to those in the Project Area), peak accelerations as high as 0.6g could occur in the Project Area./30/ This level of groundshaking could cause damage to structural elements of buildings and utility lines (twisting, breakage, debris shedding) and could cause associated ground failure, such as liquefaction (tilting or settlement of foundations), all of which pose risks of injury or death to people in or near the affected structure. To establish appropriate design parameters for the seismic-restraint systems to be built into the foundations and structures in the Project Area, the San Francisco and Uniform Building Codes require site-specific modeling to be conducted, and the resultant measures to be incorporated into the plans and specifications of the project. Incorporation of the modeling recommendations would prevent groundshaking damage to structural elements./31/,/32/

LIQUEFACTION

Treadwell & Rollo's analyses indicate that seismically induced peak ground accelerations of 0.2g or higher would cause liquefaction of some of the saturated subsurface fill materials in the Project Area. During such an earthquake, as much as 1 foot of liquefaction-induced settlement could occur in deep fills, and abrupt liquefaction-induced differential settlement probably would occur in the vicinity of old timber piles. Structures supported on these liquefiable materials could tilt or settle rapidly, thereby exposing occupants to injury or death. Deep foundations (such as pile-supported foundations)

are necessary for major structures throughout the vicinity of the Project Area to prevent the effects of liquefaction./33/

To reduce potential effects in the Liquefaction Hazard Zone, Catellus has committed to construct major structures in the Project Area on foundations supported by piles driven into dense sands, stiff clays, or bedrock in areas where such materials are too deeply buried by unengineered fill and/or Bay Mud to provide adequate support for foundations.

Although site-specific conditions dictate the appropriate pile design, precast, prestressed, sulfate-resistant concrete piles commonly are used to penetrate fill and Bay Mud. In the Project Area, piles would be supported on the bedrock in places where it is close enough beneath the ground surface to be reached easily. Where this is not the case, piles would gain support by friction developed between the surface of the pile and the dense sandy and clayey sediments below the Bay Mud. Pile length would range from about 30 feet to more than 200 feet (see Appendix A, Section 9). The location of each pile would determine its length and whether it would be supported on bedrock or in dense sediments. Where appropriate, a sulfate-resistant mix of cement would be used to protect the concrete and reinforcing steel from the corrosive effects of the fill and the Bay Mud.

The piles would be driven at least three pile diameters apart to avoid loss of uplift capacity from grouping effects (piles grouped too closely do not have sufficient soil around them to provide adequate support for the foundation). Pile locations would be predrilled through the fill, thereby reducing the noise and vibration caused by pile driving, which could annoy neighbors or damage nearby structures (discussed in "Construction Noise" in Section V.G, Noise and Vibration: Impacts). Predrilling removes rubble obstructions in the fill (which otherwise could deflect the pile, thereby reducing its support capacity) and facilitates installation of the piles. If existing wooden piles were encountered, they would be cut off below the base of the floor slabs for each new structure, and capped during the construction of the new foundation.

EXPOSURE OF CONCENTRATED POPULATIONS TO SEISMIC HAZARDS

Development of the Mission Bay Project Area would concentrate a portion of the San Francisco Bay Area population in a location subject to seismic hazards. Approximately 11,000 residents, 30,000 employees, and numerous visitors would be expected to occupy the Project Area during a given 24-hour period. The on-site population would be greatest during the normal working hours of a weekday, when most employees would be at their jobs, but many residents would be away from home. At night, the employee population would be much lower, but the resident population would be high.

During a characteristic earthquake (defined in Glossary), seismically induced groundshaking, liquefaction, and ground settlement could cause unsupported pavement and underground utility conduits to separate from pile-supported structures, thereby disrupting the infrastructure intended to serve this population. The San Francisco Bay Bridge and Golden Gate Bridge probably would be closed because of impassable approaches or spans. BART, MUNI, and Caltrain service would be halted, at least temporarily. As described in the 1990 FEIR, access to Mission Bay could be limited, particularly south of China Basin Channel. Street access to Mission Bay South could be limited to 16th Street and the Seventh Street connector which pass under I-280, and Third Street at the southern part of the Project Area. Third Street probably would be impassable at the Channel because of settlement at the Third Street Bridge approaches. The bridge approaches could be made serviceable in a relatively short time if heavy equipment were available. The Third Street Bridge probably would be stuck in its position at the time of the earthquake, most likely in the down position, because of damage to the bridge-raising mechanism. It is expected that the counterweight on the Fourth Street Bridge would be damaged, making the bridge unusable for some time. It is likely that elevated highways would suffer damage; however, it is unlikely that general collapse would occur because of recent retrofitting. The elevated highways may not be passable following a large earthquake, but this would not necessarily block access to and egress from Mission Bay./34/

Access to Mission Bay North could be impaired because of debris from damaged older existing buildings nearby. Warping and fracturing of pavement would result from liquefaction, uneven settlement, and lurching. Some of the roads probably would be passable in trucks and four-wheel drive vehicles. Severely damaged or debris-blocked roads could be made usable in a relatively short time through use of heavy equipment, if it were available locally. Mission Bay North probably would not be cut off from emergency services based north and west of Mission Bay; but travel over streets could be difficult because of damage and debris. Areas north of the Channel probably would be accessible to emergency response vehicles from Fourth Street. Areas south of the Channel would be more difficult to reach because the Third and Fourth Street Bridges would be impassable, at least temporarily. Third Street would provide access from the south, although it probably would be damaged by soil fracture./35/ If not mitigated as described in Chapter VI of this SEIR, the above-described risks to people posed by seismically induced groundshaking and liquefaction would be significant impacts of the project.

One of the major concerns is the availability of water for fighting fires. The primary water supply for fire-fighting in the Project Area is the low-pressure domestic water from the City water mains. The Auxiliary Water Supply System (AWSS), a high-pressure system, is used if the primary system does not have an adequate supply or is out of service. The Auxiliary Water Supply System for fire protection, described under "Water Supply: Setting" in Section V.M, Community Service and

Utilities, is independent of the domestic water system and is under the sole jurisdiction of the Fire Department. Pipes for this system are located under Third Street and around much of the perimeter of the Project Area. The AWSS high-pressure system provides 10,000 gallons per minute, and is adequate to serve existing land uses in the Project Area./36/ The existing system is not fully developed in the center of the Project Area, and is inadequate to serve the needs of the proposed project. Therefore, extension of the AWSS to serve the Project Area is proposed. Figure V.M.6 shows the proposed configuration of the high-pressure water supply system, which would be connected to the rest of the City's system through existing lines in Third Street and Mariposa Street. The Mission Bay North system would be connected with the proposed Mission Bay South System by a new line near Seventh Street and Berry Street, and a relocated line connecting the Fourth Street line with the Third Street line./37/ No cisterns would be located in the Project Area because four existing suction inlets in the China Basin Channel and San Francisco Bay would act as a back-up supply of water for fire-fighting if other water supplies failed.

Beginning with its 1982 landmark study, *Earthquake Planning Scenario for a Magnitude 8.3 Earthquake on the San Andreas Fault in the San Francisco Bay Area*, the California Division of Mines and Geology has consistently assumed that "all critical facilities such as hospitals, fire and police stations, emergency communications and operation centers will require standby generating equipment and emergency fuel supplies," for as long as 72 hours following a great earthquake. Even though buildings may remain standing, lifelines (i.e., water supply, communications, electrical power, and other similar facilities) may be impaired, and, thus, medical care would be severely restricted./38/ Medical service centers may be subject to a higher incidence of injuries to elderly persons and those with mobility limitations, medical equipment or supplies may be damaged or destroyed, and building access may be blocked. In the aftermath of an earthquake, integrated emergency response plans, emergency medical and housing facilities, fire-fighting, and debris removal capabilities would be necessary in the Project Area for as long as 72 hours before outside help could be expected./39/ Because of the seismic upgrade of the elevated I-280 freeway structure, emergency access from the west could be less restricted than assessed in the 1990 FEIR; however, access from the north to Mission Bay South would be difficult if one or both of the bridges that cross China Basin Channel were damaged or obstructed (see "Fire Protection: Impacts" in Section V.M, Community Services and Utilities). The City is in the process of upgrading the bridges, which should increase the likelihood that one or both would remain useable. The proposed new fire station in Mission Bay South would improve emergency response to the area in the event of a major earthquake.

Control of the hazards related to the structural components of the buildings to be constructed in the Project Area are regulated by the above-described building codes. Response plans and procedures for dealing with earthquake-related injuries and emergency issues beyond the requirements of the

applicable building codes are suggested by the Community Safety Element./40/ Mitigation Measure H.3 in Section VI.H, Mitigation Measures: Seismicity, suggests that the emergency response plan for Mission Bay must be a comprehensive preparedness and response plan for the entire Project Area, rather than a series of un-coordinated building-by-building plans, and should be prepared in consultation with the Mayor's Office of Emergency Services (OES). The components of the plan should address local community coordination and response, as well as coordination with government services such as OES or the police or fire departments. Outreach and training programs should be made available to employees and residents of the Project Area. Issues that need to be addressed by the plan include the availability of food, water, shelter, and sanitation facilities, and consideration of the need and potential locations for special operations and medical facilities in the context of the citywide Emergency Response Plan and the Project Area's location in Emergency Response District 3./41/ Similar mitigation measures were adopted in the 1990 FEIR to address issues beyond the requirements of the then-applicable building codes. Those measures that address various risks related to development of the Project Area, which have not been incorporated in the currently applicable building codes, appear in Section VI.H, Mitigation Measures: Seismicity, including Mitigation Measures H.1 through H.6.

PHASING OF INFRASTRUCTURE AND DEVELOPMENT DURING THE BUILD-OUT PERIOD

Phasing of Infrastructure

As discussed in the "Phasing of Construction of Infrastructure and Improvements in the Project Area" in Section III.B, Project Description, and in Section V.M, Community Services, of this SEIR, the preliminary infrastructure plans for development of the Project Area would extend utilities into the Project Area to serve each specific phase of development using the concept of adjacency, rather than installing all the infrastructure with the first phase. This approach allows maximum utilization of existing infrastructure where appropriate. Consequently, some portions of the Project Area would be served by new infrastructure, constructed to then-current standards, while other portions would be served by existing systems, which were constructed to earlier, less stringent standards, and which may not perform as well as new systems during earthquakes. The development of new, seismically resistant sub-surface utility lines (waste water, storm drains, gas, potable water, and AWSS) would keep pace with the construction of buildings throughout the Project Area. Depending on where initial development may be proposed, a substantial amount of each system could be built in the earliest phases of development simply to connect the Project Area with the existing portions of each system. Portions of the AWSS would be installed when the San Francisco Fire Department indicates the extension of the system is warranted (see "Fire-Fighting Water Supply" under "Water Supply: Impacts" in Section V.M, Community Services and Utilities). Infrastructure construction associated

with individual buildings would involve connecting each new structure to the portion of each system already built within the Project Area, thus bringing the infrastructure up to then-current standards on a phase by phase basis. Construction of a mass-care facility and/or an emergency response facility would be necessary when the San Francisco Fire Department indicated the population or building density warranted its/their inclusion in the Project Area.

Some grading of the Project Area, including the excavation of some potentially liquefiable materials and replacement with engineered fill, would occur prior to the construction of underground infrastructure to ensure that the systems could be designed to accommodate expected settlement along their specific routes, and to prevent liquefaction damage. This is necessary to ensure that gravity-flow systems (storm drainage, waste water) continue to have sufficient gradient to operate correctly, and that gas and potable water lines have sufficient flexibility to prevent breaks as the lines settle to their design gradients. Un-reconstructed portions of the Project Area would continue to be subject to settlement and liquefaction under conditions now existing in the Project Area.

Phasing of Development

As build-out proceeds within the Project Area, older structures would be replaced or retrofitted to meet current seismic standards. Existing or newly authorized uses could continue in existing older structures for many years before the structures were replaced or retrofitted. Expansions of, or alterations to, existing structures would be required to comply with current codes. The structures built to current code standards would be more resistant to seismic forces and would have less potential to expose occupants to injury or death during a major earthquake than existing structures which were built to earlier standards, or un-retrofitted structures which predate modern building codes and have not been retrofitted.

A potential hazard exists where older structures are adjacent to or near new structures. Although the new structure would perform adequately under seismic forces, an adjacent or nearby older structure damaged in the same earthquake could shed debris that could endanger the new structure or its occupants. Because the new structure and the infrastructure serving it would be built to then-current seismic standards, debris-shedding would be the only effect caused by its adjacency to older structures during the build-out period. This impact is not considered to be significant because the majority of existing structures are relatively low rise, light weight buildings posing limited hazards.

TSUNAMI AND SEICHE

Computer models of the height of flooding caused by seismic sea wave (tsunami) run-up (defined in Glossary) for San Francisco have been prepared by the U.S. Army Corps of Engineers (flooding levels from seiches were not calculated because they would be lower and therefore, less damaging).^{/42/} The maximum calculated run-up levels never have been recorded in the City.^{/43/} The Corps' calculations indicate that the Project Area would be subject to as much as 4.70 feet of wave run-up during the 100-year tsunami event, and 7.80 feet of wave run-up during the 500-year tsunami event.^{/44/} The Corps' run-up model was referenced to mean sea level, so an additional 2.95 feet of wave run-up must be factored into the calculation to estimate the height of "worst case" flooding during extreme high tide crest conditions, which occur about 30 times each year, and last for less than 2 hours each time.^{/45/} Therefore, the maximum expected flood elevation from 4.70 feet of wave run-up during the 100-year event would be 7.65 feet above mean sea level, or -1.01 feet San Francisco City Datum [SFCD] (defined in Glossary), during extreme high tide crest conditions. For the 500-year tsunami event, 7.80 feet of wave run-up during the maximum expected extreme high tide would result in an estimated flood elevation of 2.09 feet SFCD.

Tsunami and seiche flooding may pose a hazard to some buildings constructed as part of the project. The basic concept of flood protection is to ensure that the lowest occupied floor has at least 1 foot of clearance above the flood elevation anticipated for the 100-year event. The proposed post-settlement elevations (i.e., the surface of the ground after construction) north of 16th Street generally would be at or below 0 feet SFCD, whereas those south of 16th Street generally would be above 0 feet SFCD.^{/46/} Basement floor elevations would be lower because excavation for basements is an option in the Project Area. Most of Mission Bay North and the portion of Mission Bay South between South Common Street and the Channel would be threatened by the 100-year tsunami event because the finished ground surface elevations would be less than -1 foot SFCD.^{/47/} Subgrade areas would be threatened to an unknown extent, depending on their depth, location, and protection from overland flows.

Setbacks from the Bay and the Channel in the form of open space would provide a measure of protection from the less-than 100-year tsunami event. Without levees or bulkheads rising above the estimated 100-year run-up elevation for extreme high tides, setbacks would be only partially effective for the 100-year event. The lowest portions of the Project Area could be subject to about 2 feet of flooding during the 100-year tsunami or seiche if the event occurred during maximum expected extreme high tide crest conditions. Because these conditions exist during about 30 two-hour windows each year, the likelihood of a 100-year tsunami occurring within that window is less than one hundredth of one percent ($<0.01\%$).^{/48/}

The lowest portions of the Project Area could be subject to between 2 and 5 feet of flooding during the 500-year tsunami or seiche, if the event occurred during maximum expected extreme high tide crest conditions. The likelihood of a 500-year tsunami occurring within one of these 30 two-hour windows is less than two thousandths of one percent ($<0.002\%$), making this a very unlikely occurrence.

GLOSSARY

Bay Mud: A layered sequence of soft, plastic, expansive sediments forming the bottom of San Francisco Bay (often referred to as the “younger” Bay Mud), consisting of clay- and silt-sized particles interspersed with stringers and pockets of peat, fine sand, and minor amounts of gravel, and having a water content ranging between 30 and 92 percent (commonly 50 to 60 percent in the uppermost 50 to 100 feet of the deposit).

Characteristic Earthquake: The “moment magnitude” (see below) of the seismic event considered representative of a particular fault segment, based on seismologic observations and statistical analysis of the probability that a larger earthquake would not be generated during a given time frame. In the Bay Area, the characteristic earthquake for the Peninsula segment of the San Andreas fault has a moment magnitude (M_w) of 7.1; the entire Hayward fault, a M_w of 7.3; and the northern segment of the Calaveras fault, M_w 6.9. The term “characteristic earthquake” replaces the term “maximum credible earthquake” (see below) as a more reliable descriptor of future fault activity.

Horizontal Ground Acceleration: The rate of speed at which soil or rock materials are displaced by seismic waves. It is measured as a percentage of the acceleration of gravity ($0.5g = 50$ percent of 32 feet per second squared, expressed as an horizontal force). *Peak* horizontal ground acceleration is the maximum acceleration expected from the characteristic earthquake predicted to affect a given area. *Repeatable* acceleration refers to the acceleration resulting from multiple seismic shocks. *Sustained* acceleration refers to the acceleration produced by continuous seismic shaking from a single, long-duration event.

