Rancho Cañada Health Risk Assessment – First Draft

Project Overview

The Rancho Cañada Village (RCV) project consists of the development of a new 281-unit mixed-use residential neighborhood to be located on an 81-plus-acre site at the mouth of the Carmel Valley along Carmel Valley Road, just east of the intersection of Carmel Valley Road and Highway 1. The RCV project would result in heavy-duty construction equipment being operated in close proximity to a nearby school and church. The purpose of this HRA is to estimate the potential toxic air contaminant (TAC) exposure from RCV construction activities at the nearby school.

The location of the proposed RCV project site, estimates of required earthwork activity, and project phasing are currently available. However, detailed construction activity, such as truck routing, construction equipment usage, and buildout dates has yet to be finalized. Thus, this HRA requires the estimation of many construction details to be completed. Every effort was made to make conservative estimates of construction activity so as to ensure that the health risk estimates for the actual implementation of the RCV project provided here would not be underestimated.

The RCV Specific plan states that construction of the RCV project would take place in four phases over a period of several years. Phase I includes 98 residential units, Phase II includes 96 residential units and the south and north neighborhood parks, Phase III consists of 87 residential units, and Phase IV is the completion of the habitat preserve. It is anticipated that the entire project would be constructed within five years of approval.

The RCV includes the movement of approximately 200,000 cubic yards of soil, of which 100,000 cubic yards would be imported from off site. The applicant estimates that the importation of fill would occur over a period of 28 days and would require 7,200 truckloads of fill material obtained from an off-site location.

Vehicle Emission Factor Calculation

To date, the client has not specified the distribution and usage of heavy-duty vehicles during the proposed soil movement operations, so a number of conservative assumptions are required to conduct this HRA. It is assumed that all construction activity occurs in the year 2007. Since emission factor (EF) models demonstrate that heavy-duty EFs decrease in the short-term future, using a design year of 2007 will result in a conservative estimate of project emissions. For model calculations it is assumed that construction vehicles will be operated for a maximum of 12 hours per day.

The haul route from the off-site location to the RCV project site has yet to be determined so it is not possible to determine if there are additional sensitive receptors along the haul road path. Since a Carmel Unified School District school (hereafter referred to as ‘the school’) is adjacent to the proposed Rio Road and is also adjacent to proposed RCV residential area, it is reasonable to conclude that the school will have the greatest health risk associated with RCV project activity. As such, only the school will be analyzed in

this HRA and it can be concluded that all other sensitive receptors near RCV activities will have considerably lower health risks than the school.

As a conservative measure, it is assumed that the truck route for soil import will run the entire length of the proposed Rio Road that is adjacent to the school property. In reality, it is more likely that the truck route will cut across the work site rather than run exclusively along Rio Road.

It is assumed that the construction equipment usage for the RCV project is the same as that used in a substantially larger construction project proposed for development in nearby Sacramento, California in the year 2007. The Sacramento project involved the development of 109 acres for mixed residential/commercial purposes requiring approximately 9,000 cubic yards of soil imported per day for a total importation of approximately 425,000 cubic yards. Detailed equipment usage was made available for the Sacramento project. Since the Sacramento project required 2 times as much earthwork and 4 times as much soil importation than the RCV project, using the Sacramento data will result in a conservative HRA.

The inventory of equipment assumed for this analysis is presented as Table 1. The vehicle type, number of vehicles, horsepower, and load factors are assumed equal to the peak equipment usage in the Sacramento project. Vehicle emission factors for VOC, CO, NOX, and PM are presented in Table 2. Based on guidance from MBUAPCD, it is assumed that 1% of VOC emissions from diesel vehicles is acrolein[2]. Table 2 EFs for off-road vehicles are based on values listed in Table 7-3 of the Monterey CEQA Air Quality Guidelines[1], on-road vehicle EFs were calculated using EMFAC. Off-road vehicles are assumed to have a model year of 1997 (10 years old). The emission factor determination for the haul road is presented in Table 3 and is based on 7,200 truckloads of material being delivered over a 28-day period.

Receptor and Area Source Representations

The soil import haul route is assumed to be coincident with the proposed Rio Road. The haul route is assumed to be 60 feet wide and approximately 1,775 feet long. The on-site emissions from both on- and off-road vehicles are modeled as a triangular area with a height of 1,225 ft and a baseline of 1,925 ft. The northern edge of the haul road and on-site area source are both assumed to be 15 feet from the school property line. The actual construction activity will likely be significantly farther from the school property line; however, by modeling construction activity closer to the property line than expected, one arrives at a conservative estimation of health risk.

Receptors were located along the school property line immediately north of the proposed Rio Road, which borders the Rancho Cañada project area. Additional receptors were placed every 25 feet north of the property line for an additional 375 feet.

