Wyle Report

WR 04-31

(J/N 10488)

September 2005

California Off-Highway Vehicle Noise Study

A Report to the California Legislature
As Required by Public Resources Code
Section 5090.32(o)

Prepared for:

State of California
Department of Parks and Recreation
Off-Highway Motor Vehicle Recreation Division

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Executive Summary

Introduction

This study assists the California Department of Parks and Recreation, Off-Highway Motor Vehicle Recreation Division (OHMVR Division) in fulfilling its reporting obligations as required by California Assembly Bill 2274, Chapter 563. The Bill, signed into law on September 14, 2002, established a more stringent noise level for enforcement testing of Off-Highway Vehicles (OHVs) and amended Public Resources Code Section 5090.32 (o) to require a report examining the following issues:

- Effectiveness of the current California OHV Noise Standard;
- Effectiveness of the enforcement efforts associated with the California OHV Noise Standard;
- Effectiveness of public outreach and education programs regarding the California OHV Noise Standard;
- Feasibility of improving the California OHV Noise Standard;
- Reassessment of the grandfather dates; and
- Future reporting needs and appropriate reporting intervals.

OHV recreation is an increasingly popular activity in California. OHVs include motorcycles (dirt and dual registration bikes), all-terrain vehicles (ATVs), snowmobiles, dune buggies, sand rails, jeeps, two- and four-wheel-drive pickup trucks and sport utility vehicles (SUVs). This study focuses on off-highway motorcycles and ATVs.

Background

The OHMVR Division has provided leadership and education to the OHV community regarding the California OHV Noise Standard, and prepared law enforcement agencies for implementation of vehicle noise level enforcement testing. The OHMVR Division began education and outreach programs well before the January 1, 2003 implementation date of the current California OHV Noise Standard, and continues to support and provide leadership for enforcement of the California OHV Noise Standard in the State Vehicular Recreation Areas (SVRAs). In addition, the OHMVR Division conducts multi-agency OHV law enforcement workshops to communicate with law enforcement agencies involved in enforcing OHV-related laws and regulations in California. The OHMVR Commission helps to make enforcement of the California OHV Noise Standard a high priority through the funding of

law enforcement and equipment grants and cooperative agreements to federal and local government agencies.

The OHMVR Division established the California OHV Stakeholders Roundtable, in 2000, as an advisory group to the Division. The group was brought together to develop a consensus-building forum, consisting of representatives from land management agencies, environmental and OHV organizations, law enforcement agencies, rural counties, businesses, non-motorized recreation enthusiasts, and OHV manufacturers. The Stakeholders developed a noise sub-committee that identified options for reducing noise emissions of OHVs in California. The sub-committee's input contributed to adoption of the current, more stringent California enforcement level for OHV noise emissions.

Scope

The effort described in this report includes:

- A review of the technical literature on OHV noise emissions;
- Laboratory and field testing and analyses to investigate:
  - OHV noise sources[1];
  - Enforcement test methods[2];
  - Noise levels produced by OHVs in use[3]; and
- Attitudinal surveys.

Conclusions

Limitations of Interpretation of Study Findings

As in all technical studies, limits of the scope and findings of the present effort must be acknowledged. For example, noise emissions of vehicles measured under semi-reverberant conditions in a simulated pass-by procedure are likely to differ somewhat from those made by moving vehicles under free field conditions. Likewise, the opinions solicited from adventitious (and in some cases, small) samples of respondents are not necessarily

[1] The total noise emissions of an OHV are the sum of the noise produced by all of its mechanical components. Different methods for measuring OHV noise emphasize the noise of some components more than others.

[2] Two methods for measuring OHV noise emissions are of particular interest: one adopted by the U.S. Environmental Protection Agency for labeling of motorcycles distributed in commerce (EPA F-76a), and one adopted by California for measuring compliance with noise emission limits for OHVs in operation (Society of Automotive Engineers J-1287).

[3] All current production motorcycles (other than those intended for competition use) are subject to the Federal EPA's labeling requirement for distribution in commerce. Popular ATV models voluntarily meet this requirement as well.

representative of wider populations. Additionally, no measurements were made in this study of snowmobile noise emissions.

The present analyses do not address issues of feasibility of enforcement, nor the costs and benefits of alternative regulatory decisions to residents of areas in proximity to OHV recreation sites, nor to manufacturers, nor to sub-classes of outdoor recreationists and environmentalists. For these and other reasons, the present findings should be understood as suggestive rather than definitive.

Effectiveness Evaluations

The evaluations herein suggest the current California OHV Noise Standard, as well as the State's enforcement and its outreach and education programs, are generally effective. Large percentages of interviewed enthusiasts, riding area staff, manufacturers and environmental groups were aware of the California OHV Noise Standard and believe it is effective. A smaller percentage of residents interviewed in proximity to two OHV recreational sites were also aware of the California OHV Noise Standard. Those who were aware of the standard also believed it is effective.

Recommendations for Improving the California OHV Noise Standard

Recommendations for improving the California OHV Noise Standard, enforcement efforts and public outreach and education programs include:

- Continue outreach to inform the enthusiasts, manufacturers and others who remain unaware of the Noise Standard and its programs;
- Elimination of the tolerance while applying the Society of Automotive Engineers J-1287 (SAE J-1287) enforcement test;
- Continue enforcement of the noise level limits on public lands;
- Investigate the value and possible results of eliminating the competition OHV exemption;
- Consider the full range of outcomes before phasing in a reduction to the OHV enforcement noise limit; and
- Develop an acoustic tachometer to permit joint measurements of engine speed and vehicle noise level so one person can perform the enforcement measurement.

Acoustic Analyses

Current test methods and potential modifications for improving their application to the California OHV Noise Standard were evaluated. This evaluation included:

- Reviewing the current SAE J-1287 stationary vehicle enforcement test method and its effectiveness in discriminating between compliant and non-compliant vehicles;

- Comparing the noise levels measured by the SAE J-1287 enforcement test method with the Federal Environmental Protection Agency F-76a (EPA F-76a) noise emission test method used to label new vehicles for distribution in commerce; and
- Investigating alternative modified enforcement test methods for discriminating between compliant and non-compliant vehicles and for greater correlation with noise levels measured by the EPA F-76a certification test method.

The results suggest that:

- The relationship of A-weighted sound levels measured with SAE J-1287 and EPA F-76a test methods is limited by differences in the spectral content of engine noise in the two test methods, the position of the microphone, and the operation of the vehicle;
- The limited correlation between SAE J-1287 and EPA F-76a measurements of OHV noise emissions does not affect the ability of the SAE J-1287 stationary test method used by California to reasonably discriminate between OHVs that pass or fail the federal noise standard. The SAE J-1287 stationary test method is well suited for regulatory enforcement purposes; and
- The modified test methods investigated did not provide meaningful improvements over the SAE J-1287 test method in their ability to discriminate between compliant and non-compliant OHVs, and did not improve the correlation between SAE J-1287 and EPA F-76a measurements.

Potential Shift in Noise Level Threshold for Enforcement

The federal noise emission labeling requirement for distribution of motorcycles in commerce, 40 CFR Chapter 1, Section 205.158, does not in itself require states adopt any specific noise level threshold for enforcement of noise emissions of vehicles in use. Further, many of the OHVs tested in this study complied with the California OHV Noise Standard enforcement level but exceeded the federal labeling requirements. California may adopt a more stringent noise level threshold for OHV noise enforcement purposes if an appropriate regulatory rationale supports such a decision.

The role of regulation is to balance competing societal interests; in this case, among those of various classes of outdoor recreationists, residents of areas in proximity to OHV recreation sites, environmentalists, off-highway vehicle manufacturers, and others. The present findings alone do not dictate selection of any specific sound pressure level as a regulatory enforcement threshold. Decisions about regulatory enforcement thresholds require value judgments and a rationale based at least in part on costs and benefits. These value judgments should not be made on the basis of acoustic analyses alone, but should also be based on other analyses.

Limitations of the current enforcement test method should also be addressed before arbitrary reductions in the enforcement threshold can be considered.

Practical Considerations

Several practical concerns preclude an immediate reduction in the current OHV noise emission enforcement level by more than 2 dBA:

- A reduction of the current enforcement level by 4 dBA or more may jeopardize the simple and direct interpretability of the SAE J-1287 test results, as noise sources other than the exhaust system would begin to affect the measured sound level;
- Time is needed to educate OHV enthusiasts who are not completely informed about the California OHV Noise Standard and the need for proper vehicle maintenance;
- Time is also needed for manufacturers to develop after-market products to assist in quieting vehicles;
- Measurements made at OHV riding sites indicate an immediate reduction in the current enforcement level by 4 dBA or more would greatly increase the number of OHVs failing the test. This could induce OHV enthusiasts to increase their use of off-road areas lacking enforcement; and
- The present study did not develop definitive information from which the benefits of reductions greater than 2 dBA in the OHV noise enforcement threshold can be gauged.

A phased reduction in the enforcement threshold may nonetheless merit consideration. Currently manufactured non-competition vehicles can comply with an immediate 2 dBA reduction (from 96 to 94 dBA). Vehicles sold for competition use would also be capable of complying with a 94 dBA enforcement sound level with a quiet after-market exhaust system and/or other minor adjustments.

An eventual reduction to 92 dBA for new vehicles (both competition and non-competition motorcycles and ATVs) may also be possible, assuming manufacturers continue to achieve noise level reductions similar to those of the last three years.

Reassessment of Grandfather Dates

Paragraph 1 of Subdivision (h) of Section 38370 of the California Vehicle Code permits competition OHVs manufactured prior to January 1, 1998, and all other OHVs manufactured prior to January 1, 1986, to emit 101 dBA when measured in accordance with the test procedures of SAE J-1287. Because only small and decreasing percentages of these

grandfathered vehicles remain in use at OHV sites, for economic and technological reasons, these dates need not be modified.

Future Reporting Needs and Appropriate Reporting Intervals

An evaluation of the implications of the findings of this study for improving the California OHV Noise Standard should take place during 2005/2006, with a possible action plan identified by January 1, 2007. Future reporting intervals may include a periodic review of the various facets of the OHV noise testing program, and additional study of the costs and benefits of alternative enforcement thresholds. This additional effort could include an analysis of the noise testing procedures and characteristics of OHVs using public lands in California. The appropriate reporting intervals depend on the action plan determined by the OHMVR Division and may vary by task within that plan. The developed action plan should specify these reporting intervals.

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1.0 Introduction

Section 1.1 explains the purpose of the study. Section 1.2 describes the nature and development of off-highway vehicle recreation. Sections 1.3 and 1.4 discuss the resultant noise complaints and the roles of the California Department of Parks and Recreation with regard to off-highway vehicle noise. Section 1.5 explains the organization of the report.

1.1 Purpose of this Study

The present study was conducted to assist the California Department of Parks and Recreation, herein referred to as California State Parks, Off-Highway Motor Vehicle Recreation Division (OHMVR Division), in fulfilling its reporting obligations as required by California Assembly Bill 2274, Chapter 563. This Bill, signed into law on September 14, 2002, amended Public Resources Code Section 5090.32 Item (o) to require a report examining the following issues:

- Effectiveness of the current California Off-Highway Vehicle (OHV) Noise Standard;
- Effectiveness of the enforcement efforts associated with the California OHV Noise Standard;
- Effectiveness of public outreach and education programs regarding the California OHV Noise Standard;
- Feasibility of improving the California OHV Noise Standard;
- Reassessment of the grandfather dates; and
- Future reporting needs and appropriate reporting intervals.

This report addresses all of these issues. The above-mentioned grandfather dates are the manufacturing cut-off dates (or model year) requiring Federal Environmental Protection Agency (EPA) labeled competition OHVs and non-competition OHVs to limit sound emissions to 96 dBA from the previously required 101 dBA as measured by the Society of Automotive Engineers J-1287 (SAE J-1287) test procedure.

In California, OHVs include motorcycles (dirt and dual registration bikes), all-terrain vehicles (ATVs), snowmobiles, dune buggies, sand rails, jeeps, two- and four-wheel-drive pickup trucks and sport utility vehicles (SUVs). However, this present study focuses solely on motorcycles and ATVs, collectively referred to herein as OHVs[1].

While not required in Public Resources Code Section 5090.32 Item (o), a future study could address effective snowmobile noise enforcement in California. Previous snowmobile noise research and regulations in other states have formed a framework for further review.

[1] A brief review of a noise study and a proposed test procedure for snowmobiles is also included in the literature search section.

1.2 Trends of OHV Recreation

OHV recreation is an increasingly popular activity in California and elsewhere in the United States. Throughout California, recreationists use these vehicles for activities as varied as hunting, fishing, hiking, camping, trail and dirt road riding, rock hounding, wildlife viewing, and many other outdoor endeavors.

According to the Motorcycle Industry Council, OHV use has grown from 5,885,000 vehicles nationwide in 1997 to nearly 8,012,000 vehicles in 2003. An estimated 1,200,000 off-highway vehicles were sold in 2003, of which 130,600 were sold in California. California's 562,000 vehicles in use in 1997 grew to lead the nation with an estimated 697,000 vehicles in use in 2003. Of 15 primary OHV manufacturers internationally, five major firms supply more than 95 percent of the vehicles sold in the United States (MIC, 2004). However, inexpensive OHVs imported from China are likely to capture a sizable market share in the near future.

1.3 Complaints about the Noise of OHV Recreation

Complaints lodged with public agencies about the noise of OHV recreation have grown as the sport's popularity has increased. Early models of OHVs intended for recreational and competitive uses manufactured prior to the federal Noise Control Act of 1972 were designed for performance rather than low noise emissions. As the noise of OHVs became a land management issue, manufacturers responded with noise reduction measures. When those measures degraded performance, enthusiasts turned to after-market manufactured equipment and other modifications to restore performance, often resulting in increased noise emissions.

As described in Section 2.0, regulation authorized by the federal Noise Control Act of 1972 has required labeling of noise emissions of OHVs distributed in commerce. As sold, off-highway vehicles of modern manufacture routinely comply with the federal distribution-in-commerce noise emission requirements of the Noise Control Act of 1972. However, the Noise Control Act of 1972 also clearly allows states and local jurisdictions the right to impose operational limits.

Nonetheless, noise emissions of OHVs in operation continue to generate complaints, for reasons such as modification with after-market products and/or a lack of regular maintenance. Population growth and the spread of residential development near traditional OHV recreation facilities and sites compound the problem in California. In reaction, some enthusiast groups are attempting to educate riders that an increase in vehicle noise level does not necessarily correspond with increased vehicle performance, and that lower noise emissions can lead to fewer restrictions on riding areas ("less sound equals more ground").

1.4 Role of the OHMVR Division

The California State Parks OHMVR Division provides leadership to meet the changing needs of California's varied OHV recreation community. The OHVMR Division also works with federal, state, and local land management agencies in an effort to provide high quality, well-managed OHV opportunities. As the population continues to grow, resulting in increased development and a reduction of open space, it is important the OHMVR Division recognizes the need to find a balance between the provision of OHV recreation opportunity and the protection of natural and cultural resources.

In 2000, the OHMVR Division established the California OHV Stakeholders Roundtable as an advisory group to the Division. To develop a consensus-building forum, the OHMVR Division brought together representatives from land management agencies, environmental and OHV organizations, law enforcement agencies, rural counties, businesses, non-motorized recreation enthusiasts, and OHV manufacturers to help improve communication with and among stakeholders. The Stakeholders developed a noise sub-committee that researched and recommended options for reducing the noise level of OHVs in California. Their input to the Division contributed to the adoption of the current California OHV Noise Standard, which lowered the previous enforcement noise level of OHVs.

1.5 Organization of this Report

This report is organized into sections addressing:

- The California OHV Noise Standard and its implementation, with a summary of the literature concerning OHV noise (Section 2.0);
- Noise generation within OHVs (Section 3.0);
- Vehicle noise measurements and comparisons of enforcement test methods (Section 4.0); and
- Attitudinal surveys intended to evaluate public reaction to the California OHV Noise Standard (Section 5.0).

This report also addresses the effectiveness of the California OHV Noise Standard and its implementation. Section 6.0 summarizes and concludes the report. Supporting technical detail, including data tabulations and graphics, may be found in several Appendices following the References section.

2.0 California OHV Noise Standard and Implementation

Sections 2.1 and 2.2 discuss the noise standard and its implementation.

2.1 OHV Noise Standard

EPA regulation (40 CFR Chapter 1, Section 205.158) establishes a procedure for measuring motorcycle noise levels and labeling those that do not meet certain standards, i.e., 80 dB A-weighted noise level[2] (dBA) for OHVs with engines smaller than 170 cubic centimeters (cc) and 82 dBA for OHVs 170 cc and larger. This test method, known as Federal Environmental Protection Agency F-76a (EPA F-76a), requires operation of the vehicle under acceleration as it passes noise measurement positions located 50 feet away and perpendicular to the vehicle's path of travel. Because the test method requires a professional rider and adequate space and terrain for implementation, it is not practical as a field enforcement test. In an effort to develop a practical enforcement test method, SAE in cooperation with other groups developed the SAE J-1287 procedure that measures the noise from a stationary vehicle at 20 inches from the exhaust outlet and 45 degrees to the exhaust axis. This test is simpler to perform than the EPA F-76a test procedure, requiring only a relatively flat open surface free of large reflecting surfaces within 16 feet of the vehicle. A copy of each test standard is included in Appendices A and B.

The current California OHV Noise Standard (State of California, 2003) which became effective January 1, 2003, requires OHVs to comply with the following noise limits when measured with the SAE J-1287 test:

- Competition vehicles[3] manufactured on or after January 1, 1988 are limited to not more than 96 dBA, and not more than 101 dBA if manufactured prior to January 1, 1988; and
- All other OHVs manufactured on or after January 1, 1986 are limited to not more than 96 dBA, and not more than 101 dBA if manufactured prior to January 1, 1986.

OHVs operated in an organized racing event that is conducted under the auspices of a recognized sanctioning body, or by permit issued by the governmental authority having jurisdiction, are not subject to the above noise limits unless required by permitting jurisdictions.

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[2] An "A-weighted" sound pressure measurement is the expression of a weighting procedure intended to represent sounds containing energy at many frequencies in a manner reflective of human hearing sensitivity. Because the A-weighting network gives more emphasis to sounds at some frequencies than at others, two sounds of differing frequency content can have the same A-weighted sound level. All A-weighted sound pressure levels cited in this report are noted by "dBA".

[3] According to EPA, a "competition" motorcycle has at least four of the following six features: 10 inches of suspension travel, no lights, no manufacturer's warranty, no functional seat, an engine displacement greater than 50 cc, and no spark arrester. Such vehicles are designed for closed course, trials, and road racing rather than general OHV use. Part 205 of 40 CFR exempts "competition" motorcycles from distribution-in-commerce noise limits, but still requires muffler marking. There is no technical basis or legal requirement for California to exempt such motorcycles from enforcement of operational noise emission levels.

2.2 Implementation

The OHVMR Division provides leadership direction for implementation and enforcement of the California OHV Noise Standard. The Division enforces this standard at State Vehicular Recreation Areas (SVRAs) and has been informing enthusiasts, the public, manufacturers, and staff at public agencies and other OHV jurisdictions regarding new noise standards through education and outreach programs. Prior to the January 2003 implementation of the OHV Noise Standard, the following proactive measures were implemented by the OHVMR Division, many of which continue today. These programs include, but are not limited to:

- California OHV Noise Standard information card distribution;
- Department of Motor Vehicle (DMV) mailings to OHV owners during the registration renewal process;
- OHV law enforcement workshops;
- California State Parks OHMVR Division web site information;
- Racing event notices;
- Riding area "noise awareness" testing; and
- Provision of noise testing equipment to clubs and local, state and federal law enforcement agencies.

The OHMVR Division provides "sound cards" for distribution at SVRAs, local motorcycle clubs such as American Motorcyclist Association (AMA) Districts 36, 37 and 38, United States Forest Service (USFS) and Bureau of Land Management (BLM) recreation areas, local law enforcement agencies and OHV dealers. A letter from the California Motorcycle Dealers Association accompanied the cards that were distributed to dealers. In addition, the OHMVR Division provides direct mailings of sound cards as well as noise standard information inserts for DMV mailings.

The OHMVR Division continues to conduct multi-agency OHV law enforcement workshops specifically directed at communicating with other law enforcement agencies involved in enforcing OHV related laws in California. In part, these workshops provide an opportunity to communicate the need for consistent law enforcement application of the California OHV Noise Standard. The OHMVR Division helps to support this effort through the funding of law enforcement and equipment grants to OHV associations, as well as federal, state and local law enforcement agencies to make enforcement of the California OHV Noise Standard a high priority.

The OHMVR Division created links from the California State Parks OHMVR Division Web pages that provide information on the changes to the California OHV Noise Standard, and lists after-market products for various vehicles so enthusiasts can determine which products meet the current standard for their particular motorcycle or ATV. This website also provides a copy of the SAE J-1287 stationary enforcement test procedure from the Society of Automotive Engineers. Other on-going efforts include providing decals to be used at racing events so promoters can identify previously tested and compliant OHVs.

3.0 Basic Sound Sources and Sound Generation within OHVs

Section 3.1 reviews pertinent literature related to OHV noise and describes the genesis of the applicable noise emission test methods. Section 3.2 describes the dynamometer-based OHV noise measurements.

3.1 Review of Literature and Origin of Noise Emission Test Methods

The federal pass-by test procedure for measuring motorcycle noise emissions, EPA F-76a, was modeled after the SAE J-47 pass-by test procedure. The procedure measures the total noise emissions of a moving vehicle with a microphone located 50 feet to the side of the track. When the vehicle reaches the measurement position opposite the microphone, the vehicle is at full throttle acceleration at an engine speed calculated for its displacement. The procedure requires the test site to be flat and clear of any large reflective surface within a hundred foot radius of the microphone and points 50 feet before and after the measurement point.

The EPA F-76a measurement method is ill-suited for enforcement purposes for several reasons. The method requires more personnel, site preparation effort, and time than is practical for checking noise emissions of large numbers of vehicles. It also requires skilled riders, and may expose riders of vehicles with large-displacement engines to hazardous operating conditions.

California's enforcement test method for measuring emissions of OHVs, SAE J-1287, was developed in the 1970's and reaffirmed in July 1998. The method measures the noise emissions of a stationary vehicle at a specified Revolution Per Minute (RPM) at 20 inches from the exhaust outlet and 45 degrees from the exhaust axis. This test method is modeled closely after the International Organization for Standardization 362 test standard (ISO-362). California State Park Rangers, as well as federal, state, and local law enforcement officers use this test procedure to determine if an in-use motorcycle or ATV meets the current standard.

The SAE J-1287 test procedure allows enforcement authorities to perform an on-the-spot noise check on any OHV operating on public lands. The location of the measurement microphone emphasizes the contribution to vehicle emissions of the exhaust system, which was the dominant source on the motorcycle when the standard was first developed. While the engine exhaust may still be the dominant noise source on a modern OHV, research has shown other noise sources within the vehicle, such as combustion air intake, engine cylinder, drive train, and chain rattle are also contributors to the overall vehicle noise level (Wyle Laboratories, 1973).

At the time of a sensitivity study by Robin Harrison (Harrison, et al., 1978), there were many versions of an OHV stationary test: the U.S Forest Service procedure, the EPA F-50 standard, an International Organization for Standardization (ISO) draft survey method (later established in Europe as ISO-362 and the model for the other stationary tests listed here), the Motorcycle Industry Council (MIC) E-76, and a SAE J-1287 committee draft proposal. Each of these stationary tests required similar test set-ups and yielded very similar results. The sensitivity study evaluated the error that could result from variations in the test set-up by varying seven parameters within the original MIC E-76 test method, essentially the same method as today's SAE J-1287. These seven parameters included:

- Distance between the exhaust outlet and microphone;

- Azimuth;
- Elevation of the microphone;
- Microphone orientation;
- Engine test RPM;
- Observer position; and
- Rider position.

The study concluded a difference of 1.5 dBA could be obtained with the following variations:

- -4/+2 inches in either the distance from the microphone to the exhaust outlet or in microphone elevation;
- +/- 34 degrees in azimuth; and
- +/- 5% of engine test RPM.

Variations in the remaining three parameters had a negligible effect on the stationary test noise levels.

The SAE committee draft proposal later became the accepted SAE J-1287 stationary test. The sole purpose of this test was to discriminate between vehicles with acceptable and unacceptable exhausts systems. The SAE J-1287 stationary test was never intended to predict vehicle emissions as measured by other test procedures. Nonetheless, several investigators have examined the correlation of vehicle noise emissions as measured by stationary test methods with those performed by EPA F-76a. Reports of three such studies are reviewed below.

An unpublished test (Ziemke, 1981) by EPA's Noise Enforcement Facility (NEF), was conducted to improve upon the previously rejected EPA F-50 test method, a forerunner of today's SAE J-1287. After testing 42 motorcycles, the correlation between EPA F-50 and EPA F-76a improved with accurate control of engine speed. The study also found closer correlation between the EPA F-50 test and the EPA F-76a test by measuring at five feet to the side of the motorcycle rather than at 20 inches from the muffler.

Similar research by Borthwick (Borthwick, 1982) examined a number of variations of the SAE J-1287 stationary test to seek a better correlation with the EPA F-76a test method. The study examined 59 motorcycles tested under SAE J-1287, 20 variations of this stationary test and EPA F-76a. The 20 variations studied different engine RPM and microphone location alternatives. The study concluded that better correlation between a stationary test and the EPA F-76a can be achieved by measuring the noise level three meters to the side of the vehicle, and by using the EPA F-76a engine speed or a percentage of the EPA F-76a speed. However, this improved correlation did not significantly improve the segregation of acceptable and unacceptable motorcycles.

According to another study by Harrison, other vehicle components such as engine intake, drive train and tire/surface interaction are significant noise sources (Harrison, 1993). The main objective of this study was to determine a correlation between the SAE J-1287 and the EPA F-76a

test methods. The study concluded no linear relationship existed between the two test standards and the SAE J-1287 test cannot be used to determine the EPA F-76a noise level. However, the sample of motorcycles did not represent the OHV motorcycle population at that time as only eight off-highway motorcycles were tested, none were "in-use" motorcycles, and only one motorcycle was equipped with a modified exhaust system.

All three studies concluded that SAE J-1287 measurements do not correlate well with the EPA F-76a measurements, but recommended further examination of engine speed and microphone position.

3.1.1 Snowmobile Noise

With regard to snowmobile noise, one study on pass-by testing (Daily, 2002) and one proposed amendment to current noise regulations addressing stationary enforcement testing (State of Wisconsin, 2003) were reviewed. The former discusses the two current snowmobile noise level testing procedures developed by the SAE. The SAE J-192 and J-1161 standards are the testing procedures, both described in 36 CFR 7.21, as the procedure to measure the accelerating and cruising noise level produced by snow vehicles. Regulation 36 CFR 2.18 prohibits snowmobile use in certain National Park areas if the vehicle's noise emissions exceed 78 dBA if manufactured after July 1, 1975. The vehicle noise level may not exceed 82 dBA if manufactured between July 1, 1973 and July 1, 1975, and may not exceed 86 dBA if manufactured before July 1, 1973.

The regulation specifies measurements of the noise level at 50 feet with the snowmobile operating at or near full throttle. The study tested three snow coaches, two 4-stroke snowmobiles, a groomer and various 2-stroke snowmobiles at speeds of 20, 30, and 45 miles per hour (mph). The results indicated there are snowmobiles which comply with the standards, measuring between 71.6 and 76.8 dBA at 45 mph and as little as 65 dBA at 20 mph. The report concludes "more studies need to be done not only with the engine noise levels, but also the mechanical noise generated by the track and skis…Any regulations written should consider that over-snow vehicle noise levels are not attributable just to engine noises but also must factor in the other mechanical noises associated with tracked vehicles" (Daily, 2002).

The State of Wisconsin's proposal to amend current noise regulations relating to snowmobile noise level testing procedures is intended to provide a field-friendly test procedure for an on-the-spot noise check on snowmobiles. The proposed stationary test procedure consists of a microphone placed four meters from and perpendicular to the exhaust outlet of a snowmobile at a height of 1.22 meters above ground level. While applying brakes, the operator opens the throttle to maintain the engine speed at a steady 4,000 RPM. The A-weighted slow dynamic response noise level is then recorded. The test procedure requires two consecutive measurements within 2 decibels, which are averaged and adjusted for the type of surface on which the snowmobile was tested. Two decibels are subtracted when tested on grass or unpacked snow and four decibels subtracted when tested on a hard surface such as packed snow, pavement or gravel. Copies of the two current test procedures and the proposed modified test procedure are included in Appendix C.

3.2 Dynamometer Measurements of OHV Noise Emissions

The major noise sources for motorcycles and ATVs are:

- Engine exhaust system;
- Engine intake;
- Engine cylinder and drive train;
- Chain; and
- Tire/surface interaction.