Liquefaction: A response to severe groundshaking that can occur in loose soils. This transformation from a solid state to a liquid state (“quicksand”), as a response to seismically induced groundshaking, can cause ground settling and landsliding. Earthquake-induced liquefaction does not affect bedrock; however, it does affect certain types of alluvium and artificial fill under conditions of saturation. The characteristics of a liquefaction-prone deposit include: (1) uniformly fine sand or sandy soil; (2) saturated conditions — usually by groundwater; (3) loose to moderately dense compaction; (4) little or no clay-sized particles to act as binders. If these conditions occur within about 30 to 40 feet below the ground surface, vibration sufficiently violent to increase pore pressure beyond the shear strength of the sand particles could cause such soils to liquefy. Any structures supported on the soils would be subject to tilting or settlement (sometimes very violent and rapid) as the supporting capabilities of the liquefying soil diminished.

Maximum Credible Earthquake (MCE): The largest Richter magnitude (M) seismic event that appears reasonably likely to occur under the conditions of the presently known geological framework. This term

has been replaced by "characteristic earthquake," which is considered a better indicator of probable seismic activity on a given fault segment within a specific time frame.

Modified Mercalli Intensity (MMI) Scale: A 12-point scale of earthquake intensity based on local effects experienced by people, structures, and earth materials. Each succeeding step on the scale describes a progressively greater amount of damage at a given point of observation. Effects range from those which are detectable only by seismicity recording instruments (I) to total destruction (XII). Most people will feel Intensity IV ground motion indoors and Intensity V outside. Intensity VII frightens most people, and Intensity VIII causes alarm approaching panic. The physical effects of Intensity VIII groundshaking are general damage to ordinarily substantial buildings, including partial collapse; some damage to specially designed structures; twisting or fall of chimneys, factory stacks, towers, and unreinforced masonry walls; movement of frame houses on their foundations, if they are not bolted in place; breaking of tree limbs and decayed timber pilings; and cracking of wet ground. The physical effects of Intensity IX groundshaking are considerable damage to specially designed structures; great damage to ordinarily substantial buildings, including partial collapse; destruction of poorly built structures; and liquefaction, settlement, and ground cracking of fill and other saturated fine sandy deposits. The scale was developed in 1902 by Giuseppe Mercalli for European conditions, adapted in 1931 by American seismologists Harry Wood and Frank Neumann for conditions in North America, and modified in 1958 by Dr. Charles F. Richter to accommodate modern structural design features.

Moment Magnitude (M_w): A logarithmic scale used by modern seismologists to measure the amount of energy released by an earthquake. For the purposes of describing this energy release (i.e., the "size" of the earthquake on a particular fault segment for which seismic-resistant construction must be designed), the moment magnitude (M_w) of the characteristic earthquake for that segment has replaced the concept of a maximum credible earthquake of a particular Richter magnitude. This replacement became necessary because the Richter scale "saturates" at the higher magnitudes; that is, the Richter scale has difficulty differentiating the size of earthquakes above M 7.5. The M_w scale is proportional to the area of the fault surface that shifts (slips) during an earthquake and, thus, is directly related to the length of the rupture. It reflects the amount of "work" (in the sense of classical physics) done by the earthquake. Although the numbers of the M_w scale may appear lower than those of the traditional Richter magnitudes, they convey more precise (and more useable) information to geologic and structural engineers.

Richter Magnitude Scale: A logarithmic scale developed in 1935 to 1936 by Dr. Charles F. Richter and Dr. Beno Gutenberg to measure earthquake magnitude (M) by the amount of energy released, as opposed to earthquake intensity as determined by local effects on people, structures, and earth materials (for a description of these effects, see Modified Mercalli Intensity Scale). Each whole number on the Richter scale represents a 10-fold increase in amplitude of the waves recorded on a seismogram and about a 31-fold increase in the amount of energy released by the earthquake. Because the Richter scale tends to saturate above about M 7.5, it is being replaced in modern seismologic investigations by the moment magnitude (M_w) scale (see above).

Run-up (tsunami or seiche): The advance of water (flooding) up the foreshore of a beach or structure, caused by a submarine disturbance (see tsunami and seiche, below). Maximum run-up levels for the 100-year and 500-year tsunami events adjacent to San Francisco Bay have been calculated by Garcia and Houston (see citation in endnotes) without regard for tidal effects, and, thus, reflect the elevation, in feet,

of flooding above the normal water surface of the Bay at the time the tsunami occurs. Flooding levels from seiches would be lower, and therefore less damaging.

San Francisco City Datum: For surveying purposes in San Francisco, a local datum was established, in the 19th century, at 8.66 feet above mean sea level, approximately higher high tide at the time.

Seiche: A standing-wave oscillation of the surface of water in an enclosed or semi-enclosed basin (such as a lake, bay, or harbor) that is initiated by landslides, earthquakes, or other geologic phenomena, and continues after cessation of the originating force.

Seismic Hazard Zones: In 1991 the State of California began delineating Seismic Hazard Zones in areas of the State where local geological, geotechnical, slope, or groundwater conditions indicate a potential for permanent ground displacements caused by earthquake vibrations such that mitigation as defined in Public Resources Code Section 2693(c) would be required. The zones are revised as new information becomes available. No structure for human occupancy, with the exception of single-family wood-frame or steel-frame dwellings not exceeding two stories in height and not part of a development of four or more dwellings, may be issued a building permit within a Seismic Hazard Zone until a geotechnical evaluation of the project site is conducted and appropriate mitigation measures are incorporated in the project plans. Liquefaction Hazard Zones have been delineated for San Francisco based on areas where liquefaction has occurred historically, and where local geological, geotechnical, and groundwater conditions indicate the likelihood of permanent ground displacement caused by earthquake-induced liquefaction.

Tsunami: A large sea wave produced by any large-scale, short-duration disruption of the ocean floor, principally shallow submarine earthquakes, but also coastal or submarine earth movements (landslides), subsidence, or volcanic eruptions.

NOTES: Seismicity

1. San Francisco Planning Department, *Mission Bay Final Environmental Impact Report*, Planning Department File No. 86.505E, State Clearinghouse No. 86070113, certified August 23, 1990, Volume One, pp. II.76-II.81; Volume Two, pp. VI.K.1-VI.K.61.*
2. See Section III.B, Project Description, for a discussion of the differences in the project boundaries as compared to the project boundaries in the 1990 FEIR.
3. Schlocker, J. C., *Geology of the San Francisco North Quadrangle, California*, United States Geological Survey, Professional Paper 782, Washington, D.C., 1974, pp. 93-99 and Plates 1 and 2.
4. Jennings, C. W., *Fault Activity Map of California and Adjacent Areas, with Locations and Ages of Recent Volcanic Eruptions*, Geologic Data Map No. 6, California Division of Mines and Geology, 1994; Guter, S. K., *Seismicity of California, 1808-1987*, National Earthquake Information Center, U.S. Geological Survey, Open-File Report 88-286, 1988.
5. These two descriptive terms may be less familiar than "Richter magnitude" and "maximum credible earthquake." They are not new terms, having been used by seismologic investigators for several years, but they embody concepts that provide more useful information about the seismic conditions in California and the Bay Area than the more commonly known terms. The calculations they represent

are those actually used in geologic and structural engineering designs. They have not appeared often in planning documents because until recently the earlier terms generally were adequate for planning purposes.

6. M. D. Petersen et al., *Probabilistic Seismic Hazard Assessment for the State of California*, California Division of Mines and Geology, Open-File Report 96-08 and United States Geological Survey, Open-File Report 96-706, Appendix A, "California Fault Parameters," pp. A-1 through A-3.
7. J. F. Davis et al., *Earthquake Planning Scenario for a Magnitude 8.3 Earthquake on the San Andreas Fault in the San Francisco Bay Area*, California Division of Mines and Geology, Special Publication 61, 1982; R. D. Borchardt et al., *Maximum Earthquake Intensity Predicted on a Regional Scale*, U.S. Geological Survey, Miscellaneous Field Investigations Map MF-709, scale 1:125,000, 1975.
8. Working Group on California Earthquake Probabilities, *Probabilities of Large Earthquakes in the San Francisco Bay Region, California*, U.S. Geological Survey Circular 1053, 1990, p. 29.
9. Borchardt, R. D., J. F. Gibbs and K. R. Lajoie, *Map Showing Maximum Earthquake Intensity Predicted in the Southern San Francisco Bay Region, California, for Large Earthquakes on the San Andreas and Hayward Faults*, U.S. Geological Survey, Miscellaneous Field Studies Map MF-709, 1975, p. 11 and Sheet 2.
10. Montgomery, D. R., "Representative Damage Photographs from the Loma Prieta Earthquake," in: *The Loma Prieta (Santa Cruz Mountains), California, Earthquake of 17 October 1989*, S. R. McNutt and R.H. Sydner, editors, California Division of Mines and Geology, Special Publication 104, 1990, pp. 113-120.
11. California Division of Mines and Geology, *State of California Seismic Hazard Zones, Official Map, South Half of the San Francisco North and Part of the Oakland West Quadrangles*, released April 17, 1997, scale 1:24,000.
12. Pierzinski, D., "Tsunamis," in: *California Geology*, California Division of Mines and Geology, Vol. 33, No. 3, March 1981, pp. 58-61.
13. Dr. E. B. Thornton, Department of Oceanography, Naval Post-Graduate School, telephone conversation, October 31, 1997.
14. Geo-seismic information in this SEIR is derived from the current and previous geotechnical investigations of the Project Area, telephone conversations with the geotechnical and project engineers, geotechnical investigations for nearby sites, and published reports about the geology and seismicity of the Bay Area.
15. The results of earlier geotechnical investigations are discussed in the 1990 FEIR, Volume One, pp. II.76-II.77, and Volume Two, pp. VI.K.1-VI.K.11, VI.K.24-VI.K.30.*
16. Treadwell & Rollo, Inc., Environmental and Geotechnical Consultants, Lori A. Simpson, PE, and Frank L. Rollo, PE, *Proposed UCSF Site, Mission Bay, San Francisco, CA*, letter report to Kerstin Magary, Catellus Development Corporation, 31 October 1994, 2 pages accompanied by 38 figures; Treadwell & Rollo, Inc., Environmental and Geotechnical Consultants, Lori A. Simpson, PE, letter to EIP Associates, March 12, 1997, 1 page accompanied by 6 figures.
17. 1990 FEIR, Volume Two, pp. VI.K.9-VI.K.10, VI.K.57.*

18. Association of Bay Area Governments, *On Shaky Ground, City Maps: City of San Francisco*, Publication Number P95002EQK-SF-1, April 1995.
19. Treadwell & Rollo, Inc., Environmental and Geotechnical Consultants, Lori A. Simpson, PE, letter to EIP Associates, March 12, 1997, 1 page accompanied by 6 figures, see "Depth to Water Table" and "Thickness of Fill."
20. *Alquist-Priolo Earthquake Fault Zoning Act*, California Public Resources Code, Division 2. "Geology, Mines and Mining," Chapter 7.5 "Earthquake Fault Zones," Sections 2621 through 2630; signed into law December 22, 1972, amended 1974, 1975, 1976, 1979, 1991, 1993, 1994. Prior to 1994 this legislation was known as the Alquist-Priolo Special Studies Zones Act.
21. *Seismic Hazards Mapping Act*, California Public Resources Code, Division 2. "Geology, Mines and Mining," Chapter 7.8, effective date April 1, 1991.
22. Hart, E.W., *Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps*, California Division of Mines and Geology, Special Publication 42, revised 1994, 34 pages.
23. State Mining and Geology Board, *Guidelines for Evaluating and Mitigating Seismic Hazards*, 1997, p. 7.
24. California Division of Mines and Geology, *State of California Seismic Hazard Zones, Official Map, South Half of the San Francisco North and Part of the Oakland West Quadrangles*, released April 17, 1997, scale 1:24,000.
25. City and County of San Francisco Municipal Code, *1995 San Francisco Building Code*, adopted December 14, 1995, Chapters 16, 18, 33, A16 and A33. Chapters 16 and A16 of the San Francisco Building Code deal with structural force design requirements, including (but not limited to) regulations governing seismic-resistant construction. Chapters 18, 33, and A33 deal with foundations, retaining walls, excavation and grading, including (but not limited to) requirements for foundation investigations, seismic-resistant design, stable cut- and fill-slopes, and drainage and erosion control.
26. City and County of San Francisco, *San Francisco General Plan, Community Safety Element*, adopted April 27, 1997 by the San Francisco Planning Commission, approved August 11, 1997 by the Board of Supervisors, 25 pages, 7 maps (various scales).
27. Charles Ng, Inspector, San Francisco Department of Building Inspection, telephone conversation with EIP Associates, October 24, 1994.
28. University of California, Office of the President, *University Policy on Seismic Safety*, revised January 17, 1995.
29. University of California San Francisco, *UCSF Long Range Development Plan Final Environmental Impact Report*, State Clearinghouse No. 95123032, January 1997, pp. 408-410.*
30. Treadwell & Rollo, *Draft Geotechnical Investigation, Pacific Bell Park, San Francisco, CA*, September 4, 1996, Appendix E, Seismic Hazard Analysis, Figures E-7 - E-12. A copy of this report is on file for public review at the Office of Environmental Review, Planning Department, 1660 Mission Street, San Francisco.

31. C. S. Shields, Geotechnical Engineer, Treadwell & Rollo, Inc., various personal communications with EIP Associates, July 30 to October 4, 1996.
32. C. S. Shields, Geotechnical Engineer, Treadwell & Rollo, Inc., various personal communications with EIP Associates, July 30 to October 4, 1996.
33. Treadwell & Rollo, *Draft Geotechnical Investigation, Pacific Bell Park, San Francisco, CA*, September 4, 1996, Appendix E, Seismic Hazard Analysis, Figures E-7 - E-12.
34. 1990 FEIR, Volume One, pp. II.79-II.80.*
35. 1990 FEIR, Volume One, pp. II.79-II.80; Volume Two, pp. VI.K.34-VI.K.39.*
36. Steve Van Dyke, Superintendent, Bureau of Engineering and Water Supply, San Francisco Fire Department, telephone conversation with EIP Associates, September 5, 1997.
37. The Honorable Mayor Willie Lewis Brown, Jr., Office of the Mayor, *Mission Bay: Conceptual Framework for a Proposal for the Catellus Development Portion of the South of Channel Redevelopment Plan Area*, letter to Commissioner Dar Singh, July 7, 1997, Exhibit C, p. 6.*
38. Davis, J.F., J.H. Bennett, G.A. Borchardt, J.E. Kahle, S.J. Rice, and M.A. Silva, *Earthquake Planning Scenario for a Magnitude 8.3 Earthquake on the San Andreas Fault in the San Francisco Bay Area*, California Division of Mines and Geology, Special Publication 61, 1982, pp. 125-134.
39. Steinbrugge, K.V., J.H. Bennett, H.J. Lagorio, J.F. Davis, G.A. Borchardt, and T.R. Topozada, *Earthquake Planning Scenario for a Magnitude 7.5 Earthquake on the Hayward Fault in the San Francisco Bay Area*, California Division of Mines and Geology, Special Publication 78, 1987, pp. 87-93.
40. City and County of San Francisco, *San Francisco General Plan*, Community Safety Element, adopted April 27, 1997 by the San Francisco Planning Commission, approved August 11, 1997 by the Board of Supervisors, Policies 3.1 through 3.7 and 4.1 through 4.4, pp. I.4.21-I.4.24.*
41. Paul Deutsch, Senior Environmental Planner, Mission Bay EIR Coordinator City and County of San Francisco, Planning Department, memorandum to EIP Associates, March 4, 1998.
42. Garcia, A.W., and J. R. Houston, Type 16 Flood Insurance Study: Tsunami Predictions for Monterey and San Francisco Bays and Puget Sound, U.S. Army Corps of Engineers Technical Report H-75-17, Hydraulics Laboratory, U.S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi, November 1975, pp. 4-6.
43. City and County of San Francisco, *San Francisco General Plan*, Community Safety Element, adopted April 27, 1997 by the San Francisco Planning Commission, approved August 11, 1997 by the Board of Supervisors, pp. I.4.8 and I.4.11.
44. Garcia, A.W., and J. R. Houston, Type 16 Flood Insurance Study: Tsunami Predictions for Monterey and San Francisco Bays and Puget Sound, U.S. Army Corps of Engineers Technical Report H-75-17, Hydraulics Laboratory, U.S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi, November 1975, Figure 56.

45. An extreme high tide is any tide rising at least 1.75 feet above mean sea level. This elevation translates to -6.91 feet San Francisco City Datum, because mean sea level is 8.66 feet below the City Datum ($-8.66 + 1.75 = -6.91$).