Dispersion Modeling Results

The ISC3 dispersion model was used to estimate downwind concentrations of pollutants from on-site construction and hauling activities. Meteorological data collected at the nearby Castroville station for 1992 was used for ISC3 modeling, which was provided by the MBUAPCD. As shown in Figure 1, the 1-hour maximum acrolein concentration for the assumed project configuration was 8.5 ug/m^3 which is approximately 45 times greater than the MBUAPCD reference concentration of 0.19 ug/m^3. Based on one month of continuous exposure to earthwork activities, the maximum 70-year cancer risk was determined to be approximately 20 excess cancers per million people.

Both the acrolein and cancer risks associated with this project as modeled are **significant**. It is recommended that the client make more refined estimates of construction activities to avoid the worst case assumptions used in this analysis.

References

[1]CEQA Air Quality Guidelines Prepared by the Monterey Bay Unified Air Pollution Control District (MBUAPCD). Adopted October 1995, last revised June 2004.

[2]Personal Correspondence with David Craft at Monterey Bay Unified Air Pollution Control District. February 27, 2007.

Table 1. Rancho Cañada project assumed on- and off-road vehicle distributions.

Usage Type	Equipment Type	Equipment Type Example	# Vehicles	Horsepower	Fuel	Load Factor	Average Speed (mph)	Model Year
Off-road	Graders	CAT 14H Motor Grad	5	220	Diesel	0.61	Variable	1997
Off-road	Tractors/Loaders/Backhoes	John Deere 8570	2	250	Diesel	0.55	Variable	1997
Off-road	Scrapers	CAT 615C II	2	265	Diesel	0.72	Variable	1997
Off-road	Crawler Tractors	CAT D8R	2	310	Diesel	0.64	Variable	1997
Off-road	Soil Compactor	CAT 825H Soil Comp.	4	315	Diesel	0.62	Variable	1997
Off-road	Off Road Water	CAT 623G Water Pull	5	365	Diesel	0.72	Variable	1997
Off-road	Excavators	Komatsu PC 750 LC	2	454	Diesel	0.57	Variable	1997
On-road	Street Sweeper	Variable	1	Variable	Diesel	N/A	15	Variable
On-road	Water Truck	Variable	5	Variable	Diesel	N/A	15	Variable
On-road	Bottom Dump	Variable	Variable	Variable	Diesel	N/A	15	Variable
On-road	On site Pickup	Variable	3	Variable	Diesel	N/A	15	Variable

Table 2. Rancho Cañada project on-site emission factors (EFs).

			Single Vehicle EF (g/s)					Total Fleet Emission Factors (g/s)				
Equipment Type	**Location**	**# Vehicles**	**VOC**	**Acrolein**	**CO**	**NOX**	**PM**	**VOC**	**Acrolein**	**CO**	**NOX**	**PM10**
Graders	On-site	5	0.012	0.000	0.034	0.233	0.006	0.060	0.001	0.172	1.165	0.028
Tractors/Loaders/Backhoes	On-site	2	0.012	0.000	0.035	0.239	0.006	0.025	0.000	0.070	0.477	0.011
Scrapers	On-site	2	0.017	0.000	0.049	0.331	0.008	0.034	0.000	0.098	0.663	0.016
Crawler Tractors	On-site	2	0.018	0.000	0.051	0.344	0.008	0.035	0.000	0.101	0.689	0.016
Soil Compactor	On-site	4	0.017	0.000	0.050	0.339	0.008	0.070	0.001	0.200	1.356	0.032
Off Road Water	On-site	5	0.024	0.000	0.067	0.456	0.011	0.118	0.001	0.336	2.281	0.055
Excavators	On-site	2	0.023	0.000	0.066	0.449	0.011	0.046	0.000	0.132	0.899	0.022
Street Sweeper	On-site	1	0.007	0.000	0.062	0.052	0.002	0.007	0.000	0.062	0.052	0.002
Water Truck	On-site	5	0.007	0.000	0.062	0.052	0.002	0.034	0.000	0.311	0.262	0.009
On site Pickup	On-site	3	0.003	0.000	0.035	0.009	0.000	0.008	0.000	0.106	0.026	0.001
Total On-Site Emission (not including the haul route)								**0.436**	**0.004**	**1.588**	**7.871**	**0.191**

Table 3. Rancho Cañada haul road emission factor determination.