Several of these sources are absent during stationary noise measurements conducted in accordance with SAE J-1287. Their absence may account in part for differences in the level and character of noise emissions vis-à-vis those measured by the EPA F-76a pass-by test with the engine accelerating under load. Loading the engine causes it to work harder, thereby altering its noise emissions due to increased combustion, mechanical, and flow noise. The purpose of the dynamometer testing was to quantify the effects of engine load on vehicle noise emissions, and to investigate the contributions of noise sources other than the exhaust system to overall noise emissions.

3.2.1 Measurement Method and Procedure

Dynamometer measurements were conducted in the FMF facility in Rancho Dominguez, California in October, 2003. A Dynojet Model 250 dynamometer at this facility applies a fixed load to the vehicle under test. The dynamometer room measured 25′ x 30′ x 10′ high, and was acoustically treated prior to the testing with 4 inches of fiberglass duct-liner board on the walls and 2 inches on the ceiling to reduce room-reflections that might influence the measurements.

Eight microphones were positioned as shown in Figure 3-1. Microphones 1 and 7 were located 20 inches from the exhaust outlet and 45 degrees to the exhaust axis per SAE J-1287. Microphones 2 and 3 were positioned 20 inches from the engine cylinder. Microphones 4 and 5 were positioned 20 inches from the muffler casing. Microphone 6 was positioned 20 inches from the chain. Microphone 8 was positioned 6 feet from the front of the vehicle. The intent of microphone 8 was to monitor the overall noise of the vehicle. The 6 feet distance was the greatest distance possible due to limitations of space in the dynamometer room.

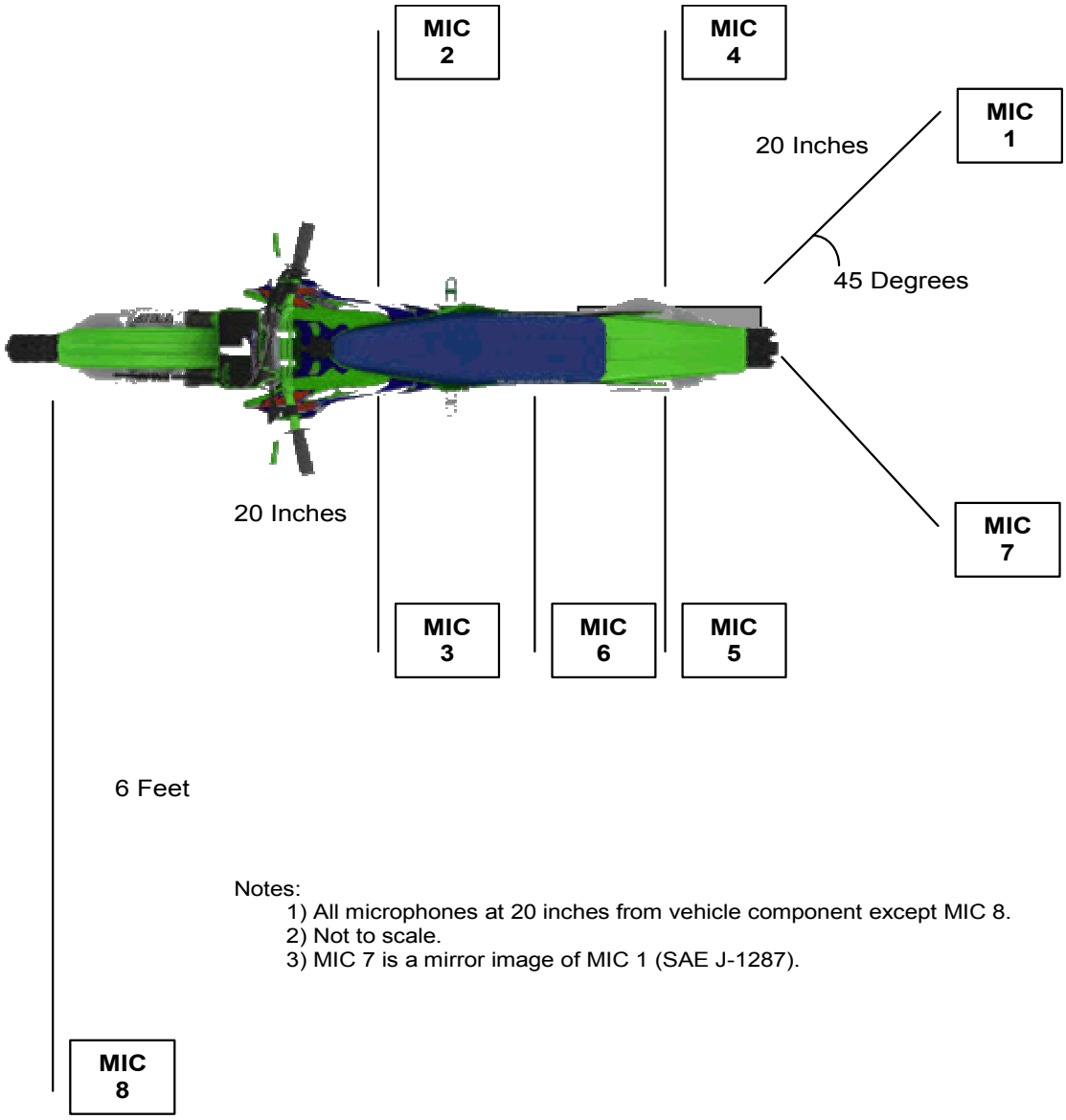


Figure 3-1. Dynamometer Testing Equipment Setup

3.2.2 Measurement Results

Detailed information regarding the ambient dynamometer room noise levels and sound intensity measurements performed to validate the sound pressure level measurements may be found in Appendix D.

Measurements were conducted on five vehicles (three motorcycles and two ATVs) to investigate OHV sound sources, and the relationship between EPA qualification testing by the EPA F-76a acceleration test method and the SAE J-1287 stationary enforcement test. The EPA F-76a test procedure was simulated by operating the vehicle in accordance with the requirements of the test standard, except the vehicle remained in a stationary position on the dynamometer with only the

rear wheel spinning, and non-standard microphone measurement positions were employed. The noise level at the 50-foot microphone position specified in EPA F-76a was not measured. The intent of the six-foot measurement position was for evaluation of the relative noise levels between vehicles and between microphone positions. The standard SAE J-1287 stationary measurements conformed to all test requirements. Additional measurements were made with the dynamometer operating at the EPA F-76a engine speed as well as at the SAE J-1287 engine speed. The measurement conditions were as follows:

- Simulation of the EPA F-76a test method with the vehicle stationary;
- Standard SAE J-1287 testing;
- Modified SAE J-1287 testing using:
  - EPA F-76a engine RPM;
  - Vehicle in gear with inertial dynamometer loading;
  - Vehicle in gear with inertial dynamometer loading and engine operating at the EPA F-76a RPM;
  - Vehicle in gear with the dynamometer providing different percentages of full load on the engine at:
    - SAE J-1287 RPM; and
    - EPA F-76a RPM.

This range of measurement conditions permitted comparison of individual sound sources and overall vehicle noise emissions in the EPA F-76a and SAE J-1287 procedures. It also permitted investigation of potential alternative methods and/or measurement locations for improving the stationary enforcement test for identifying vehicles that do not meet the EPA F-76a noise standards.

The motorcycles tested were a Honda CRF-450R (a water-cooled four-stroke), a Yamaha YZ-250 (a water-cooled two-stroke), and a Honda XR-400R (an air-cooled four-stroke). The ATVs tested were a Honda TRX-400EX and a Kawasaki KFX-700. Each vehicle was tested with stock mufflers and an after-market muffler.

3.2.3 Comparison of Noise Emissions Under SAE J-1287 and EPA F-76a Test Conditions

The results of the dynamometer noise measurements allow for comparison of vehicle noise emissions in California's constant engine speed measurement condition with its emissions in a simulation of EPA F-76a's pass-by conditions. Because the noise emissions of vehicles change with operating conditions, the testing of one vehicle, a Honda CRF-450R, was tested in a stationary mode under various engine load conditions. This stationary testing was performed in accordance with the SAE J-1287 test procedures, except the clutch was engaged with the wheels driven on the dynamometer under an engine load. Measurements were made at the engine speeds specified by both the SAE J-1287 and EPA F-76a test procedures. The engine load conditions used during SAE J-1287 testing of this vehicle were 50%, 75% and 100% of full load.

The results of these measurements are presented in Figure 3-2 and show the noise emissions in the simulated EPA F-76a and in the SAE J-1287 procedure with the engine fully loaded operating at the EPA F-76a engine speed (73% of redline RPM (engine speed)) were within +/- 1 dBA at all microphone positions. The measured noise levels of the simulated EPA F-76a test must represent the noise emissions of the vehicle under fully loaded conditions because the matching noise levels of the SAE J-1287 measurements were made under 100% load at the EPA F-76a specified RPM. The only missing component of this simulated measurement is the tire/road surface interaction noise not present during dynamometer testing. The noise levels measured for lower engine load and engine speed conditions for this vehicle fall in intermediate ranges between the fully loaded and unloaded noise levels. Due to the concerns about engine failure caused by the strain placed upon this vehicle during the loaded stationary tests, no other vehicles were tested under these extreme conditions.

Conditions for noise emission measurements for the remaining vehicles included the EPA F-76a simulation and the SAE J-1287 stationary test at both the EPA F-76a and SAE J-1287 engine RPM with the rear wheel either stationary or rotating with the dynamometer under no load. The results of these tests may be found in Appendix D with additional discussion and analysis of the test data. Also included in Appendix D is an investigation into alternate microphone positions for improving the relationship between the stationary and moving vehicle test results. The investigation indicated that the alternate microphone positions explored did not improve this relationship.

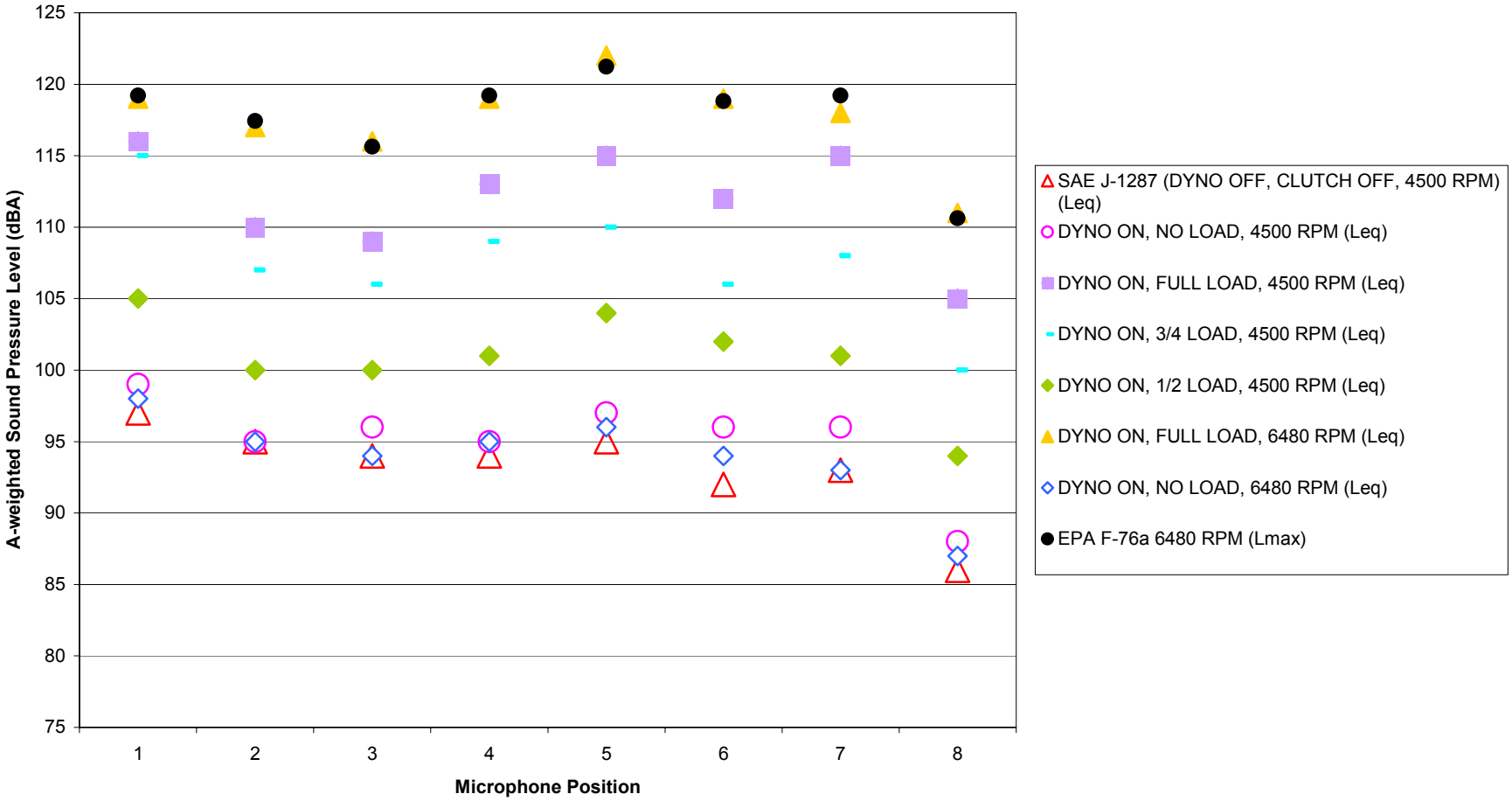


Figure 3-2. Honda CRF-450R Dynamometer Noise Measurements

3.2.4 Spectral Content of Engine Emissions under Various Load Conditions

Frequency analyses were conducted to compare the spectral composition of vehicle noise emissions under various load conditions. Figures 3-3 and 3-4 show the spectral content of noise levels measured at Microphone 1 for the SAE J-1287 test position under various test conditions for the Honda CRF-450R. Figure 3-3 compares the frequency spectrum of noise during testing at the SAE J-1287 engine speed of 4500 RPM under the following test conditions:

- Standard SAE J-1287 test;
- SAE J-1287 test with dynamometer operating with no load;
- SAE J-1287 test with dynamometer providing:
  - ½ of full engine load;
  - ¾ of full engine load; and
  - Full load.

Figure 3-3 also shows the ambient noise level in the room.

Figure 3-3 shows the spectrum of the vehicle's noise emissions in the SAE J-1287 test is quite different from that of the vehicle under engine load. Figure 3-4 confirms this by comparing the spectrum of the EPA F-76a test at 6480 RPM with modified SAE J-1287 tests run at 6480 RPM (the standard SAE J-1287 engine speed for this vehicle is 4500 RPM) with the engine under no load (dynamometer on, no load), and with the engine under full load (dynamometer on, 100% load).[4] The change in the frequency spectrum of the noise between the no-load (SAE J-1287 test procedure) and full-load (EPA F-76a test procedure) conditions is one of the main reasons there is no simple relationship between the EPA F-76a and SAE J-1287 test methods. Another interesting aspect of Figure 3-4 is the close relationship in the spectra of the EPA F-76a test performed at 6480 RPM and the modified SAE J-1287 test performed at 6480 RPM and 100% engine load. Because the spectrum of the modified SAE J-1287 test performed with the engine fully loaded is similar to that of the EPA F-76a spectrum, it is apparent that the EPA F-76a test procedure measures the vehicle noise under fully loaded conditions.

[4] Note the vehicle in the standard SAE J-1287 test is stationary, while these modified SAE J-1287 tests had the wheels rotating with the engine under no load for one test and under full load for the second test.

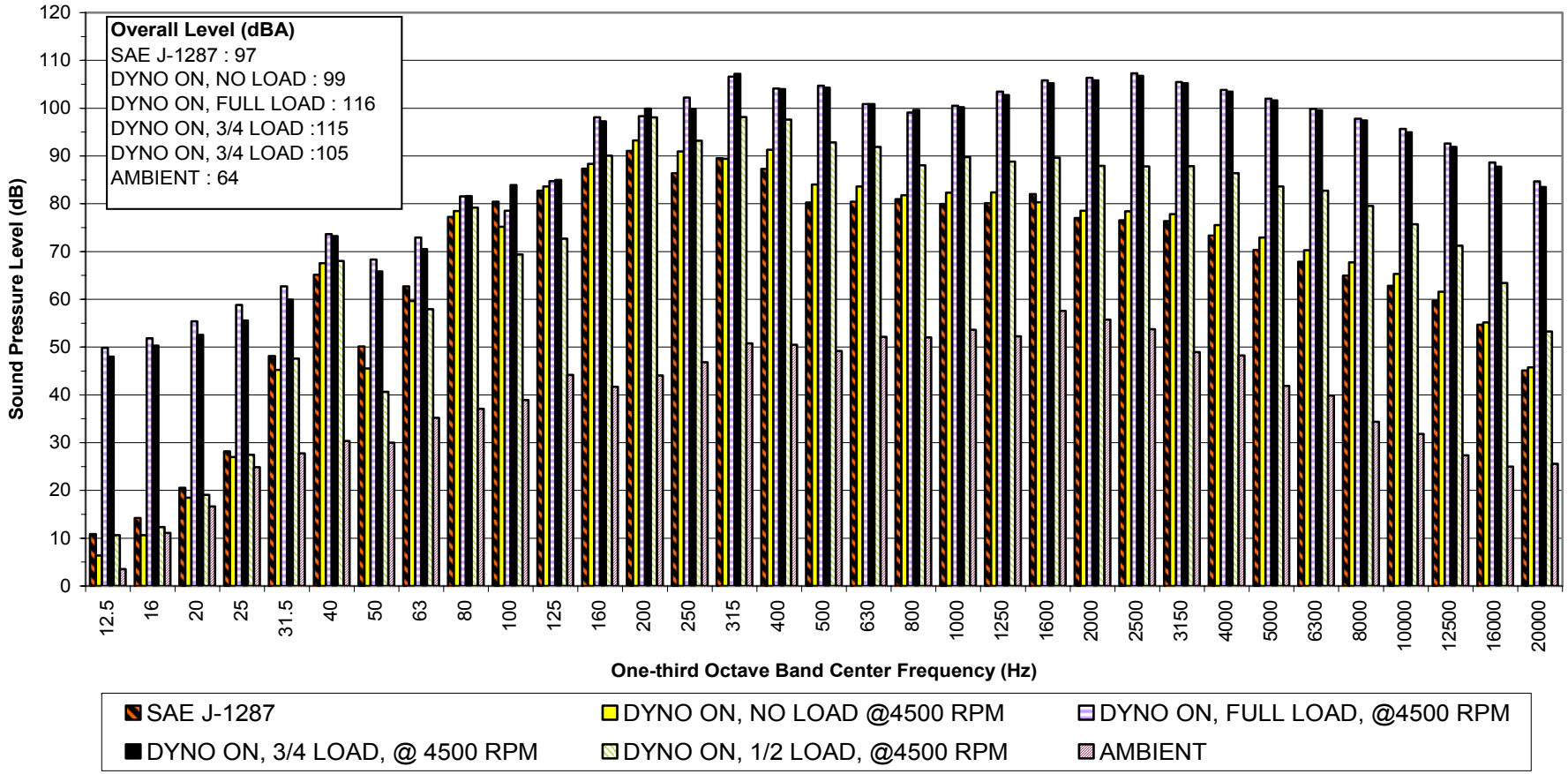


Figure 3-3. Dynamometer Testing Frequency Spectrum, Honda CRF-450R, 4500 RPM, Microphone #1

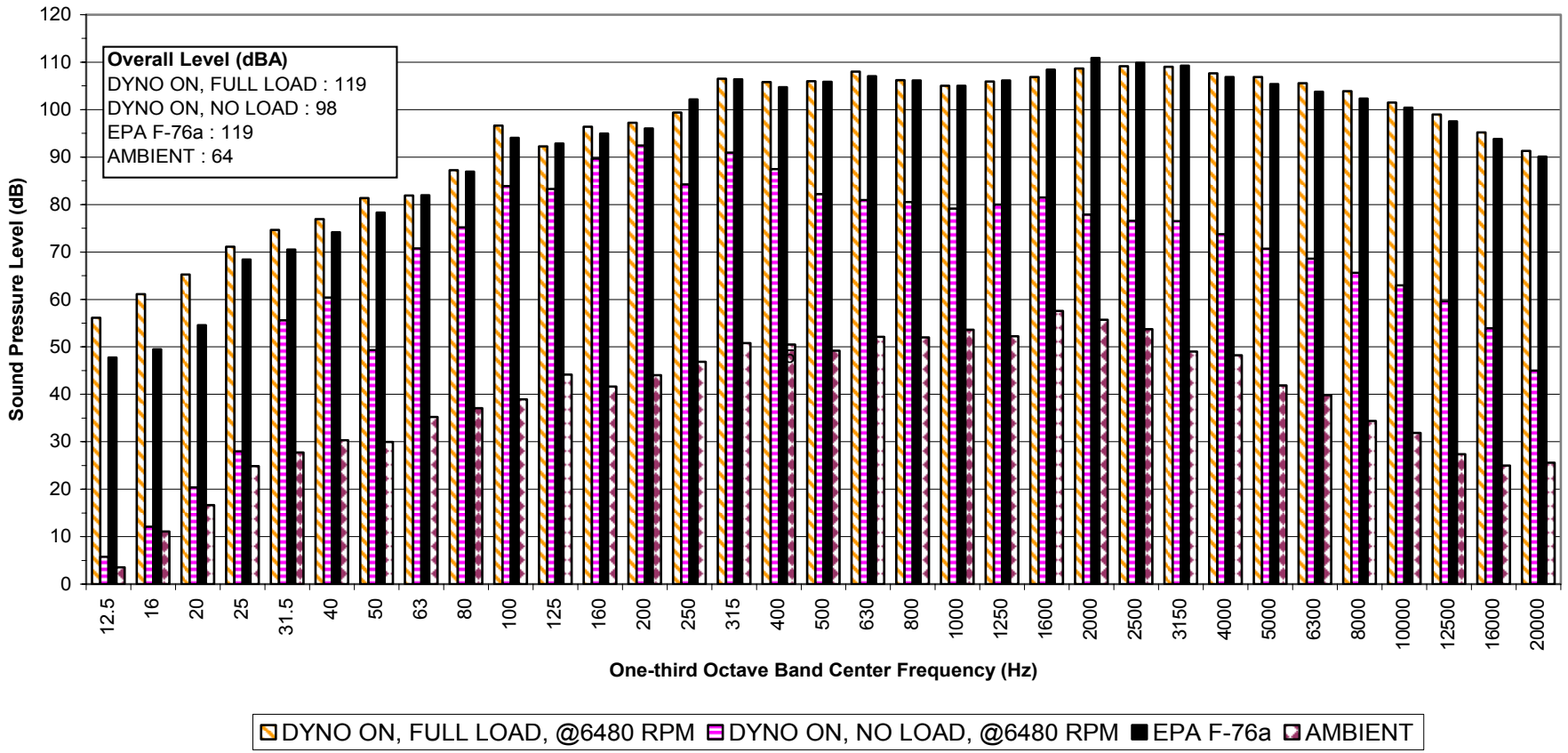


Figure 3-4. Dynamometer Testing Frequency Spectrum, Honda CRF-450R, 6480 RPM, Microphone #1

3.2.5 Dynamometer Testing Conclusions

Noise measurements in the dynamometer room indicate noise sources other than the muffler exhaust contribute to overall vehicle noise emissions, and the SAE J-1287 test procedure emphasizes exhaust noise due to its measurement location near the muffler. The measurements also confirm that no fully predictive relationship can exist between noise levels as measured by SAE J-1287 and EPA F-76a procedures. The limited relationship between the two test results is attributable to 1) noise created by sources for which the SAE J-1287 test method was not intended to measure, and 2) procedural differences between the SAE J-1287 and EPA F-76a measurements that result in different engine loading conditions which in turn cause differences in the spectral content of the engine noise.

4.0 Field Measurements of OHV Noise

Section 4.1 discusses the field measurements used to compare pass-by and static noise levels. Section 4.2 presents the results of the measurements. Sections 4.3 and 4.4 present the results of in-situ noise measurements. Section 4.5 discusses the investigation into other measurement positions. Section 4.6 contains the chapter's conclusions.

4.1 Comparisons of Pass-by and Static Noise Levels

Field measurements were conducted for the purpose of comparing compliance/failure results of EPA F-76a and ISO-362 pass-by tests and stationary tests of motorcycles and all-terrain vehicles representing a cross-section of OHVs currently in use. Two goals of the measurements were 1) to determine the lowest SAE J-1287 enforcement level that would not surpass the EPA requirements as measured by EPA F-76a; and 2) to investigate the possibility of a new or modified enforcement test with a better relationship to EPA F-76a.

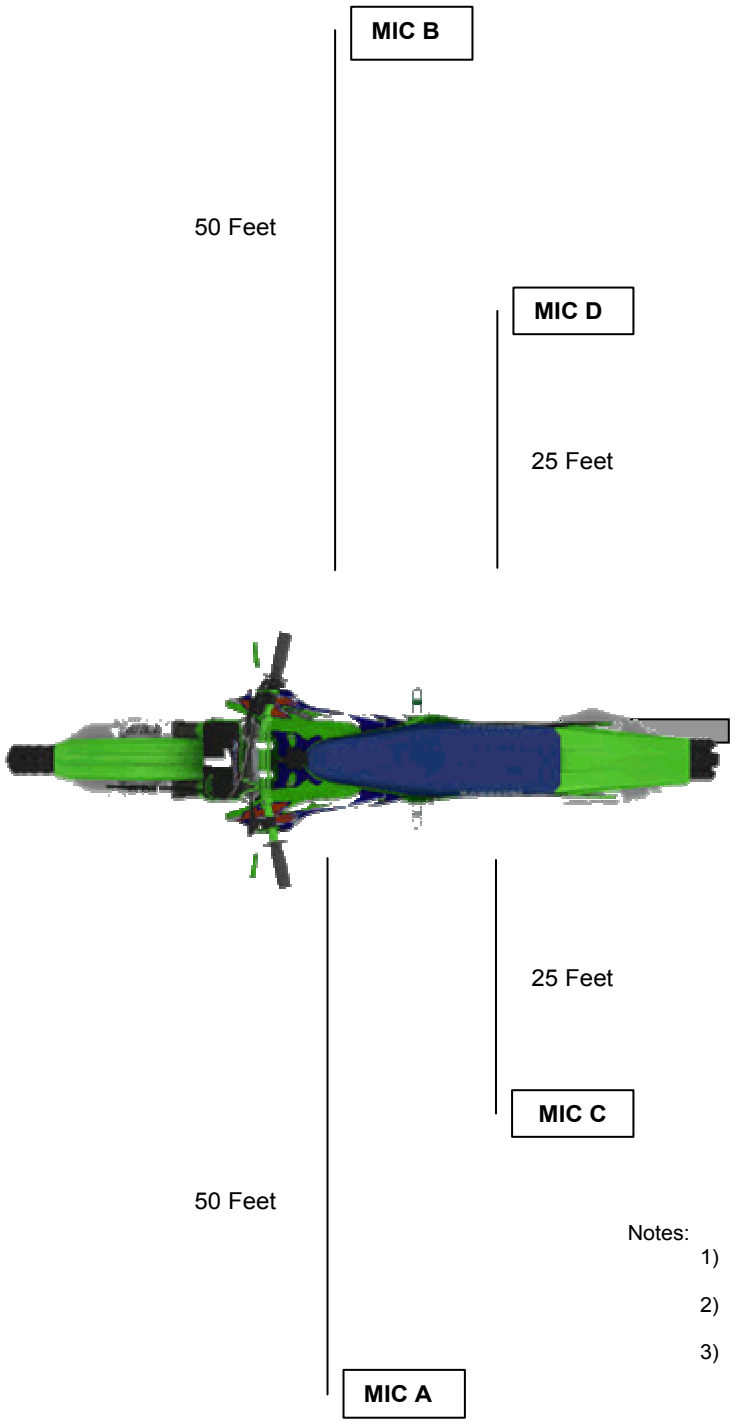
The vehicles tested included competition motorcycles which are not required to conform to the EPA F-76a noise limits, but cannot use public lands without conforming to SAE J-1287 noise limits.[5] The stationary tests include SAE J-1287, ISO- 5130, and other plausible test methods. Vehicle testing was conducted at Cable Airport in Upland, California. A taxiway leading from airplane hangars to the runway provided a large asphalt area meeting the basic requirements of the EPA F-76a test. There was also a dirt area adjacent to the taxiway for use in replicating field enforcement conditions for stationary testing of vehicles.

Sound level meters positioned along the taxiway recorded noise levels at 25 feet from the vehicle for ISO-362, and 50 feet from the vehicle for EPA F-76a. Figure 4-1 illustrates this test setup. Figure 4-2 indicates the location of microphones relative to the test vehicle for the stationary testing. In this diagram, each numbered microphone location represents a sound level meter. A data recorder was used to record signals only from microphones 1 through 8.

A California OHV registration database was obtained to guide selection of vehicles to represent those commonly found in OHV riding areas. Some of these vehicles were tested with stock and after-market mufflers to provide a broader range of vehicles.