Maximum run-up levels for the 100-year and 500-year tsunami events adjacent to San Francisco Bay calculated by Garcia and Houston (see endnote 41) do not account for tidal effects, and, thus, reflect the flood elevations reached above the normal water surface of the Bay at the time tsunami occur. For the 100-year tsunami event at the Project Area, 4.70 feet of wave run-up occurring during an extreme high tide would result in a flood elevation at least as high as 6.45 feet above mean sea level ($4.70 + 1.75 = 6.45$). This elevation translates to -2.21 feet San Francisco City Datum ($-8.66 + 6.45 = -2.21$).

Extreme high tides of 2.95 feet above mean sea level (-5.71 feet San Francisco City Datum) occur every winter in San Francisco Bay, so the maximum estimated flood elevation from 4.70 feet of run-up for the 100-year tsunami event during the maximum expected extreme high tide would be 7.65 feet above mean sea level ($4.70 + 2.95 = 7.65$), or -1.01 feet San Francisco City Datum. For the 500-year tsunami event, 7.80 feet of run-up during the maximum expected extreme high tide would result in an estimated flood elevation of 10.75 feet above mean sea level ($7.80 + 2.95 = 10.75$), or 2.09 feet San Francisco City Datum.

46. KCA Engineers, Inc., Proposed Grade After Settlement, Sheet 1 of 1, scale 1 inch equals 200 feet, KCA # GRAD-TC 97.0250/15, August 5, 1997.
47. KCA Engineers, Inc., Proposed Grade After Settlement, Sheet 1 of 1, scale 1 inch equals 200 feet, KCA # GRAD-TC 97.0250/15, August 5, 1997.
48. Assuming 30 maximum expected extreme high tide crests of less than 2 hours duration in an average year of 365.25 days (8766 hours), the statistical probability of a 100-year tsunami (i.e., the one percent event) occurring within one of those 30 two-hour windows is $0.01 \times (30 \div [8766 \div 2]) = 0.0000684$. Rounded and expressed as a percent likelihood, this number is smaller than one hundredth of one percent ($<0.01\%$).
- Similarly, the statistical probability of a 500-year tsunami (i.e., the one-fifth of one percent (0.2 %) event) occurring within one of the 30 two-hour windows is $0.002 \times (30 \div [8766 \div 2]) = 0.0000137$. Rounded and expressed as a percent likelihood, this number is smaller than two thousandths of one percent ($<0.002\%$).

- * A copy of this report is on file for public review at the Office of Environmental Review, Planning Department, 1660 Mission Street, San Francisco.

I. HEALTH AND SAFETY

Proposed project-related uses that could involve the use, storage, and disposal of hazardous materials include UCSF uses, research and development, light industry, and some commercial activities. This section describes the existing environmental setting and potential impacts related to such hazardous materials, particularly as they relate to health and safety issues. Because of the nature of the proposed future activities, the types of materials addressed throughout this section include hazardous chemicals, radioactive materials, and biohazardous materials. These terms are defined in the Glossary at the end of this section and in Appendix H, Health and Safety.

Many health and safety issues related to proposed future activities in the Project Area were not addressed in the 1990 FEIR because some Commercial Industrial uses discussed in this SEIR were not anticipated at that time. For this reason, this section contains primarily new information not otherwise included in the 1990 FEIR. The endnotes for this section begin on p. V.I.42.

SETTING

EXISTING HAZARDOUS MATERIALS AND WASTE

Section V.J, Contaminated Soils and Groundwater: Setting, describes subsurface hazardous materials in the Project Area. In addition to these hazardous materials, some existing operations in the Project Area involve hazardous materials use and hazardous waste generation. The Project Area is industrial in nature and is occupied by warehouses, sand and gravel processing facilities, truck terminals, and light manufacturing, among other uses. Large portions of the Project Area are now vacant or covered by large warehouses. As suggested in Table V.I.1, most of the hazardous materials handled in the Project Area are used for maintenance activities, and the existing quantity of hazardous materials is relatively small. None of these existing activities are known to involve radioactive or biohazardous materials or wastes.

HEALTH AND SAFETY LAWS AND REGULATIONS

As a result of the health and safety risks associated with the use of hazardous materials, hazardous materials use, storage, and disposal are subject to numerous laws and regulations at various levels of government. These laws and regulations relate to occupational safety, hazardous materials management, building and fire safety, hazardous waste management, hazardous materials

**TABLE V.I.1
EXAMPLES OF EXISTING FACILITIES
LIKELY TO USE HAZARDOUS MATERIALS /a/**

Existing Facilities	Type of Operations
Primary Facilities in the Project Area	
SF Autocenter Body Shop 1420 Fourth Street, Suite 299A	Autobody repair, painting, and related service
Cable Car Advertisers, Inc. 1201 Sixth Street	Vehicle storage, rehabilitation, and maintenance
S&S Trucking and Peak Engineering 1335 Sixth Street, Suite 3	Trucking and related maintenance
Bay Area Super Shuttle 700 16th Street, Suites 3A and 3B	Van service maintenance and storage
Pacific Coast Bus Service, Inc. 375 Illinois Street	Charter bus storage and maintenance
Multi-Craft Auto Body Shop 1355A Sixth Street	Autobody repair, painting, and related service
Example Facilities Near the Project Area	
Crowley Marine Services Pier 54	Tug and barge, and related maintenance
Caltrain 700 Fourth Street	Commuter train service and maintenance

Note:

- a. Three facilities identified in the 1990 FEIR (Volume Two, Table VI.N.1, p. VI.N.15) that handled hazardous waste are no longer a part of the Project Area. H&H Ship Service has ceased operations, and the site of its former operations is no longer within the boundaries that define the Project Area. The site of Pacific Motor Trucking Company (1355 Sixth Street) is now occupied by American Storage Unlimited, a storage company. The site of Salinas Valley-Santa Cruz Motor Express (1760 Third Street) is now occupied by John Wagner Associates, Inc., a construction company.

Source: EIP Associates.

transportation, radioactive materials, and biological safety. Important health and safety laws that apply to the Project Area include the following:

- Federal Animal Welfare Act
- Federal Hazardous Materials Transportation Authorization Act

- California Occupational Safety and Health Act
- California Hazardous Substances Information and Training Act
- California Hazardous Waste Control Law
- California Accidental Release Prevention Law
- California Underground Storage Tank Law
- California Aboveground Petroleum Storage Act
- California Radiation Control Law
- California Medical Waste Management Act
- San Francisco Fire Code
- San Francisco Building Code
- San Francisco Hazardous Materials Permit and Disclosure Ordinance

Table V.I.2 provides a brief overview of these laws and regulations, and Appendix H provides more detailed information. Appendix H updates and expands the description of hazardous materials and waste regulations summarized in the 1990 FEIR./1/

Generally, UCSF is subject to state and federal regulation, but not local regulation, except where state and federal agencies have specifically delegated oversight authority to local agencies. For this reason, the UCSF site would be subject to the local implementation of state Business Plan requirements through the San Francisco Hazardous Materials Permit and Disclosure Ordinance as described in Table V.I.2 and Appendix H, but not to local San Francisco building and fire codes. UCSF is subject to California building and fire codes. As a Certified Unified Program Agency, the San Francisco Department of Public Health has been authorized by the California Environmental Protection Agency to oversee many hazardous materials and waste management issues at UCSF, as discussed further in Appendix H.

COMMON INDUSTRY PRACTICES

Some aspects of hazardous materials use do not clearly fall within the jurisdiction of any particular agency to regulate and oversee. For example, the use of biohazardous materials is not regulated in the same way as are hazardous chemical and radioactive materials. The U.S. Department of Health and Human Services has established standards for working with biohazardous materials, including infectious agents, infected animals, and recombinant DNA (defined in "Definitions" in

TABLE V.I.2
SUMMARY OF HEALTH AND SAFETY LAWS AND REGULATIONS

Occupational Safety	Occupational safety standards exist in federal and state laws to minimize worker safety risks from both physical and chemical hazards in the workplace. The California Division of Occupational Safety and Health (Cal/OSHA) and the federal Occupational Safety and Health Administration (Fed/OSHA) are the agencies responsible for assuring worker safety in the handling and use of hazardous materials in the workplace. Cal/OSHA assumes primary responsibility for developing and enforcing standards for safe workplaces and work practices. Among other requirements, Cal/OSHA obligates many businesses to prepare Injury and Illness Prevention Plans/a/ and Chemical Hygiene Plans./b/ Fed/OSHA's Bloodborne Pathogens Standard requires the use of Universal Precautions (handling all human blood and certain body fluids as if they contain infectious agents) in the workplace./c/
Hazardous Materials Management	<p>State, federal, and local laws require planning to ensure that hazardous materials are properly used, stored, and disposed of, and, in the event that such materials are accidentally released, to prevent or to minimize injury to health or the environment. These laws require hazardous materials users to prepare written plans, such as Hazard Communication Plans/d/, Hazardous Materials Business Plans (called "registrations" in San Francisco)/e/, and Chemical Hygiene Plans./f/ Laws and regulations require hazardous materials users to store hazardous materials appropriately and to train employees to manage these materials safely. A number of agencies participate in enforcing hazardous materials management requirements, but the San Francisco Department of Public Health is the agency most involved in overseeing hazardous materials management within San Francisco. The Department of Public Health is the Certified Unified Program Agency in San Francisco.</p> <p>Businesses that handle certain very hazardous substances must undertake a systematic analysis of their operations, study the potential consequences of possible worst-case accidents, and prepare Risk Management Plans to reduce apparent risks./g/ In San Francisco, this process is overseen by the Department of Public Health, which determines compliance with Accidental Release Prevention program requirements. Risk Management Plans are to be made available to the public for review. In addition, the State Office of Emergency Services administers the California Emergency Plan to respond to hazardous materials incidents and to coordinate the responses of other agencies, including the San Francisco Public Health and Fire Departments./h/ Both departments provide hazardous materials emergency response services if needed.</p>
Building and Fire Safety	The San Francisco Building and Fire Codes amend and otherwise incorporate the California Building and Fire Codes./i/ These laws specify management practices for flammable materials, including some packaging and containment requirements. They also set forth appropriate construction standards (e.g., fire separations and fire suppression systems) depending on occupancy classifications. The San Francisco Fire Department and Department of Building Inspection review proposed building design plans to ensure compliance with Fire and Building Code requirements. As a state agency, UCSF is subject only to the State Building and Fire Codes.

(Continued)

TABLE V.I.2 (Continued)

Hazardous Waste Management	The California Environmental Protection Agency Department of Toxic Substances Control regulates the generation, transportation, treatment, storage, and disposal of hazardous waste in California./j/ Laws impose “cradle to grave” regulatory systems for handling hazardous waste in a manner intended to protect human health and the environment. The San Francisco Department of Public Health enforces on-site waste management requirements that apply to hazardous waste generators, such as requirements for secondary containment around stored wastes to prevent environmental contamination in the event of a spill. The Department of Public Health also inspects for compliance with state permitting requirements applicable to facilities conducting hazardous waste operations subject to permit by rule, conditional exemption, or conditional authorization.
Hazardous Materials Transportation	The U.S. Department of Transportation regulates hazardous materials transport between states./k/ Within California, the state agencies with primary responsibility for enforcing federal and state regulations, and for responding to transportation emergencies, are the California Highway Patrol and the California Department of Transportation. Together, federal and state agencies determine driver training requirements, load labeling procedures, and container specifications. Although certain requirements apply to the transport of hazardous materials, requirements for transporting hazardous waste are more stringent, and hazardous waste haulers must be licensed to transport hazardous wastes on public roads.
Radioactive Materials	The Radiologic Health Branch of the California Department of Health Services administers the federal and state radiation safety laws that govern the storage, use, transportation, and disposal of radioactive materials./l/ The Radiologic Health Branch licenses institutions that use radioactive materials. To maintain a radioactive materials license, an institution must meet training and radiation safety requirements and be subject to routine enforcement inspections.
Biological Safety	<p>Biological safety is not regulated in the manner that hazardous chemicals and radioactive materials are; however, the San Francisco Hazardous Materials Permit and Disclosure Ordinance does track the use of infectious agents./m/ Institutions conducting research funded by the National Institutes of Health must follow guidelines for working with biohazardous materials, including infectious agents, infected animals, and recombinant DNA./n/</p> <p>Under the 1985 Animal Welfare Act, the U.S. Department of Agriculture establishes standards for animal care and worker safety for activities involving certain research animal species./o/ Organizations are required to establish an Institutional Animal Care and Use Committee to review and approve protocols for work in which laboratory animals are used. Institutions that use animals for research and receive federal funds must also comply with the <i>Guide for the Care and Use of Laboratory Animals</i>/p/ and the <i>U.S. Government Principles for the Utilization and Care of Vertebrate Animals</i>/q/. The California Medical Waste Management Act applies to the generation, transportation, treatment, storage, and disposal of medical waste, and imposes</p>

(Continued)

TABLE V.I.2 (Continued)

Biological Safety (cont.)	a "cradle to grave" tracking system, and a calibration and monitoring system, for on-site treatment./r/ Facilities in San Francisco that treat medical wastes must obtain a permit and are subject to audits by the San Francisco Public Health Department. Medical waste is to be transported in closed red bags marked "biohazard" and placed inside hard-walled containers with lids.
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Notes:

- a. California Code of Regulations, Title 8, Section 3203(a)(7).
- b. California Code of Regulations, Title 8, Section 5191(e).
- c. California Code of Regulations, Title 8, Section 5193(c); Code of Federal Regulation, Title 29, Section 19100.1030(q).
- d. California Labor Code, Sections 6317 and 6423; California Code of Regulation, Section 5194.
- e. California Health and Safety Code, Section 25505; City and County of San Francisco Municipal Code, Health Code, Part II, Chapter V, Article 21.
- f. California Code of Regulations, Title 8, Section 5193(e).
- g. California Health and Safety Code, Section 25531.
- h. California Government Code, Title 2, Section 8550.
- i. City and County of San Francisco Municipal Code, Building Code, 1995 Edition; City and County of San Francisco Municipal Code, Fire Code, 1995 Edition.
- j. California Code of Regulations, Title 22, Section 66260.1.
- k. Code of Federal Regulations, Title 49, Parts 106, 107, 171-179, 190-192, 397.
- l. California Code of Regulations, Title 17, Section 30190.
- m. City and County of San Francisco Municipal Code, Health Code, Part II, Chapter V, Article 21.
- n. U.S. Department of Health and Human Services National Institutes of Health, *Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines)*, January 1996. U.S. Department of Health and Human Services Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health, *Biosafety in Microbiological and Biomedical Laboratories*, 3rd Edition, May 1993.
- o. United States Code, Title 7, Section 2131.
- p. National Research Council, *Guide for the Care and Use of Laboratory Animals*, 1996.
- q. Office of Science and Technology Policy, Federal Register, Vol. 50, No.97, May 20, 1985.
- r. California Health and Safety Code, Section 25015.

Source: EIP Associates.

Appendix H)./2/ In many instances, following these guidelines is not necessarily required by state or federal laws. However, these standards are normally respected as guidelines and employed as a matter of standard industry practice by most handlers of biohazardous materials.

As discussed in more detail in Appendix H, the U.S. Department of Health and Human Services has defined four levels of containment practices (biosafety levels) to ensure biological health and safety. Biosafety levels are based on the infectious characteristics of the agents involved, the quantities and concentrations of the agents, the safety practices in the laboratory, and the availability of therapeutic measures and vaccines. Following U.S. Department of Health and Human Services guidelines means

evaluating the hazards posed by the infectious agents or recombinant DNA to be used, and selecting physical facilities and implementing safety and containment practices as appropriate for the level of hazard (the biosafety level).

APPLICABLE PLANS AND POLICIES

Local plans and policies relating to hazardous materials, hazardous waste, and health and safety are summarized below.

Community Safety Element

San Francisco has adopted a Community Safety Element as part of its General Plan.^{/3/} The goal of the element is to improve coordination of City programs that address physical hazards and potential disasters. An objective of the element is to reduce structural and non-structural hazards to life safety, and to minimize property damage and resulting social, cultural, and economic dislocations resulting from future disasters. To this end, San Francisco policy is to enforce state and local codes that regulate the use, storage, and disposal of hazardous materials so as to prevent, contain, and effectively respond to accidental releases. Another objective of the element is to protect life and property from disasters by providing effective emergency response. Related San Francisco policies include maintaining a comprehensive Emergency Operations Plan (see below), conducting periodic exercises of the plan, maintaining an adequate Emergency Command Center, expanding San Francisco's fire prevention and fire-fighting capabilities, and establishing emergency access routes.