Haul Road Emission Constants	
Project Duration (days)	28
Round Trips	7200
Round Trips / day	257.143
Effective Vehicles / day	514.286
Effective Vehicles / sec	0.143
Roadway Width (feet)	60
Roadway Width (m)	18.288

Haul Road Emissions	VOC	Acrolein	CO	NOX	PM10
Single Vehicle EF (g/mile)	1.615	0.016	14.927	12.587	0.414
Fleet EF (g/mile-sec)	0.231	0.002	2.132	1.798	0.059
Feet EF (g/m-sec)	0.000	0.000	0.001	0.001	0.000
Fleet EF (g/m^2-sec)	7.839E-06	7.839E-08	7.245E-05	6.110E-05	2.009E-06

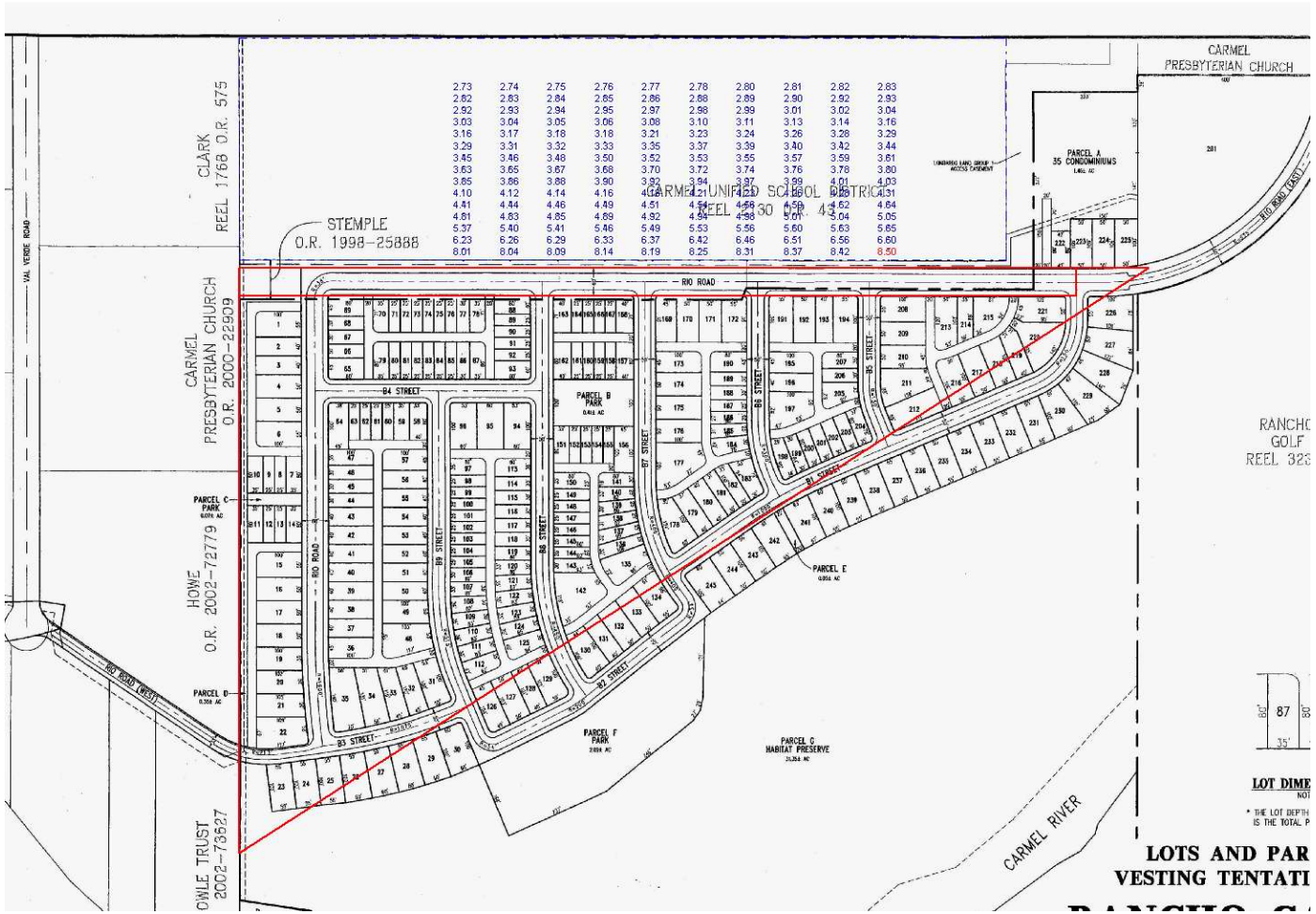

Figure 1. ISC3 modeling of the Rancho Cañada project. The haul road area source is shown in red coincident with the northern section of the proposed Rio Road. The earthwork activity is modeled as a triangular area source shown above. The blue numbers located in the north of the figure are the estimated 1-hour maximum acrolein concentrations on the school property at the location of the number. The maximum 1-hour acrolein concentration is approximately 8.5 ug/m^3.