Each vehicle was first tested according to the EPA F-76a and ISO-362 procedures. Engineers monitored the sound level meter positions located on each side of the vehicle path. They noted the sound level for each pass-by of the vehicle and notified the vehicle operator if any discrepancies were observed. The EPA F-76a test method requires measuring six pass-bys within

[5] According to EPA, a "competition" motorcycle has at least four of the following six features: 10 inches of suspension travel, no lights, no manufacturer's warranty, no functional seat, an engine displacement greater than 50cc, and no spark arrester. Such vehicles are designed for closed course, trials, and road racing rather than general OHV use. Part 205 of 40 CFR exempts "competition" motorcycles from distribution-in-commerce noise limits, but still requires muffler marking. There is no technical basis or legal requirement for California to exempt such motorcycles from enforcement of operational noise emission levels.



Notes:
1) Microphones A and B at 50 feet utilized for Federal EPA F-76a testing.
2) Microphones C and D at 25 feet utilized for ISO-362 testing.
3) Not to Scale.

Figure 4-1. Microphone Measurement Locations for Pass-by Testing at Cable Airport

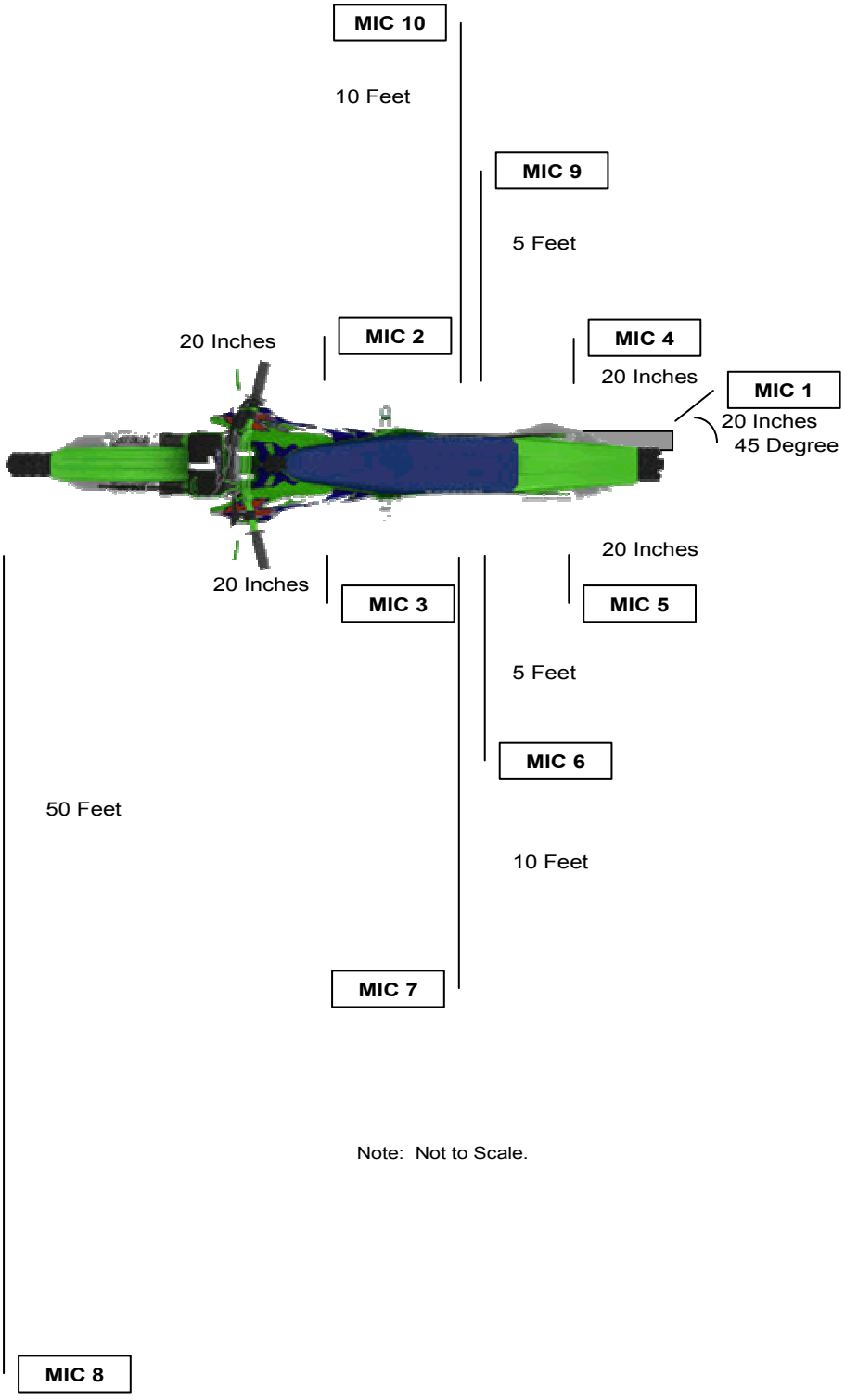


Figure 4-2. Microphone Measurement Locations for Stationary Testing at Cable Airport

two decibels of each other. The highest and lowest values are dropped, and the arithmetic average sound level from the side with the higher noise levels is reported. ISO-362 requires four consecutive pass-bys within 2 decibels of each other, and reporting the arithmetic average sound level from the side with the higher noise levels.

After the pass-by test was completed, the vehicle was moved to the stationary test location. The operator adjusted the throttle for constant SAE J-1287 test RPM and the sound level was recorded. The SAE J-1287 test was then repeated at the EPA F-76a engine speed on a few of the vehicles, after which the ISO-5130 test was performed. Several vehicles were then moved to a maintenance station where the muffler was changed for a second set of measurements.

4.2 Results of Comparative Measurements

Table 4-1 summarizes the noise levels measured during testing conducted April 5-6, 2004, August 11-12, 2004, and October 13, 2004. Additional data may be found in Appendix E. Many, but not all, of the vehicles with stock exhaust systems met the EPA F-76A standards, even though they were not new vehicles, and the mileages and maintenance histories were unknown. The noise emissions of vehicles labeled for competition were typically between 95 and 99 dBA per SAE J-1287. When these competition motorcycles were fitted with quieter after-market exhaust systems, their noise emissions were reduced by 2 to 9 dBA and complied with the non-competition vehicle noise limit of 96 dBA of the California OHV Noise Standard.

Table 4-1 includes two columns indicating whether the vehicle complied with the appropriate noise level limits as measured by the EPA F-76a (labeling limits) and SAE J-1287 (California operational) test methods. All vehicles that complied with the EPA F-76A noise limit also complied with the California OHV Noise Standard. However, the SAE J-1287 enforcement test also passed every motorcycle in the test fleet for which the EPA F-76a test result was as much as 10 dBA greater than the EPA F-76A noise limit, and even passed some motorcycles 12 to 15 dBA greater than the EPA F-76a noise limit. For ATVs, the SAE J-1287enforcement test passed one ATV whose emissions exceeded the EPA F-76a noise limit by 7 dBA.

The lowest enforcement level for motorcycles in the test fleet that does not fail motorcycles conforming to the EPA F-76a requirements is 90 dBA. Table 4-2 identifies the motorcycles that would pass and fail using this 90 dBA limit, showing that the SAE J-1287 test procedure using a 90 dBA limit does not fail any motorcycle tested within the test fleet that passed the EPA F-76a test. This modified limit fails most other tested motorcycles that failed the EPA F-76a test, with the exception of four motorcycles that measured 1, 2, and 7 dBA over the EPA F-76a test sound level limit.

However, there are difficulties in basing the enforcement level threshold on the relationship between the EPA F-76a operational and SAE J-1287 stationary test methods. The following analysis of the statistical relationship of the data measured in this study using both test methods indicates the complexity of the issue.

Table 4-1. Vehicle Test Results

	Vehicle Characteristics						EPA F-76a		SAE	Pass/Fail by:	
Type	Manufacturer	Model	Stroke	Competition (yes or no)	Cooling (Air or Water)	Exhaust System	Sound Limit, dBA	Test Result, dBA	J-1287 Test Result, dBA	EPA F-76a	SAE J-1287, 96 dBA limit
MOTORCYCLE	HONDA	CRF-450R	4	YES	Water	FMF "Q"	82	87	93	F	P
	HONDA	CRF-450R	4	YES	Water	Stock	82	96	99	F	F
	SUZUKI	RM250	2	YES	Water	FMF SHORTY	82	89	94	F	P
	SUZUKI	RM250	2	YES	Water	Stock	82	89	96	F	P
	SUZUKI	RM250	2	YES	Water	FMF TURBINE CORE 2	82	92	95	F	P
	YAMAHA	YZ-250	2	YES	Water	FMF "Q"	82	89	93	F	P
	YAMAHA	YZ-250	2	YES	Water	FMF "Q"	82	92	95	F	P
	YAMAHA	YZ-250	2	YES	Water	Stock	82	94	95	F	P
	YAMAHA	YZ-250	2	YES	Water	FMF SHORTY	82	95	96	F	P
	YAMAHA	YZ-250F	4	YES	Water	BIG GUN RACE	82	96	104	F	F
	HONDA	CR-85R	2	YES	Water	FMF SHORTY	80	95	97	F	F
	YAMAHA	YZ-125	2	YES	Water	FMF TURBINE CORE 2	80	89	91	F	P
	YAMAHA	YZ-125	2	YES	Water	Stock	80	89	95	F	P
	YAMAHA	YZ-125	2	YES	Water	Stock	80	94	93	F	P
	YAMAHA	YZ-125	2	YES	Water	FMF SHORTY	80	97	98	F	F
	KTM	200 EXC	2	no	Water	Stock (Modified air box)	82	89	87	F	P
	KTM	525EXC	4	no	Water	Stock	82	97	95	F	P
	HONDA	CRF-250X	4	no	Water	Stock	82	75	88	P	P
	HONDA	CRF-250X	4	no	Water	Stock	82	81	90	P	P
	HONDA	CRF-250X	4	no	Water	FMF "Q"	82	83	91	F	P
	HONDA	CRF-250X	4	no	Water	YOSHIMURA QUIET	82	85	93	F	P
	HONDA	CRF-250X	4	no	Water	MODIFIED Stock	82	85	96	F	P
	HONDA	CRF-250X	4	no	Water	PC496 PERFORMANCE	82	91	95	F	P
	YAMAHA	TTR-230	4	no	Air	Stock	82	81	88	P	P
	YAMAHA	WR250	2	no	Water	FMF "Q"	82	93	99	F	F
	YAMAHA	WR-250F	4	no	Water	Stock (Broken air box)	82	89	86	F	P
	HONDA	XR-400R	4	no	Air	Stock	82	84	89	F	P
	HONDA	XR-400R	4	no	Air	HONDA MODIFIED TIP	82	88	95	F	P
	HONDA	XR-400R	4	no	Air	FMF "Q"	82	90	91	F	P
	HONDA	XR-400R	4	no	Air	PROCIRCUIT T4	82	93	98	F	F
	HONDA	CRF-150F	4	no	Air	Stock	80	80	86	P	P
	HONDA	XR-80R	4	no	Air	Stock	80	81	84	F	P
ATV	HONDA	SPORTREX 90				Stock	80	75	80	P	P
	YAMAHA	YFZ450				Stock	82	77	84	P	P
	HONDA	TRX450R				Stock	82	78	84	P	P
	HONDA	FOREMAN				FMF POWERLINE	82	78	91	P	P
	HONDA	RECON 250				Stock	82	79	84	P	P
	HONDA	FOREMAN				Stock	82	79	89	P	P
	SUZUKI	LTZ400				Stock	82	79	87	P	P
	KAWASAKI	KFX700				YOSHIMURA	82	89	95	F	P

* Vehicles labeled “Competition Only” cannot legally be used on public lands within California without conforming to California’s sound limits as measured by SAE J-1287.

Table 4-2. Vehicle Test Data Compared to SAE J-1287 Test with 90 dBA Limit

	Vehicle Characteristics						EPA F-76a		SAE	Pass/Fail by:		
											SAE J-1287	
Type	Manufacturer	Model	Stroke	Competition (yes or no)	Cooling (Air or Water)	Exhaust System	Sound Limit, dBA	Test Result, dBA	J-1287 Test Result, dBA	EPA F-76a	96 dBA Limit	90 dBA Limit
MOTORCYCLE	HONDA	CRF-450R	4	YES	Water	FMF "Q"	82	87	93	F	P	F
	HONDA	CRF-450R	4	YES	Water	Stock	82	96	99	F	F	F
	SUZUKI	RM250	2	YES	Water	FMF SHORTY	82	89	94	F	P	F
	SUZUKI	RM250	2	YES	Water	Stock	82	89	96	F	P	F
	SUZUKI	RM250	2	YES	Water	FMF TURBINE CORE 2	82	92	95	F	P	F
	YAMAHA	YZ-250	2	YES	Water	FMF "Q"	82	89	93	F	P	F
	YAMAHA	YZ-250	2	YES	Water	FMF "Q"	82	92	95	F	P	F
	YAMAHA	YZ-250	2	YES	Water	Stock	82	94	95	F	P	F
	YAMAHA	YZ-250	2	YES	Water	FMF SHORTY	82	95	96	F	P	F
	YAMAHA	YZ-250F	4	YES	Water	BIG GUN RACE	82	96	104	F	F	F
	HONDA	CR-85R	2	YES	Water	FMF SHORTY	80	95	97	F	F	F
	YAMAHA	YZ-125	2	YES	Water	FMF TURBINE CORE 2	80	89	91	F	P	F
	YAMAHA	YZ-125	2	YES	Water	Stock	80	89	95	F	P	F
	YAMAHA	YZ-125	2	YES	Water	Stock	80	94	93	F	P	F
	YAMAHA	YZ-125	2	YES	Water	FMF SHORTY	80	97	98	F	F	F
	KTM	200 EXC	2	no	Water	Stock (Modified air box)	82	89	87	F	P	P
	KTM	525EXC	4	no	Water	Stock	82	97	95	F	P	F
	HONDA	CRF-250X	4	no	Water	Stock	82	75	88	P	P	P
	HONDA	CRF-250X	4	no	Water	Stock	82	81	90	P	P	P
	HONDA	CRF-250X	4	no	Water	FMF "Q"	82	83	91	F	P	F
	HONDA	CRF-250X	4	no	Water	YOSHIMURA QUIET	82	85	93	F	P	F
	HONDA	CRF-250X	4	no	Water	MODIFIED Stock	82	85	96	F	P	F
	HONDA	CRF-250X	4	no	Water	PC496 PERFORMANCE	82	91	95	F	P	F
	YAMAHA	TTR-230	4	no	Air	Stock	82	81	88	P	P	P
	YAMAHA	WR250	2	no	Water	FMF "Q"	82	93	99	F	F	F
	YAMAHA	WR-250F	4	no	Water	Stock (Broken air box)	82	89	86	F	P	P
	HONDA	XR-400R	4	no	Air	Stock	82	84	89	F	P	P
	HONDA	XR-400R	4	no	Air	HONDA MODIFIED TIP	82	88	95	F	P	F
	HONDA	XR-400R	4	no	Air	FMF "Q"	82	90	91	F	P	F
	HONDA	XR-400R	4	no	Air	PROCIRCUIT T4	82	93	98	F	F	F
	HONDA	CRF-150F	4	no	Air	Stock	80	80	86	P	P	P
	HONDA	XR-80R	4	no	Air	Stock	80	81	84	F	P	P
ATV	HONDA	SPORTREX 90				Stock	80	75	80	P	P	n/a
	YAMAHA	YFZ450				Stock	82	77	84	P	P	
	HONDA	TRX450R				Stock	82	78	84	P	P	
	HONDA	FOREMAN				FMF POWERLINE	82	78	91	P	P	
	HONDA	RECON 250				Stock	82	79	84	P	P	
	HONDA	FOREMAN				Stock	82	79	89	P	P	
	SUZUKI	LTZ400				Stock	82	79	87	P	P	
	KAWASAKI	KFX700				YOSHIMURA	82	89	95	F	P	

* Vehicles labeled “Competition Only” cannot legally be used on public lands within California without conforming to California sound limits as measured by SAE J-1287.

The vehicle test data also support the earlier conclusion that no fully predictive relationship exists between noise levels measured by the SAE J-1287 and EPA F-76a procedures.

Figure 4-3 illustrates the relationship between noise emissions as measured by the SAE J-1287 and EPA F-76a test methods for the 40 vehicles tested under both methods. The linear correlation between the two noise measurements (0.82) leaves one-third of the variance in the relationship between the two measurement methods unexplained. Regression analysis indicates the SAE J-1287 value may be predicted from the EPA F-76a measurement by multiplying the EPA F-76a measurement by 0.643 and adding 36 decibels. Alternatively, the EPA F-76a value may be predicted from the SAE J-1287 measurement by multiplying the SAE J-1287 measurement by 1.04 and subtracting 9 decibels.

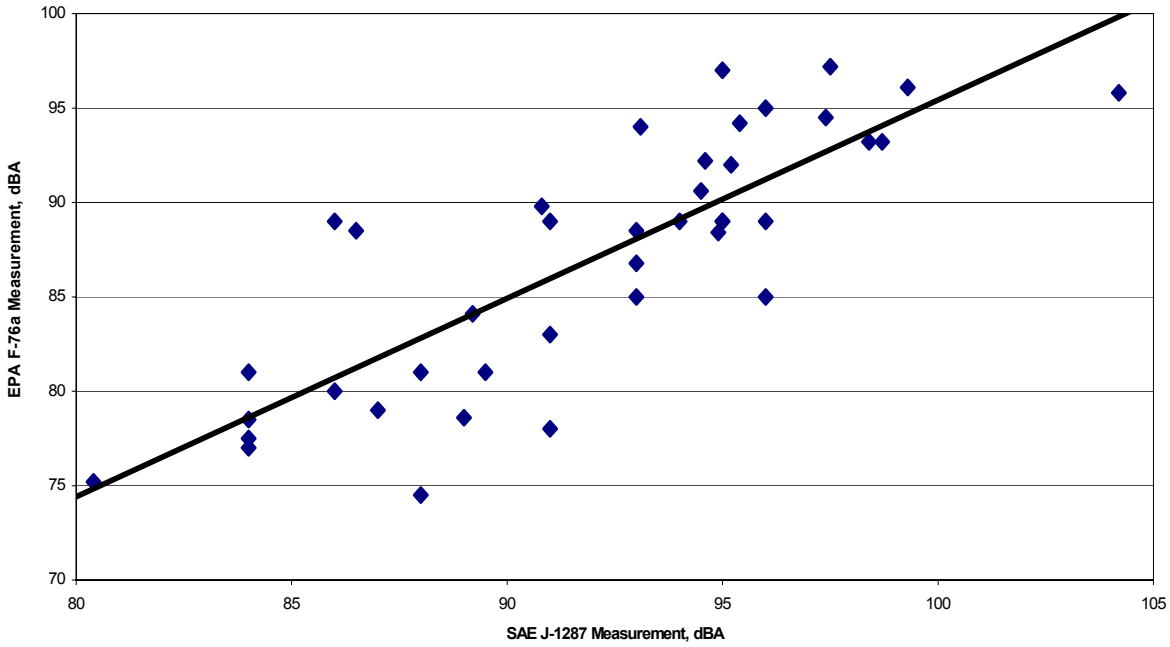


Figure 4-3. Relationship Between Noise Emissions of 40 Motorcycles and ATVs as Measured by SAE J-1287 and EPA F-76a Methods

Because the relationship between the SAE J-1287 (the stationary enforcement method measured at 20 inches) and EPA F-76a (total vehicle noise measured at 50 feet) measurements is imperfect, the errors of prediction can be large. When EPA F-76a values are predicted from SAE J-1287 measurements, the error of prediction can be as much as 7.9 dBA, and the average (unsigned) error of prediction is 2.9 dBA. When SAE J-1287 values are predicted from EPA F-76a measurements, the error of prediction can be as much as 7.2 dBA, and the average (unsigned) error of prediction is 2.3 dBA.

For example, consider the stock Honda CRF-250X motorcycle. The measured SAE J-1287 noise level was 88 dBA and the EPA F-76a noise level was 75 dBA. The "regression line" in Figure 4-3

predicts 82.9 dBA for the EPA F-76a noise level based on the SAE J-1287 measured value. The prediction is 7.9 dBA greater than the measured value of 75 dBA.

Because the relationship between noise emissions measured by the SAE J-1287 and EPA F-76a test procedures is uncorrelated, any effort to construct a rationale for setting California's noise level threshold for operational noise enforcement purposes on the basis of the relationship between EPA F-76a and SAE J-1287 noise measurements can lead to significant prediction errors. Average errors of prediction greater than 2 dBA and maximum errors approaching 8 dBA are counterproductive for enforcement purposes because they are likely to complicate enforcement by inviting challenge.

4.3 Measurements Conducted at Various OHV Sites

Noise measurements were conducted at the following three OHV recreation sites to assess the percentage of vehicles conforming to the California OHV Noise Standard:

- Jawbone Canyon (Federal Bureau of Land Management, BLM);
- Hollister Hills SVRA; and
- Hungry Valley SVRA.

At Jawbone Canyon (BLM) and Hungry Valley SVRA, noise emissions of enthusiasts' vehicles were measured on an informational rather than enforcement basis. Table 4-3 summarizes these measurements. More detailed information may be found in Appendix F.

Table 4-3. OHV Recreational Site Vehicle Testing

OHV SITE	MOTORCYCLES			ATVs	TOTAL VEHICLES
	2-Stroke	4-Stroke	Total		
Jawbone Canyon (BLM)	16	32	48	6	54
Hollister Hills SVRA	21	43	64	7	71
Hungry Valley SVRA	29	36	65	9	74

OHV SITE	TOTAL VEHICLES	CONFORMING		NON-CONFORMING	
		NUMBER	PERCENTAGE	NUMBER	PERCENTAGE
Jawbone Canyon (BLM)	54	43	80%	11	20%
Hollister Hills SVRA	71	47	66%	24	34%
Hungry Valley SVRA	74	44	59%	30	41%
Totals/Averages	199	134	67%	65	33%

No general conclusions may be drawn solely from these data because of the voluntary nature of the vehicle testing at Jawbone Canyon (BLM) and Hungry Valley SVRA, and aggressive testing of vehicles not previously certified to be in conformance at Hollister Hills SVRA. For example, while it may appear from the tables that more vehicles at Jawbone Canyon (BLM) conform to the California OHV Noise Standard than at Hollister Hills SVRA, enthusiasts operating noisy vehicles had the choice at Jawbone Canyon (BLM) to decline a test while those at Hollister Hills

SVRA were strongly encouraged and in some cases required by park rangers to test as a result of an aggressive noise testing program. However, this data can be used to approximate the change in the percentage of conforming vehicles that would result from lowering the SAE J-1287 noise limit. See Table 4-4.

Table 4-4. Effect of Reducing the SAE J-1287 Enforcement Level

OHV SITE	ENFORCEMENT LEVEL:							
	90 dBA		92 dBA		94 dBA		96 dBA	
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
Jawbone Canyon (BLM)	24%	76%	33%	67%	67%	33%	80%	20%
Hollister Hills SVRA	10%	90%	24%	76%	38%	62%	66%	34%
Hungry Valley SVRA	20%	80%	30%	70%	47%	53%	59%	41%
Average	18%	82%	29%	71%	49%	51%	67%	33%

The effect of reducing the enforcement level would be to lower the vehicle compliance from an average of 67% with the current 96 dBA limit to 49% using 94 dBA, 29% using 92 dBA, and 18% using 90 dBA for the vehicles tested in this study.

4.4 Hollister Hills State Vehicular Recreation Area Vehicle Testing

The Hollister Hills State Vehicular Recreation Area (SVRA) is a popular SVRA within the California State Park system, and is unique in that staff has actively tested motorcycles and ATVs for over two years and have maintained a comprehensive noise database.

The Hollister Hills SVRA database was analyzed to identify the year in which OHVs were manufactured as well as trends in noise level testing. Enthusiasts at Hollister Hills SVRA were strongly encouraged and sometimes required by park rangers to participate in noise tests. Figure 4-4 shows the number of OHVs tested within the SVRA by vehicle model year. Less than 4% of the in-use vehicles were manufactured prior to the January 1, 1986 grandfather date and hence required to meet a less restrictive standard of 101 dBA as measured by the SAE J-1287 test procedure. As might be expected, the number of these vehicles has also decreased over the testing period, from 109 in 2002 to 32 in 2004. Analysis of the database also indicates the number of competition vehicles manufactured prior to the January 1, 1998 grandfather date complying with the 101 dBA noise level but not complying with the 96 dBA noise level has steadily decreased from 195 vehicles in 2002, to 101 in 2003, and to 34 in 2004. This percentage of older competition vehicles tested and complying with the 101 dBA noise limit to total vehicles tested has decreased from 7.7% to 4.3% to 2.2% over this period. The vast majority (72%) of OHVs used in the SVRA today were manufactured in 2000 or later.

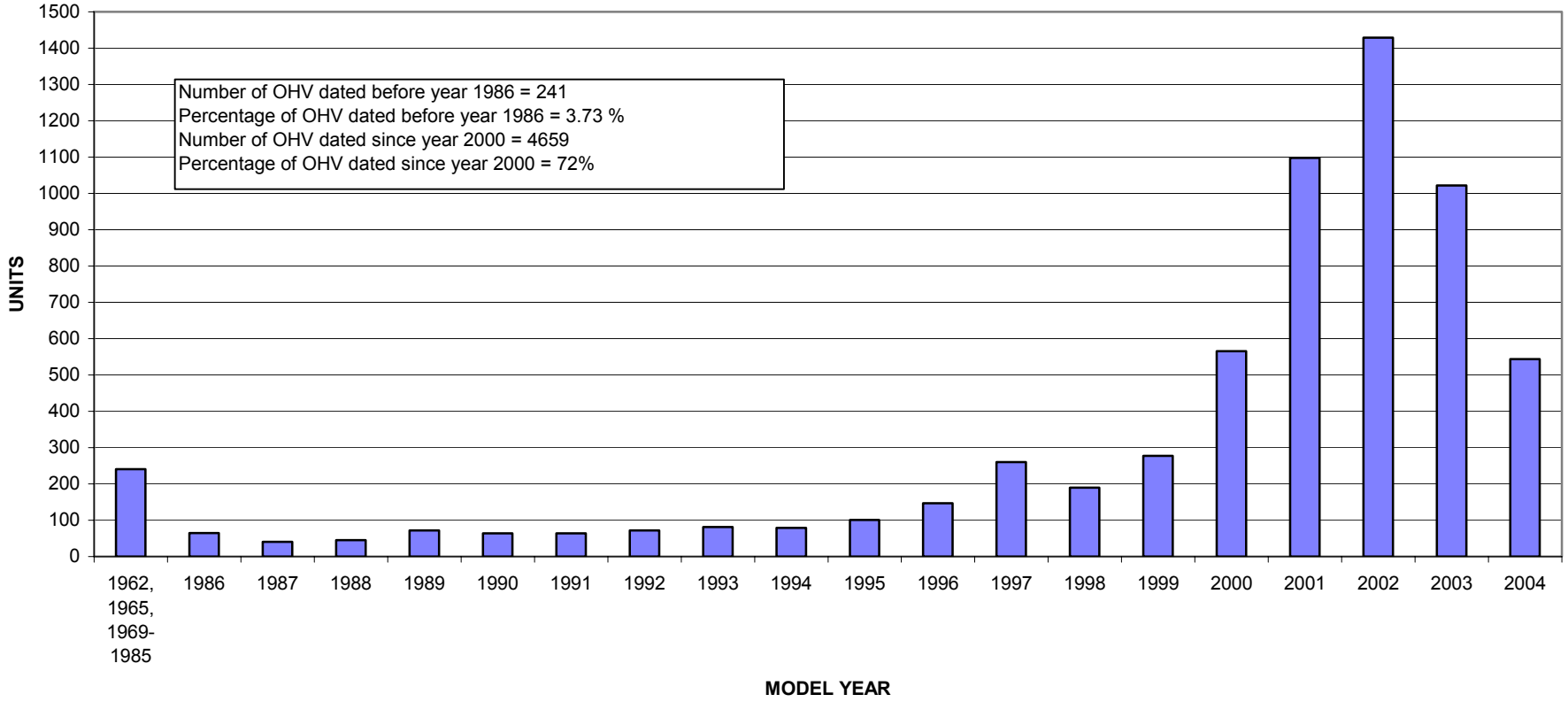


Figure 4-4. Hollister Hills SVRA Vehicle Test Data Analysis
Vehicles Tested By Model Year

Figure 4-5 illustrates the vehicle noise test level as a function of the test year. It is evident from the figure and backed by database analysis that the trend over a three-year period indicates there are fewer non-conforming OHVs using the SVRA. This decrease in non-conforming vehicles may be due to many factors, including but not limited to:

- Outreach and education of enthusiasts;
- OHV manufacturers reducing vehicle noise levels;
- Enthusiasts retiring older non-conforming OHVs;
- Lower noise emission after-market products; and
- Enforcement of OHV noise limits.