Area Plan for Emergency Response to Hazardous Materials Incidents

Pursuant to the California Emergency Services Act, San Francisco has prepared a plan to address emergencies involving the release of hazardous materials. The *Area Plan for Emergency Response to Hazardous Materials Incidents* addresses pre-emergency planning, describes agency notification and coordination procedures, specifies personnel training, and lists available supplies and equipment.^{/4/} Copies of the plan are distributed among the San Francisco Public Health, Fire, Police, and Public Works Departments; the Red Cross; paramedics; and other agencies.

San Francisco Hazardous Waste Management Plan

Hazardous waste is and would continue to be generated in the Project Area. The *City and County of San Francisco Hazardous Waste Management Plan* was prepared 1) "to protect and preserve public health and safety and maintain the economic viability of the County and the State," 2) "to prevent

damage to the environment from the adverse effects of hazardous wastes,” and 3) “to control hazardous waste through pollution prevention . . . in this order of priority: source reduction. . . ; recycling and reuse; treatment. . . ; and disposal. . . .”/5/ The objectives of the plan include, among others, controlling illegal disposal; reducing reliance on out-of-county treatment, storage, and disposal facilities; educating the public about household hazardous waste and providing means for proper disposal of household hazardous wastes; and educating and assisting small businesses in improving their waste management. Programs proposed under the plan include, among others, enforcing San Francisco’s Hazardous Materials Permit and Disclosure Ordinance, developing a household hazardous waste education and technical assistance program that includes information about safer substitutes and proper disposal methods, and establishing a small quantity generator storage or treatment station.

The *Hazardous Waste Management Plan* identifies hazardous waste facility (i.e., long-term storage, treatment, or disposal facility) siting criteria. The criteria relate to location (e.g., proximity to public facilities, waste generators, and recreation areas, and zoning), hazards (e.g., seismic, flooding, and unstable soil hazards), public safety (e.g., distance from residents, immobile populations, and transportation routes), and physical limitations (e.g., soils, air quality, and depth to groundwater). The *Hazardous Waste Management Plan* limits the potential sites for new hazardous waste management facilities to areas zoned M-2, upon conditional use authorization provided that certain criteria are met. No hazardous waste facilities are proposed for the Project Area, but the Castle Metals and Esprit sites are currently designated M-2 and could potentially be considered for hazardous waste facility sites.

San Francisco Household Hazardous Waste Element

Policies regarding household hazardous waste are relevant because residents in the Project Area would generate household hazardous waste in the future. The City and County of San Francisco’s *Integrated Waste Management Plan* consists of the *City and County of San Francisco Source Reduction and Recycling Element*, the *City and County of San Francisco Solid Waste Generation Study*, and the *City and County of San Francisco Household Hazardous Waste Element*. The objectives of the *Household Hazardous Waste Element* include expanding existing recycling of household hazardous waste; reducing improper household hazardous waste disposal; encouraging source reduction by promoting safer substitutes and reusable products; improving the understanding of San Francisco residents about the need to manage their household hazardous wastes properly; and coordinating efforts with other environmental and waste management education programs./6/

IMPACTS

STANDARDS OF SIGNIFICANCE

Health and safety impacts would be considered significant for purposes of this SEIR if the project would create substantial public health or safety hazards, or would involve the use, production, or disposal of materials in a manner that poses substantial hazards to people or the environment, including animal and plant populations. Impacts would also be considered significant if the project would interfere with emergency response plans or emergency evacuation plans, or would conflict with adopted environmental plans and goals related to hazardous materials and wastes.⁷⁷ The significance of impacts of individual projects is determined on a case-by-case basis.

ANALYTICAL APPROACH

In most cases, the laws and regulations pertaining to hazardous materials management are sufficient to ensure worker, public, and environmental health and safety. The “Hazard Assessment” in Appendix H provides evidence that supports the assumption that regulatory compliance effectively minimizes most health and safety risks resulting from hazardous materials and waste management prior to disposal. However, the discussion below identifies areas where impacts related to hazardous materials may, nonetheless, be significant because the enforcement of existing laws and regulations alone does not necessarily ensure that potential impacts will be reduced to a less-than-significant level. In these cases feasible mitigation measures are identified.

This analysis considers the range and nature of foreseeable hazardous materials use, storage, and disposal resulting from the project. It then identifies the primary ways that these hazardous materials could expose individuals or the environment to health and safety risks. It also considers the likely controls that would be in place to minimize these health and safety risks. As indicated above, substantial compliance with applicable federal, state, and local health and safety laws and regulations (as summarized in Table V.I.2 and described in detail in “Regulatory Setting” in Appendix H) by UCSF, residents, and businesses of the Project Area is considered necessary to preclude health and safety impacts. Local and state agencies would be expected to continue to enforce applicable requirements to the extent that they do so now.

The types of businesses and the range and types of uses that are expected to locate in the Project Area can be identified; however, the specific prospective businesses that could locate in the Project Area are unknown at this time. Regulatory compliance records are therefore available only for UCSF. UCSF summarized its record in its *Long Range Development Plan Final Environmental Impact Report*

(LRDP FEIR). Several state and local agencies have cited UCSF for a range of violations, some of which involved occupational safety, air emissions, radioactive materials handling, biohazardous waste management, and fire safety provisions. Many violations have been corrected during the inspections (e.g., closing containers when not in use). Some violations have required corrective action and a notice of compliance (e.g., training hospital staff in the proper disposal of medical waste). Occasionally, a new capital project has been needed to address a violation (e.g., installing a new fire alarm and sprinkler system). In all cases, UCSF has taken steps to respond to and correct these problems./8/,/9/

The project would involve a variety of land uses, including residences, retail space, entertainment facilities, community facilities, open space, and Commercial Industrial uses. UCSF operations would involve a number of these uses, including substantial research activities and a possible community clinic. Commercial Industrial uses could include biotechnology, semiconductor, computer, or other types of research and development operations; multi-media or software companies; light manufacturing; and office space. As a result, this analysis assumes and evaluates a broad range of potential businesses that could handle hazardous materials in the Project Area.

HAZARDOUS MATERIALS USE, STORAGE, AND DISPOSAL

Types of Hazardous Materials Users

Nearly all project uses would involve the use of hazardous materials at varying levels. In each case, the potential hazards would depend on what materials would be used, where the materials would be used, how they would be used, and who would use them. Households and certain businesses (e.g., office-based businesses) would use relatively small quantities of hazardous materials when compared with certain other businesses (e.g., those engaged in research and development or light manufacturing). Businesses that handle larger quantities of hazardous materials would often also use a wider variety of materials. This variety could include less common materials, such as radioactive materials or biohazardous materials. These businesses would be subject to relatively more intense regulation and oversight than businesses that handle smaller quantities of more common materials. Employees of these businesses would also typically receive special training (often required by law) to help them understand the hazards they face.

Because the types of hazardous materials found in homes and many other businesses would often be common household products, and because individuals such as residents and office workers would not usually receive any special hazardous materials training, the hazards associated with these common materials could often go unrecognized. Because residential and other small quantity hazardous

materials users would differ from large quantity users in terms of 1) the types of materials handled, 2) the training provided to the individuals who handle the materials, and 3) the regulatory enforcement provided by oversight agencies, the health and safety issues pertaining to these groups would be different. For this reason, this analysis evaluates these two types of hazardous materials users separately in some cases.

Commercial Industrial Uses

Most project-related businesses that handle relatively large quantities of varying types of hazardous materials would occupy the Commercial Industrial space. Commercial Industrial uses could include biotechnology, semiconductor, computer, or other types of research and development operations; multi-media or software companies; light manufacturing; and office space. Many of these uses would involve mostly common office functions. For example, since modern offices rely heavily on the use of personal computers, the potential operations of multi-media or software companies would be similar to those of most office environments. Offices are like households in that, although hazardous materials are used there, the materials are typically common household products. Potentially hazardous office supplies include paints, aerosols, cleaners, disinfectants, adhesives, correction fluid, and fluorescent light bulbs.

Some potential research and development functions of computer firms could resemble office uses, particularly if they were to involve the development of new software. Other research and development operations could involve “dry” laboratories, where relatively small or negligible quantities of chemicals would be used. The remainder of the Commercial Industrial space could consist of “wet” laboratories or light industries, where relatively larger quantities of hazardous materials could be handled routinely. Some of these operations could include radioactive materials or biohazardous materials.

UCSF, which would occupy a substantial portion of the Project Area, would conduct health sciences instruction and research at this site. For this reason, the Project Area could be an attractive location for health sciences businesses seeking to associate with UCSF. These businesses would probably engage in research and development operations complementary to UCSF activities, specializing in biotechnology or other life science-related research and development. If successful, they could also manufacture and market complementary products, such as medical devices or pharmaceuticals. This type of manufacturing would be expected to occupy a relatively small portion of the Commercial Industrial space. Pilot-scale manufacturing would be much more likely than large-scale manufacturing./10/ Large-scale manufacturing would more likely locate away from urban and seismic hazards, where properties could be less expensive and a less expensive work force could be available.

The primary businesses occupying the Commercial Industrial areas would seek to benefit from the intellectual dialogue that would be possible if located near a major research institution such as UCSF.

Operations other than biology-based research and development would be possible at the Project Area, but Commercial Industrial space related to the life sciences would be most likely. Furthermore, other types of “wet” research and development laboratories would rely on many of the same basic techniques found in life science laboratories, as described below.

Research and Development

Laboratory-based research and development (or “wet” research) could involve a broad spectrum of activities requiring the use of laboratory bench space, laboratory support space (e.g., tissue culture rooms, media preparation areas, cold rooms, glassware wash areas, and dark rooms), and other ancillary facilities (offices and work stations, storage areas, libraries, and meeting rooms). Typical “wet” laboratories contain work benches, sinks, storage areas, fume hoods, biosafety cabinets, and a wide variety of instruments and equipment. Each instrument is generally associated with one or more basic techniques. Like the appliances in a typical household kitchen, the instruments range in size from as small as a blender to as large as a commercial restaurant or deli refrigerator (kitchen appliances are, in fact, common in laboratories). The equipment housed in a laboratory depends on the technologies employed and the materials handled. Many laboratories also include space for computers that control instruments or are used to store and analyze data. Most laboratory work in the life sciences is performed at room temperature or body temperature under normal atmospheric pressure. Other types of laboratories could use a greater range (lower and higher) of temperatures and pressures.

Standard laboratory techniques include measuring weights and volumes, gently heating and cooling materials, and shaking and stirring solutions. These standard techniques are often used in association with more sophisticated techniques, as described in Table V.I.3. Some of the techniques described in Table V.I.3 involve the use of hazardous materials. By describing many common laboratory activities, Table V.I.3 suggests the nature of the hazards posed by some laboratory operations. Research and development laboratories typically use relatively small quantities of these materials at any one time.

Hazardous Materials Use, Storage, and Disposal in Research and Development

The quantities of hazardous materials that would be used, stored, and disposed of with the project cannot be quantified precisely because the specific future businesses of the Project Area are unknown,

**TABLE V.I.3
COMMON LABORATORY ACTIVITIES**

Physical Techniques	<i>Physical techniques include heating, stirring, and other techniques as illustrated by the following examples.</i>
Microscopy	The common light microscope is used to magnify small specimens, such as bacteria. More sophisticated microscopes operate on very similar principles.
Photometry	Photometry involves shining ultraviolet, visible, or near-infrared light through less than an ounce of solution to determine what substance is in the solution and how much there is.
Chromatography	Chromatography is a method of separating different components of a mixture by flowing the mixture (dissolved in a water solution with salts or a mixture of organic solvents) through a stationary substance (such as a silica gel or specially coated glass beads). Under appropriate conditions, the mixture may be separated as some components are slowed down by the stationary substance more than others. Chromatography can require several ounces or gallons of material.
Electrophoresis	During electrophoresis, a mixture is placed in a gelatin-like material and a voltage (e.g., 1,000 volts) is applied across the gel. In time, the voltage will separate the components of the mixture by pulling components with greater electric charges through the gel faster. Electrophoresis can require several ounces or quarts of materials.
Centrifugation	Centrifuges spin solutions (usually in capped tubes or bottles) around a central axis. This spinning creates a centrifugal force that drives heavier (and usually larger) particles to the bottom. Researchers centrifuge volumes of liquids ranging from a few drops to about a quart.
Filtration	Filtration separates mixtures on the basis of size. Researchers filter volumes of liquids ranging from a few drops to several quarts to remove suspended particles.
Lyophilization	Lyophilization is "freeze drying." Water and more volatile substances are extracted by freezing a solution and applying a vacuum to it, leaving dry solids or oils behind, as when freeze-drying coffee.
Sterilization	Laboratory materials and equipment are often sterilized through treatment with steam and pressure. Chemical techniques also exist for disinfection.
Chemical Techniques	<i>Some chemicals are hazardous materials, while others are not. Life science laboratories involve primarily simple chemicals (like sugars and salts) as nutrients in solutions that support cell growth and reproduction. Most molecules of biological interest are handled in water-based solutions. For this reason, biological research typically uses a preponderance of water-soluble chemicals and relatively smaller amounts of organic chemicals, such as solvents.</i>
Use of Reagents	Researchers use chemical reagents as starting materials for many types of chemical reactions. Such reactions are used to chemically change other chemicals or biological molecules. Chemical reactions are necessary for many techniques, such as staining cells (dyes) and developing photographic film (developers and fixers). The volume used depends on the reactions, but typically involves a quart or less.

(Continued)

TABLE V.I.3 (Continued)

Use of Solvents	Some chemicals can be used to dissolve other materials to create a homogeneous mixture or solution. These solvents can be used to transfer substances between containers, extract substances from complex mixtures, or carry substances through other processes or equipment.
Use of Enzymes	Enzymes are proteins that perform specific biological reactions at the molecular level. In the strictest sense, they are very large chemicals. They perform many biological tasks much more efficiently than other chemical techniques, but are rarely hazardous. Experiments typically require a fraction of a drop of an enzyme-containing solution.
Use of Radionuclides	Certain chemicals contain radioactive atoms, or radionuclides, which emit radiation. Current methods for detecting radionuclides allow researchers to use less than 1 millicurie of these materials in typical experiments. Most radionuclides are used as tracers to find out what happens to an atom or molecule through the course of an experiment.
Biological Techniques	<i>Most biological techniques involve individual cells, cultures, or tissues and applications of normal biological processes. Use of research animals is sometimes required to study biological effects that cannot be adequately evaluated in a test tube or culture dish. Animal research and care require common veterinary medicine techniques, such as tests of biological functions (e.g., temperature, pulse), clinical assays (on blood or urine), x-rays, injections, surgery, and necropsy. Recombinant DNA technology combines many of the chemical and physical techniques described above in applications related to biological materials. Two primary recombinant DNA techniques are cell culture and cloning, as described below.</i>
Cell Culture	Cell culture refers to growing cells in a laboratory setting, such as in a culture dish. Microorganisms can be cultured if provided appropriate nutrients for survival in a water-based growth medium. Sometimes several gallons of growth medium can be used to grow a culture. A researcher can select and control which cells are grown in a growth medium by either supplying critical nutrients in the solution or by keeping certain substances necessary for cell survival out of the medium. Typical organisms used for these purposes include <i>E. coli</i> K12 and baker's yeast.
Cloning	Extremely specific enzymes are used to cut DNA (deoxyribonucleic acid) molecules at specific, desired points. Later, the DNA fragments may be recombined in a different order using another set of enzymes. The result may be a new or altered DNA genetic code. The process of using the new genetic code to perform some function (like making a protein) is called "expression." Ultimately, many copies of the new DNA may be made by inserting it into cells (e.g., bacteria or yeast) that replicate very quickly. In this way, many copies of the new DNA molecules may be produced. This process is called "cloning." Moving DNA from one organism to another or rearranging an organism's DNA is called "genetic engineering." The use of genetic engineering, in part, defines most biotechnology work.

Source: EIP Associates

and because hazardous materials use, storage, and disposal by any business is subject to continuous change as technologies develop and mature. Even if the project occupants were known, businesses and UCSF cannot reasonably be expected to predict in advance every possible chemical or combination of chemicals they could conceivably use. However, the discussion below illustrates the range and nature of foreseeable hazardous materials use, storage, and disposal by project-related Commercial Industrial uses and UCSF.

Approach Used to Estimate Hazardous Materials Quantities

The estimates presented below assume that research and development laboratories uses would occupy about 50% of the proposed Commercial Industrial space. To ensure a conservative approach, additional estimates are provided that assume that research and development laboratory uses would occupy about 75% of the proposed Commercial Industrial space. This assumption is conservative in that it probably leads to overestimates of hazardous materials quantities. The estimates below also assume that research and development activities would relate primarily to biotechnology, biomedical, or other life science research. This assumption is reasonable because UCSF would be expected to draw these types of uses to the Project Area. This assumption is also somewhat conservative because other types of Commercial Industrial uses (e.g., computer software and multimedia businesses) would likely handle hazardous materials in lesser quantities.

