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## Analysis of Stage II Vapor Recovery Emission Reductions

### Introduction:

Volatile organic compounds (known as VOCs) are a component in the formation of ozone, a pollutant that is regulated by EPA. When at their highest, ozone levels in the greater Tucson area approach the existing limit, although the region remains in compliance with air quality standards. New proposed regulations will make the limit for ozone more stringent and increase the potential for our region to be in violation of air quality standards.

When vehicles are fueled, gasoline vapors escape as the tank is filled. The control of emissions resulting from refueling is known as Stage II Vapor Recovery.

Pima Association of Governments (PAG) has conducted an air quality analysis to identify the portion of VOCs that would be controlled by Stage II vapor recovery systems. PAG used a model known as EPA MOBILE6.2 to estimate emissions from the vehicle fleet.

### Method:

The EPA MOBILE6.2 model was run using current local vehicle registration data for Pima County provided by the Arizona Department of Transportation. Although ozone is generally seen as a summer pollutant, the analysis was done for both summer and winter and averaged for an annual estimate. Local factors such as climate, fuel and vehicle emissions inspection programs, were incorporated into the model. PAG also averages data from high and low altitude scenarios to better represent elevation in the Tucson region.

Model runs were done to estimate total VOC emissions from on-road vehicles and the contribution from refueling emissions for the years 2010, 2015, 2020 and 2030. The model was run to identify emissions with and without Stage II controls. For the scenario with Stage II controls, the model runs assumed introduction of the program in 2008 with a two-year phase-in, as well as 80 percent program efficiency for light duty gas vehicles, light duty gas trucks and heavy duty gas vehicles.

### Onboard Refueling Vapor Recovery:

Vehicle registration records indicate that about 50 percent of vehicles registered in Pima County are equipped with onboard refueling

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vapor recovery (ORVR) systems. These systems are designed to capture VOC emissions during refueling and operate at 95 to 98 percent efficiency. All passenger cars manufactured since 2001 have ORVR systems, and since 2001, medium and heavy duty trucks have been phased in to now include ORVR systems. With each passing year, the percentage of vehicles with ORVR emission control systems increases since older vehicles without those systems are replaced with those that do.

**Results:**

During each model year scenario that is run, values for emissions of VOCs are generated. As would be expected, the amount of emissions reduced through the use of Stage II emission controls decreases with time as more vehicles with on board systems replace vehicles without those systems. Even though vehicle miles of travel (VMT) increase in future years, the greater proportion of vehicles with on board control systems that will be on our roads results in fewer overall emissions during refueling. The result is that, over time, the incremental benefit of Stage II emission controls is reduced, as seen in the chart below.

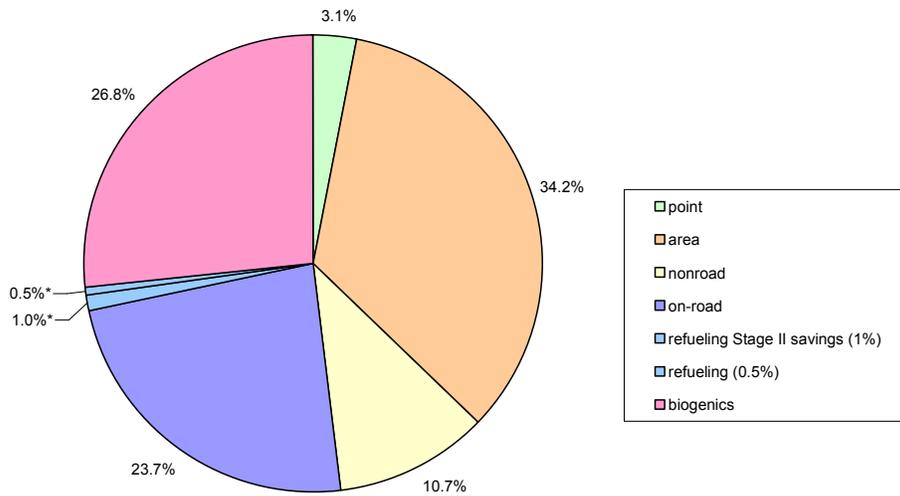
***VOC Emissions from On-road Vehicles, with and without Stage II (tons/year)***

	Total VOC emissions from On-road Vehicles	VOC emissions from refueling without Stage II controls	VOC emissions from refueling with Stage II controls
2010	10,209	605	219
2030	5,345	289	198

While a comprehensive emissions inventory has not been developed for the Tucson region, data from combined partial inventories show that total VOC emissions from all sources for 2010 can be estimated at approximately 40,696 tons/year. In 2010, emission reductions realized from Stage II emission controls would be approximately 1.06 tons/day. In future years, as older vehicles are replaced with newer, cleaner burning vehicles with on board control systems, the benefit of Stage II emission control systems would be reduced significantly. In 2030, the estimated emissions benefit from Stage II is about 0.16 tons/day.

The following pie chart shows the estimated relative contribution of the VOC sources for eastern Pima County for 2010. The refueling savings using Stage II are identified.

**Sources of VOC Emissions - Estimate for 2010 (percent)**



\* Refueling VOC emissions total 1.5%

The annual VOC emissions from on-road vehicles and the refueling portions both with and without Stage II are graphed below. The gap between emissions with and without Stage II recovery narrows considerably over time as newer vehicles with on board control systems occur in a greater proportion of all vehicles.

**VOC Emissions from On-road Vehicles with and without Stage II (tons/year)**