The current California OHV Noise Standard emphasizes the importance of each of the above factors.

Additional analysis of different model years of specific vehicles tested at Hollister Hills SVRA indicates a vehicle noise reduction of more than 1 dBA over a three-year manufacturing period.

4.5 Investigation into Other Stationary Test Measurement Positions

The stationary testing of vehicles at Cable Airport included all of the microphone measurement positions used in the dynamometer facility as well as 5 feet and 10 feet from both sides of the vehicle and 13 feet and 50 feet from the left side of the vehicle. The microphone position at 50 feet provided a check on the far-field noise level for comparison with the other microphone noise levels to determine the boundary between near- and far-field acoustic conditions. In the far-field, noise levels should decrease by about 6 dB per doubling of distance.

The measured data was analyzed at each microphone position to determine if the noise level measured at any one position more closely correlates with the measured EPA F-76a noise level. The dynamometer data analysis (Section 3.2) confirmed the noise measured at the SAE J-1287 microphone position near the exhaust consists primarily of exhaust noise, and therefore it cannot provide measured sound levels that relate to those of EPA F-76a procedure. The SAE J-1287 measurement position is also in the acoustic near-field, and several additional microphone positions used in the vehicle testing represented the far-field noise region. The investigation included comparison of near- and far-field microphone positions and their correlation results based on the EPA F-76a test procedure.

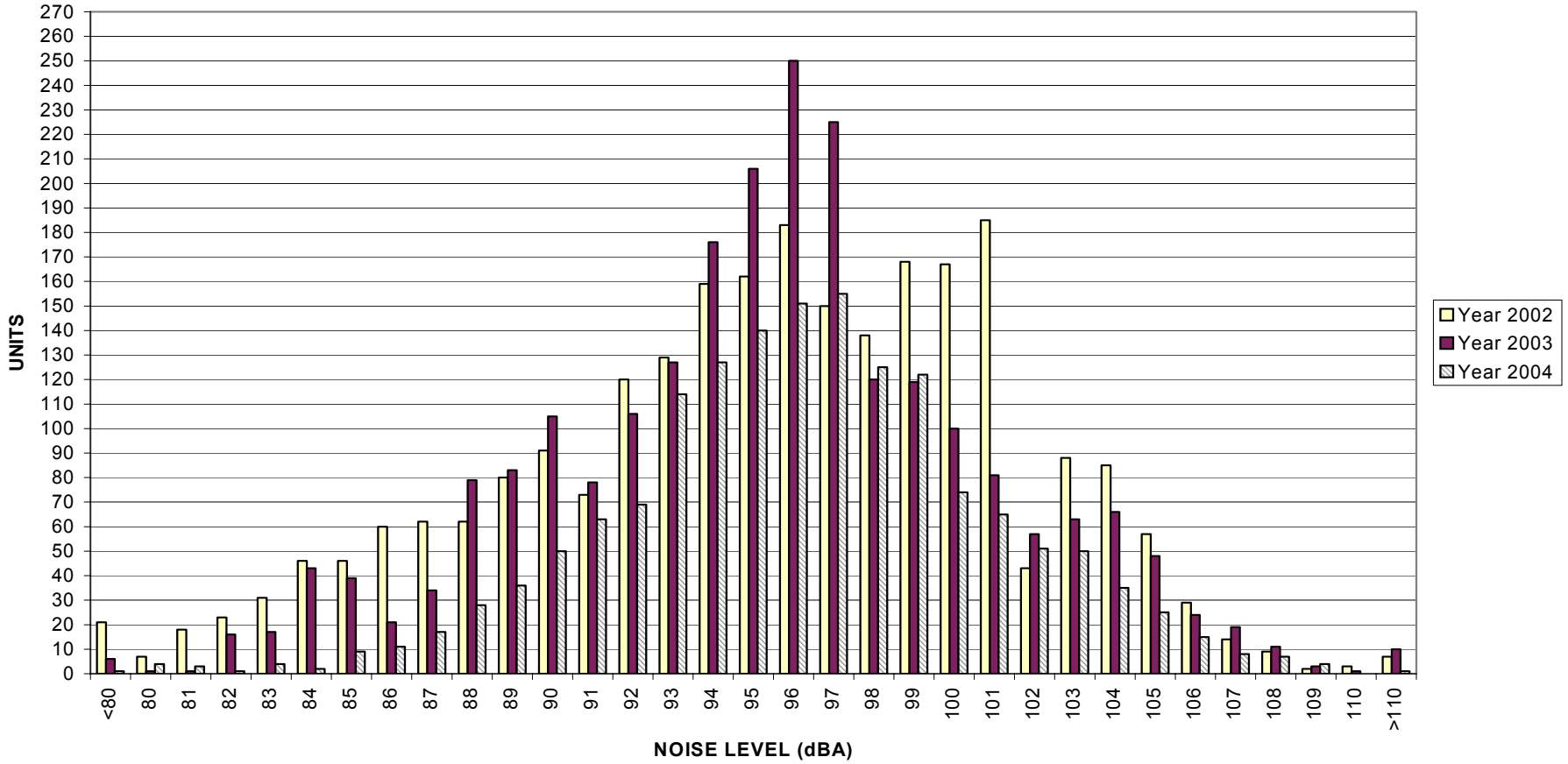


Figure 4-5. Hollister Hills SVRA Vehicle Test Data Analysis
Vehicle Sound Level by Test Year

The investigation employed two techniques. In the first, the variations in differences between the EPA F-76a noise level and each stationary measurement noise level were reviewed. The second technique established the lowest measured noise level at a position for the stationary test that did not fail vehicles complying with the EPA F-76a noise limit and evaluated the number of vehicles conforming to the California OHV Noise Standard but not in compliance with the EPA F-76a noise limit. These analyses revealed that none of the ancillary measurement positions provided benefits over the SAE J-1287 microphone position using 90 dBA as the noise level limit. See Table 4-5. The table indicates that for the SAE J-1287 stationary test of a vehicle under no engine load, the SAE J-1287 measurement position (Microphone 1) allowed the fewest number of EPA F-76a non-conforming vehicles to pass the California OHV Noise Standard, and therefore performs better than the other chosen measurement positions used in the study, including the positions chosen in the far-field noise region.

Table 4-5. Comparison of Alternate Microphone Measurement Positions for Stationary Vehicle Testing

MICROPHONE #	1	2	4	9	10
LOCATION	SAE J-1287	20 Inches From Cylinder	20 Inches From Muffler	5 Feet From Vehicle	10 Feet From Vehicle
NON-CONFORMING* VEHICLES PASSED	4	5	5	8	8

* Vehicles tested in the study and determined non-conforming with EPA labeling limits.

4.6 Conclusions

4.6.1 Study of Alternate Measurement Methods

It does not appear that another test measurement position is beneficial. A better test procedure may be possible at a higher engine speed; however, this test could result in possible harm to the vehicle engine. A test procedure correlating better with EPA F-76a would require some type of engine loading. An engine loaded test such as an idle-max-idle test (engine in neutral) is a possibility if the maximum RPM was limited to some percentage of the EPA F-76a test engine speed. This would require a device able to monitor the engine speed to keep test personnel from overshooting the test-intended engine speed. This type of testing was not performed in this study due to a lack of adequate instrumentation and the possibility of damaging test vehicles. One potential resolution for investigating this option is to partner with industry to create a device for this purpose. Two manufacturers are currently investigating development of an "acoustic tachometer" that could be set for capturing the noise level at an operator-specified engine speed.

4.6.2 Competition Vehicle Exemption

The majority of the OHVs tested in this study that were designed to conform to the EPA noise standard, measured very close to the appropriate noise level despite usage and maintenance unknowns. Those that did not conform to the noise limit had modifications to the exhaust or air intake, or were clearly not properly maintained. Testing of vehicles labeled as competition-use (not required to conform to the EPA standard) verified these vehicles did not typically conform to the EPA standard, but they did measure close to the stationary noise limit, established by the California OHV Noise Standard, and tested significantly lower when fitted with a noise-reducing

after-market muffler. This calls into question the exemption of competition vehicles from noise limits when operating on a closed course.

4.6.3 Reducing the OHV Noise Enforcement Level

The OHVMR Division should consider reviewing a reduction in the SAE J-1287 enforcement level. However, there are practical issues that exist which may preclude an immediate change to the California OHV Noise Standard. The EPA F-76a Noise Emission Standard requires compliance only during the first year of vehicle operation and the noise limit does not apply after this time period. Reducing the enforcement level would also greatly increase the number of vehicles failing the test and may result in more OHV use outside of legal riding areas. As discussed in Section 5.0 of this report, OHV enthusiasts are not completely informed about the California OHV Noise Standard, and therefore additional time is needed for education and outreach. Meanwhile, manufacturers continue to develop products with reduced noise emissions that will assist in quieting OHVs. Depending on the OHMVR Division's objectives, a reduction in noise level could be phased in over a period of time.

4.6.4 OHV Noise Standard Effectiveness and Grandfather Date Impacts

The analysis of vehicle test data from Hollister Hills SVRA indicates the California OHV Noise Standard is effective, especially with stringent enforcement, as the number of non-conforming vehicles in the SVRA has been reduced over time. The analysis also indicates the grandfather dates for non-competition and competition vehicles (which allow older vehicles to emit 101 dBA rather than 96 dBA) are not a significant issue. Less than 4% of non-competition vehicles and just over 2% of competition vehicles actively used at these facilities are subject to these dates.

5.0 Attitudinal Surveys

Attitudinal surveys were conducted to evaluate the effectiveness of the current California OHV Noise Standard in reducing public objections to perceived excessive noise levels of OHVs. Questionnaires were administered to adventitious samples of neighbors of OHV sites, site staff, enthusiasts, representatives of the environmental community, and after-market equipment manufacturers to investigate the following issues:

- Effectiveness of the current California OHV Noise Standard in reducing public objections to OHV noise emissions;
- Effectiveness of outreach and education programs;
- Public perception of (1) enforcement effectiveness, (2) the competition bike exemption, and (3) noise from different OHV classes; and
- Effect of the lower decibel requirement on OHV enthusiasts' satisfaction, on after-market manufacturers, and on the perceptions of neighbors and landowners in proximity to OHV riding areas.

Because respondent selection methodology did not permit determination of the degree of representation of wider populations, inferences drawn from the present findings should not be generalized beyond the respondents who were interviewed. Further, for lack of any estimates of the noise exposure of respondents, no dosage-effect analyses are possible. A discussion of the survey development, the questionnaires, results, and sample size of each survey may be found in Appendix G. The sample size of each survey is discussed below.

Section 5.1 addresses the design of the attitudinal survey and Section 5.2 presents a summary of the survey's results. Section 5.3 concludes the chapter with recommendations.

5.1 Survey Design

5.1.1 Sampling

Adventitious samples of various sizes were selected within five classes of respondents:

- OHV site staff (22 completed personal interviews at three sites);
- OHV site neighbors (162 completed telephone interviews at two sites);
- OHV site enthusiasts (854 completed personal interviews at three sites);
- Environmentalists (18 completed mail interviews); and
- Vehicle and after-market manufacturers (4 completed mail interviews).

5.1.2 Interviews

Interviews were conducted at three California OHV sites with site staff, residents of nearby areas, and OHV site enthusiasts on days of high-volume use. The OHV sites were:

- Jawbone Canyon/Ridgecrest (BLM)
- Hollister Hills SVRA
- Hungry Valley SVRA

Jawbone Canyon is a Bureau of Land Management (BLM) site, while Hollister Hills and Hungry Valley are both State Vehicular Recreation Areas (SVRAs). Site enthusiasts, site staff, and residents of areas in the general vicinity of Jawbone Canyon and Hollister Hills were interviewed. No residential areas are located in immediate proximity to Hungry Valley SVRA.

The environmental groups surveyed were organizations belonging to the California OHV Stakeholders Roundtable and additional groups recommended by the OHMVR Division. The groups to which survey questionnaires were sent may be found in Appendix G.

Sixteen manufacturers of OHV equipment who market their products in California were surveyed. Questionnaires were sent to the manufacturers shown in Appendix G.

OHV site staff and enthusiasts were interviewed in person, OHV site neighbors were interviewed by telephone, and environmental groups and manufacturers were interviewed by mail.

5.1.3 Questionnaire Design

Separate questionnaires were developed for site staff, enthusiasts, and residents of areas in proximity to OHV recreation sites. The general pattern of questioning was as follows:

- The background of the respondent; (approximate age, sex, length of residence, employment, or use of OHV site, occupation, amount of time at home or at site, and leisure activities);
- Opinions concerning the local environment; (air and water quality, traffic, housing and crime issues);
- Opinions about noise issues: nearby industry, road traffic, aircraft, rail traffic, boating, off-highway vehicles;
- Noise from specific classes of off-highway vehicles; and
- The California OHV Noise Standard; (awareness of the standard, awareness of implementation, public outreach, and education efforts, opinions about changes in the OHV noise emissions as a result of the standard, and opinions about the effects of the standard on their environment or sport).

The questionnaire mailed to environmental group representatives inquired about the nature of the group and its objectives relative to OHV noise issues, awareness of implementation, public outreach, and education efforts regarding the California OHV Noise Standard, and opinions about the sufficiency of the standard and these efforts.

The questionnaire mailed to after-market manufacturers concerned the nature of the products manufactured, the awareness of implementation, public outreach, and education efforts regarding the standard, and opinions about the effect the standard and these efforts have on the industry.

5.1.4 Selection and Training of Interviewers

The project manager from the project team selected interviewers for the OHV site staff, enthusiast, and neighbor surveys. A training program was developed and administered to these applicants prior to beginning their interviews. The results of these interviews were carefully monitored to assure adherence to standards.

5.2 Summary of Survey Results

5.2.1 OHV Site Enthusiasts

The typical rider interviewed at the OHV sites was a male between the ages of 18 and 50, riding a non-competition motorcycle for more than six years, and currently riding more than once per month in a particular riding area. Approximately one-third of the respondents believed motorcycles and ATVs operating within their riding area are quieter since January 2003. A small percentage of respondents, approximately 15%, believed sport-utility vehicles were also quieter. More than 75% of the total respondents knew about the California OHV Noise Standard. Of these, 50% knew the 96 dBA noise limit, and 70% believed the standard was at least somewhat effective. Sixty percent of the total respondents said they were familiar with the enforcement procedures, and of these, 78% believed the enforcement methods were effective. Thirty percent of the total respondents stated they were familiar with the OHMVR Division's outreach and education programs, and 76% of the respondents that were familiar with these programs believed the efforts were effective. Less than a quarter of the total respondents (22%) believed the implementation of the California OHV Noise Standard had lessened the enjoyment of their sport.

One-third of the total respondents believed there had been a reduction in off-highway motorcycle and ATV noise since January of 2003. The California OHV Noise Standard did not require a noise level reduction for new OHVs. Rather, the goal was to identify and bring into compliance the vehicles which typically utilize an improper after-market muffler or non-standard vehicle modification. The fact that a portion of the respondents had recognized a reduction in OHV noise emissions is positive. The most common ways an enthusiast might have become aware of a reduction in noise emissions were: 1) to have been required to bring a vehicle into compliance or know someone who had to comply, 2) to have visited riding areas with aggressive enforcement efforts, 3) to have become aware of noise limits through local club involvement, or 4) to have attended a competition event requiring noise level compliance.

While only 30% of all respondents stated awareness of the OHMVR Division's outreach and education efforts, the fact that 75% were aware of the Standard indicates these efforts have somehow reached them. The respondents may not have realized this outreach included information received either by DMV mailings, sound cards produced by the OHMVR Division and received from dealerships, or through local group meetings or other avenues such as trade journal articles, compliance decals, and local sound limit signs. Additionally, enthusiasts with quiet vehicles may pay no attention to outreach on sound issues that do not pertain to them.

Three-quarters of the total respondents were aware of the California OHV Noise Standard. Nearly three-fourths of those aware of the Standard, the enforcement methods, and the OHMVR Division's outreach efforts, believed these components were effective. Sixty percent of the respondents were also familiar with the enforcement efforts.

At Hollister Hills SVRA, where enforcement is aggressive, respondents were generally more aware than respondents at the other two sites of:

- A reduction in vehicle noise emissions;
- The existence of the California OHV Noise Standard;
- The effectiveness of the California OHV Noise Standard;
- The enforcement methods;
- The effectiveness of the enforcement efforts; and
- The outreach and education efforts of the OHMVR Division.

Table 5-1 provides a summary of these conclusions.

Table 5-1. OHV User Survey Responses

QUESTION	RESPONSE
Typical rider	Male, age 18-50, non-competition motorcycle, riding for over 6 years and more than once a month in a particular riding area
Vehicle noise reduced	Yes – approximately 33%
Knowledge of standard	75% aware; 50% of these were aware of noise limit
Standard's effectiveness	70% of those aware of the standard believed it was at least somewhat effective
Enforcement methods	60% familiar; 78% of these believed it was effective
OHMVR Division outreach	30% familiar; 76% of these believed it was effective
Impact on enjoyment	22% believed the standard hurt their enjoyment of the sport

5.2.2 OHV Site Staff

The overall impression of the interviewed OHV site staff was the California OHV Noise Standard has been successful in reducing vehicle noise levels, the current enforcement efforts are effective and the OHMVR Division's outreach and education efforts have been valuable. A majority (64%) of these respondents believed there had been a reduction in noise emissions from both motorcycles and ATVs since January 2003. The remaining 36% of the respondents, who believed there had been no change in vehicle noise emissions, included five of the seven respondents at

Jawbone Canyon (BLM), and one of the three respondents at Hungry Valley SVRA. All of the 12 respondents at Hollister Hills SVRA believed there had been a reduction in OHV noise emissions. In addition to addressing the objectives of the study, the survey provided site staff an opportunity to present recommendations for improving the California OHV Noise Standard and the enforcement and outreach efforts. The following list presents those recommendations:

- Provide additional staff, equipment and training;
- Develop noise emission limits on closed-course competition events;
- Ensure manufacturers comply with the California OHV Noise Standard;
- Lower the noise limit on either all motorcycles or at least competition bikes;
- Simplify field enforcement methods so one officer can perform noise test measurements;
- Continue to employ outreach and education booths at sites, especially during special events;
- Provide additional outreach and education through DMV and OHV enthusiast publications;
- Provide signage at OHV sites to inform enthusiasts of the California OHV Noise Standard; and
- Issue citations for non-compliance.

Table 5-2 summarizes these conclusions.

Table 5-2. OHV Site Staff Survey Responses

QUESTION	RESPONSE
Typical staff member	Male, 18-50 years of age, working more than one year for the park in their present position
Vehicle noise reduced	Yes – 64% overall; Jawbone Canyon (BLM)–29%, Hollister Hills SVRA–100%, Hungry Valley SVRA–67%
Standard's effectiveness	95% felt Noise Standard was at least somewhat effective
Enforcement methods	100% felt it was effective
OHMVR Division outreach	95% felt it was effective

The staff at Hollister Hills SVRA felt unable to issue citations to every offender while performing their other assigned duties, and suggested additional staff would help fulfill this need. While the staff at Jawbone Canyon (BLM) and Hungry Valley SVRA did not specifically call for more staff, they believed more enforcement was needed. The OHMVR Division should review this suggestion with regard to both informing the OHV enthusiasts and to reducing potential impacts on neighboring lands. Hollister Hills SVRA made improvements in this area by training seasonal employees to perform noise checks in addition to already trained park rangers. In regard to requiring noise limits on closed-course competition, Hollister Hills SVRA has successfully incorporated this idea. Because their neighbors do not discriminate between noise emissions from vehicles on or off these competition courses, Hollister Hills SVRA began utilizing American

Motorcyclist Association-sanctioned noise emission limits for these courses, and the staff has recognized a decline in neighbor complaints since incorporating these limits.

The suggestion to ensure manufacturers comply with the California OHV Noise Standard may be confused with the lack of vehicle maintenance or the fact that many enthusiasts replace stock mufflers with higher noise emission after-market mufflers. As demonstrated in the previous section on vehicle testing, the test results identified evidence of manufacturer compliance on four new or infrequently used vehicles, and also identified non-compliance of numerous frequently used vehicles due to neglect of required maintenance or from vehicle modification.

The SAE J-1287 enforcement testing requires an officer to hold a sound level meter 20 inches and 45 degrees off-axis from the muffler exhaust, hold a reed tachometer securely to the vehicle, and adjust the vehicle throttle to maintain a constant engine speed. The officer typically relies on the enthusiast to either secure the tachometer to the vehicle or adjust the vehicle throttle while the officer performs the other two tasks. The sound level meter could be placed on a tripod, but this requires the officer to carry a tripod at all times and requires additional set-up time for the measurement. It is also difficult to monitor both the tachometer and the sound level meter to ensure the measurement occurs at the appropriate RPM. A device that measures both engine speed and noise level would simplify this procedure.

The other suggestions address continuation of current outreach and education efforts, and issuing citations to offenders. Continued outreach is important because the OHMVR Division's goal is 100% awareness of the California OHV Noise Standard, and approximately 25% of OHV enthusiasts surveyed lack this awareness. Additional surveys may be needed to monitor this awareness.

5.2.3 Residents of Areas in Proximity to OHV Sites

Approximately equal numbers of men and women living in proximity to two OHV riding area sites were interviewed. The majority of respondents were over 40 years of age and had lived in their home for four or more years. Respondents were no more concerned about noise in general than they were about other neighborhood issues, such as traffic, schools, housing, crime, air quality and water quality. Fifteen percent of the respondents cited annoyance from motorcycle noise, as opposed to 5% or fewer who cited annoyance from noise from aircraft, nearby business, automobiles, sport utility vehicles, and trucks. It was unclear whether respondents were more annoyed by noise from off-highway vehicles than by road traffic noise.

Most respondents believed there had been no recent reduction in their noise environment. Seven percent or fewer believed there had been any reduction in environmental noise. However, 16% of respondents living in proximity to Hollister Hills SVRA believed on-road motorcycle noise had been reduced, and 20% thought off-road motorcycle noise had been reduced. About two-thirds of the respondents at both sites believed there had been no change in noise from on-road or off-road motorcycles. Between 12% and 23% of the respondents believed that both on-road and off-road vehicles had become noisier. Tables 5-1 through 5-9 summarize the data. The row labeled "Weighted Average" in each table shows the weighted average of responses from 103 respondents at Jawbone Canyon but only 58 at Hollister Hills SVRA.

Table 5-3. OHV Neighbor Surveys
Neighbors Slightly or Not At All Concerned About Neighborhood Issues

RIDING AREA	TRAFFIC	SCHOOLS	HOUSING	CRIME	NOISE	AIR QUALITY	WATER QUALITY
Jawbone Canyon (BLM)	88%	86%	83%	88%	84%	85%	88%
Hollister Hills SVRA	71%	90%	90%	90%	85%	88%	81%
Weighted Average	81%	87%	85%	88%	84%	86%	85%

Table 5-4. OHV Neighbor Surveys
Environmental Noise Sources Causing No Annoyance or Very Slight Annoyance

RIDING AREA	AIRCRAFT	RAILROAD	BUSINESS	AUTO	SUV	TRUCK	ON-ROAD MOTORCYCLES	OFF-ROAD		
								MOTORCYCLES	ATVs	SUVs
Jawbone Canyon (BLM)	92%	98%	97%	89%	86%	88%	74%	70%	76%	85%
Hollister Hills SVRA	90%	95%	94%	88%	88%	83%	71%	74%	79%	83%
Weighted Average	92%	96%	89%	89%	87%	86%	73%	72%	77%	84%

Table 5-5. OHV Neighbor Surveys
Environmental Noise Sources Causing Great Annoyance

RIDING AREA	AUTO	SUV	TRUCK	ON-ROAD MOTOR-CYCLES	OFF-ROAD		
					MOTOR-CYCLES	ATVs	SUVs
Jawbone Canyon (BLM)	3%	4%	4%	16%	13%	10%	6%
Hollister Hills SVRA	9%	5%	7%	14%	16%	12%	10%
Weighted Average	5%	4%	5%	15%	14%	11%	8%

Table 5-6. OHV Neighbor Surveys
Environmental Noise Slightly Quieter Since January 2003

RIDING AREA	AIRCRAFT	BUSINESS	AUTO	SUV	TRUCK	ON-ROAD MOTORCYCLES	OFF-ROAD		
							MOTORCYCLES	ATVs	
Jawbone Canyon (BLM)	1%	1%	2%	-	-	-	2%	2%	1%
Hollister Hills SVRA	2%	-	2%	4%	4%	16%	18%	23%	5%
Weighted Average	1%	1%	2%	1%	1%	6%	8%	10%	3%

Table 5-7. OHV Neighbor Surveys
Environmental Noise Slightly Quieter Since January 2003

RIDING AREA	AIRCRAFT	BUSINESS	AUTO	SUV	TRUCK	ON-ROAD MOTORCYCLES	OFF-ROAD		
							MOTORCYCLES	ATVs	SUVS
Jawbone Canyon (BLM)	3%	3%	3%	4%	4%	4%	2%	2%	2%
Hollister Hills SVRA	0%	7%	-	-	-	-	2%	-	-
Weighted Average	2%	4%	2%	3%	3%	3%	2%	1%	1%

Table 5-8. OHV Neighbor Surveys
Environmental Noise Unchanged Since January 2003

RIDING AREA	AIRCRAFT	BUSINESS	AUTO	SUV	TRUCK	ON-ROAD MOTORCYCLES	OFF-ROAD		
							MOTORCYCLES	ATVs	SUVS
Jawbone Canyon (BLM)	90%	65%	84%	89%	79%	73%	70%	80%	86%
Hollister Hills SVRA	32%	77%	77%	72%	74%	52%	53%	56%	70%
Weighted Average	69%	69%	82%	83%	77%	66%	64%	72%	80%

Table 5-9. OHV Neighbor Surveys
Environmental Noise Slightly Noisier Since January 2003

RIDING AREA	ON-ROAD MOTOR-CYCLES	OFF-ROAD		
		MOTOR-CYCLES	ATVs	SUVs
Jawbone Canyon (BLM)	19%	22%	13%	7%
Hollister Hills SVRA	30%	26%	19%	23%
Weighted Average	23%	23%	15%	13%

Table 5-10. OHV Neighbor Surveys
Environmental Noise Significantly Noisier Since January 2003

RIDING AREA	ON-ROAD MOTOR-CYCLES	OFF-ROAD		
		MOTOR-CYCLES	ATVs	SUVs
Jawbone Canyon (BLM)	4%	4%	3%	4%
Hollister Hills SVRA	2%	2%	2%	2%
Weighted Average	3%	3%	3%	3%

Of the respondents at Jawbone Canyon (BLM), 20% were aware of the California OHV Noise Standard, while at Hollister Hills SVRA where SVRA staff employs the greatest enforcement effort, the percentage was 50%. Of those aware of the Standard, more than half at Jawbone Canyon (BLM) knew the correct noise limit but only 10% of those at Hollister Hills SVRA knew the limit. Of those who were aware of the California OHV Noise Standard, 86% at Jawbone Canyon (BLM) and 93% at Hollister Hills SVRA believed it was effective.

Thirteen percent of the enthusiasts surveyed at Jawbone Canyon (BLM) and 36% at Hollister Hills SVRA had some knowledge of enforcement efforts while 73% and 100%, respectively, of these respondents thought the enforcement efforts were effective. Due to the low number of responses, the accuracy of these percentages of effectiveness is questionable. Only 7% of respondents from Jawbone Canyon (BLM) were aware of the OHMVR Division's outreach and education efforts, while 33% from Hollister Hills SVRA were aware. Each one of the respondents who were aware of these efforts believed they were effective.

At Jawbone Canyon (BLM), 59% of the respondents believed the California OHV Noise Standard and its implementation had been somewhat or very effective in reducing noise from off-highway vehicles, while at Hollister Hills SVRA, the percentage was 83%. However, a significant percentage of neighbors, approximately 90%, do not think OHV noise has been reduced, while 68%, 79%, and 83% are unaware of the California OHV Noise Standard, the enforcement efforts, and the OHMVR Division's outreach, respectively.

Table 5-11. OHV Neighbor Responses

QUESTION	RESPONSE
Typical neighbor	Over 40 years of age, living in home 4 years or more
Environmental issues	No more concerned about noise than other issues
Noise Sources	Motorcycles more annoying than other common noise sources
Vehicle Annoyance	Equally annoyed with on-road and off-road, 13-16%
Vehicle Noise Reduced	4% at Jawbone Canyon (BLM); 19% at Hollister Hills SVRA
Awareness of Standard	22% at Jawbone Canyon (BLM); 50% at Hollister Hills SVRA
Noise Limit Knowledge	59% of those aware at Jawbone Canyon (BLM); 10% at Hollister Hills SVRA
Standard's effectiveness	86% of those aware at Jawbone Canyon (BLM); 93% at Hollister Hills SVRA*
Enforcement methods	Aware – 13% at Jawbone Canyon (BLM); 36% at Hollister Hills SVRA Effective – 73% of those aware at Jawbone Canyon (BLM); 100% at Hollister Hills SVRA*
OHMVR Division outreach	Aware – 7% at Jawbone Canyon (BLM); 33% at Hollister Hills SVRA Effective – 100% of those aware*
Effectiveness of California OHV Noise Standard and its Implementation in reducing OHV noise	59% at Jawbone Canyon (BLM) 83% at Hollister Hills SVRA

* Indicates accuracy of percentages questionable due to low number of responses.