Similar operations undertaken elsewhere can be used to illustrate activities foreseeable at the Project Area. UCSF's LRDP FEIR describes UCSF's laboratory research activities in general terms./11/ In that report, UCSF projected that its Mission Bay site could involve the annual use of about 42,200 gallons of liquid chemicals, 235,000 pounds of solids, and 122,000 cubic feet of compressed gases. UCSF's 1990 *Laurel Heights Environmental Impact Report* describes laboratory research activities related to the School of Pharmacy and provides an inventory of chemicals purchased by the School of Pharmacy./12/ UCSF's 1995 *Revised Laurel Heights Plan; Center for Social, Behavioral and Policy Sciences, and Campus Administration Environmental Impact Report* describes the nature of laboratory research and estimates the types and quantities of hazardous materials for that project on the basis of a representative selection of laboratories at other UCSF sites./13/ The *University of California San Francisco—Mount Zion Hospital and Medical Center Proposed Integration Agreement Environmental Impact Report*, *University of California San Francisco/Mount Zion Program Revisions and Associated Building Projects Subsequent Environmental Impact Report*, and *University of California San Francisco Parnassus Heights Central Utilities Plant Project Environmental Impact Report* provide additional information about UCSF operations./14/ These documents provide information useful in understanding UCSF's possible hazardous materials use, storage, and disposal activities at its new campus site in the Project Area.

Various environmental impact reports have been prepared for specific research and development projects proposed by private businesses. For example, the *Chiron Development Plan Environmental Impact Report* prepared by the City of Emeryville assesses the impacts of expanding Chiron Corporation's research and development headquarters in Emeryville./15/ Because Chiron is an international biotechnology company engaged in research and development related to molecular biology, biochemistry, and related life sciences, its operations, on average, are representative of many proposed Project Area Commercial Industrial uses. Because Chiron Corporation's Emeryville operations are representative of many prospective Commercial Industrial users, data presented in the *Chiron Development Plan Environmental Impact Report* are used here to illustrate the range and nature of hazardous materials use, storage, and disposal anticipated by Commercial Industrial uses.

Data from the Chiron report were adjusted on the basis of proportional research and development space to reflect the level of activity anticipated for the proposed Commercial Industrial space. In 1994, Chiron Corporation occupied 118,000 gross square feet (gross sq. ft.) of space with research activities and 60,000 gross sq. ft. of space with product development and small-scale manufacturing operations. The total area devoted to these research and development uses was 178,000 gross sq. ft. Commercial Industrial uses in Mission Bay South would occupy 5,557,000 gross sq. ft. of space. Assuming that about 50% of this space would actually be research and development space (with the balance being office space and office-related uses), the combined research and development space in these subareas would be about 2,779,000 gross sq. ft. This amount of space is about 16 times greater than Chiron Corporation's research and development space in 1994 (178,000 gross sq. ft.). Therefore, 1994 data from the *Chiron Development Plan Environmental Impact Report*, increased by a factor of 16, reflect a reasonable estimate of hazardous materials use, storage, and disposal by Commercial Industrial uses under this project.

To ensure a conservative analysis, hazardous materials projections are also presented here assuming that about 75% of the Commercial Industrial space would be occupied by research and development space. Using this assumption, about 4,168,000 gross sq. ft. of the 5,557,000 gross sq. ft. of Commercial Industrial space would be occupied by research and development laboratories, a space about 23 times larger than the space Chiron occupied in 1994.

The estimated hazardous materials quantities provided below are reasonable and illustrative of hazardous materials use, but they are also conservative for the following reasons:

- A substantial portion of the Commercial Industrial research and development space could be occupied by businesses (e.g., software companies) that do not operate "wet" laboratories, whereas relatively little of this space would likely be occupied by greater hazardous materials users.

- In estimating most hazardous materials quantities on the basis of Chiron Corporation data, hazardous materials use related to Chiron's research, development, small-scale manufacturing, and production-scale (large-scale) manufacturing activities were included. However, Chiron's 1994 production-scale manufacturing space (40,000 gross sq. ft.) was not included when calculating the scaling factors of 16 and 23.
- The estimated hazardous materials quantities presented here assume that laboratory-based research and development space (which is a proportion of total floor space within the Commercial Industrial land use designation) would be occupied exclusively by laboratories and ancillary space (as presented in the *Chiron Development Plan Environmental Impact Report*). In contrast, Commercial Industrial space in the Project Area would be occupied by a full complement of business functions (e.g., offices and support space) in addition to the space assigned specifically for laboratories.

Estimated Hazardous Materials Quantities

Estimated quantities of hazardous chemicals, radioactive materials, and biohazardous materials that could reasonably be expected to be managed by the largest potential users of these materials are provided below. These businesses and other entities would be located primarily in Mission Bay South in Commercial Industrial and UCSF space.

Hazardous Chemicals

On the basis of the approach described above, Table V.I.4 presents estimated chemical storage by project-related Commercial Industrial uses and UCSF. To the extent possible, the chemicals in Table V.I.4 have been grouped by category of hazardous material, including flammable materials, corrosive materials, oxidizers (reactive materials that often release oxygen upon reaction), and toxic substances. Appendix Table H.1 lists examples of these types of chemicals by category. These examples include liquids, solids, and gases. As suggested by Appendix Table H.1, some of the chemicals included in Table V.I.4 (e.g., some of those in the "other materials" category, like amino acids and mineral oil) may not be particularly hazardous. Table V.I.5 presents estimated hazardous waste to be generated by Commercial Industrial uses and UCSF. Categories similar to those in Table V.I.4 are used to the extent possible. Table V.I.5 estimates that the total hazardous waste generation by Commercial Industrial uses could reach 1,300 tons per year. This compares to about 63 tons per year estimated by UCSF for its portion of the site.^{16/} This difference illustrates the conservative assumptions used to estimate quantities for Commercial Industrial businesses. The total quantity of hazardous waste generated throughout San Francisco on an ongoing basis is approximately 16,000 tons per year.^{17/}

**TABLE V.I.4
ESTIMATED CHEMICAL STORAGE
BY COMMERCIAL INDUSTRIAL USES AND UCSF (ASSUMING COMMERCIAL INDUSTRIAL
OPERATIONS PRIMARILY RELATED TO THE LIFE SCIENCES)**

Chemical Type	Chemical Storage (assuming life science labs occupy 50% of the Commercial Industrial space) (tons)	Chemical Storage (assuming life science labs occupy 75% of the Commercial Industrial space) (tons)
Flammable Materials (materials that can sustain a fire if ignited)	200	300
Corrosive Materials (acidic or basic materials, which can corrode living tissue and other materials)	77	120
Oxidizers (reactive materials that often release oxygen upon reaction)	9.4	14
Toxic Substances	23	35
Other Materials /a/	65	97
Commercial Industrial Subtotal	380	570
UCSF	250	250
TOTAL	630	820

Notes:

All figures in this table have been rounded to two significant figures.

a. The "other materials" category could include some materials that are not hazardous.

Source: EIP Associates, based on information from City of Emeryville, *Chiron Development Plan Environmental Impact Report*, State Clearinghouse No. 94063005, June 1995, and John Shaver, UCSF Office of Environmental Health and Safety, data provided to Michelle Schaefer, Campus Planning Office, February 13, 1998.

Although the hazardous materials projections described above are reasonable, conservative, and illustrative, certain businesses that would be allowed in Commercial Industrial areas could handle a different mix of materials. As indicated above, for example, semiconductor (computer chip) research and development could exist within Commercial Industrial areas. Such research and development operations, while they would involve many of the same physical and chemical techniques described

TABLE V.I.5
ESTIMATED HAZARDOUS CHEMICAL WASTE
GENERATED BY COMMERCIAL INDUSTRIAL USES AND UCSF

Chemical Waste Type	Annual Waste Generation (assuming life science labs occupy 50% of the Commercial Industrial space) (tons)	Annual Waste Generation (assuming life science labs occupy 75% of the Commercial Industrial space) (tons)
Flammable Liquids	330	490
Corrosive Liquids	140	210
Flammable Corrosive Liquids	17	26
Oxidizers	9.4	14
Toxic Substances	9.4	14
Oil	56	84
Other Wastes /a/	330	490
Commercial Industrial Subtotal	890	1,300
UCSF	63	63
TOTAL	950	1,400

Notes:

All figures in this table have been rounded to two significant figures.

a. The "other wastes" category could include some wastes that are not hazardous.

Source: EIP Associates, based on information from City of Emeryville, *Chiron Development Plan Environmental Impact Report*, State Clearinghouse No. 94063005, June 1995, and University of California San Francisco, *Long Range Development Plan Environmental Impact Report*, State Clearinghouse No. 95123032, January 1997, Volume II, p. 387.

above, would not likely involve radioactive or biohazardous materials. In contrast to research and development in the life sciences, they could involve greater use of certain chemicals, particularly inorganic acids, organic solvents, cryogenic (very cold) liquids, and compressed gases. Compressed gas cylinders could contain such substances as air, argon, helium, nitrogen, oxygen, arsine, chlorine, fluorine, boron trifluoride, phosphine, freons, silane, hydrogen chloride, and hydrogen bromide. Some of these gases are toxic, corrosive, or flammable. Appendix Table H.3 is similar to Table V.I.4, but it assumes computer and other "high tech" research and development instead of life science research and development./18/ It is presented only to illustrate the differences between the hazardous chemicals handled by these two types of research and development. As discussed above under

“Approach Used to Estimate Hazardous Materials Quantities,” the data presented in Table V.I.4 are believed to conservatively err on the high side.

The California Department of Toxic Substances reports that the hazardous wastes generated by the semiconductor industry in the greatest volumes are water-based wastes (e.g., hydrofluoric, hydrochloric, phosphoric, and sulfuric acids) and organic solvent wastes (e.g., isopropanol, acetone, and propylene glycol monomethyl ether acetate).^{19/} Some semiconductor research and development processes may involve high-temperature work, particularly to create polysilicon crystals. Large-scale semiconductor manufacturing operations are not expected to locate within the Project Area.

Radioactive Materials

Although the use, storage, and disposal of radioactive materials would be highly variable and depend on the specific research and development projects undertaken at any particular time, Table V.I.6 illustrates the quantities of radionuclides that could be used in project-related Commercial Industrial space and at UCSF. It separates long-lived radionuclides from short-lived radionuclides because, as discussed below, available waste disposal options for these two groups differ.

Biohazardous Materials and Animals

Research and development operations in the fields of biotechnology, health, medicine, and related life science disciplines typically involve biological materials. The majority of this work involves non-hazardous organisms, such as *E. coli* K12 bacteria and baker's yeast. *E. coli* K12 is a bacterial strain that, through mutations, has lost the ability to survive in humans. Baker's yeast is the same as the yeast used to make bread. These organisms may be handled using Biosafety Level 1 containment because they pose minimal or no known potential hazard to individuals and the environment.

Biosafety levels are based on the characteristics of the agent handled and the hazards it poses. Agents that require Biosafety Level 2 or Biosafety Level 3 containment pose increasingly greater hazards. Appendix Table H.2 lists examples of infectious agents by the level of containment (biosafety level) typically used to handle them. Most of these infectious agents would not be handled in the Project Area, but these examples represent the range and nature of the biological materials that could be handled there. Depending on particular circumstances, a biosafety level other than that indicated in Appendix Table H.2 could be appropriate when handling a particular infectious agent. Appendix Table H.4 defines the types of hazards posed by infectious agents for each biosafety level and describes appropriate containment facilities and practices. The need for Biosafety Level 4

TABLE V.I.6
ESTIMATED RADIOACTIVE MATERIAL PURCHASES, STORAGE, AND DISPOSAL
BY COMMERCIAL INDUSTRIAL USES AND UCSF

Radionuclides	Assuming Life Science Labs Occupy 50% of the Commercial Industrial Space			Assuming Life Science Labs Occupy 75% of the Commercial Industrial Space		
	Approx- imate Annual Purchases (curies)	Approx- imate Storage at Any One Time (curies)	Approx- imate Annual Waste Disposal (curies)	Approx- imate Annual Purchases (curies)	Approx- imate Storage at Any One Time (curies)	Approx- imate Annual Waste Disposal (curies)
Long-Lived Radionuclides						
Hydrogen-3	5.80	3.80	5.30	8.70	5.60	8.00
Carbon-14	0.0038	0.0025	0.41	0.0056	0.0038	0.61
	—	—	—	—	—	—
Commercial Industrial Subtotal	5.80	3.80	5.70	8.70	5.60	8.60
UCSF	1.9	1.9	2.00	1.9	1.9	2.00
	—	—	—	—	—	—
TOTAL	7.7	5.7	7.70	11	7.5	11.00
Short-Lived Radionuclides						
Phosphorus-32	5.60	0.87	12.00	8.40	1.30	17.00
Sulfur-35	6.90	2.00	5.60	10.00	3.00	8.40
Chromium-51	1.90	0.30	2.80	2.80	0.45	4.20
Iodine-125	1.70	0.39	3.90	2.60	0.59	5.90
	—	—	—	—	—	—
Commercial Industrial Subtotal	16.00	3.60	24.00	24.00	5.40	36.00
UCSF	16	5.1	12.00	16	5.1	12.00
	—	—	—	—	—	—
TOTAL	32	8.7	36.00	40	10	48.00

Note: All figures in this table have been rounded to two significant figures.

Source: EIP Associates, based on information from City of Emeryville, *Chiron Development Plan Environmental Impact Report*, State Clearinghouse No. 94063005, June 1995; University of California San Francisco, *Long Range Development Plan Environmental Impact Report*, State Clearinghouse No. 95123032, January 1997, Volume II, p. 388; and John Shaver, UCSF Office of Environmental Health and Safety, data provided to Michelle Schaefer, Campus Planning Office, February 13, 1998.

containment is not foreseeable because research involving dangerous or exotic organisms occurs in very few locations in the U.S., primarily at facilities that specialize in such work.

As with all research and development operations, the use of biological materials in the Project Area would be dynamic, especially because living organisms continually grow, multiply, and die. For this reason, biological materials are difficult to quantify or estimate. However, as indicated in the UCSF and Chiron studies, relatively little biohazardous material would be stored when experiments are not in progress./20/ Typically, small containers containing an ounce or less of a master culture are stored in refrigerators and freezers, and these cultures are used to grow larger cultures when needed for experiments. Standard practice is to inactivate or kill most cultures at the end of experiments.

Some research and development activities in the Project Area could involve animals. For example, the U.S. Food and Drug Administration requires experimental drugs to be tested on animals prior to conducting studies in humans. The most common laboratory animals are rodents, but other animals may also be used. At most facilities, animals are typically housed at a central vivarium according to standards described in the *Guide for the Care and Use of Laboratory Animals*./21/ Assuming that 50% of the Commercial Industrial space would house laboratory research and development, about 78,000 rats and mice, 19,000 guinea pigs, 7,800 frogs, and 310 rabbits could be used for research purposes each year by Commercial Industrial activities in the Project Area./22/ If 75% of the Commercial Industrial space were occupied by laboratories, then these numbers could be about 50% greater. Animals other than those listed above could be used, and research animals used by UCSF would be in addition to those estimated here for Commercial Industrial uses.

As a result of work involving biohazardous materials at UCSF and Commercial Industrial businesses, biohazardous waste would be generated. Much of this waste would be inactivated on site, but some could be shipped off site for treatment and disposal as medical waste. Between about 9,000 and 14,000 cubic yards of medical waste could be shipped from the Project Area each year by Commercial Industrial uses, depending on the percentage of the Commercial Industrial space occupied by laboratories./23/ UCSF would generate an additional 2,000 cubic yards of medical waste./24/ If UCSF were to operate an outpatient clinic, additional medical waste could be generated, depending on the nature of the clinic.

POTENTIAL ENVIRONMENTAL IMPACTS OF HAZARDOUS MATERIALS AND WASTE MANAGEMENT

This analysis addresses residents and businesses that would handle relatively small quantities of hazardous materials first, followed by a discussion of businesses that would handle relatively large quantities of these materials.

Small Quantity Hazardous Materials Users

Hazardous materials are handled and stored routinely by households and most businesses. Typical household hazardous materials include oils (e.g., motor oil and hydraulic oil), fuels (e.g., gasoline and diesel), paints (both latex and oil-based), solvents (e.g., degreasers, paint thinners, and aerosol propellants), acids and bases (e.g., automobile battery fluids, swimming pool chemicals, and many cleaners), disinfectants, metals (e.g., thermometers, batteries, and photography chemicals), and pesticides.

Most businesses use similar materials, and some (e.g., gas stations, dry cleaners, and photoprocessors) use hazardous materials specifically related to their business activities. For example, supermarkets and gas stations stock hazardous materials for sale to consumers. Service stations handle fuel, motor oil, antifreeze, and other fluids. Supermarkets handle automotive fluids, cleaners, pesticides, and batteries. Dry cleaners handle perchloroethylene. Photoprocessors handle fixer and developer chemicals.

