ATTACHMENT 3
ROG and NOx Emissions
Agricultural Irrigation Pumps
San Joaquin Valley

Revised May 20, 2003

EMISSION INVENTORY SUMMARY CATEGORY
Food and Agricultural Processing (Combustion)

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION
052-042-1200-0000 (83998) Agricultural Irrigation Pumps

METHOD FOR CALCULATING EMISSIONS

Emissions in this source category come from the operation of agricultural irrigation pumps. Emissions are estimated by multiplying the population of pumps by their horsepower rating, emission factor, load factor, and number of operating hours. Diesel engines account for approximately 95% of the emissions from agricultural irrigation engines in the San Joaquin Valley. Table 1 below shows the assumptions used in estimating the emissions from diesel-fueled agricultural irrigation engines in the Valley.

Table 1. Diesel-Fueled Agricultural Irrigation Pump Assumptions

Engine Class	Pop	HP	ROG EF (g/bhp-hr)	NOx EF (g/bhp-hr)	Load Factor	Operating Hours (hr/yr)
New - Tier I	2150	209	1	6.9	0.65	1500
New - Tier II	100	209	1	4.9	0.65	1500
Old - Pre-1975	225	161	1.1	11	0.65	1000
Old - Post -1975	2025	161	0.6	11	0.65	1000
Total	4500					

The population of diesel-fueled agricultural irrigation pumps was estimated based on the number of Carl Moyer Program applications received by the San Joaquin Valley UAPCD, as well as information from a report written for the District in 1996 by Sonoma Technology, Inc. (STI) entitled " Emission Inventory of Agricultural Irrigation Combustion Engines Used for Irrigation in the SJVUAPCD." To date, the District has provided funds under the Moyer Program to replace 2250 diesel-powered agricultural irrigation pumps, of which 2150 are Tier I and 100 are Tier II. The District estimates there are an additional 2250 older diesel agricultural irrigation pumps which have not been replaced under the Moyer Program. Based on STI survey data, it is estimated that 10% or 225 of these pumps are pre-1975 and the remaining 90% or 2025 pumps are post-1975.

Horsepower ratings and ROG and NOx emission factors for the new pumps was obtained from the Moyer Program applications and for the old pumps was based on the 1996 STI report. The 65% load factor was assumed to be reasonable based on discussions with District staff. New pumps were assumed to operate 1500 hours per year based on Moyer Program applications while old pumps were assumed to operate only 1000 hours per year.

ROG and NOx EMISSIONS IN THE SAN JOAQUIN VALLEY

Based on the assumptions provided in Table 1, ROG and NOx emissions from agricultural irrigation engines on a typical summer day in the San Joaquin Valley are provided in Tables 2 and 3 below. Emissions for the year 1999 are based on information provided from the District while emissions for the year 2010 were forecasted by the ARB from the 1999 estimates using the growth and control assumptions described in the following section.

Table 2. Summer ROG Emissions (tons per day)

Major Category	1999	2010
Agricultural Irrigation Pumps	2.5	2.4

Table 3. Summer NOx Emissions (tons per day)

Major Category	1999	2010
Agricultural Irrigation Pumps	23.3	22.6

GROWTH AND CONTROL ASSUMPTIONS

Growth - Irrigated crop acreage projections developed by the Department of Water Resources (DWR) are used as the growth surrogate for agricultural irrigation pumps. DWR's projected overall decline in SJV irrigated crop acreage of –0.3% per year agrees with historical data from the California Department of Food and Agriculture, as well as anecdotal evidence provided through discussions with county agricultural commissioners and other agricultural experts. A more detailed discussion of the basis for the use of this proposed growth surrogate is provided in the accompanying document, "Forecasting Air Pollution Emissions from Agricultural Operations in the San Joaquin Valley" dated May 20, 2003.

Control – No control is currently assumed for agricultural irrigation pumps.

TEMPORAL ACTIVITY

Agricultural irrigation pumps operate at various times during any given operating day. But it is the monthly variation that proves most significant for this category and for their contribution to excessive ozone formation, a “summer” phenomenon. By “summer”, the ARB refers to the months May through October, when we see the ozone standards most often violated.

The current monthly temporal profile for agricultural irrigation pumps was developed based on the 1996 STI report. As shown in Table 4 below, we assume that 67% of the agricultural irrigation pump emissions occur in the summer and 33% in the winter.

Table 4. Monthly Activity for Agricultural Irrigation Pumps in the SJV[1]

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
4.4	4.4	4.4	11.5	11.5	11.5	13.4	13.4	13.4	4.0	4.0	4.0

Summer	67.3
Winter	32.7

[1]From 1996 STI report.