5.2.4 Manufacturers and Environmental Groups

The study queried manufacturers and environmental groups to ascertain their evaluation of the effectiveness of the California OHV Noise Standard. Twenty-three of the 37 groups receiving the surveys provided responses. The groups receiving surveys and those responding are listed in Appendix G. Due to the voluntary nature of the survey, the responses are not equally weighted between the two groups, as 74% of the responders considered themselves an environmental organization and 22% considered themselves part of the OHV industry.

Table 5-10 indicates the results of the surveys. Over 80% of those surveyed were aware of the California OHV Noise Standard, and 65% of those who were aware of the California OHV Noise Standard believed they were at least somewhat effective. Nearly two-thirds were aware of the California OHV Noise Standard's enforcement efforts, and 56% of those believed they were at least somewhat effective. Nearly two-thirds were aware of the OHMVR Division's outreach and education efforts, and over 70% of those believed they were effective. While two-thirds of those aware of the California OHV Noise Standard believed it was effective, the average respondent could not identify the change caused by the Noise Standard as positive or negative.

Table 5-12. Manufacturer and Environmental Groups Survey Responses

QUESTION	RESPONSE
Awareness of California OHV Noise Standard	83%
Standard's effectiveness	65% of those aware felt it was at least somewhat effective
Enforcement methods	65% were aware
Enforcement effectiveness	56% of those aware felt it was at least somewhat effective
OHMVR Division outreach	65% were aware
Outreach effectiveness	71% of those aware felt they were at least somewhat effective
Change due to California OHV Noise Standard	9% negative; 59% no change; 32% positive

NOISE LEVEL CHANGE	MOTORCYCLES	ATVs	SUVs
QUIETER	30%	17%	0%
NO CHANGE	52%	65%	22%
LOUDER	17%	17%	78%

In discussions with several industry stakeholders, it is apparent the OHV industry is actively working to lower the OHV noise levels. Large displacement four-stroke competition motorcycles produce higher noise levels than their two-stroke counterparts, but manufacturers have continued development of engines with lower noise levels as indicated by independent vehicle testing and now produce more EPA F-76a noise level conforming four-stroke vehicles (DPS Inc. – ChemHelp). Based on industry trends and over time, these conforming OHVs will replace many of the non-conforming OHVs. Additionally, the after-market industry continues to develop products to retrofit some of the louder exhaust systems to reduce noise levels of OHVs. Due to these manufacturer and after-market developments, supported by the test results of this study and others, it is feasible to reduce the enforcement noise level for new OHVs, both competition and non-competition, to 94 dBA. As these trends continue, the OHMVR Division may consider supporting a reduction to 92 dBA in the future.

The elimination of the competition exemption appears to be a feasible option for reducing the impact of OHV sound emissions. Additional help is needed from the U.S. and international racing communities in providing an effective sound emissions enforcement rules program. The youth of the motor sport industry often imitate the professionals they follow in the competition arena, much as they do in other sports, by purchasing the same equipment, and are not concerned if that equipment raises their vehicle noise level. Without noise emission rules or when these rules are not strictly enforced, there is no incentive for compliance, and these non-conforming products become a mainstay in the sport perpetuating the noise emission problem. The professionals and others operating these competition vehicles also have the ability to ride these vehicles to their full potential and, therefore, to their highest noise levels. This problem would be greatly reduced if competition vehicles were under the same rules as their non-competition counterparts.

5.2.5 Summary of Opinions of Interview Respondents

The opinions of respondents to the various questionnaires may be summarized as follows:

- The current California OHV Noise Standard has been effective in reducing public objections to OHV noise emissions.
- The outreach and education programs of the OHMVR Division have been effective, as a large percentage of enthusiasts and virtually all riding area staff, equipment manufacturers, and environmental groups are aware of the California OHV Noise Standard and its related issues.
- The perceptions of those who are aware of the enforcement methods believe these methods are effective.
- These perceptions are more strongly held at the riding area where staff employs the greatest enforcement effort.
- The sound limit exemption for OHVs engaged in competition events needs further review.
- The lower noise emission requirements of the California OHV Noise Standard have not significantly reduced enthusiasts' enjoyment of the sport.
- While some individual neighbors may be vocal on the issue, the average neighbor does not seem very concerned about OHV noise.
- The perception of residents in proximity to OHV riding areas who are aware of the California OHV Noise Standard is that the sound limit requirement has been effective.
- The original equipment manufacturers are actively designing quieter equipment, and are currently producing many four-stroke vehicles that conform to the EPA F-76a noise limits.
- The majority of manufacturers and environmental groups believe the California OHV Noise Standard has been effective.

Further attention and analysis may include: 1) additional outreach to inform more neighbors about the California OHV Noise Standard, 2) continued outreach and education programs for enthusiasts, 3) additional enforcement efforts, and 4) elimination of the exemption for OHVs engaged in competition events.

5.3 Recommendations

The following recommendations ensue from analysis of the survey results:

- Continue outreach and education efforts

  The California OHV Noise Standard would be more effective if public awareness was increased. The OHMVR Division should continue its efforts to educate OHV enthusiasts. Additionally it might be helpful to develop an education program to inform neighbors

about the California OHV Noise Standard and its effectiveness in reducing the noise emissions from non-compliant vehicles. The key efforts in this endeavor include:

1. Outreach and education booths at OHV sites, especially during special events;
2. Continued outreach through the Department of Motor Vehicles;
3. OHV publications;
4. Distributed leaflets; and
5. Noise enforcement signage at riding area entrances.

- Implement competition vehicle noise limits on closed-course events

  OHV land managers should consider a phased approach to require all closed-course competition events to enforce a noise limit to reduce the noise emissions from vehicles engaged in competition.

- Investigate enforcement procedure improvements

  The OHMVR Division should also increase the efficiency of enforcement efforts by investigating the feasibility of developing a simple device for measuring vehicle noise level and engine speed so a single officer can easily perform the measurement and apply effective enforcement measures.

Additional interviewing could be useful to expand the enthusiast survey to quantify ways to improve the outreach and education programs. These surveys can incorporate questions to identify the particular groups of enthusiasts that are not aware of the California OHV Noise Standard, how to reach those enthusiasts, and which outreach efforts provide the most education to those aware of the standard. There is a direct relationship between level of awareness associated with the California OHV Noise Standard and its effectiveness.

6.0 Summary

In five subsections, this chapter summarizes the findings of this study.

6.1 Vehicle Noise Levels and Testing Methods

Measurements of OHV noise emissions conducted in a dynamometer room suggest that sources other than exhaust noise contribute to the overall vehicle noise level. Because the SAE J-1287 stationary test emphasizes engine exhaust noise, and because OHV spectra and A-weighted noise emissions vary with engine load, the relationship between SAE J-1287 and EPA F-76a test methods does not support precise prediction of one measurement from the other.

Field measurements indicated vehicles designed to comply with EPA F-76a noise emission levels typically produced noise levels complying with the labeling requirement. Vehicles which failed to comply included those labeled as competition-use only, non-competition vehicles with modifications to either exhaust or air intake systems, and those not maintained with periodic service.

Modifications to either microphone position or engine speed of the SAE J-1287 method do not substantially improve the correlation with noise levels measured by the EPA F-76a test method. Nonetheless the SAE J-1287 test method correctly discriminates between compliant and non-compliant vehicles, even with newer vehicles having lower exhaust noise levels.

It may be feasible to develop an engine-loaded stationary test similar to an idle-max-idle test (engine in neutral) that would relate to the EPA F-76a test method. The potential test would require development of an acoustic tachometer device that could quickly capture the noise level at an equipment operator-specified engine speed while alerting the test engineer of reaching the test engine speed. This new method would limit the engine speed to a percentage of the maximum horsepower RPM to prevent engine damage.

6.2 Effectiveness of the California OHV Noise Standard, Enforcement Efforts, and Outreach

Most of the persons interviewed for this study believe the California OHV Noise Standard has been effective. Nearly all of the OHV riding area staff interviewed believed the California OHV Noise Standard was effective, while 90% of the interviewed residents of areas in the general vicinity of OHV riding areas, who were also aware of the standard, considered it to be either somewhat or very effective. Most respondents also believed the enforcement efforts and the outreach and education programs were effective. Awareness of the California OHV Noise Standard and its effectiveness was greatest among respondents at the riding area where enforcement is most aggressive.

Table 6-1 summarizes the survey responses. The table indicates the OHMVR Division needs to continue its efforts educating the 25% of enthusiasts not aware of the California OHV Noise Standard and to consider developing an education program to inform neighbors about the California OHV Noise Standard.

Table 6-1. Summary of Survey Responses

QUESTION Those aware of:	ENTHUSIASTS	OHV STAFF	NEIGHBORS	MANUFACTURERS & ENVIRONMENTAL GROUPS
The California OHV Noise Standard	75%	100%	30%	83%
The California OHV Noise Standard and considered it effective	70%	95%	90%	65%
The Enforcement methods of the California OHV Noise Standard	60%	100%	21%	65%
The Enforcement methods and considered them effective	78%	100%	91%	56%
The OHMVR Division's Outreach and Educational Efforts	30%	100%	16%	65%
The Outreach efforts and considered them effective	76%	95%	100%	71%

Based on survey responses and discussions with the survey groups, recommendations to the OHMVR Division for improving the effectiveness of the California OHV Noise Standard that should be considered include:

- Increase the enforcement efforts by one or more of the following:
  - Provide additional staff and equipment;
  - Simplify the enforcement method through the development of an acoustic tachometer so one officer can perform the measurement with a device that measures vehicle engine speed and noise level;
  - Issue citations for non-compliance;
- Eliminate the competition vehicle exemption and enforce noise level limits on closed-course competition events;
- Reduce the enforcement noise level limit;
- Continue outreach and education program efforts using:
  - Education booths at OHV sites, especially during special events;
  - Public service announcements in industry publications;
  - Providing signage at OHV sites to educate enthusiasts about the California OHV Noise Standard;
- Elimination of tolerance while applying the SAE J-1287 enforcement test.

6.3 Feasibility of Improving the California OHV Noise Standard

The results of this study indicate the SAE J-1287 test method and associated measurement microphone position provide a reasonable procedure for measuring OHV noise levels for discriminating between compliant and non-compliant vehicles, but does not produce vehicle noise levels which relate to the levels measured by the EPA F-76a method. A stationary method testing a vehicle under engine load might be feasible with the development of the acoustic tachometer device mentioned in Section 6.1. Two manufacturers are currently developing an acoustic tachometer for measuring both engine speed and noise levels. This device would simplify the existing enforcement method and improve the implementation of the standard.

The vehicle tests performed as part of this study indicate that the enforcement noise level for the SAE J-1287 test can be lowered without conflicting with the EPA F-76a noise emission standard. However, some practical issues exist that preclude an immediate reduction in the enforcement level. From the SAE J-1287 vehicle measurements within OHV sites, reducing the enforcement level would greatly increase the number of vehicles failing the test and may result in more OHV use outside of legal riding areas. Another concern is OHV enthusiasts are not yet completely informed regarding the California OHV Noise Standard and its current enforcement level. Additional time is needed to educate enthusiasts, while manufacturers continue to develop products to assist in quieting these vehicles. The OHMVR Division may want to consider phasing-in a reduction in the enforcement level in the future. The first step in a phased approach would be the elimination of tolerance while applying the SAE J-1287 enforcement test. Manufactured non-competition vehicles currently comply with a 94 dBA enforcement noise level while vehicles labeled for competition use are capable of complying with a 94 dBA enforcement noise level with a quiet after-market exhaust system and possibly other suitable adjustments. A plausible future enforcement level of 92 dBA for new vehicles is foreseeable assuming manufacturers achieve similar noise level reduction as realized over the past three years.

6.4 Reassessment of Grandfather Dates

The grandfather date allowing non-competition vehicles manufactured prior to January 1, 1986 does not appear to be a significant issue. Testing data at Hollister Hills SVRA, where most vehicles have been noise tested, indicates only 4% of the OHVs using the SVRA were manufactured before this date. Additionally, the number of these vehicles in use at Hollister Hills SVRA decreased from 109 in 2002 to 31 in 2004, corresponding to a percentage of tested vehicles of 4.3% in 2002 to 2.0% in 2004.

The grandfather date for competition vehicles of January 1, 1998 also does not appear to be a significant issue. The number of these vehicles tested at Hollister Hills SVRA conforming to 101 dBA and not conforming to 96 dBA has steadily decreased from 195 in 2002, to 101 in 2003, and to 34 in 2004. As a percentage of vehicles tested, this was 7.7% in 2002, 4.3% in 2003, and 2.2% in 2004. It appears that the retirement of these older vehicles has continued to reduce noise emissions.

6.5 Future Reporting Needs and Reporting Intervals

The OHMVR Division should evaluate this study to determine which recommendations to implement to improve the California OHV Noise Standard and its effectiveness. Additional surveys need administering to collect information on the 25% of enthusiasts unfamiliar with the California OHV Noise Standard and to determine how best to successfully reach them. An education program could also be developed to inform the neighbors around OHV sites of the California OHV Noise Standard. Finally, the evaluation of these recommendations should take place during the 2005/2006 calendar years with a proposed action plan developed by January 1, 2007.

The OHMVR Division should continue the collection of OHV noise emission testing data at each of its OHV sites to provide information on the noise levels and other characteristics of vehicles using these sites. This data would assist in future assessments of the effectiveness of the California OHV Noise Standard.

References

Borthwick, 1982. Evaluation of Alternative Motorcycle Noise Stationary Test Procedures, 1982 National Conference on Environmental and Occupational Noise, Written to National Association of Noise Control Officials, Fort Walton Beach, Florida, 1982.

Daily, 2002. Daily, J., Supplemental Over-Snow Vehicle Sound Level Measurement, prepared for the State of Wyoming, Jackson Hole Scientific Investigations, Inc., 2002.

Harrison, 1993. Correlation of Off-Highway Motorcycle Sound Test Methods: EPA/SAE, U.S. Department of Agriculture, Forest Service, 1993.

Harrison et al., 1978. One-Half Meter Stationary Motorcycle Noise Test: Sensitivity Study, Harrison, R., R. Hagie, and J. Walsh, Internoise 8-10 May, 1978, San Francisco, CA, 1978.

MIC, 2004. "Off-Highway Motorcycles and ATVs - Industry Trends", Presentation, from E-mail, 2 Jenner Street, Suite 150, Irvine, California 92618, August 2004.

State of California, 2003. California Vehicle Code, section 38370 (h) (1).

State of Wisconsin, 2003. Proposal to Amend NR 6.08(1)(title) and (c), (4) and (6) and to create NR 6.03(1m) and 6.08(1m) relating to snowmobile noise testing procedures, LE-40-03, Natural Resources Board, http://www.dnr.state.wi.us/org/es/enforcement/docs/le4003.pdf, 2003.

Wyle Laboratories, 1973. Davy, B.A., and B.H. Sharp, Wyle Research Report No. WR 73-10. "Cost Effectiveness Study of Major Sources of Noise, Volume II, Automobiles and Light Trucks", El Segundo, California, June 1974.

Ziemke, 1981. NEF Motorcycle Short Test Development Program, Phase V, unpublished test report, June 1981, US Environmental Protection Agency, Noise Enforcement Facility, Sandusky, Ohio, 1981.

APPENDIX A

SAE J-1287 Procedure

The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE STANDARD

SAE J1287 | REAF. JUL1998

Issued 1980-06
Reaffirmed 1998-07

Superseding J1287 JUN93

An American National Standard

Measurement of Exhaust Sound Levels of Stationary Motorcycles

Foreword—This Reaffirmed Document has been changed only to comply with the new SAE Technical Standards Board Format. The Definitions Section has changed to Section 3. All other section numbers have been changed accordingly.

1. Scope—This SAE Standard establishes the test procedure, environment, and instrumentation for determining the sound levels of motorcycles under stationary conditions. This test will measure primarily exhaust noise and does not represent the optimum procedure for evaluating total vehicle noise. For this purpose, SAE J331 or SAE J47 is recommended.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J47—Maximum Sound Level Potential for Motorcycles
SAE J184—Qualifying a Sound Data Acquisition System
SAE J213—Definitions—Motorcycles
SAE J331—Sound Levels for Motorcycles
SAE J1349—Engine Power Test Code—Spark Ignition and Diesel
SAE TSB 002 JUN86—Preparation of SAE Technical Reports

2.1.2 ANSI PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI S1.4-1983—Specification for Sound Level Meters

3. Definitions

3.1 Field Calibration—Calibration of the sound level meter using an external sound level calibrator, an internal calibration means, or any other method which will ensure the accuracy of sound level meter readings.

3.2 Longitudinal Plane Of Symmetry—As defined in SAE J213.

3.3 Rated Engine Speed—The engine speed in revolutions per minute at which the engine delivers its maximum Net Brake Power as defined in SAE J1349, as determined by the manufacturer.

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4. ***Instrumentation—***The following instrumentation shall be used:

4.1 A sound level meter meeting the Type 1, Type S1A, Type 2, or Type S2A requirements of ANSI S1.4-1983.

4.1.1 As an alternative to making direct measurements using a sound level meter, a microphone or sound level meter may be used with a magnetic tape recorder and/or a graphic level recorder or other indicating instrument, provided the system meets the requirements of SAE J184.

4.2 A sound level calibrator with an accuracy of ±0.5 dB (see 7.9).

4.3 A windscreen which does not affect microphone response more than ±1 dB for frequencies of 63 to 4000 Hz and ±1.5 dB for frequencies of 4000 to 10 000 Hz.

4.4 An engine speed tachometer or other means of determining engine speed, with a steady-state accuracy of ±3% at the test speed.

4.5 An anemometer with steady-state accuracy of ±10% at 9 m/s (20 mph).

5. ***Test Site***

5.1 The test site shall be a flat, open surface free of large sound-reflecting surfaces (other than the ground) such as parked vehicles, signboards, buildings, or hillsides located within 5 m (16 ft) of the motorcycle being tested and the location of the microphone.

5.2 The surface of the ground within the area described in 5.1 shall be paving or hard-packed earth, level within an average slope of 40 mm/m (0.5 in/ft), and shall be free of loose or powdered snow, plowed soil, grass of a height greater than 150 mm (6 in), trees, or other extraneous material.

6. ***Procedure***

6.1 A rider shall sit astride the motorcycle in normal riding position with both feet on the ground. If this is not possible because of the seat height of the motorcycle, and for three-wheeled motorcycles, the rider shall sit in the normal riding position with one or both feet on the footrests. If necessary, an assistant may hold the motorcycle by the forks, front wheel, or handlebars so that it is stationary with its longitudinal plane of symmetry vertical. In the alternative, the rider may use a box, rock, or other object to rest his feet upon to steady the motorcycle, as long as the motorcycle longitudinal plane of symmetry is vertical and stationary.

The rider shall run the engine with the gearbox in neutral at a speed equal to one-half of the rated engine speed.

6.1.1 If no neutral is provided, the motorcycle shall be operated either with the rear wheel(s) at least 50 mm (2 in) clear of the ground or with the drive chain or belt removed, or with the clutch, if the motorcycle is so equipped, disengaged.

6.2 The engine of the motorcycle under test shall be at normal operating temperature during the test.

7. ***Measurements***

7.1 The sound level meter shall be set for the A-weighting network and should be set for slow dynamic response. (See Appendix A, Section A.5.)

7.2 Tests shall be made on each side of the motorcycle having an exhaust outlet.

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7.3 The microphone shall be located behind, 0.5 m ± 0.01 m (20 in ± 1/2 in) from, and within 0.01 m (1/2 in) of the same height as the exhaust outlet and at a 45 degrees ± 10 degrees angle to the normal line of travel of the motorcycle. If there is more than one exhaust outlet per side, the microphone shall be located with reference to the rearmost outlet.

The longitudinal axis of the microphone shall be in a plane parallel to the ground plane. The axis of the microphone shall be oriented as specified for free field response by the manufacturer (see Figure 1).

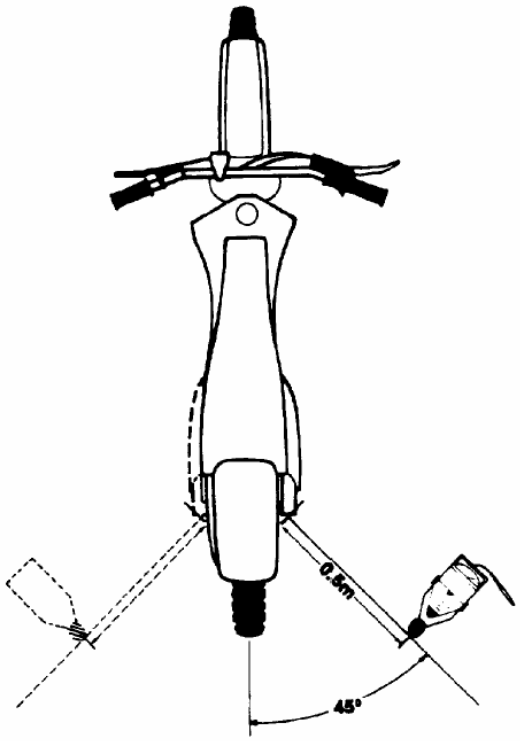

FIGURE 1—SOUND LEVEL AND MICROPHONE LOCATION AND ORIENTATION

7.4 No wire or other rigid means of distance measurement shall be attached to the sound measuring system.

7.5 The sound level recorded shall be that measured during steady-state operation at the engine speed (±200 rpm) determined in Section 6 measured on the loudest side of the motorcycle (if outlet located on both sides — see 7.2). The test speed in rpm shall also be recorded.

7.6 The ambient sound level (including wind effects) at the test site due to sources other than the motorcycle being measured shall be at least 10 dB lower than the sound level produced by the motorcycle under test.

7.7 Wind speed at the test site during the test shall be less than 9 m/s (20 mph).

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7.8 While making sound level measurements, not more than one person other than the rider, the measurer, and the assistant (if necessary) (see 6.1) shall be within 3 m (10 ft) of the motorcycle under test or the microphone, and that person shall be directly behind the measurer on a line through the microphone and the measurer.

7.9 Calibration of the sound level meter using the sound level calibrator (see 4.2) shall be made immediately before the first test of each test day and should be made at the end of each test day. Field calibration should be made at intervals of no more than 1 h.

8. General Comments

8.1 It is essential that persons conducting the test be knowledgeable of the test procedure and use of the instrumentation.

8.2 Proper use of all test instruments is essential to obtain valid measurements. Operating manuals or other literature furnished by the instrument manufacturer should be referred to, for both recommended operation of the instrument and precautions to be observed.

8.3 Specific Items for Consideration

8.3.1 The type of microphone, its directional response characteristics, and its orientation relative to the source of sound.

8.3.2 The effects of ambient weather conditions on the performance of all instruments (that is, temperature, humidity, and barometric pressure).

8.3.3 Proper acoustical calibration procedure to include the influence of extension cables, etc.

8.4 Although either Type 1 or Type 2 sound level meters may be used with this procedure, it is suggested that a Type 1 instrument be considered as it generally has lesser overall tolerance which can result in more accurate measurements.

8.5 The use of the word "shall" in the procedure is to be understood as obligatory. The use of the word "should" is to be understood as advisory. The use of the word "may" is to be understood as permissive.

PREPARED BY THE SAE MOTORCYCLE COMMITTEE

SAE J1287 Reaffirmed JUL1998

APPENDIX A

This procedure can be adapted to a variety of uses, which may include exhaust system certification, enforcement of in-use motorcycle standards, and use by motorcycle competition bodies to ensure some silencing of race vehicles. As provided in TSB 002, this Appendix adds supplementary engineering reference data and educational material and is not an integral part of the basic technical report. Accordingly, a description of the variations used shall be reported along with test results obtained using the variations provided in this Appendix. Such results shall not be reported as having been obtained according to the standard conditions of this document. Some of these uses may require less precision than is called for in the procedure. Accordingly, the following changes may be made for convenience with the realization that accuracy may suffer.

A.1 ***Enforcement Testing***—When used for enforcement, this procedure is intended to be a pass-fail test. A ±1.5 dB variation due to changes in test conditions, motorcycles, and instruments can occur. Test to test variations within this limit shall be considered acceptable. If limits are to be set according to this procedure, these variations should be considered when limits are chosen.

In enforcement situations, it is often easier to use one-half of the redline speed (redline speed is the lowest numerical engine speed included in the red zone on the motorcycle tachometer) rather than the test speed specified in 6.1. One-half of redline speed is a higher test speed than one-half of rated rpm; thus, the measured sound level will be higher, and a 3 dB tolerance must be added to the applicable sound level limit.

While site tolerances may be relaxed somewhat without serious degradation of precision in the method, site parameters, as described in Section 5, should be as closely adhered to as possible. It is unlikely that useful results will be obtained if, for instance, any other motorcycle or other vehicle or person is within 6 ft of the test motorcycle, or if the motorcycle is tested while it is loaded in a pickup truck or on a trailer.

A.2 ***Instrumentation***—Type 1 instrumentation, which generally can provide the most accurate measurements, should be used when the need for accuracy is great, such as certification of exhaust systems, or enforcement action which may result in some form of penalty.

Type 2 instrumentation could be appropriate for some enforcement work, such as a preliminary screening test, or for general data gathering. On the other hand, instrumentation which is less precise than Type 1 or Type 2 may be appropriate in cases such as at a racetrack or motorcycle park, when the primary interest is securing some noise reduction from the motorcycles operated within, and not measuring for the purpose of meeting specific maximum noise limits. Selection of equipment should reflect the need for accuracy (particularly considering any consequences) balanced against cost. Caution should be exercised, however, when selecting equipment which does not conform with ANSI standards. Experience with consumer electronic types of sound level meters indicates most such meters do not possess operating characteristics of sufficient accuracy or consistency to yield meaningful results. Meters which meet obsolete ANSI S1.4 Type 3 specifications, however, are sufficiently accurate for less demanding applications such as racetrack enforcement.

A.3 ***Procedure***—When making comparison measurements where a single variable is to be evaluated, such as comparing the sound level of two different exhaust systems on the same vehicle, selection of the correct engine speed according to 6.1 is not critical as long as the same engine speed is used for each test.

A.4 ***Racing Motorcycles***—This procedure may be used for sound testing of racing motorcycles. An appropriate test speed for both four-stroke and two-stroke high-performance competition motorcycles for which the rated engine speed is not known is determined from Equation A1:

$$\text{Test Speed} = \frac{306\,000}{\text{stroke in millimeters}} \text{ or } \left(\frac{12\,000}{\text{stroke in inches}}\right) \qquad \text{(Eq. A1)}$$

-5-

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A.5 ***Dynamic Response***—Use of slow dynamic response is specified, but fast dynamic response may be used. Because of the essentially constant nature of the sound level, either mode is acceptable; the meter is easier to read when slow response is used.

A.6 ***Wind Speed***—If it is not possible to delay testing until the specified wind conditions prevail, testing can be performed in higher winds. In this case, the motorcycle should be positioned so that the prevailing wind direction is parallel to the normal direction of travel of the motorcycle.

A.7 ***Alternate Engine Speed***—If the rated engine speed for a particular motorcycle is unknown, then the test speed shall be calculated from either Equations A2 or A3:

$$\text{For four-stroke engines} = \frac{250\,000}{\text{stroke in millimeters}} \text{ or } \left(\frac{9800}{\text{stroke in inches}}\right) \qquad \text{(Eq. A2)}$$

$$\text{For two-stroke engines: } \frac{200\,000}{\text{stroke in millimeters}} \text{ or } \left(\frac{7900}{\text{stroke in inches}}\right) \qquad \text{(Eq. A3)}$$

SAE J1287 Reaffirmed JUL1998

Rationale—This Reaffirmed Document has been changed only to comply with the new SAE Technical Standards Board Format. Definitions have changed to Section 3. All other section numbers have been changed.

Relationship of SAE Standard to ISO Standard—Not applicable.

Application—This SAE Standard establishes the test procedure, environment, and instrumentation for determining the sound levels of motorcycles under stationary conditions. This test will measure primarily exhaust noise and does not represent the optimum procedure for evaluating total vehicle noise. For this purpose, SAE J331 or SAE J47 is recommended.