Although individual households and many businesses use relatively small volumes of hazardous materials, the total volume of the hazardous materials managed by all of these households and businesses is substantial. In 1990, San Francisco households generated about 1,600 tons of hazardous waste.^{/25/} Because many hazardous materials are consumed through their use (e.g., fuel, paint, aerosols), the quantity of hazardous materials handled by San Francisco is believed to be substantially greater than the volume of hazardous waste estimated to be generated. In San Francisco, about 90% of business-related hazardous waste generators are small businesses^{/26/}; therefore, small businesses also use substantial quantities of hazardous materials.

Commercial products are labeled to inform users of potential risks and to instruct users in appropriate handling procedures. Although households are relatively less regulated than businesses, the risks posed by hazardous materials use at project-related residences would be similar to those in similar residential areas. The home use of common household hazardous materials is typically considered to pose an acceptable level of risk.

San Francisco oversees many hazardous materials requirements placed on businesses. Specifically, the San Francisco Department of Public Health, as a Certified Unified Program Agency, oversees hazardous materials registrations, underground storage tank programs, aboveground petroleum storage tank spill prevention control and countermeasure plans, risk management plans, and some fire safety planning. Additionally, businesses are regulated as employers and are therefore required to ensure employee safety.^{/27/} Specific requirements include identifying hazardous materials in the workplace,

providing safety information to workers that handle hazardous materials, and adequately training workers. Because of this regulatory structure, the business-related use of relatively small quantities of hazardous materials similar to household products would not pose greater risks than the use of such materials by households. For this reason, the use of relatively small quantities of common hazardous materials by businesses would be within acceptable risk levels and would not create any substantial public health hazards.

Large Quantity Hazardous Materials Users

Businesses using relatively large quantities of hazardous materials (in comparison to households and office-based businesses) would use materials similar to those described for households above, but they could also use other materials. Most large-quantity hazardous materials users would occupy the Commercial Industrial or UCSF space in Mission Bay South. Hazardous materials use, storage, and disposal quantities are estimated for Commercial Industrial and UCSF space above. Some aboveground and underground storage tanks could also be installed to store hazardous materials for project-related businesses (e.g., diesel fuel), and the San Francisco Department of Public Health would oversee their operation and maintenance.

Potential Hazards

The project-related use of hazardous chemical materials would be overseen by the San Francisco Department of Public Health, a Certified Unified Program Agency. If properly managed, hazardous chemicals would generally pose minimal health and safety risks. If improperly managed, hazardous chemicals could pose chronic and acute health and safety hazards. Laboratory activities generally involve relatively small quantities of materials (typically less than 1 quart), but pilot-scale manufacturing or other light industrial activities could involve substantially greater quantities at any one time.

Radioactive materials could also be handled by project businesses and UCSF, particularly in life science laboratories. Typically, less than a millicurie of radioactivity would be used for any single laboratory experiment, and radioactive materials use would be overseen by the California Department of Health Services Radiologic Health Branch according to radioactive materials licenses issued by the branch. Radioactive materials would pose minimal potential for exposure. Exposure would also be limited to individuals in the immediate vicinity of the materials. Accidental exposure to radioactive materials could cause headaches, skin burns, and chronic illnesses, including cancer.

Typical work involving biological materials, including infectious agents, would be conducted using Biosafety Level 1 or Biosafety Level 2 containment practices, because these lower hazard activities would be most common. The particular hazards of potential infection would depend on the specific agent encountered. The need for Biosafety Level 3 containment would be less common, and the need for Biosafety Level 4 containment is not foreseeable, because these most hazardous activities occur at very few locations throughout the U.S. and are not typically necessary for routine research and development operations.

Some animals could be required for study purposes by Commercial Industrial businesses and UCSF. Hazards related to the use of animals for study purposes can be controlled. Animal-related hazards include potential bites or scratches, and the transmittal of naturally occurring or research-related diseases. Specific hazards would relate to the type of animals involved, the types of infectious agents involved, and the ability of the animals to transmit diseases to humans or animals.

Hazard Assessment

The "Hazard Assessment" in Appendix H contains the detailed technical data supporting the hazard assessment summary contained in this section for the project activities that would involve relatively large quantities of hazardous materials. The assessment was used to focus the discussion presented here on the most important issues. The hazard assessment considers the types of materials to be managed and the potential routes whereby human or environmental exposure to these hazardous materials could occur. It then assesses the likely adequacy of foreseeable controls, including compliance with applicable laws and regulations, and the application of standard industry safety practices.

The analysis in Appendix H is in two parts. The first part evaluates potential worker exposure to hazardous materials. Worker exposure is primarily of local importance (i.e., it relates primarily to the immediate vicinity of the hazardous materials operations). The second part evaluates potential exposure of the public (or off-site individuals within or outside the Project Area, but not necessarily in the immediate vicinity of the hazardous materials operations). In each case, both routine and upset (accident) conditions are examined.

As listed in Table V.I.7, the primary routes through which project workers could be exposed to hazardous materials in the workplace would include inhalation, ingestion, contact with skin or eyes, puncture wounds, and other accidents. Standard practices summarized in Table V.I.7 would serve to control the potential for hazardous materials exposure through these pathways. Many of these measures would be required by laws and regulations. Others are not specifically required, per se, but

TABLE V.I.7
EXPOSURE PATHWAYS AND CONTROLS—WORKERS

Exposure Pathway	Examples of Control Measures
Inhalation (breathing a hazardous substance)	<ul style="list-style-type: none"> • Working with volatile materials in fume hoods /a/ • Working with potentially aerosol-suspended biohazardous materials in biosafety cabinets /b/ • Keeping containers closed when not in use • Wearing face masks or respirators, as necessary
Ingestion (swallowing a hazardous substance)	<ul style="list-style-type: none"> • Not eating or drinking near hazardous materials • Not storing food in refrigerators used for hazardous materials • Not smoking near hazardous materials • Washing hands and work areas
Contact (absorbing a hazardous substance through the skin or eyes)	<ul style="list-style-type: none"> • Wearing protective clothing and shoes, as necessary • Wearing eye protection (glasses or goggles), as necessary • Wearing gloves, as necessary • Washing hands and work areas • Working with radioactive materials behind shields • Keeping animals in cages when not handling them
Injection (puncturing or cutting the skin with a contaminated object)	<ul style="list-style-type: none"> • Participating in awareness training • Keeping sharps in puncture-resistant containers • Keeping animals in cages when not handling them • Learning how to handle animals to prevent bites and scratches
Accidents	<ul style="list-style-type: none"> • Participating in emergency response training • Maintaining emergency equipment (e.g., safety showers, emergency eye washes, first aid kits, neutralizing substances for corrosive materials) • Providing appropriate lips on shelves where hazardous materials are stored and other restraints where necessary • Storing flammable materials in fire-rated cabinets • Providing secondary containment for hazardous materials that are not in use • Calling San Francisco Fire Department and Hazardous Materials Emergency Response Team, if necessary

Notes:

- Fumes hoods are cabinets with front-opening (usually sliding) glass doors connected to overhead exhaust fans that draw air from the room through the cabinet and expel it into the atmosphere through rooftop stacks.
- Biosafety cabinets look similar to fume hoods. They filter aerosols and remove particles from the air, but do not necessarily exhaust the filtered air to the outdoors.

Source: University of California San Francisco, *Revised Laurel Heights Plan; Center for Social, Behavioral and Policy Sciences, and Campus Administration Environmental Impact Report*, State Clearinghouse No. 95033072, September 6, 1996, p. 140. Table modified by EIP Associates.

would likely result from the implementation of regulatory requirements (e.g., the preparation of various health and safety plans as described in Table V.I.2 and Appendix H under "Regulatory Setting"). Many of these measures also serve to control the potential exposure to hazardous materials by off-site receptors.

Table V.I.8 lists the primary routes through which the environment (including off-site receptors) could be exposed to hazardous materials, including air emissions (addressed more fully in "Toxic Air Contaminants" in Section V.F, Air Quality: Setting and Impacts; transport to, from, or around the Project Area; waste disposal; direct and indirect human contact; and possible accidents. The standard practices summarized in Table V.I.8 serve to control the potential for hazardous materials exposure through these pathways. Again, many of these standard practices are required by law, and most others would likely result from any good faith effort to comply with regulatory requirements.

As a result of the analysis presented in Appendix H, two areas of concern are addressed here. These areas relate to standard biohazardous materials practices not required by law and the potential for certain types of accidents to harm individuals in the Project Area and its vicinity. The analysis in Appendix H concludes that other potential exposure paths would be unlikely to result in substantial exposure and, therefore, would not pose significant health and safety risks.

Enforcement of Guidelines for Work Involving Biohazardous Materials and Animals

Relying on the various biohazardous materials guidelines provided by U.S. Department of Health and Human Services agencies (e.g., the National Institutes of Health's *NIH Guidelines*) has become standard industry practice for addressing health and safety issues associated with work involving biohazardous materials and research animals. However, no regulatory body requires businesses in San Francisco to follow such guidance unless the business receives funding from the federal government. UCSF accepts federal funding and, as a matter of institutional policy, adheres to applicable guidelines related to the use of biohazardous materials and research animals. Many businesses that would occupy Commercial Industrial areas of Mission Bay South may not secure federal funding, but most would adhere to standard industry practices anyway. However, no independent organization would oversee the practice of applicable health and safety guidelines, and adherence to these guidelines, however probable, cannot necessarily be assumed. Compliance with applicable guidelines would be needed to conclude that individuals and the environment would not be harmed as a result of work involving biohazardous materials, including research animals. The potential for the project to pose a worker or public health hazard in the absence of compliance with biohazardous materials guidelines could be a significant impact. Mitigation Measure I.1 in Section VI.I, Mitigation Measures: Health and Safety, if implemented, would avoid this significant impact.

TABLE V.I.8
EXPOSURE PATHWAYS AND CONTROLS—PUBLIC AND ENVIRONMENT
(OFF-SITE, BOTH INSIDE AND OUTSIDE THE PROJECT AREA)

Exposure Pathway	Examples of Control Measures
Air Emissions	<ul style="list-style-type: none"> • Using fume hood ventilation system to dilute and subsequently disperse emissions to the atmosphere /a/
Transport To, From, and Around the Site	<ul style="list-style-type: none"> • Following packaging requirements specified by the U.S. Department of Transportation, the U.S. Postal Service, and the California Department of Health Services (Radiologic Health Branch and Medical Waste Program) • Identifying container contents with appropriate labels • Using licensed hazardous waste haulers • Documenting hazardous waste shipments • Placing animals in cages or boxes for transport
Waste Disposal	<ul style="list-style-type: none"> • Training workers • Segregating wastes • Collecting hazardous waste for appropriate disposal • Monitoring wastewater to the extent feasible • Diluting and treating sewage from the site • Checking loads at the San Francisco solid waste transfer station • Labeling trash cans • Following federal and state hazardous waste disposal regulations and procedures, including those for hazardous waste manifest documentation
Human Contact	<ul style="list-style-type: none"> • Identifying container contents with appropriate labels • Training workers • Implementing standard hygiene practices (e.g., wearing protective clothing and gloves, leaving protective clothing at work, and washing hands and work areas) • Implementing medical surveillance programs to monitor the health of those who work with certain biohazardous materials • Monitoring the exposure of those who work with radioactive materials • Keeping animal cages behind closed doors to prevent escapes
Other Accidents	<ul style="list-style-type: none"> • Providing emergency response training • Maintaining emergency equipment (e.g., safety showers, emergency eye washes, first aid kits, neutralizing substances for corrosive materials) • Calling San Francisco Fire Department and Hazardous Materials Emergency Response Team, if necessary • Conducting facility inspections and preventative maintenance

Notes:

- a. Fume hoods are cabinets with front-opening (usually sliding) glass doors connected to overhead exhaust fans that draw air from the cabinet and expel it into the atmosphere through rooftop stacks. See the discussion in Toxic Air Contaminants under V.F., Air Quality: Impacts.

Source: University of California San Francisco, *Revised Laurel Heights Plan; Center for Social, Behavioral and Policy Sciences, and Campus Administration Environmental Impact Report*, State Clearinghouse No. 95033072, September 6, 1996, p. 141. Table modified by EIP Associates.

Biohazardous materials handling guidelines were developed primarily to protect workers, not the public or the environment. To a substantial degree, compliance with these guidelines would also serve to protect the public and the environment from exposure to biohazardous materials, but in certain cases, adherence to these worker safety guidelines may not adequately protect the public and environment. For example, U.S. Department of Health and Human Services guidelines allow substantial discretion in their application, particularly in regard to appropriate Biosafety Level 3 facilities (Appendix H describes biosafety levels). Of particular concern is that guidelines do not indicate with certainty whether exhaust from Biosafety Level 3 laboratories must be filtered before being released to the atmosphere:

[In Biosafety Level 3 laboratory facilities,] a ducted exhaust air ventilation system is provided. This system creates directional airflow that draws air from "clean" areas into the laboratory toward "contaminated" areas. The exhaust air is not recirculated to any other area of the building, and is discharged to the outside with filtration and other treatment optional. The outside exhaust must be dispersed away from occupied areas and air intakes. Laboratory personnel must verify that the direction of the airflow (into the laboratory) is proper./28/

Biosafety Level 3 activities involve organisms with a high potential for aerosol transmission. If filtering does not occur, and if the organisms being handled pose serious human health hazards, then these organisms could be released to areas where the public or the environment could be affected. This potential health hazard could pose hazards to people or, depending on the materials being handled, animal or plant populations. Without incorporating adequate assurances regarding filtering exhaust from Biosafety Level 3 laboratories a potentially significant environmental impact could occur. This impact would be caused by activities in Mission Bay South but could affect receptors in Mission Bay South, Mission Bay North, and elsewhere in the vicinity of the Project Area. UCSF has indicated that its activities in the Project Area would probably be limited to those requiring Biosafety Level 1 or Biosafety Level 2 containment./29/ Mitigation Measure I.2 in Section VI.I, Mitigation Measures: Health and Safety, if implemented, would avoid this significant impact.

This analysis assumes that no activities requiring Biosafety Level 4 containment would occur in the Project Area. Biosafety Level 4 containment is appropriate for operations involving dangerous or exotic agents that pose high risks of life-threatening disease or aerosol-transmitted infections, or related agents with unknown risks of transmission./30/ Such operations would be highly unlikely to be proposed in the future, and Mitigation Measure I.3 in Section VI.I, Mitigation Measures: Health and Safety, would ensure that this important assumption of the analysis is correct.

Risk of Upset

The use of hazardous materials poses risks of upset (accidents). Most accident risks would be adequately addressed by implementing required health and safety plans, providing emergency response training, and providing emergency response services (discussed as a separate issue below). However, of particular concern would be materials that could harm people without providing an ample opportunity for evacuation and clean-up. Such materials could include highly toxic gases or explosive materials. An example of a material that could release toxic vapors would be ammonia, a substance UCSF could need to operate emissions control equipment if UCSF were to construct a central utilities plant. Serious risks could also result from handling other types of very hazardous materials. For example, toxic gases often handled in "high tech" or semiconductor research and development could pose substantial hazards to the public or the environment if they were to be released off site.

Businesses that handle sufficient quantities of these very hazardous materials would be required to prepare Risk Management Plans.^{/31/} (These are not the same Risk Management Plans described in Section V.J, Contaminated Soils and Groundwater.) Risk Management Plans must be prepared by some facilities to comply with state and federal Accidental Release Prevention program requirements. The state program calls for facilities preparing Risk Management Plans to systematically study their operations to anticipate worst-case events. Risk Management Plans are to disclose any residents, workers, school children, and children at child care facilities who could be subject to substantial risks in the event of a worst-case accident. Facilities are directed to identify measures they will take to reduce potential accident risks. In California, Risk Management Plans must be made available for public review. Then, local implementing agencies (e.g., the San Francisco Department of Public Health in this case) are to determine whether the Risk Management Plans adhere to applicable regulations.

The potential for school children to be exposed to risks associated with the use of hazardous materials, particularly the types of very hazardous materials for which Risk Management Plans must be prepared, has resulted in school site selection criteria set forth in laws and regulations.^{/32/} These criteria are intended to reduce the risks to which school children could be exposed. Requirements for facilities handling very hazardous materials mirror those for facilities emitting toxic air contaminants, as described under "School Siting Criteria" in Section V.F, Air Quality: Setting.

Implementing Risk Management Plans and following school siting criteria would ensure that the impact of routine accident risks would be less than significant. Because the greatest potential for hazardous materials accidents would occur in Commercial Industrial and UCSF space, this issue

relates primarily to Mission Bay South. Residents and other individuals in Mission Bay North and elsewhere near the Project Area could also be affected. California laws regarding the siting of schools near hazardous materials operations are discussed in "School Siting Criteria" in Section V.F, Air Quality: Setting.