Reference Section

SAE J47—Maximum Sound Level Potential for Motorcycles

SAE J184—Qualifying a Sound Data Acquisition System

SAE J213—Definitions—Motorcycles

SAE J331—Sound Levels for Motorcycles

SAE J1349—Engine Power Test Code—Spark Ignition and Diesel

SAE TSB 002 JUN86—Preparation of SAE Technical Reports

ANSI S1.4-1983—Specification for Sound Level Meters

Developed by the SAE Motorcycle Committee

APPENDIX B

Federal EPA F-76a Test Procedure

APPENDIX I TO SUBPARTS D AND E OF PART 205—MOTORCYCLE NOISE EMISSION TEST PROCEDURES

APPENDIX I–1 TO SUBPARTS D AND E—TEST PROCEDURE FOR STREET AND OFF-ROAD MOTORCYCLES

(a) *Instrumentation.* Proper usage of all test instrumentation is essential to obtain valid measurements. Operating manuals or other literature furnished by the instrument manufacturer must be referred to for both recommended operation of the instrument and precautions to be observed. The following instrumentation must be used, where applicable:

(1) A sound level measurement system which meets the type S1A requirements of American National Standard Specification for Sound Level Meters, ANSI S1.4–1971. As an alternative to making direct measurements using a sound level meter, a microphone or sound level meter may be used with a magnetic tape recorder and/or a graphic level recorder or indicating instrument provided that the system meets the performance requirements of ANSI S1.4–1971. The sound level measurement system must be calibrated at least annually to insure that the system meets the performance requirements of ANSI S1.4–1971.

(2) An acoustic calibrator with an accuracy of within ±0.5 dB. The calibrator must be checked annually to verify that its output is within the specified accuracy.

(3)(i) An engine speed measurement system having the following characteristics:

(A) Steady-state accuracy of within ±3% of actual engine speed in the range of 45% to 100% of the engine speed (RPM) where peak net brake power (maximum rated RPM) is developed; and

(B) Response characteristics such that, when closing RPM is indicated under an acceleration as described below, actual engine speed is no more than 3 percent (of closing RPM) greater than the specified closing RPM.

(ii) The vehicle tachometer may be used to ascertain:

(A) The approach RPM provided it meets the specifications in paragraph (a)(3)(i)(A).

(B) The closing RPM provided it meets the specifications in paragraphs (a)(3)(i)(A) and (B).

(iii) Indirect engine speed measurement systems, such as systems which determine engine speed from vehicle speed measurement, may be used provided the specifications of paragraph (a)(1)(i) are met.

(4) An anemometer with steady-state accuracy of within ±10% at 20 km/h (12.4 mph).

(5) A microphone wind screen which does not affect microphone response more than ±0.5 dB for frequencies of 20–4000 Hz or ±1.0 dB for frequencies of 4000–10,000 Hz, taking into account the orientation of the microphone.

(b) *Test site.* (1) The measurement area within the test site must meet the following requirements and be laid out as described:

(i) The following points must be established:

(A) Microphone target point—a reference point on the vehicle path;

(B) End point—a point on the vehicle path 7.5 ± 0.3m (24.6 ± 1.0 ft) beyond the microphone target point, and

(C) Microphone location point—a point 15± 0.3m (49.2 ± 1.0 ft) from the microphone target point on a normal to the vehicle path through the microphone target point.

(ii) The microphone must be:

(A) Positioned at the microphone location point 1.2 ± 0.1 m (3.9 ± 0.3 ft) above the ground plane; and

(B) Oriented in a plane perpendicular to the vehicle path, and at an angle for which the microphone was calibrated to have the flatest response characteristics over the frequency range of 100 Hz to 10,000 Hz when measured with respect to the motorcycle source.

(iii) The surface of the ground within at least the triangular area formed by the microphone location and the points 15 ± 0.3m (49.2 ±1.0 ft.) prior to and 15 ± 0.3 m (49.2 ± 1.0 ft.) beyond the microphone target point must be flat (+ 5 cm (2.0 in)) and level (grade not more than 0.5% along vehicle path), have a concrete or sealed asphalt surface, and be free from snow, soil or other extraneous material.

(iv) The vehicle path must be relatively smooth and of sufficient length for safe acceleration, deceleration and stopping of the motorcycle.

(2) The test site must be flat, open space free of large sound-reflecting surfaces (other than the ground), such as parked vehicles, sign-boards, buildings or hillsides located within a 30 ± 0.3 m (98.4 ± 1.0 ft) radius of the microphone location and the following points on the vehicle path (see Figure 1):

(i) The microphone location point;

(ii) A point 15 ± 0.3 m (49.2 ± 1.0 ft.) before the microphone target point; and

(iii) A point 15 ± 0.3 m (49.2 ± 1.0 ft) beyond the microphone target point.

(c) *Measurement procedure.*

(1) To establish the acceleration point, the end point must be approached in second gear from the reverse of the intended test direction at a constant engine speed of 50% of maximum rated RPM or closing RPM less ten percent (of maximum rated RPM), whichever is lower, (±2.5% of observed reading). When the front of the motorcycle reaches the end point (approached from the reverse direction), the throttle must be smoothly and fully opened to accelerate the motorcycle past the microphone target point under wide open throttle. When the motorcycle reaches closing RPM the throttle must be smoothly and fully closed. An ignition disable device may be used to turn off the engine at closing RPM in lieu of closing the throttle manually. The location of the front of the motorcycle at the time of throttle closure is the acceleration point for the test runs. The test runs must be made in the opposite direction. A sufficient number of trial runs must be made to assure accurate establishment of the acceleration point.

(2) Closing RPM must be determined according to the motorcycle engine displacement, as follows (see Figure 2):

Displacement (cc)	Closing RPM (Fraction of maximum rated RPM—percent)
0 to 175	95
176 to 675	109 to 0.08×(engine displacement in cc)
676 and above	55

(3) The distance from the acceleration point to the end point must be at least 10 m (32.8 ft). If this distance is less than 10 m (32.8 ft) by the procedure specified in paragraph (c)(1), above, third gear, if the motorcycle is so equipped, must be used. If the distance is still less than 10 m (32.8 ft), fourth gear, if the motorcycle is so equipped, must be used, and so on. If closing RPM is reached before the vehicle travels 10 m (32.8 ft), with the vehicle in its highest gear, the throttle must be opened less rapidly, but in such a manner that full throttle and closing RPM are attained at the end point.

(4) If the motorcycle is equipped with an automatic transmission, the procedure specified in paragraph (c)(1), must be followed except that the lowest selectable range must be employed, and the procedure specified in paragraph (c)(3) must be followed using the next selectable higher range, if necessary, and if the vehicle is so equipped. If closing RPM is reached before the vehicle travels 10 m (32.8 ft.), the throttle must be opened less rapidly, but in such a manner that full throttle and closing RPM are attained at the end point.

(5) Throttle opening must be controlled to avoid excessive wheel slip or lift-off.

(6) To conduct a sound measurement, the motorcycle must proceed along the vehicle path in the forward direction in second gear (or higher gear as applicable under paragraph (c)(3)) at a constant engine speed of 50% of maximum rated RPM or at closing RPM less ten percent (of maximum rated RPM), whichever is lower (± 2.5 percent of observed reading). When the front of the vehicle reaches the acceleration point, the throttle must be smoothly and fully opened. Full acceleration must continue until closing RPM is reached, which must occur within ± 1.0 m (3.3 ft.) of the end point, and at which time the throttle must be smoothly and fully closed. An ignition disable device may be used to turn off the engine at closing RPM in lieu of closing the throttle manually.

(7) A sufficient number of preliminary runs must be conducted before the testing to familiarize the rider with the test procedure and operating conditions of the vehicle. The engine temperature must be within the normal operating range prior to each run.

(d) *Measurements.* (1) The sound level meter must be set for fast response and for the A-weighting network. The microphone wind screen must be used. The sound level meter must be calibrated with the acoustic calibrator as often as is necessary throughout testing to maintain the accuracy of the measurement system.

(2) The sound level meter must be observed throughout the acceleration period. The highest sound level obtained for the run must be recorded.

(3) Measurements must be made until at least four readings from each side are within 2 dB of each other. The noise level for each side is the average of the four which are within 2 dB of each other. The noise level reported must be for that side of the motorcycle having the highest noise level.

(4) While making sound level measurements, not more than one person other than the rider and the observer reading the meter may be within 15 m (49.2 ft) of the vehicle or microphone, and that person must be directly behind the observer reading the meter, on a line through the microphone and the observer.

(5) The ambient noise level (including wind effects) at the test site due to sources other than the motorcycle being measured must be at least 10 dB lower than the noise level at the microphone location produced by the motorcycle under test.

(6) Wind speed at the test site during tests must be less than 20 km/h (12.4 mph).

(e) *Required data.* For each valid test, the following data must be recorded:

(1) Motorcycle type, serial number, model year, and date of manufacture.

(2) Names of persons conducting test.

(3) Test location.

(4) Wind speed and ambient noise level measured on the same day as the test and representative of conditions during the test.

(5) Motorcycle engine displacement, maximum rated RPM, and closing RPM.

(6) The gear used for testing if other than second gear; or type of transmission and description of testing if motorcycle is equipped with automatic transmission.

(7) Description of the sound level meter including type, serial number, and calibration date.

(8) Description of the external acoustic calibrator including type, serial number, and calibration date.

(9) Description of the tachometer or engine speed measurement system used for conducting the test.

(10) Maximum noise level for each pass on each side of the motorcycle including invalid readings and reasons for invalidation.

(11) Reported noise level.

(12) Other information as appropriate to completely describe testing conditions and procedure.

APPENDIX I–2 TO SUBPARTS D AND E—TEST PROCEDURE FOR STREET MOTORCYCLES THAT MEET THE DEFINITION OF §205.151(A)(2)(II) (MOPED-TYPE STREET MOTORCYCLES)

(a) *Instrumentation.* Proper usage of all test instrumentation is essential to obtain valid measurements. Operating manuals or other literature furnished by the instrument manufacturer must be referred to for both recommended operation of the instrument and precautions to be observed. The following instrumentation must be used, where applicable:

(1) A sound level measurement system which meets the type SIA requirements of American National Standard Specification for Sound Level Meters, ANSI S1.4–1971. As an alternative to making direct measurements using a sound level meter, a microphone or sound level meter may be used with a magnetic tape recorder and/or a graphic level recorder or indicating instrument provided that the system meets the performance requirements of ANSI S1.4–1971. The sound level measurement system must be calibrated at least annually to insure that the

system meets the performance requirements of ANSI S1.4–1971.

(2) An acoustic calibrator with an accuracy of within ±0.5 dB. The calibrator must be checked annually to verify that its output is within the specified accuracy.

(3) An anemometer with steady-state accuracy of within ±10% at 20 km/h (12.4 mph).

(4) A microphone wind screen which does not affect microphone response more than ±0.5 dB for frequencies of 20–4000 Hz or ±1.0 dB for frequencies of 4000–10,000 Hz, taking into account the orientation of the microphone.

(b) *Test site.* (1) The measurement area within the test site must meet the following requirements and be laid out as described:

(i) The following points must be established:

(A) Microphone target point—a reference point on the vehicle path;

(B) End point—a point on the vehicle path 7.5±0.3 m (24.6±1.0 ft) beyond the microphone target point; and

(C) Microphone location point—a point 15±0.3 m (49.2±1.0 ft) from the microphone target point on a normal to the vehicle path through the microphone target point. Alternately, the microphone location point may be a point 7.5±0.3 m (24.6±1.0 ft) from the microphone target point provided that the sound level reported is adjusted as provided in this appendix under paragraph (d)(3).

(ii) The microphone must be:

(A) Positioned at the microphone location point 1.2±0.1 m (3.9±0.3 ft) above the ground plane; and

(B) Oriented in a plane perpendicular to the vehicle path, and at an angle for which the microphone was calibrated to have the flattest response characteristics over the frequency range of 100 Hz to 10,000 Hz when measured with respect to the motorcycle source.

(iii) The surface of the ground within at least the triangular area formed by the microphone location and the points 15±0.3 m (49.2±1 ft) prior to and 15±0.3 m beyond the microphone target point must be flat (±5 cm (2.0 in)) and level (grade not more than 0.5% along vehicle path), have a concrete or sealed asphalt surface, and be free from snow, soil or other extraneous material.

(iv) The vehicle path must be relatively smooth and of sufficient length for safe acceleration, deceleration and stopping of the motorcycle.

(2) The test site must be a flat, open space free of large sound-reflecting surfaces (other than the ground), such as parked vehicles, signboards, buildings or hillsides located within a 30±0.3 m (98.4±1.0 ft) radius of the microphone location and the following points on the vehicle path (see Figure 1):

(i) The microphone location point;

(ii) A point 15±0.3 m (49.2±1 ft) before the microphone target point; and

(iii) A point 15±0.3 m (49.2±1 ft) beyond the microphone target point.

(c) *Measurement procedure.* (1) The combined weight of the test rider and test equipment used on the motorcycle must not be more than 80 kg (176 lb) nor less than 75 kg (165 lb). Weights shall be placed on the motorcycle saddle behind the rider to compensate for any difference between the actual driver/equipment load and the required 75 kg (165 lb) minimum.

(2) The motorcycle must approach the microphone target point with the throttle fully open and in the highest gear. The motorcycle must start such that maximum speed is reached before the vehicle is within 7.5 m of the microphone target point. The motorcycle must continue along the vehicle path with fully open throttle and at maximum speed past the end point, at which time the throttle must be closed.

(3) If the motorcycle is equipped with an automatic transmission, the procedure of paragraph (1), above, must be followed except that the highest selectable range shall be employed.

(d) *Measurements.* (1) The sound level meter must be set for fast response and for the A-weighting network. The microphone wind screen must be used. The sound level meter must be calibrated with the acoustic calibrator as often as is necessary throughout testing to maintain the accuracy of the measurement system.

(2) The sound level meter must be observed throughout the passby period. The highest noise level obtained for the run must be recorded.

(3) At least three measurements shall be made for each side of the motorcycle. Measurements must be made until at least three readings from each side are within 2 dB of each other. The noise level for each side must be the average of the three. The noise level reported must be for that side of the motorcycle having the highest noise level. If the microphone location point is 7.5 m from the vehicle path as allowed in this appendix under paragraph (b)(1)(i)(c), the noise level must be adjusted by subtracting 6 dB prior to being reported.

(4) While making noise level measurements, not more than one person other than the rider and the observer reading the meter may be within 15 m (49.2 ft) of the vehicle or microphone, and that person must be directly behind the observer reading the meter, on a line through the microphone and the observer.

(5) The ambient sound level (including wind effects) at the test site due to sources other than the motorcycle being measured must be no greater than 60 dB if the microphone is located 15 m from the vehicle path or 66 dB if the microphone is located 7.5 m from the vehicle path as allowed in this appendix under paragraph (b)(1)(i)(c).

(6) Wind speed at the test site during tests must be less than 20 km/h (12.4 mph).

(e) *Required data.* For each valid test, the following data must be recorded:

(1) Motorcycle type, serial number, model year, and date of manufacture.

(2) Names of persons conducting test.

(3) Test location.

(4) Wind speed and ambient noise level measured on the same day as the test and representative of conditions during the test.

(5) Description of the sound level meter including type, serial number, and calibration date.

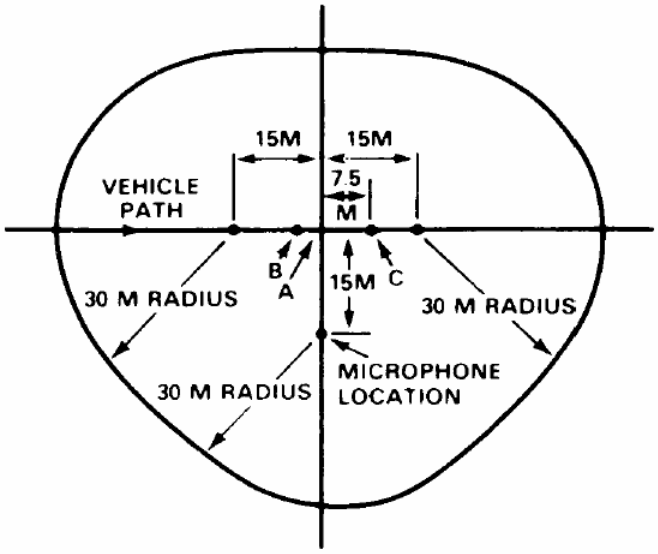
(6) Description of the external acoustic calibrator including type, serial number, and calibration date.

(7) Maximum noise level for each pass on each side of the motorcycle including invalid readings and reasons for invalidation.

(8) Reported noise level.

(9) Other information as appropriate to completely describe testing conditions and procedure.

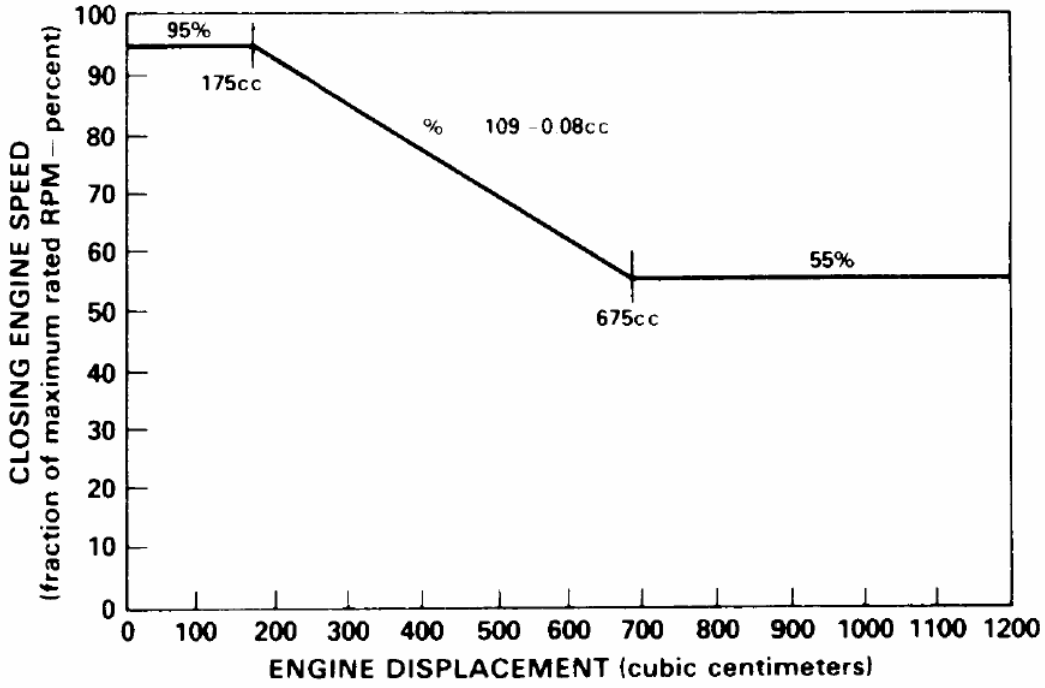
FIGURE 1 – TEST MEASUREMENT AREA



A – MICROPHONE TARGET POINT
B – ACCELERATION POINT (VARIABLE)
C – END POINT

TEST MEASUREMENT AREA

FIGURE 2 – CLOSING RPM



APPENDIX C

Current SAE Snowmobile Procedures and State of Wisconsin Standard

EXTERIOR SOUND LEVEL FOR SNOWMOBILES—SAE J192 APR80

SAE Recommended Practice

Report of the Vehicle Sound Level Committee, approved September 1970, last revised November 1973, reaffirmed without change April 1980.

1. Introduction—This SAE Recommended Practice is intended as a guide toward standard practice, but may be subject to frequent change to keep pace with experience and technical advances.

2. Scope—This SAE Recommended Practice establishes the instrumentation, test site, and test procedure for determining the maximum exterior sound level for snowmobiles.

3. Instrumentation—The following instrumentation shall be used for the measurements required:

3.1 A sound level meter which meets the Type 1 requirements of ANSI S1.4—1971, Specification for Sound Level Meters.

3.1.1 As an alternative to making direct measurements using a sound level meter, a microphone or sound level meter may be used with a magnetic tape recorder and/or a graphic level recorder or other indicating instrument provided the system meets the requirements of SAE J184.

3.1.2 The microphone shall be used with an acceptable windscreen. To be acceptable, the screen must not affect the microphone response by more than ±1 dB for frequencies of 20–4000 Hz or ±1½ dB for frequencies of 4000–10,000 Hz.

3.2 An acoustic calibrator.

3.3 Calibrated engine speed tachometer.

3.4 Thermometer.

3.5 Barometer.

3.6 Sling psychrometer, or dew point apparatus.

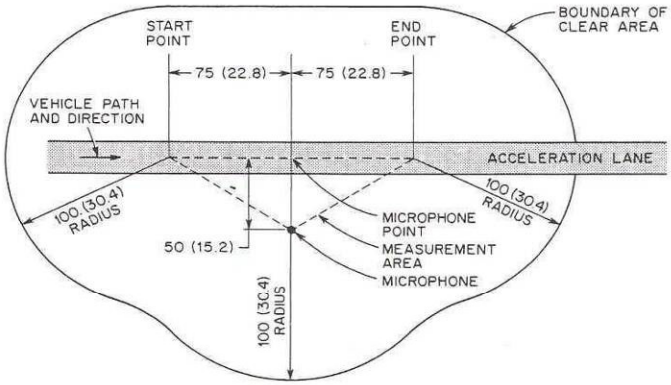
3.7 Windvane.

3.8 Anemometer.

4. Test-Site

4.1 A suitable test site is a level open space free from the effects of large sound reflecting surfaces. Parked vehicles, signboards, or other obstacles must not be located within 100 ft (30 m) of either the vehicle path or the microphone. (See Fig. 1.)

4.2 The microphone shall be located 50 ft (15 m) from the centerline of the vehicle path and 4 ft (1.2 m) above the snow or turf. The normal to the vehicle path from the microphone shall establish the microphone point on the



NOTE: THE START AND END POINT ARE SHOWN FOR A LEFT-TO-RIGHT VEHICLE PASSBY; THESE SHOULD BE REVERSED FOR A RIGHT-TO-LEFT PASSBY.

DIMENSIONS ARE FT (m)

FIG. 1—UNIDIRECTIONAL TEST SITE LAYOUT

4.3 The measurement area shall be the triangular area formed by the start point, the end point, and the microphone location.

4.4 The surface of the ground within the measurement area, including the vehicle path, shall be covered with a maximum of 3 in. (75 mm) loose snow over a base consisting of at least 2 in. (50 mm) of snow sufficiently compacted to support the snowmobile without penetration. An alternate

used, which, except for the vehicle operating path, shall be free of visible droplets of water.

4.5 The reference point of the vehicle, to indicate where the vehicle is on the vehicle path, shall be the front of the vehicle ski(s).

4.6 While making sound level measurements, not more than one person other than the observer reading the meter shall be within 50 ft (15 m) of the vehicle or microphone, and that person shall be directly behind the observer reading the meter, on a line through the microphone and the observer.

4.7 The ambient A-weighted sound level (including wind effects), coming from sources other than the vehicle being measured, shall be at least 10 dB lower than the level of the tested vehicle.

5. Procedure

5.1 Vehicle Operation—A full-throttle acceleration test as specified below is the basis for establishing maximum noise capabilities of the snowmobile.

5.1.1 For the test, accelerate the vehicle from a standing start by establishing wide-open throttle at the start point shown in Fig. 1. Maintain wide-open throttle until the end point is reached. The centerline of the vehicle must not deviate more than 3 ft (1 m) from either side of the centerline of the vehicle path. Record the maximum engine speed reached.

5.2 The sound level meter shall be set for fast response and the A-weighting network.

5.2.1 The applicable reading shall be the highest sound level indicated for the run, between the start point and the end point, ignoring unrelated peaks due to extraneous noises.

5.2.2 Test runs shall be repeated until three readings within a 2 dB range per vehicle side have been obtained. The sound level for each side of the vehicle shall be the average of all three readings, rounded to the nearest integer. The sound level reported shall be that for the side of the vehicle with the highest readings.

5.3 During the test period, the atmospheric temperature, pressure, humidity, wind speed, and wind direction shall be recorded at intervals not exceeding 1 h.

6. General Comments

6.1 It is recommended that persons technically trained and experienced in the current techniques of sound measurements select the equipment and conduct the tests.

6.2 The operation of recording and measuring equipment is likely to be affected by temperature near or below 32°F (0°C); hence, special precautions must be taken to ensure the reliability of sound level meter readings and/or recordings.

6.3 Proper acoustical calibration procedure shall include the influence of extension cables, etc. Field calibration shall be made immediately before and after each test sequence. Internal calibration means is acceptable for field use, provided that external calibration is accomplished immediately before and after field use.

6.4 A 2 dB tolerance over the sound level limit shall be included to provide for variations in test site, temperature gradients, wind velocity gradients, test equipment, and inherent differences in nominally identical vehicles. (It has been observed that under some test site conditions, variability in test results greater than 2 dB can be experienced.)

6.5 Instrument manufacturer's specifications for the proper use of the test equipment shall be adhered to.

6.6 Measurements shall be made only when the wind speed is below 12 mph (19 km/h) and the barometric pressure is between 27.5 and 30.5 in. Hg (93 and 103 kPa).

6.7 The vehicle manufacturer's recommendations governing the proper operation of the vehicle shall be followed.

7. Reference Material—Suggested reference material, or subsequent revisions thereof, is as follows:

7.1 ANSI S1.1—1960 (R 1971), Acoustical Terminology.

7.2 ANSI S1.4—1971, Specification for Sound Level Meters.

7.3 ANSI S1.13—1971, Methods of Measurements of Sound Pressure Levels.

7.4 SAE J184, Qualifying a Sound Data Acquisition System.

Application for copies of ANSI documents should be addressed to: American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

OPERATIONAL SOUND LEVEL MEASUREMENT PROCEDURE FOR SNOW VEHICLES—SAE J1161 APR80

SAE Recommended Practice

Report of the Off-Road Sound Level Committee, approved November 1976, reaffirmed without change April 1980. Rationale statement available.

1. Scope—This recommended practice establishes the instrumentation, test site, and test procedure for determining the exterior operational sound level for snowmobiles.

2. Instrumentation—The following instrumentation shall be used, where applicable, for the measurements required:

2.1 A precision sound level meter which meets the Type 1 requirements of American National Standard Specification for Sound Level Meters (S1.4-1971).

2.1.1 As an alternate to making direct measurements using a sound level meter, a microphone or sound level meter may be used with a magnetic tape recorder and/or graphic level recorder or indicating meter providing the system meets the requirements of SAE J184, Qualifying a Sound Data Acquisition System.

2.1.2 The microphone shall be used with a windscreen that will not affect the microphone response by more than ±1 dB for frequencies of 20–4000 Hz or ±1.5 dB for frequencies of 4000–10 000 Hz at zero wind speed conditions.

2.2 An acoustic calibrator (accuracy within ±0.5 dB).

2.3 A calibrated vehicle speed indicating system (accuracy within ±5% at test speed).

2.4 A thermometer (accuracy within ±1°C [2°F]).

2.5 A barometer (accuracy within ±1%).

2.6 A psychrometer or dew point apparatus.

2.7 An anemometer (accuracy within ±1%).

2.8 A windvane or other device for the measurement of wind direction.

3. Test Site

3.1 A suitable test site is a level open space free from the effects of large sound reflecting surfaces. Parked vehicles, signboards, and other obstacles must not be located within 30.4 m (100 ft) of either the vehicle path or the microphone (see Fig. 1).

3.2 The microphone shall be located 15.2 m (50 ft) from the centerline of the vehicle path and 120 cm (48 in) above the snow or turf. The normal to the vehicle path from the microphone shall establish the microphone point on the vehicle path.

3.3 The measurement area shall be the triangular area formed by the start point, the end point, and the microphone location.

3.4 The surface of the ground within the measurement area, including the vehicle path, shall be covered with a maximum of 7.5 cm (3 in) loose snow over a base consisting of at least 5 cm (2 in) of snow sufficiently compacted to support the snowmobile without penetration. As an alternative, a surface of turf, primarily grass up to a maximum of 7.5 cm (3 in) in height may be used, which, except for the vehicle operating path, shall be free of visible droplets of water.

3.5 The reference point of the vehicle, to indicate when the vehicle is at any of the points on the vehicle path, shall be the front of the vehicle skis.

3.6 While making sound level measurements not more than one person, other than the observer reading the meter and the test driver, shall be within 15.2 m (50 ft) of the vehicle path or microphone and that person shall be directly behind the observer reading the meter on a line through the microphone and observer.

3.7 The ambient A-weighted sound level (including wind effects) coming from sources other than the vehicle being measured, shall be at least 10 dB lower than the noise level with the vehicle operating under test conditions.

4. Procedure

4.1 **Vehicle Operation**—A constant speed as specified below is the basis for determining the operational sound level of the snowmobile.

4.1.1 Before reaching the start point, accelerate the vehicle to the speed of 24 ± 3 km/h (15 ± 2 mile/h). Maintain this constant speed with throttle held as steady as possible through to the end point. The centerline of the vehicle must not deviate more than 1 m (3 ft) from either side of the centerline of the vehicle path.