POTENTIAL ENVIRONMENTAL IMPACTS OF HAZARDOUS WASTE GENERATION AND DISPOSAL

Residents and Similar Waste Generators

Businesses generate hazardous waste as a routine consequence of handling hazardous materials. Historically, many businesses have found complying with hazardous waste regulations to be difficult and expensive. In one survey, over half of the businesses questioned regarding their hazardous waste management practices admitted to disposing of some hazardous wastes inappropriately./33/ These businesses stored hazardous wastes indefinitely, flushed wastes down sewers, combined hazardous wastes with nonhazardous solid waste for disposal, and poured wastes on the ground./34/ Conditions are believed to have improved in recent years as a result of public awareness campaigns that seek to minimize environmental and safety hazards such as contamination of solid waste landfills and surface water, and sanitation worker injuries./35/

Households have posed similar disposal challenges. According to San Francisco's Household Hazardous Waste Element (prepared in 1992), about 1,600 tons of household hazardous waste are generated in San Francisco each year. At that time, about 1,400 tons (over 85%) was estimated to be disposed of inappropriately./36/ A 1985 Association of Bay Area Governments survey estimated that a typical household improperly disposes of between 1.8 and 3.5 gallons of hazardous waste each year./37/ At this rate, because the project could involve about 5,880 households, between 11,000 and 21,000 gallons of household hazardous waste could be improperly disposed of each year. This estimate is believed to be conservative in light of the programs implemented since the original studies were completed in the mid-1980's.

To provide households and businesses with more convenient and more affordable hazardous waste management options, San Francisco has developed programs specifically targeted to assist households and other small quantity hazardous waste generators with their waste disposal needs. The San Francisco Hazardous Waste Management Program implements public education campaigns, provides advisory and educational services, conducts waste reduction demonstration projects, recognizes waste reduction efforts through an awards program, and offers literature to assist businesses with hazardous waste reduction, recycling, and disposal.

San Francisco also funds a permanent household hazardous waste collection facility where San Franciscans can take their household hazardous waste for disposal at no direct cost. Over 10% (about 400 tons per year) of San Francisco's household hazardous waste is managed through the household hazardous waste collection facility./38/ A similar program for conditionally exempt small quantity generators (businesses that generate very small quantities of hazardous waste) operates one day each month. This program handles about 36 tons per year./39/ Although businesses must pay to use the facility, the cost is substantially less than they would pay by using an independent contractor.

To further reduce the impact of hazardous waste being inappropriately disposed of, San Francisco's solid waste disposal contractor implements a load-checking program called the Waste Acceptance and Control Program. This program seeks to identify hazardous wastes in the solid waste stream and track down the businesses responsible for the waste. Many hazardous materials users are also visited by the San Francisco Water Pollution Prevention Program, which educates businesses regarding acceptable disposal practices. These programs are expected to continue and expand as development occurs in San Francisco.

Larger Waste Generators

Businesses that generate substantial volumes of hazardous waste are less likely to use inappropriate disposal methods as a result of more intense regulatory oversight. However, even proper hazardous waste disposal, regardless of the method selected, often affects the environment. Hazardous waste landfills generally leak at some point and occasionally fail. Waste incinerators release toxic air contaminants to the atmosphere and result in ash that contains unburnable hazardous constituents (such as metals). Most other treatment and recycling methods also result in hazardous residuals that must be disposed of as hazardous waste. These residuals are either incinerated or landfilled. For this reason, the generation and disposal of hazardous waste is considered to be a form of pollution, and current hazardous waste management policies designate hazardous waste disposal as the least desirable management approach./40/ Waste management strategies that seek to prevent pollution by reducing waste generation at its source are considered the most desirable approach. Pollution prevention is a national objective as established by the Pollution Prevention Act of 1990. These priorities are reflected in the *City and County of San Francisco Hazardous Waste Management Plan*./41/

As indicated above, a project that would involve the disposal of materials in a manner that poses substantial hazards to people or the environment could result in a significant impact. Aside from this qualitative standard no authoritative agency has developed a quantitative standard for determining at what point increased hazardous waste generation and disposal would be considered significant. Therefore, the impacts of each project must be considered on a case-by-case basis, as discussed below

for the project's expected contribution to hazardous chemical waste, radioactive waste, and biological and medical waste generation.

Hazardous Chemical Waste

The project would incrementally contribute to the volume of hazardous chemical waste generated in San Francisco. The largest hazardous chemical waste generators in the Project Area would be expected to be located in Mission Bay South, where the Commercial Industrial and UCSF activities would be located. The increased hazardous waste generation would increase the volume of waste managed at hazardous waste facilities inside and outside California. The increased demand for waste treatment and disposal would incrementally contribute to the demand for new hazardous waste treatment, recycling, and disposal facilities. The likely effects of hazardous waste disposal would probably occur far from the Project Area.

California's hazardous chemical waste generators rely heavily on out-of-state treatment and disposal facilities to meet their disposal needs. For example, no hazardous waste incinerators in California accept waste from third-party generators. Out-of-state facilities may not receive environmental supervision equivalent to that of California. Therefore, the possibility exists that some hazardous waste generated as a result of the project could be managed at facilities that do not comply with some standards deemed appropriate by California.

The project would contribute to cumulative hazardous chemical waste generation as discussed under "Cumulative Effects," below.

Radioactive Waste

The California Department of Health Services Radiologic Health Branch issues permits that allow users of radioactive materials to hold short-lived radioactive waste (waste containing radionuclides whose half-lives are less than 90 days) for decay. Under some circumstances, some water-based radioactive substances may be released into the sewer if allowed by the California Department of Health Services and permitted by the San Francisco Department of Public Works. Some biohazardous waste containing radionuclides may be incinerated. Dry long-lived radioactive waste (waste containing radionuclides whose half-lives are greater than 90 days) is to be disposed of at a low-level radioactive waste landfill. Regular disposal is generally required to prevent waste from accumulating and to ensure that little waste remains when a facility is closed.

The availability of radioactive waste landfills to serve California's low-level radioactive waste generators is unreliable. California belongs to the Southwestern Low-Level Radioactive Waste Disposal Compact, a group of four states that, together, are responsible for disposing of their low-level radioactive waste. Since the early 1980's, California has been attempting to construct a low-level radioactive waste disposal facility at Ward Valley, California, to serve the compact. At this time, the project is delayed pending transfer of the disposal site property from the federal government to state control. For this reason, Californians must rely on out-of-state disposal facilities for their radioactive waste. California's low-level radioactive waste disposal facility may become available within the next few years, but for conservative analysis purposes, this SEIR assumes it to be unavailable.

Under the federal Low-Level Radioactive Waste Policy Act and its 1985 amendments, out-of-state disposal sites may choose not to accept California's radioactive waste. At present, project-related radioactive waste generators would have only one facility, located in Barnwell, South Carolina, willing to accept their low-level radioactive waste. The government of South Carolina decides each year whether it will accept out-of-state radioactive wastes. South Carolina has chosen to reject radioactive waste generated outside South Carolina in the past, leaving many California radioactive waste generators with no feasible disposal methods. Until dependable disposal options are established for long-lived radioactive waste, whenever South Carolina rejects shipments, radioactive waste generators could have to indefinitely store these wastes on site or send them off-site to a licensed storage facility until a disposal site becomes available. Storage in lieu of disposal must be approved by the Radiologic Health Branch.

The Radiologic Health Branch guides radioactive waste generators in determining whether to hold, store, or dispose of their radioactive waste. According to the Radiologic Health Branch's advice, California radioactive materials licensees should 1) minimize the amount of low-level radioactive waste in possession and avoid accumulating waste that cannot be disposed of at this time; 2) segregate radioactive wastes subject to compact regulations from wastes not subject to these regulations; 3) segregate waste that can be disposed of or reduced in volume by approved treatment methods, such as incineration or compaction; 4) segregate short-lived radioactive waste for decay; 5) consider recycling radioactive materials; 6) consider extended on-site storage of any remaining low-level radioactive waste; and 7) consider non-radioactive substitutes./42/

Under the project, the type of dry radioactive waste that would generally be sent for landfill would consist primarily of contaminated debris, such as used gloves, bench paper, paper towels, pipettes, and small pieces of plastic. Given the nature of this waste, storage of long-lived radioactive waste for several years would probably not present any substantial health or safety risks to workers or the

public. However, the potential for adverse environmental effects would become more difficult to assess if the duration of the disposal limitations were to increase. The project could, over an extended period of time, incrementally contribute to the continuing generation of radioactive waste for which appropriate disposal opportunities may not always exist. Prompt disposal of radioactive waste is a generally recognized standard for radioactive waste management.

Project-related radioactive waste generation would contribute to cumulative radioactive waste generation as discussed below under "Cumulative Effects." Because the Commercial Industrial and UCSF activities anticipated for Mission Bay South would be responsible for the radioactive waste expected to be generated within the Project Area, this issue relates to Mission Bay South and not to Mission Bay North.

Biohazardous and Medical Waste

Most project-related biohazardous and sharps waste would be sterilized on site using an autoclave (pressure and steam treatment) or chemical disinfectants. However, some project-related biohazardous waste would be shipped off site by authorized haulers for disposal as medical waste. Medical waste treatment facilities have been sited regionally with success./43/ California has excess medical waste treatment capacity; therefore, existing medical waste management capabilities would be expected to meet the demands of project-related medical waste generation./44/ Common off-site treatment methods involve autoclaving, microwave sterilization, and incineration. As with all hazardous waste disposal technologies, these options involve water discharges, air emissions, or residuals that must be landfilled. The project-related disposal of medical waste would contribute incrementally to cumulative medical waste generation (see "Cumulative Effects," below).

OTHER ISSUES

Physical Hazards

Potential physical safety hazards would exist in the Project Area, particularly in Commercial Industrial areas and at UCSF. These hazards could include, among others, electrical shock hazards from high voltage equipment, safety risks posed by compressed gas cylinders (including those filled with inert gases), radiation hazards from x-ray equipment (regulated as radioactive material), and exposure to intense ultraviolet light or lasers. Other more common hazards would include slips and falls, and overexertion. For the most part, individuals in the Project Area would not be exposed to any unusual hazards; however, workers engaged in activities that present special hazards, such as those mentioned above, must be adequately trained in accordance with Injury and Illness Prevention

Plan requirements./45/ Good faith compliance with such occupational safety regulatory requirements would minimize risks posed by physical hazards to a level of insignificance.

Emergency Response Capabilities

Occasional accidents would be probable at the proposed laboratories and other industrial uses during the life of the project. To minimize the risks posed by potential hazardous materials incidents, emergency response planning is a critical component of many health and safety laws and regulations, and standard safety practices.

Most accidents would not have any substantial off-site consequences, but if an accident were to warrant off-site assistance, the San Francisco Fire Department would provide first response capabilities (see "Fire Protection: Setting and Impacts" in Section V.M, Community Services and Utilities). This means that the Fire Department would identify the incident as a hazardous materials incident and deny access to affected areas until hazardous materials specialists could arrive. San Francisco operates a Hazardous Materials Emergency Response Team housed at Fire Station 36 at Oak and Franklin Streets. The San Francisco Department of Public Health offers technical assistance to the Fire Department team 24 hours each day. Under optimal conditions, the Hazardous Materials Emergency Response Team can respond within about 15 minutes of being called by the firefighters providing first response services./46/

At UCSF, Environmental Health and Safety staff respond, and would continue to respond, to relatively minor hazardous materials incidents, such as small spills contained inside laboratory rooms. UCSF would ensure that at least one health and safety professional would be available 24 hours a day to respond to such hazardous materials problems at UCSF. If necessary, UCSF staff would call for assistance from the San Francisco Fire Department.

The San Francisco Fire Department responds to about 180 hazardous materials calls per year (about one every other day)./47/ These hazardous materials responses involve at least six trained and equipped individuals. Of these 180 calls, the Fire Department notifies the Department of Public Health for assistance roughly 40 to 50 times per year. Past incidents have included abandoned waste, hypodermic needles, illicit drug laboratories, asbestos waste, and odor complaints. Incidents that pose serious and immediate safety hazards occur only once or twice a year./48/

Although the capacity of the Fire Department to serve the existing level of demand may be adequate, the project would incrementally increase the demand for these emergency response services. Although the existing frequency of hazardous materials calls is relatively high, no more than one

major hazardous materials incident typically occurs at any one time. The project would increase this possibility somewhat, however. Additional personnel and equipment may be necessary to serve the increased demand resulting from the project, but the project would be implemented with adequate emergency response planning because the Project Area would be included in updates to the *Area Plan for Emergency Response to Hazardous Materials Incidents*. Personnel and equipment needs would be fiscal budgeting decisions affecting the City's General Fund, and would not constitute a significant environmental effect under CEQA.

Potential Catastrophes

A major catastrophe could generate demand for emergency response services in excess of available resources, and in San Francisco, a major earthquake is a catastrophe posing realistic concerns (see "Project Area Characteristics" in Section V.H, Seismicity: Setting). The project would increase the population density of the Project Area and develop uses that pose different and potentially greater hazards than those that exist now.

During an earthquake, structures containing hazardous materials or pipelines used to transfer hazardous materials could be damaged. Nonstructural seismic safety (e.g., the potential for falling containers and shelves holding hazardous materials) would be of particular concern. Chemical spills and splashes could release toxic gases or harm individuals working in the vicinity of the hazardous materials. Although incompatible chemicals would be required to be segregated when stored, spills could lead to the mixing of incompatible chemicals. Such mixing could lead to chemical reactions and possible fires or releases. Safety requirements enforced by the Department of Public Health (e.g., securing certain types of containers and installing lips on shelves where hazardous materials are stored) would serve to reduce such risks to acceptable levels, but there is no way to completely eliminate structural and nonstructural seismic safety risks.

By themselves, isolated hazardous materials incidents would likely pose limited serious threats because bench-scale operations involve relatively small quantities of these materials (assuming that emergency response equipment and personnel would be available). But during a catastrophe, many life-threatening incidents could occur at once, and emergency response capabilities could be overwhelmed. Furthermore, during a catastrophe, hazardous materials incidents would not be the only concern. Other types of incidents requiring emergency response services may take priority over responding to hazardous materials problems. The priorities given in response to different incidents occurring at the same time would be determined in accordance with the *San Francisco General Plan* Community Safety Element and the *Area Plan for Emergency Response to Hazardous Materials Incidents*. Emergency responders would be dispatched to locations where they would be most needed.

The emergency evacuation plans and emergency response plans implemented by individual businesses would be the first line of defense in controlling hazardous materials emergencies. This emergency planning is required by several hazardous materials laws and regulations (see Appendix H) and the San Francisco Fire Code. The greatest hazardous material concern in a catastrophe would be risks that cannot be avoided by evacuating the site of an actual or potential hazardous materials release. Evacuation planning is required by Hazard Communication Program regulations./49/

As discussed above, hazardous chemicals can cause safety concerns, such as fires or explosions. In regard to radioactive materials, successful building evacuation would minimize risks of substantial radiation exposure because project-related radioactive materials use would involve low-level radiation sources, and because relatively small quantities would be stored in any one place. In the event of a catastrophic fire (such as one caused by a major earthquake), radioactive materials could be released, but they would likely disperse well into the atmosphere and become more dilute. Any exposure would generally be temporary and relatively small. Similarly, biohazardous materials would be unlikely to be released from buildings in dangerous quantities because liquids and solids would be contained by the building structure. In the event of a catastrophic fire, these materials would likely be destroyed rather than released in an active or hazardous form. Because operations would cease following a catastrophic earthquake, any potentially hazardous airborne aerosols would settle indoors (and probably inside a biosafety cabinet) shortly thereafter. Research animals infected with potentially transmittable diseases, if any, would be unlikely to escape during a catastrophe because, assuming standard guidelines were followed, they would be housed in cages behind closed doors. Multiple levels of containment would obstruct animal escape routes.

Following a major catastrophe, an effective evacuation by individuals in immediately affected areas would be expected to address the most immediate health and safety concerns related to hazardous materials. Providing hazardous materials emergency response capabilities sufficient to respond to all of the hazardous materials incidents likely to follow a major catastrophe may be an unreasonable goal for San Francisco to pursue. Following a catastrophe, the focus of emergency services providers should be to protect the public from imminent dangers and to provide individuals in the community with the means to protect their own safety, as discussed under "Exposure of Concentrated Populations to Seismic Hazards" in Section V.H, Seismicity: Impacts, where a potentially significant impact in this regard is identified. Implementing effective emergency plans would serve to protect the public from serious incidents that do not pose immediate hazards beyond the affected area. Mitigation measures identified in VI.H, Mitigation Measures: Seismicity, would address this concern.

Land Use and Planning Issues

Depending on the risk of upset posed by specific hazardous materials operations, project-related Commercial Industrial uses and UCSF activities could pose hazards to neighboring land uses. As discussed above, the greatest potential for problems would be if UCSF or a business were to handle a hazardous material posing off-site hazards of toxic gas releases or explosions, particularly if such operations were located near residents, schools, day care centers, or public places. Compliance with Risk Management Plan requirements would minimize this impact by reducing the likelihood of an upset occurring. Also, the state school siting criteria would ensure that exposure to hazardous materials is considered in the school siting process.

Land use changes in the Project Area would eliminate the heavy industrial zoning at the Castle Metals site. As a result of this zoning change, this site would no longer meet the siting criteria for new hazardous waste facilities set forth in the *City and County of San Francisco Hazardous Waste Management Plan*. Because this area could no longer be considered a possible site for new hazardous waste management facilities, the siting of such facilities in San Francisco could potentially become incrementally more difficult. Because hazardous waste facility siting criteria relate at least in part to public safety, proposed land uses in the Project Area could also inhibit the development of hazardous waste facilities south of the Project Area by increasing the number of individuals located near the existing M-2 areas to the south. With or without the project, the suitability of these M-2 areas for hazardous waste facilities would be limited due to relatively small site sizes and the proximity of residences and live/work uses.

CUMULATIVE EFFECTS

The health and safety hazards posed by most hazardous materials are local in nature. They do not typically combine in any cumulative sense with the hazards of other projects. The possible exceptions, however, include potential toxic air emissions, transportation of hazardous materials in the project vicinity, and waste disposal. The need to respond to hazardous materials emergencies could also increase as a result of cumulative development.

Regarding cumulative toxic air emissions, cumulative development could increase the overall concentrations of toxic air contaminants in the San Francisco Bay Area, and project-related stationary and mobile emissions sources could contribute to this increase. Cumulative issues related to toxic air emissions are discussed under "Toxic Air Contaminants" in Section V.F, Air Quality: Impacts.

Transportation

Regarding transportation, hazardous materials are transported on virtually all public roads, particularly since all motor vehicles contain hazardous materials (e.g., fuel) in addition to any hazardous cargo that may be on board. The project would contribute little to cumulative transportation hazards. The cumulative effects of transportation of hazardous materials is comprehensively addressed by regulatory requirements. As discussed under "Hazard Assessment" in Appendix H, packaging requirements for hazardous materials and wastes minimize the potential consequences of possible accidents during transport. Also, the vehicle accident rate is relatively small and not all accidents release hazardous materials.

Hazardous Waste Disposal

Regarding waste disposal, as cumulative development occurs in San Francisco and at the state and regional levels, more hazardous wastes will likely be generated. Project-related hazardous waste generation would contribute to cumulative increases in hazardous waste generation. The incremental effects of proposed increases in hazardous waste generation and hazardous waste recycling, treatment, and disposal (discussed under "Larger Hazardous Waste Generators," above) would also contribute to cumulative effects. In light of the discussion above regarding project-related hazardous waste generation, cumulative increases in waste generation could result in the management of wastes in a manner that poses hazards to people and animal and plant populations. While the project's contribution to this cumulative impact would be incremental and relatively small, the potential impact could be considered significant.

The San Francisco Hazardous Waste Management Program is currently working to reduce the volume of hazardous waste generated by San Francisco businesses and sent to hazardous waste treatment, storage, and disposal facilities. Many businesses are required to prepare Hazardous Waste Minimization Plans pursuant to the California Hazardous Waste Source Reduction and Management Review Act. The San Francisco Department of Public Health, as a Certified Unified Program Agency, has the authority to review these plans to improve compliance. This authority is reinforced by provisions of the San Francisco Hazardous Materials Permit and Disclosure Ordinance./50/ Businesses not subject to the California Hazardous Waste Source Reduction and Management Review Act may be asked to prepare a Hazardous Waste Audit Checklist developed by the California Department of Toxic Substances Control.

As discussed in UCSF's LRDP FEIR, UCSF adopted a mitigation measure to implement hazardous waste handling, minimization, and disposal measures at Mission Bay consistent with safety

requirements and applicable laws and regulations./51/ By this, UCSF intends to extend its existing hazardous waste minimization plan to the new site; to implement operational controls required to comply with laws and regulations, including monthly safety and compliance audits and training staff; and to implement procedures to minimize increases in long-lived radioactive waste generation.

By encouraging pollution prevention strategies, these measures implemented by the City of San Francisco and UCSF are consistent with the hazardous waste management hierarchy set forth in the *City and County of San Francisco Hazardous Waste Management Plan*./52/ However, the foreseeable project-related contribution to cumulative hazardous waste generation, particularly long-lived radioactive waste generation, would not necessarily be small compared to the existing amount believed to already be generated in San Francisco. Furthermore, San Francisco does not currently oversee any aspect of radioactive waste management. Efforts to address cumulative hazardous waste generation and disposal impacts would require the additional commitment of federal, state, and other local agencies. For these reasons, efforts to offset the project-related contribution to cumulative hazardous waste generation and disposal impacts may not be successful, resulting in a residual impact that could be significant and may be unavoidable.

Hazardous Materials Emergencies

Regarding hazardous materials emergencies, the project and future development in San Francisco could combine cumulatively to increase the demand for hazardous materials emergency response services. This increase could be sufficiently large that emergency responders could be forced to prioritize among more than one hazardous materials incident occurring at the same time. However, two major hazardous materials incidents would remain unlikely to occur simultaneously, and this cumulative impact would be less than significant. As discussed above, however, a major catastrophe could overwhelm emergency response capabilities, including those needed to respond to the Project Area (see Section V.H, Seismicity: Impacts, "Exposure of Concentrated Populations to Seismic Hazards" and Section VI.H, Mitigation Measures: Seismicity).

GLOSSARY

Appendix H presents more detailed definitions of the following terms.

Hazardous materials: Materials that, due to their quantity, concentration, or physical or chemical characteristics, pose a significant hazard to human health and safety, or to the environment, if released into the workplace or the environment.

Hazardous wastes: Wastes that, due to their quantity, concentration, or physical, chemical, or infectious characteristics, may either 1) increase mortality or serious illness, or 2) pose a substantial hazard to human

health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Radioactive materials: Contain atoms with unstable nuclei that spontaneously emit ionizing radiation to increase their stability.

Radioactive wastes: Radioactive materials that are discarded or abandoned.

Biohazardous materials: Materials containing infectious agents that require Biosafety Level 2 or greater safety precautions or cells containing recombinant DNA molecules with codes that can be expressed to create a protein.

Medical waste: Waste resulting from the diagnosis, treatment, or immunization of human beings or animals; research pertaining to these activities; or the production of biologics (naturally occurring therapeutic pharmaceutical products or their derivatives)./53/

NOTES: Health and Safety

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2. a) National Research Council, *Guide for the Care and Use of Laboratory Animals*, 1996.
b) U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health, *Biosafety in Microbiological and Biomedical Laboratories*, 3rd ed., May 1993.
c) U.S. Department of Health and Human Services, National Institutes of Health, *Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines)*, January 1996.
3. City and County of San Francisco, Planning Department, *San Francisco General Plan*, Community Safety Element, April 1997.*
4. City and County of San Francisco, *Area Plan for Emergency Response to Hazardous Materials Incidents*, March 1993.
5. City and County of San Francisco, *City and County of San Francisco Hazardous Waste Management Plan*, February 1992, pp. ES-2-ES-8, 6-11, 7-3, 7-30, and 7-35.
6. City and County of San Francisco, *City and County of San Francisco Household Hazardous Waste Element*, September 1992, pp. 1-5, 1-6, and 2-6.*
7. CEQA Guidelines, Appendix G.
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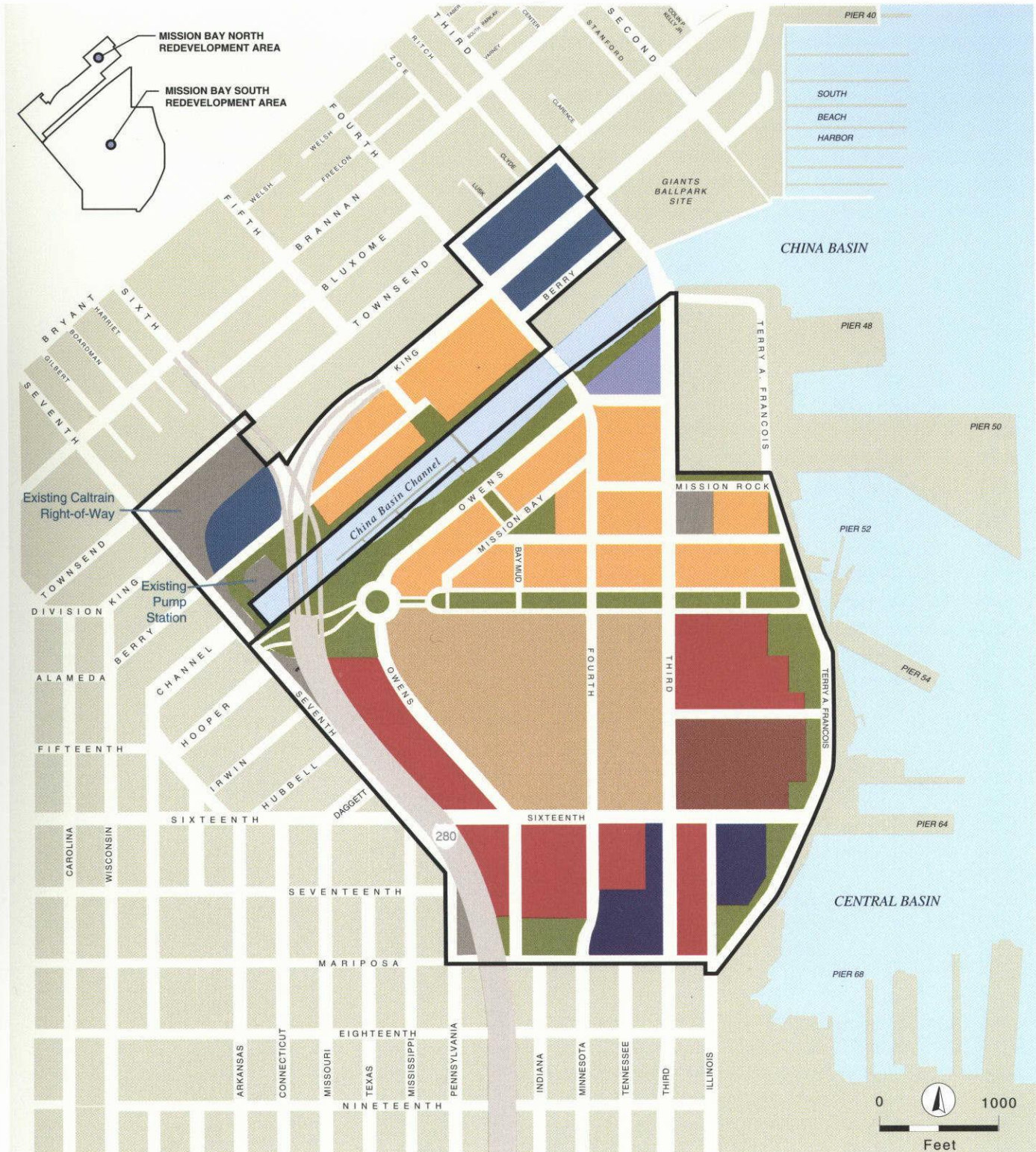
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11. University of California San Francisco, *UCSF Long Range Development Plan Final Environmental Impact Report*, State Clearinghouse No. 95123032, certified January 1997.
12. University of California San Francisco, *Laurel Heights Environmental Impact Report*, certified April 1990.
13. University of California San Francisco, *Revised Laurel Heights Plan; Center for Social, Behavioral, and Policy Sciences Environmental Impact Report*, State Clearinghouse No. 95033072, certified September 6, 1995, Volume II, Health and Safety Technical Memorandum.
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15. City of Emeryville, *Chiron Development Plan Environmental Impact Report*, State Clearinghouse No. 94063005, certified June 1995.
16. University of California San Francisco, *UCSF Long Range Development Plan Final Environmental Impact Report*, State Clearinghouse No. 95123032, January 1997, Volume II, p. 387.
17. Paul Fresina, Business Program Manager, San Francisco Hazardous Waste Management Program, telephone conversation, December 11, 1997.
18. Hewlett Packard Laboratories, Palo Alto, California; Hazardous Materials Management Plans are on file with the City of Palo Alto Fire Department, 1997.
19. California Department of Toxic Substances Control, "Assessment of the Semiconductor Industry Facility Planning Efforts—Report Overview" (<http://www.cwo.com/~opptd/pollprev/pubs/semicond.htm>), Publication No. 530, 1994.
20. a) University of California San Francisco, *Revised Laurel Heights Plan; Center for Social, Behavioral, and Policy Sciences Environmental Impact Report*, State Clearinghouse No. 95033072, certified September 6, 1995, Volume II, Health and Safety Technical Memorandum, p. 4.7.

b) City of Emeryville, *Chiron Development Plan Environmental Impact Report* (Draft EIR Volume, February 1995, p. III.G.14), State Clearinghouse. No. 94063005, certified June 1995.
21. National Research Council, *Guide for the Care and Use of Laboratory Animals*, 1996.

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23. City of Emeryville, *Chiron Development Plan Environmental Impact Report*, State Clearinghouse No. 94063005, certified June 1995.
24. University of California San Francisco, *UCSF Long Range Development Plan Final Environmental Impact Report*, State Clearinghouse No. 95123032, January 1997, Volume II, p. 388.
25. City and County of San Francisco, *City and County of San Francisco Household Hazardous Waste Element*, September 1992, p. 2-1.
26. City and County of San Francisco, *City and County of San Francisco Hazardous Waste Management Plan*, February 1992.
27. California Code of Regulations, Title 8.
28. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health, *Biosafety in Microbiological and Biomedical Laboratories*, Third Edition, May 1993, p. 31.
29. This analysis assumes that UCSF has no current plans to operate any laboratories requiring Biosafety Level 3 containment. According to Michelle Schaefer, Environmental Coordinator, University of California San Francisco (facsimile to EIP Associates, January 9, 1998), if UCSF were to engage in activities in the Project Area that were to require Biosafety Level 3 containment, it would conduct additional environmental review, as necessary. The additional environmental review would identify any proposal-specific potential impacts and, if warranted, mitigation measures or alternatives that would reduce or avoid the impacts.
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32. California Health and Safety Code, Article 1, Section 42301.6(a); California Code of Regulations, Title 5, Section 14010; California Education Code, Section 17213.
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34. Association of Bay Area Governments, *Toxics Away! The Alameda County Pilot Collection Program for Small Quantity Generators of Hazardous Wastes*, April 1988.
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36. City and County of San Francisco, *City and County of San Francisco Household Hazardous Waste Element*, September 1992, p. 2-6.
37. Association of Bay Area Governments, *The Disposal of Hazardous Waste by Small Quantity Generators: Magnitude of the Problem*, June 1985, p. I-1.

38. a) City and County of San Francisco, *City and County of San Francisco Household Hazardous Waste Element*, September 1992.
b) Aaron Richardson, Technical Writer, Sanitary Fill Company, facsimile to EIP Associates, December 22, 1997.
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42. Edgar D. Bailey, Chief, Radiologic Health Branch, California Department of Health Services, Radiation Safety Bulletin 94-1, "South Carolina Legislature Adjourns Without Extending Access to Barnwell," June 3, 1994.
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48. Richard Lee, Senior Industrial Hygienist, San Francisco Department of Public Health, telephone conversation, December 16, 1997.
49. California Code of Regulations, Title 8, Section 5191.
50. San Francisco Health Code, Section 1110.1(e).
51. University of California San Francisco, *UCSF Long Range Development Plan Final Environmental Impact Report*, State Clearinghouse No. 95123032, certified January 1997, Volume I, p. S-51.
52. City and County of San Francisco, *City and County of San Francisco Hazardous Waste Management Plan*, February 1992, pp. ES-2-ES-8, 6-11, 7-3, 7-30, and 7-35.
53. California Health and Safety Code, Section 25033.2.

* A copy of this report is on file for public review at the Office of Environmental Review Planning Department, 1660 Mission Street, San Francisco.



SOURCE: San Francisco Redevelopment Agency

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| COMMERCIAL INDUSTRIAL | MISSION BAY RESIDENTIAL | MISSION BAY PUBLIC FACILITIES |
| COMMERCIAL INDUSTRIAL / RETAIL | HOTEL | PROPOSED BOUNDARIES OF MISSION BAY REDEVELOPMENT AREAS |
| MISSION BAY NORTH RETAIL | MISSION BAY OPEN SPACE | |
| MISSION BAY SOUTH RETAIL | UCSF (includes City school site) | |

NOTE: See Table III.A.2 for types and amounts of uses.