5. Measurements

5.1 The sound level meter shall be set for *slow* response and the A-weighted network.

5.2 The applicable sound level reading shall be the highest indicated for the run, between the start point and the end point, ignoring unrelated peaks due to extraneous noise.

5.3 During the test period, the atmospheric temperature, pressure, humidity, wind speed, and wind direction shall be recorded at intervals not to exceed one h. Also record test surface conditions.

5.4 Test runs shall be repeated until three readings within a 2 dB range per vehicle side have been obtained. The sound level for each side of the vehicle shall be the average of all three readings, rounded to the nearest integer. The sound level reported shall be that for the side of the vehicle with the highest average.

6. General Comment

6.1 It is recommended that persons technically trained and experienced in the current technique of sound measurement select the equipment and conduct the tests.

6.2 The operation of recording and measuring equipment is likely to be affected by low temperatures. Where measurements are undertaken at temperatures near or below 0°C (32°F), special precautions must be taken to ensure the reliability of sound meter readings and/or recordings.

6.3 Instrument manufacturers' specifications for the proper use of all the test equipment shall be adhered to.

6.4 Measurements shall be made only when the wind speed is below 19 km/h (12 mile/h) and absolute barometric pressure is between 93 and 103 kPa (27.5 and 30.5 in of mercury).

6.5 The vehicle manufacturers' recommendation governing the proper operation of the vehicle shall be followed.

6.6 Proper acoustical calibration procedure shall include the influence of extension cables, etc. Field calibration shall be made immediately before and after each test sequence. Internal calibration means is acceptable for field use, provided external calibration is accomplished immediately before and after field use.

6.7 A 2 dB tolerance over the sound level limit shall be included to provide for variations in test sites, temperature gradients, wind velocity gradients, test equipment, and inherent differences in nominally identical vehicles.

7. Reference Material—Suggested reference material or subsequent revisions thereof, is as follows:[1]

7.1 ANSI S1.1-1960 (R-1971) Acoustical Terminology.

7.2 ANSI S1.2-1962 (R-1971) Method for the Physical Measurement of Sound.

7.3 ANSI S1.4-1971 Specification for Sound Level Meters.

7.4 ANSI S1.3-1971 Methods for the Measurement of Sound Pressure Levels.

7.5 SAE J184—Qualifying a Sound Data Acquisition System.

[1] Application for copies of references 1–4 should be addressed to:
The American National Standards Institute, Inc.
1430 Broadway
New York, New York 10018

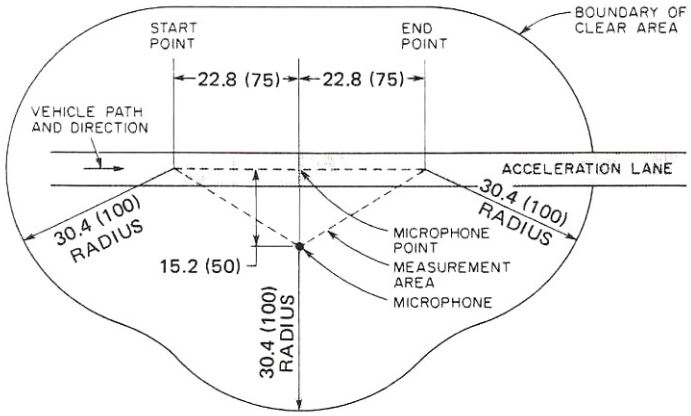


FIG. 1—UNIDIRECTIONAL TEST SITE LAYOUT

ORDER OF THE STATE OF WISCONSIN NATURAL RESOURCES BOARD
AMENDING AND CREATING RULES

The State of Wisconsin Natural Resources Board proposes an order to amend NR 6.08(1)(title) and (c), (4) and (6) and to create NR 6.03(1m) and 6.08(1m) relating to snowmobile noise testing procedures

LE-40-03

Analysis Prepared by the Department of Natural Resources

Statutory authority: s. 227.11(2)(a), Stats.
Statutes interpreted: s. 350.09(7), Stats.

Current state law requires snowmobiles to meet certain noise levels. For snowmobiles that are manufactured and sold or offered for sale in Wisconsin, the noise limit has been set at 78 decibels since 1975. For snowmobiles that the operated by the consumer in Wisconsin, noise emissions are limited to excessive or unusual levels.

The proposed rule will provide a field-friendly test procedure (stationary test) for testing snowmobile noise emissions on consumer machines. The proposed test procedures have been adopted by the Society of Automotive Engineers for law enforcement as a means to identify loud and obnoxious snowmobiles in the field. The proposed rule will also provide a definition for excessive or unusual noise which is currently undefined.

SECTION 1. NR 6.03(1m) is created to read:

NR 6.03(1m) "Excessive or unusual noise" means noise as measured by the procedures herein that is emitted above 82 dB by every snowmobile manufactured after July 1, 1972 and before July 2, 1975 and that is operated in the state or noise that is emitted above 78 dB by every snowmobile that is manufactured after July 1, 1975 and that is operated in the state.

SECTION 2. NR 6.08(1)(title) and (c) are amended to read:

NR 6.08(1)(title) SOUND LEVEL LIMIT AND MANUFACTURER PROCEDURES.

(c) The sound level requirements and testing criteria of the Society of Automotive Engineers Technical Report ~~J192a,~~ J192 as amended ~~1975,~~ shall be adhered to in certifying compliance with snowmobile sound level requirements for every snowmobile manufactured and offered for sale or sold in the state of Wisconsin.

SECTION 3. NR 6.08(1m) is created to read:

NR 6.08(1m) SOUND LEVEL LIMIT AND OPERATOR PROCEDURES. (a) Definitions for use in this section include:

1. "Field calibration" means calibration of the sound level meter using an external sound level calibrator that will ensure the accuracy of the microphone and sound level meter.

2. "Internal calibration" means calibration of the sound level meter by an internal oscillator or other means. The sound level meter internal calibration may be used, provided that the overall response of the sound level meter and microphone are evaluated by an external acoustic calibrator meeting the requirements of par. (d)3. at the start and at the end of each test day.

3. "Longitudinal plane of symmetry" means the plane perpendicular to the horizon with the snowmobile sitting on a level surface which is parallel to the normal direction of travel and equidistant between the skis.

4. "Technician" means a person trained to properly collect sound levels using the procedure in this section.

(b) The total vehicle noise produced by every snowmobile manufactured after July 1, 1972 and before July 2, 1975 and that is operated in the state of Wisconsin may not exceed 82 dB on an A weighted network when measured in accordance with the procedures required in this section.

(c) The total vehicle noise produced by every snowmobile that is manufactured after July 1, 1975 and that is operated in the state of Wisconsin may not exceed 78 dB on an A weighted network when measured in accordance with the procedures required in this section.

(d) Instrumentation (sound meters to be used). The following instrumentation shall be used:

1. A sound level meter that conforms to Type 1, Type SIA, Type 2 or Type S2A requirements of ANSI SI.4-1983.

2. A microphone of the free-field type.

3. A sound level calibrator with an accuracy of ±0.1 dB.

4. A windscreen which does not affect microphone response more than ±l.0 dB for the frequency range of 63 to 4,000 Hz and ±l.5 dB for frequencies ranging from 4,000 to 10,000 Hz. An engine speed tachometer or other means of determining engine speed with a steady-state accuracy of ±3% at the prescribed test speed.

(e) Test site criteria. 1. The test site shall be a flat, open surface free of large sound-reflecting surfaces, other than the ground, such as parked vehicles, signboards, buildings or hillsides located within 5 m (16 ft.) of the snowmobile being tested and the location of the microphone.

2. The preferred surface of the ground within the test site area shall be grass or snow; however, dirt, gravel or pavement may be used when tested according to procedures listed in par. (g)8.

(f) Measurements. 1. The sound level meter shall be set for A-weighting network and slow dynamic response.

2. The sound level meter shall be calibrated and adjusted, if necessary, so that the meter reads within 0.1 dB of the true level at the microphone.

3. The microphone shall be located on the side of the snowmobile towards which the exhaust outlets are directed.

4. The longitudinal axis of the microphone shall be in a plane parallel to the ground plane. There may be no physical attachment between the snowmobile and the microphone/sound level meter.

5. The microphone shall be located at a distance of 4.00 m /157.5 inches from the longitudinal plane of symmetry and 1.22 m /48.0 inches above the ground plane in line with the exhaust outlet. If there is more than one exhaust outlet it shall be located with reference to the center-most point of the multiple outlets.

(g) Procedure. 1. No person other than the snowmobile operator and the person performing the sound level measurements shall be within 3 m (10 ft) of the snowmobile or the microphone. If another observer is present, he or she shall remain in a fixed position behind the sound level meter.

2. With the snowmobile engine shut off, the technician shall observe the overall ambient sound level at the measurement location. The technician shall record this level, including wind effects. In order for a test to be valid, the measured sound level of the snowmobile shall be at least 10 dB higher than the recorded ambient sound level.

3. Operate the snowmobile in the following manner:

a. The snowmobile shall be parked at the test site with an operator seated in the normal operating position, and the forward traveling path of the snowmobile clear of obstructions.

b. The operator shall hold the brake throughout the test.

c. The operator shall start the engine and run until reaching normal operating temperature range, as specified by the manufacturer.

d. While holding the snowmobile stationary by applying the brakes, the operator shall slowly open the throttle until a steady 4,000, but no less than 3,750, rpm engine speed is achieved.

4. The technician shall measure the sound level observed during steady-state operation at a maximum of 4,000 rpm, but not less than 3,750 rpm over a period of not less than 4 seconds. The technician shall record the average reading.

5. Immediately following the first test, the test shall be repeated in an identical manner and a second reading shall be recorded.

6. The 2 readings shall be within 2 dB of one another.

7. The technician shall record both sound levels and shall average the 2 readings. If the 2 readings are not within 2 dB, the technician shall repeat the test procedure until 2 readings within 2 dB are obtained.

8. Using the average of both sound levels, the technician shall subtract; 2 dB when testing on grass or unpacked snow and shall subtract 4-dB when testing on hard surfaces such as packed snow, pavement or gravel in order to be comparable to SAE J192 - *Exterior Sound Level for Snowmobiles*.

a. For snowmobiles manufactured after July 1, 1972 and before July 2, 1975 the level may not exceed 82 dB after subtracting the required 2 dB or 4 dB from the averaged result.

b. For snowmobiles that are manufactured after July 1, 1975, the level may not exceed 78 dB after subtracting the required 2 dB or 4 dB from the averaged result.

c. The technician shall repeat the ambient sound level measurement.

d. The technician shall repeat the calibration procedure. If the calibration has shifted more than 0.2 dB, the individual test is invalid.

(h) No person may operate a snowmobile that is equipped with a muffler cut out, by-pass switch or similar device.

SECTION 4. NR 6.08(4) and (6) are amended to read:

NR 6.08(4) Copies and amendments of the ~~1975~~ Society of Automotive Engineers Technical Report ~~J192a~~ J192, entitled "Exterior Sound Levels for Snowmobiles"; 1973 Society of Automotive Engineers Technical Report J280, entitled "Snowmobile Headlamps"; and 1972 Society of Automotive Engineers Technical Report J279, entitled "Snowmobile Tail Lamps", are available for inspection in the following offices:

(6) REFUSAL TO ALLOW TESTING. No operator or owner of any snowmobile may deny inspection or testing of the equipment or operating system of a snowmobile or may refuse to operate his or her snowmobile in a manner prescribed by the law enforcement officer who reasonably suspects a violation of snowmobile equipment requirements found in either ch. 350, Stats., or this subchapter.

SECTION 5. EFFECTIVE DATE. This rule shall take effect the first day of the month following publication in the Wisconsin administrative register as provided in s. 227.22(2)(intro.), Stats.

SECTION 6. BOARD ADOPTION. This rule was approved and adopted by the State of Wisconsin Natural Resources Board on _____.

Dated at Madison, Wisconsin _____.

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

By _____
Scott Hassett, Secretary
(SEAL)

APPENDIX D

Dynamometer Data and Analysis

D.1 Ambient Noise Levels

Figure D-1 indicates the measured background levels within the dynamometer room at each of the eight microphone positions. Exhaust fan noise and general machine shop activities from other areas of the facility determine this ambient noise level. The ambient noise level measured approximately 70 dBA or less at microphones 1 through 5 and less than 66 dBA at microphones 6 through 8. The ambient noise level was a minimum of 11 dBA below the measured noise data as indicated in Table D-1 and therefore did not influence the measured noise levels during the various test conditions.

Table D-1. Comparison of Minimum Dynamometer Noise Data with Maximum Ambient Noise

	Measured Noise Levels (dBA) at Microphone Position							
	1	2	3	4	5	6	7	8
Test Data Minimum (L_{eq})	83	85	87	84	86	86	83	76
Ambient Noise Maximum (L_{eq})	70	70	66	73	68	65	65	65
Difference (Test minus Ambient)	13	15	21	11	18	21	18	11

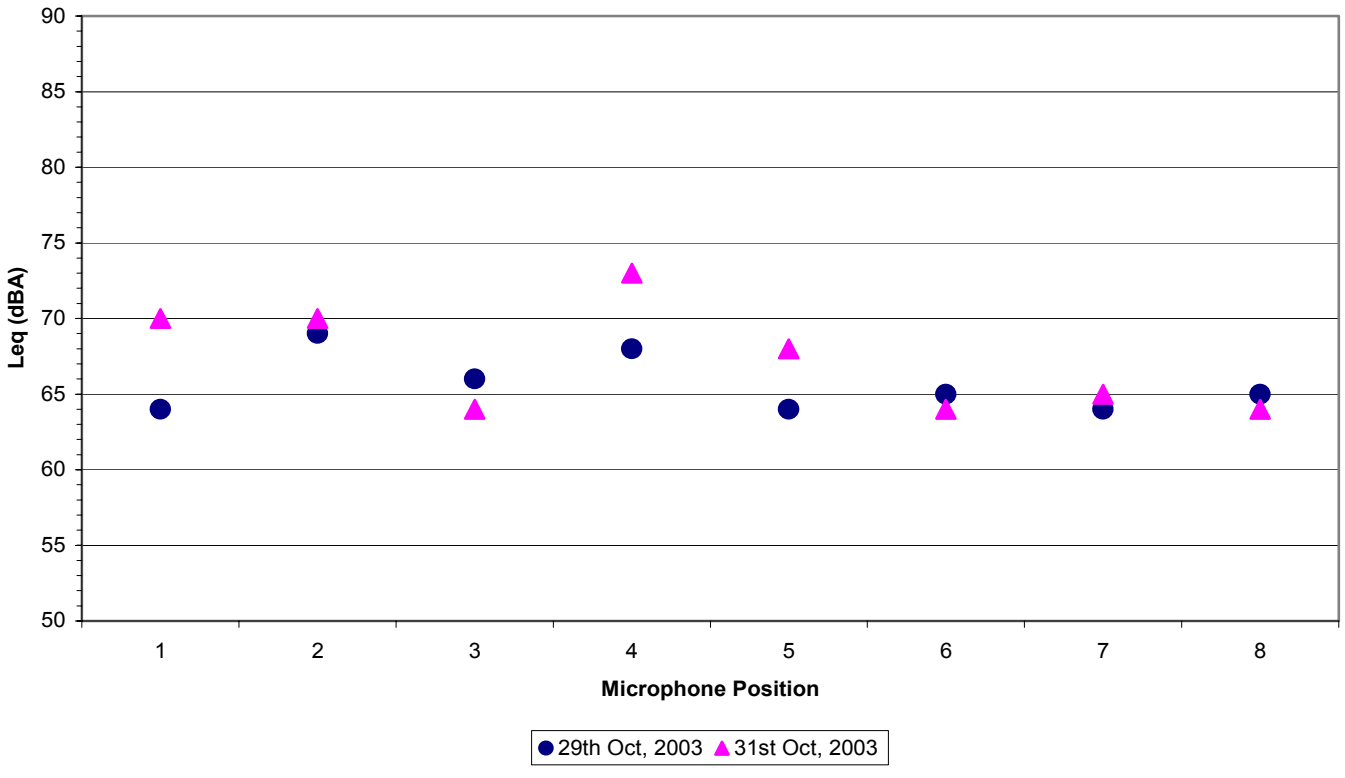


Figure D-1. OHV Dynamometer Room Ambient Levels

D.2 Sound Intensity Measurements

Sound intensity measurements were conducted as a check on the viability of using simple sound pressure level measurement techniques for identifying sound sources within the vehicles. Sound pressure measurements indicate the sound level at a specific measurement point, such as near the engine cylinder. The measured sound level may be influenced, however, by sound emanating from the engine intake or from the muffler, or by reflected sound from a wall surface. Sound intensity measurements discriminate between sounds from different sources and reflected sound by measuring the energy flow emanating from a sound source in a perpendicular direction. By measuring this energy flow over a surface area enclosing the sound source, the sound field around the source is mapped identifying the relative contributions from different areas of the source.

Figures D-2 and D-3 show the sound intensity measurements performed on two motorcycles, the Honda CRF-450R and the Honda XR-400. These figures indicate the sound energy flow over rectangular surfaces on the top and on each side of the vehicle. By visualizing the four rectangular surfaces folded down from the center of the figure, one can visualize the sound energy flowing out from the vehicle. Comparing the sound pressure levels shown on the Figures D-2 & D-3 with the relative microphone sound level from the sound pressure level measurements can test the viability of using the simpler sound pressure measurements for identifying vehicle noise sources and their relative contribution to the overall vehicle noise level. Table D-2 compares the sound intensity measurements of Figures D-2 and D-3 with the sound pressure level measurements of Figure 2 of the main report text and Figure D-11 under the same operating characteristics for each vehicle. While sound intensity measurements provide more detailed information on the noise radiating from the vehicle, the data indicate that adequate information for this study was available using the simpler sound pressure level techniques.

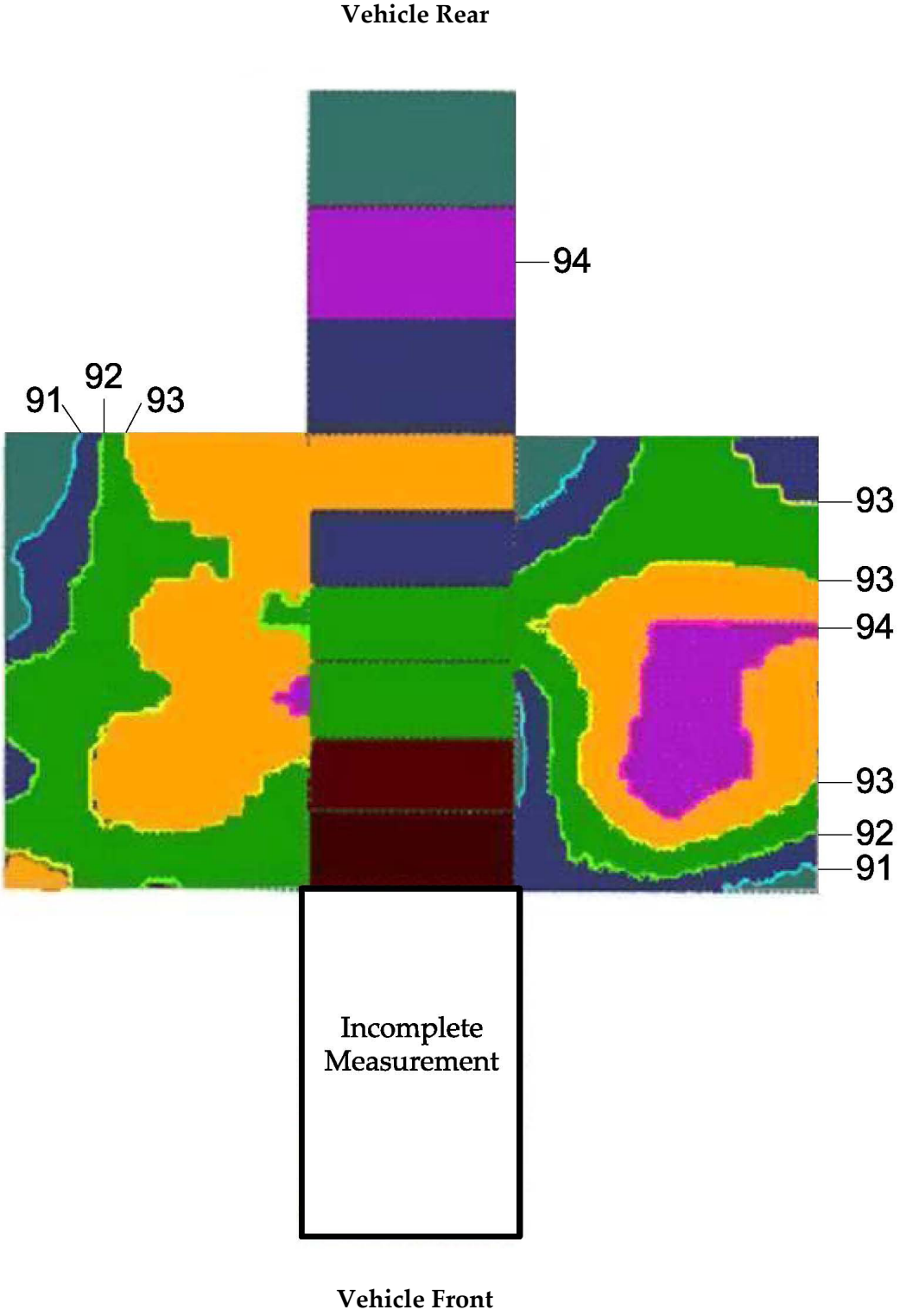


Figure D-2. Sound Intensity Measurement of Honda CRF-450R Motorcycle
Sound Pressure Level in dBA

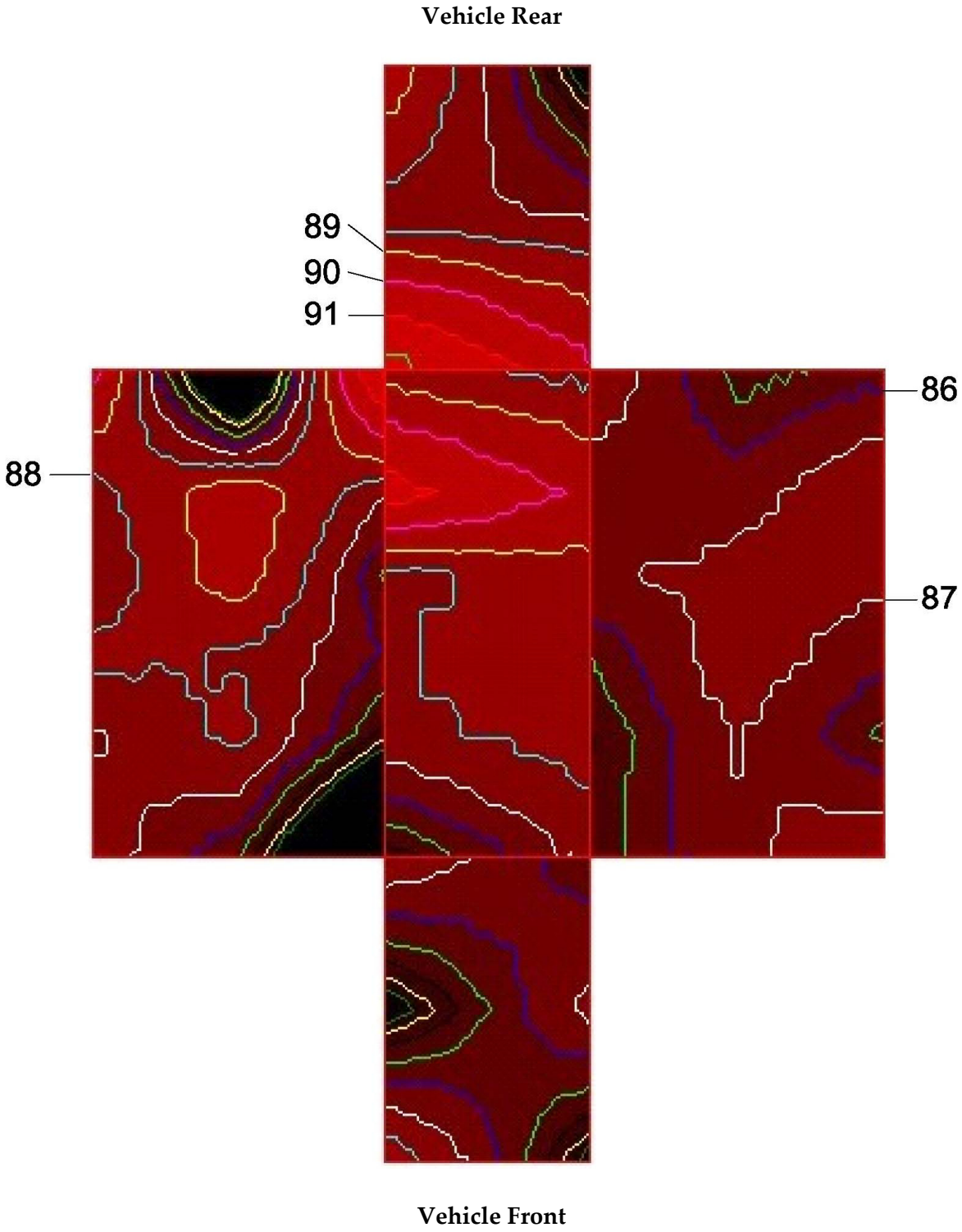


Figure D-3. Sound Intensity Measurement of Honda XR-400 Motorcycle
Sound Pressure Level in dBA

Table D-2. Comparison of Sound Intensity and Sound Pressure Level Measurements

Vehicle	Measurement	Measured Levels (dBA) at Microphone Position							
		1	2	3	4	5	6	7	8
Honda CRF-450R	Sound Intensity	94	93	94	93	93	92	94	--
	Sound Pressure	97	95	94	94	95	92	93	86
	Difference Minus (Intensity Pressure)	-3	-2	0	-1	-2	0	+1	n/a
Honda XR-400	Sound Intensity	90	87	87	86-88	86	87	88	--
	Sound Pressure	89	87	87	87	86	87	86	79
	Difference Minus (Intensity Pressure)	+1	0	0	-1 to +1	0	0	+2	n/a

D.3 Vehicle Noise Levels

Figure 3-2 of the main report text and Figures D-4 through D-12 present the sound pressure levels measured close to the vehicles at each of the eight microphone positions. The measured noise levels of various sources on each vehicle were within +/- 4 dBA of each other under varying test conditions for the range of motorcycles and ATVs tested. Depending on the vehicle and the test conditions, the main sources of noise were muffler exhaust, muffler breakout (muffler case-radiated noise), air intake and engine noise. The results affirm the information gathered from the literature survey that the muffler is not always the dominant noise source it was on earlier vehicles. Each of these noise sources contributes appreciably to the overall noise level emanating from the typical OHV. As demonstrated by Figure 3-2, loading the engine increases the importance of all noise sources, not only the exhaust.

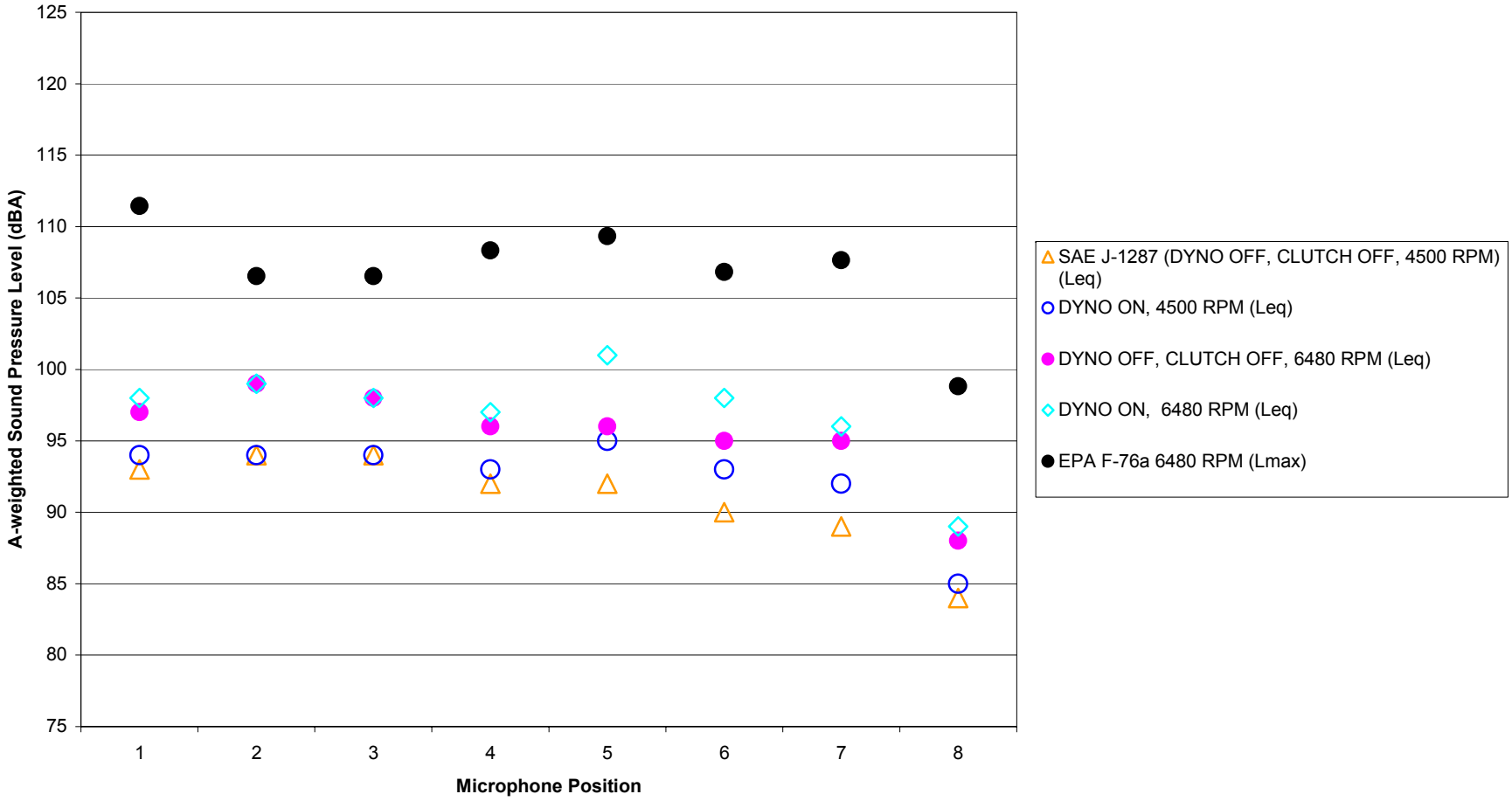


Figure D-4. Honda CRF-450R with Noise Reduction Muffler Dynamometer Noise Measurements

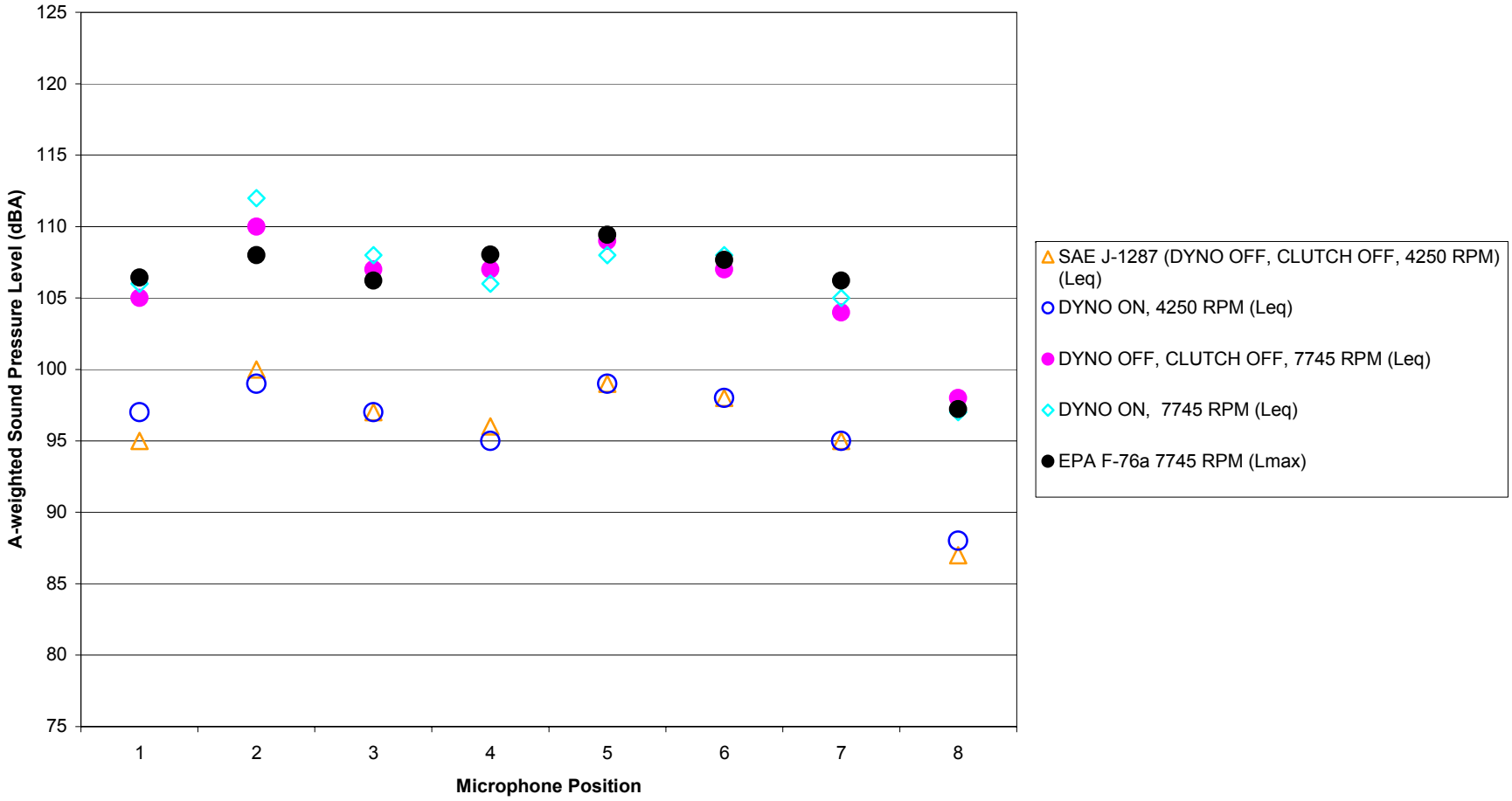


Figure D-5. Yamaha YZ250 Dynamometer Noise Measurements

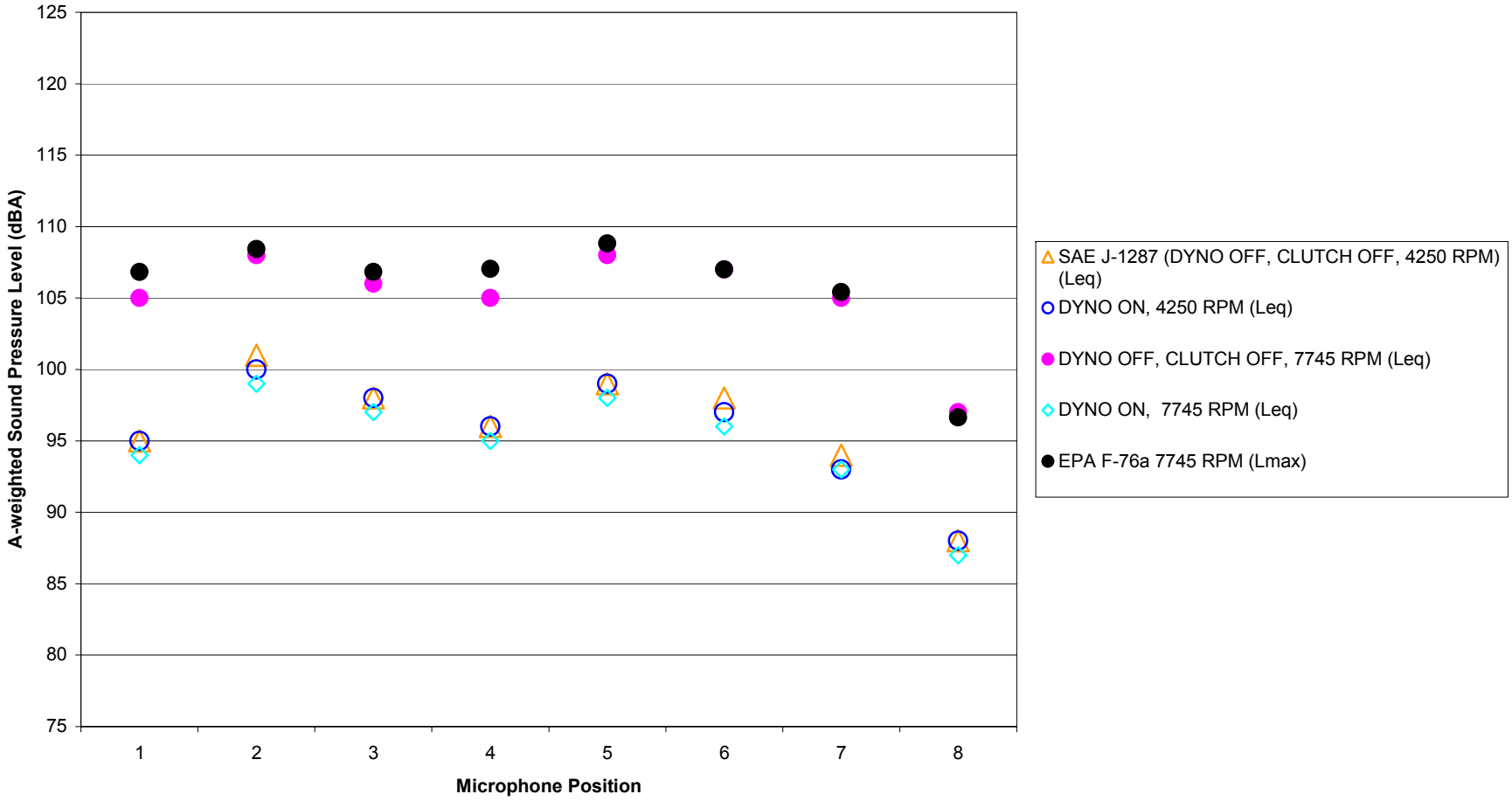


Figure D-6. Yamaha YZ250 with Noise Reduction Muffler Dynamometer Noise Measurements

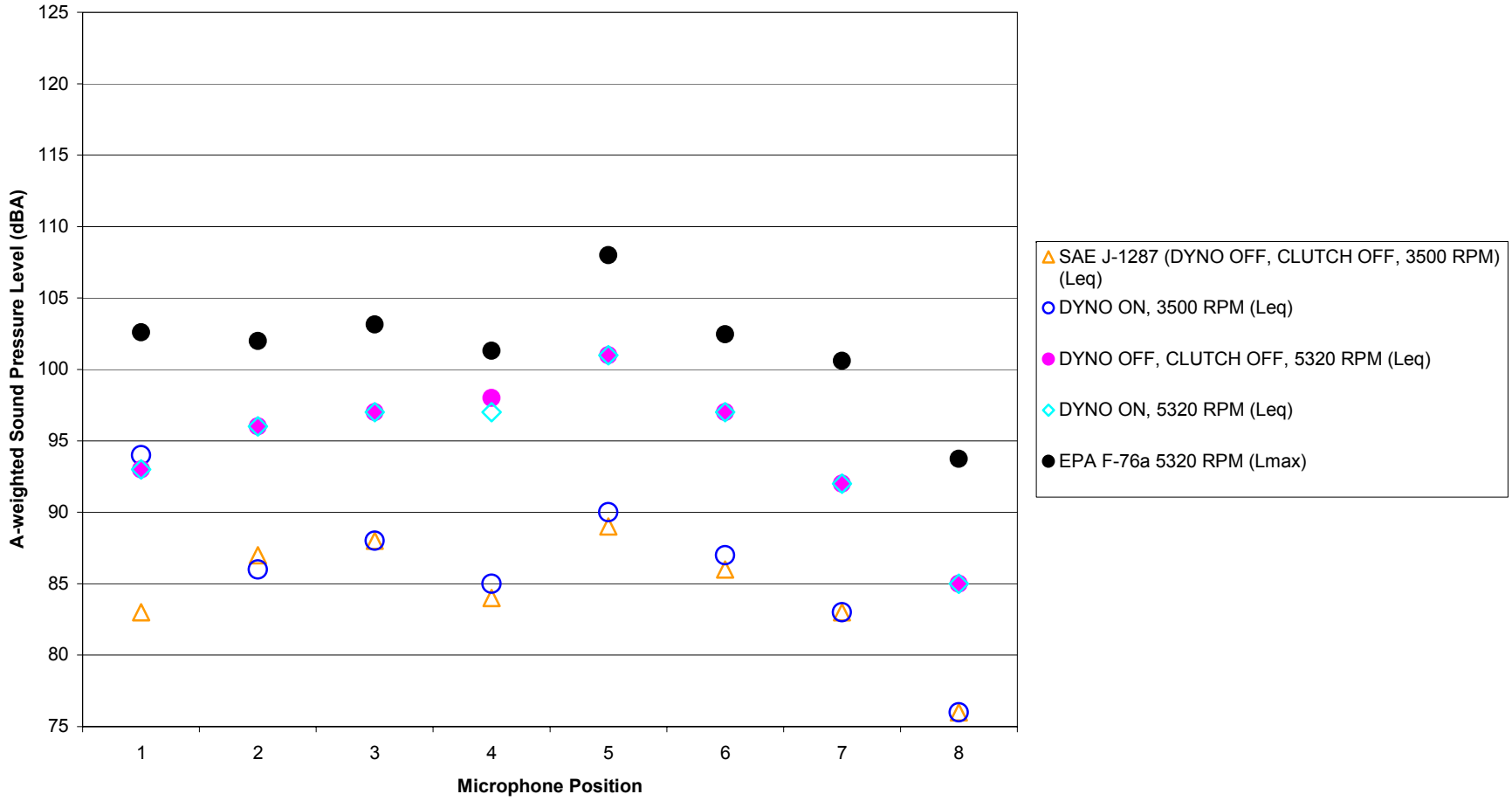


Figure D-7. Honda TRX4000EX (ATV) Dynamometer Noise Measurements

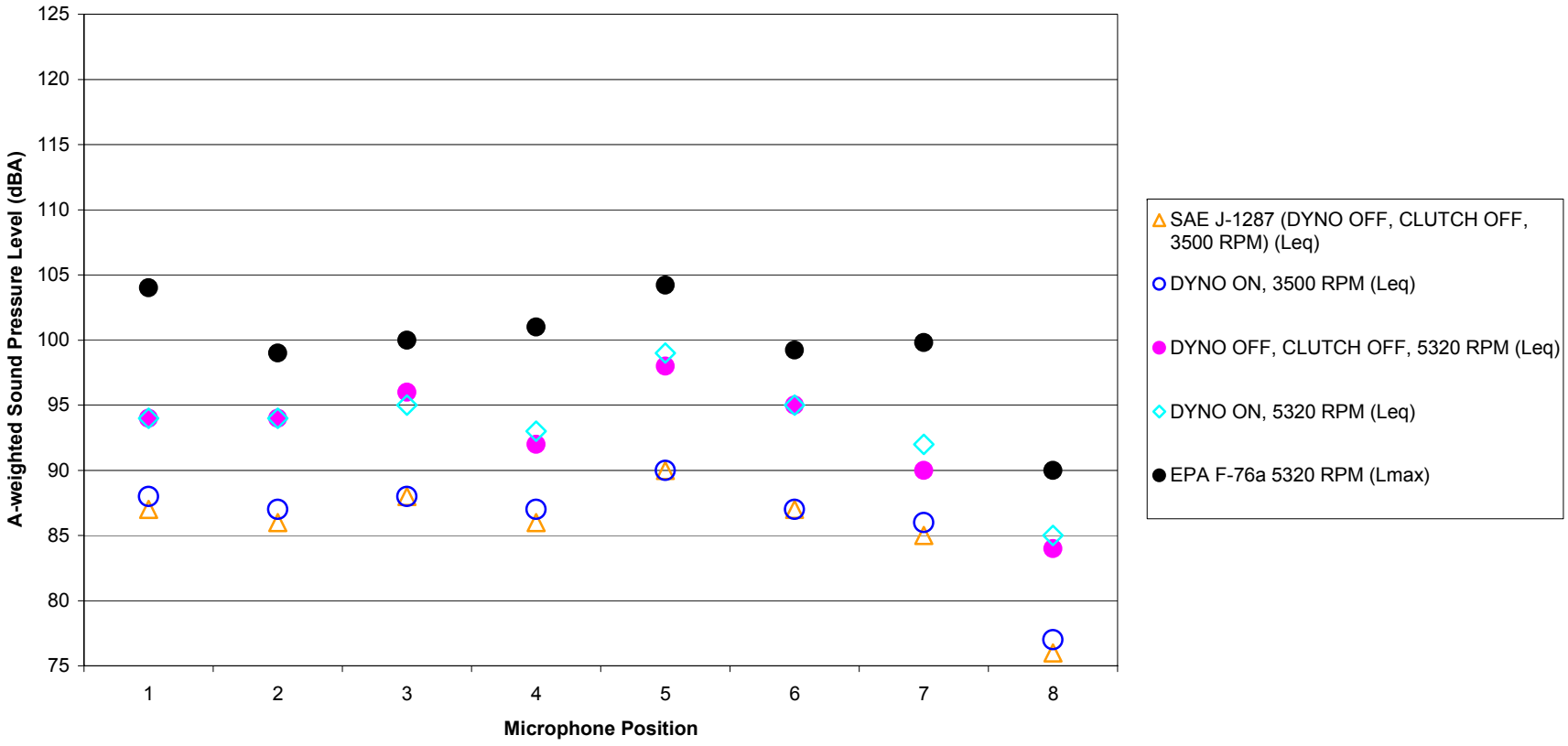


Figure D-8. Honda TRX4000EX (ATV) with Noise Reduction Muffler Dynamometer Noise Measurements

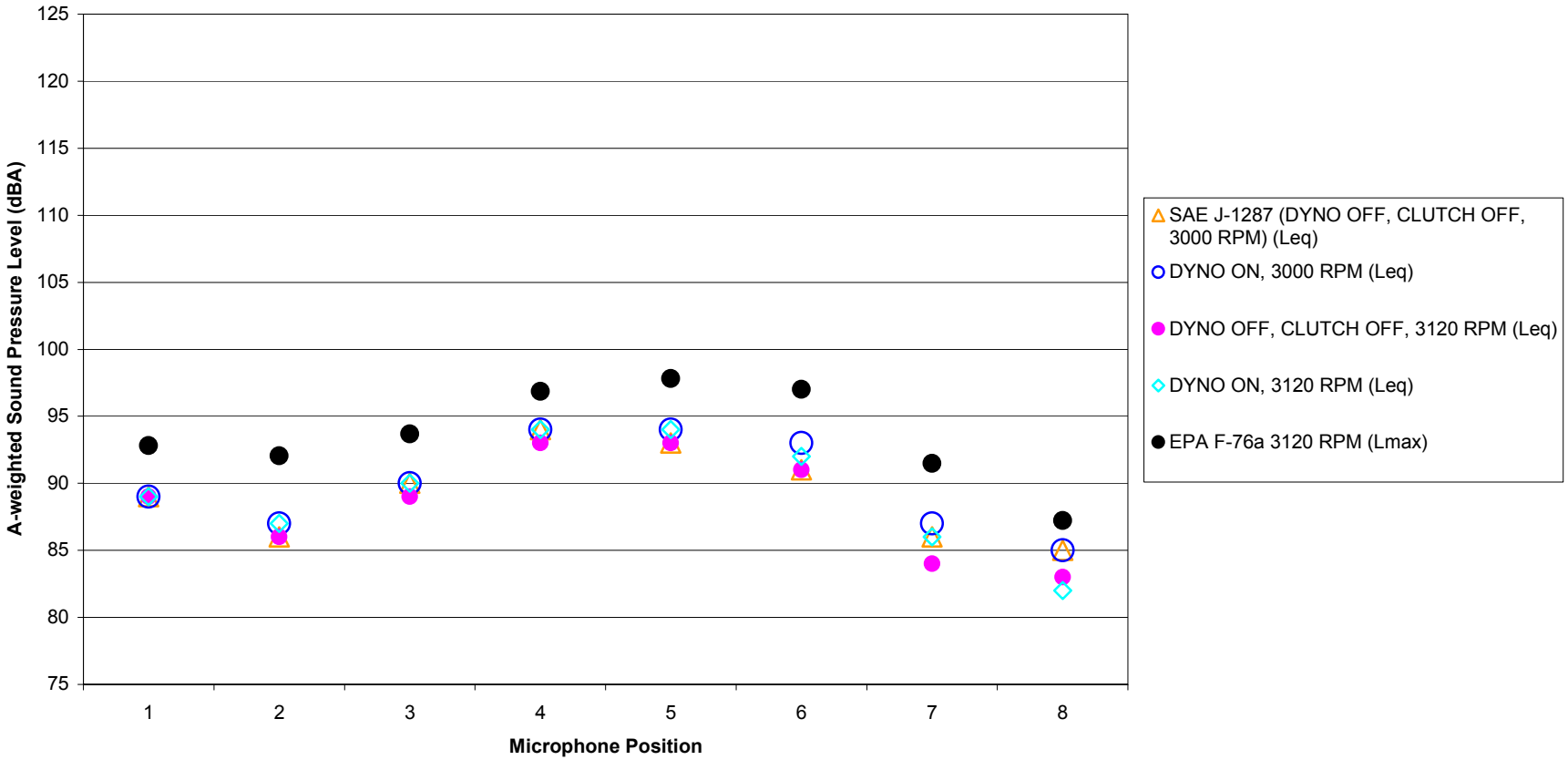


Figure D-9. Kawasaki Kawasaki KFX700 (ATV) Dynamometer Noise Measurements

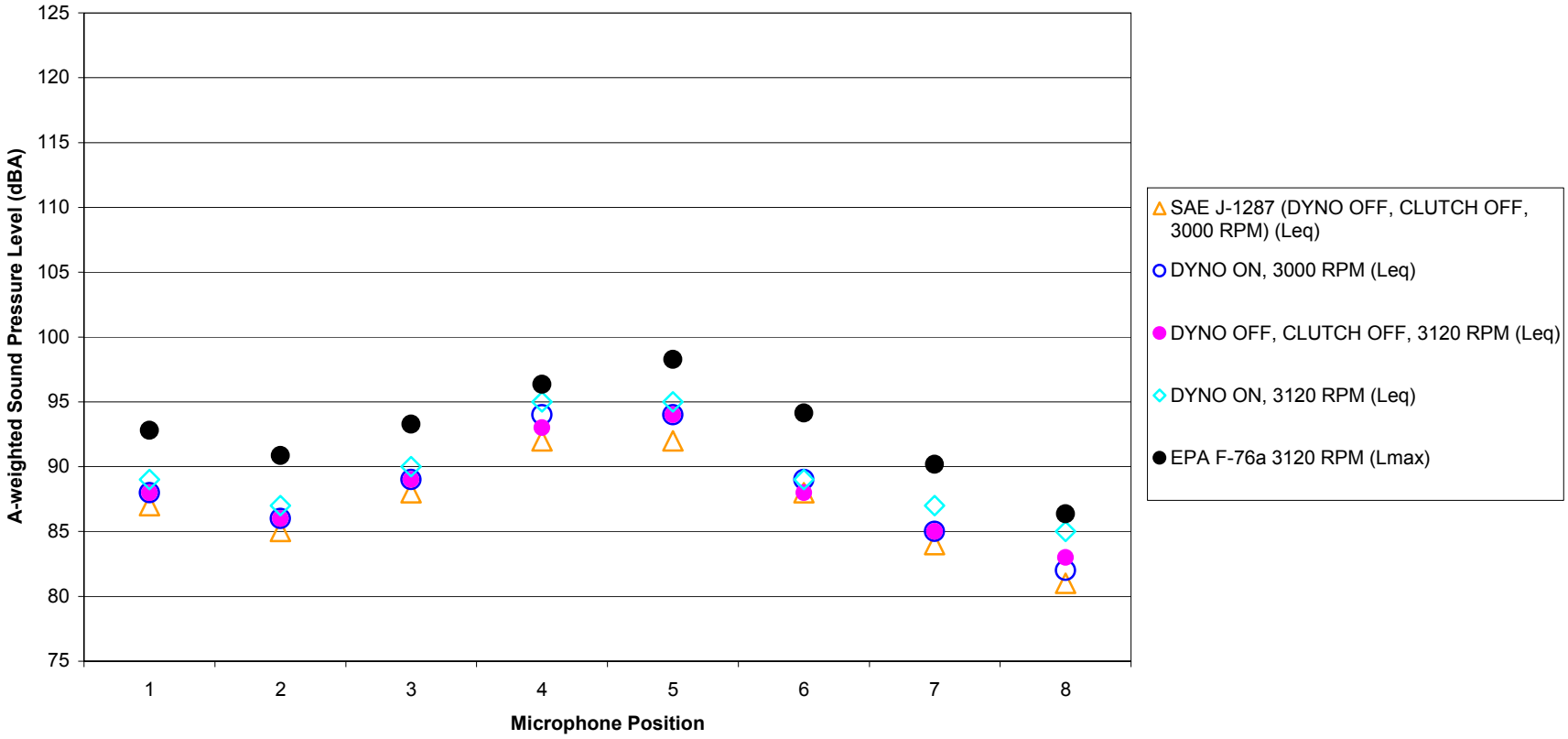


Figure D-10. Kawasaki KFX700 with Noise Reduction Muffler Dynamometer Noise Measurements

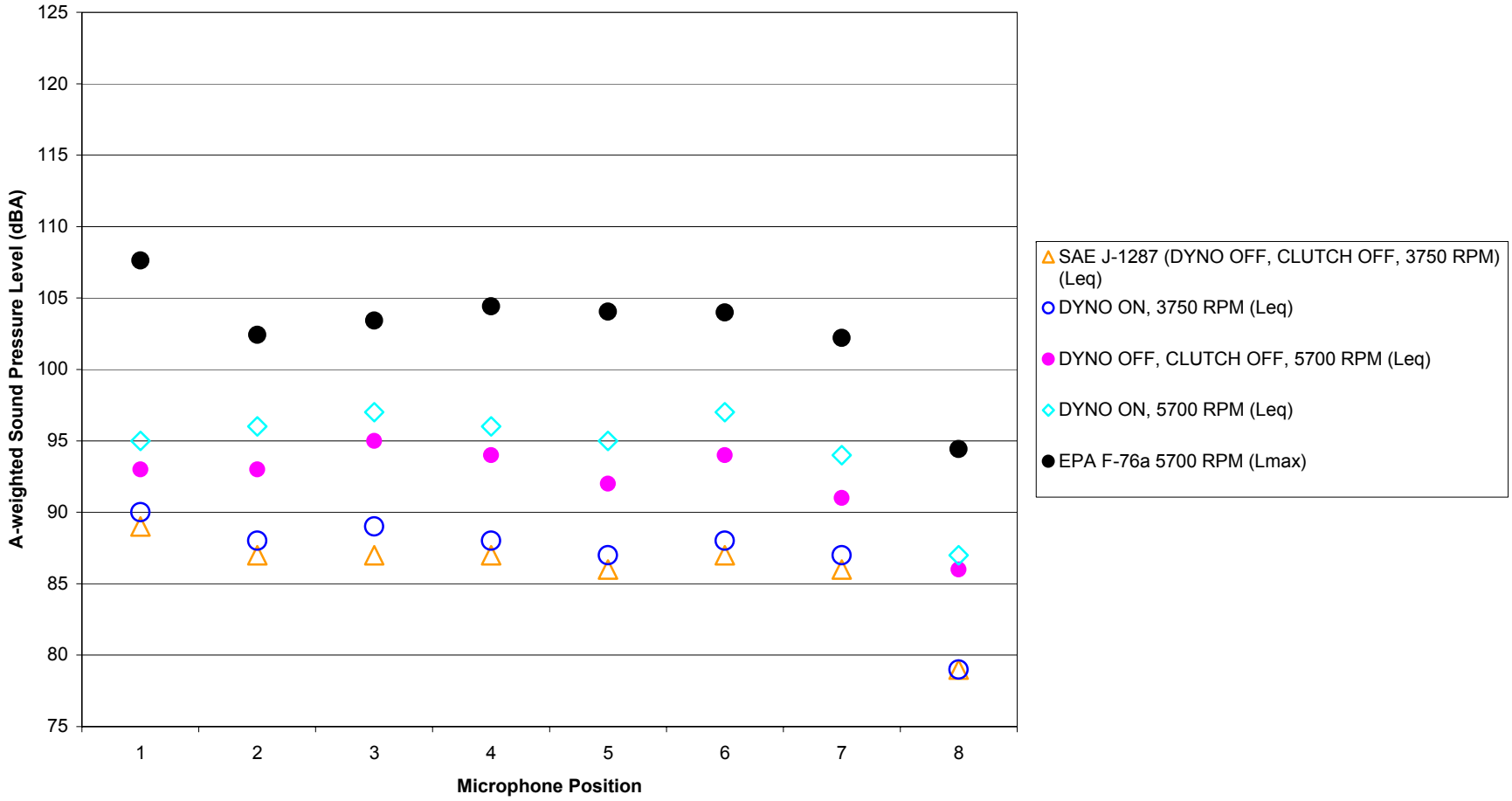


Figure D-11. Honda XR400R Dynamometer Noise Measurements

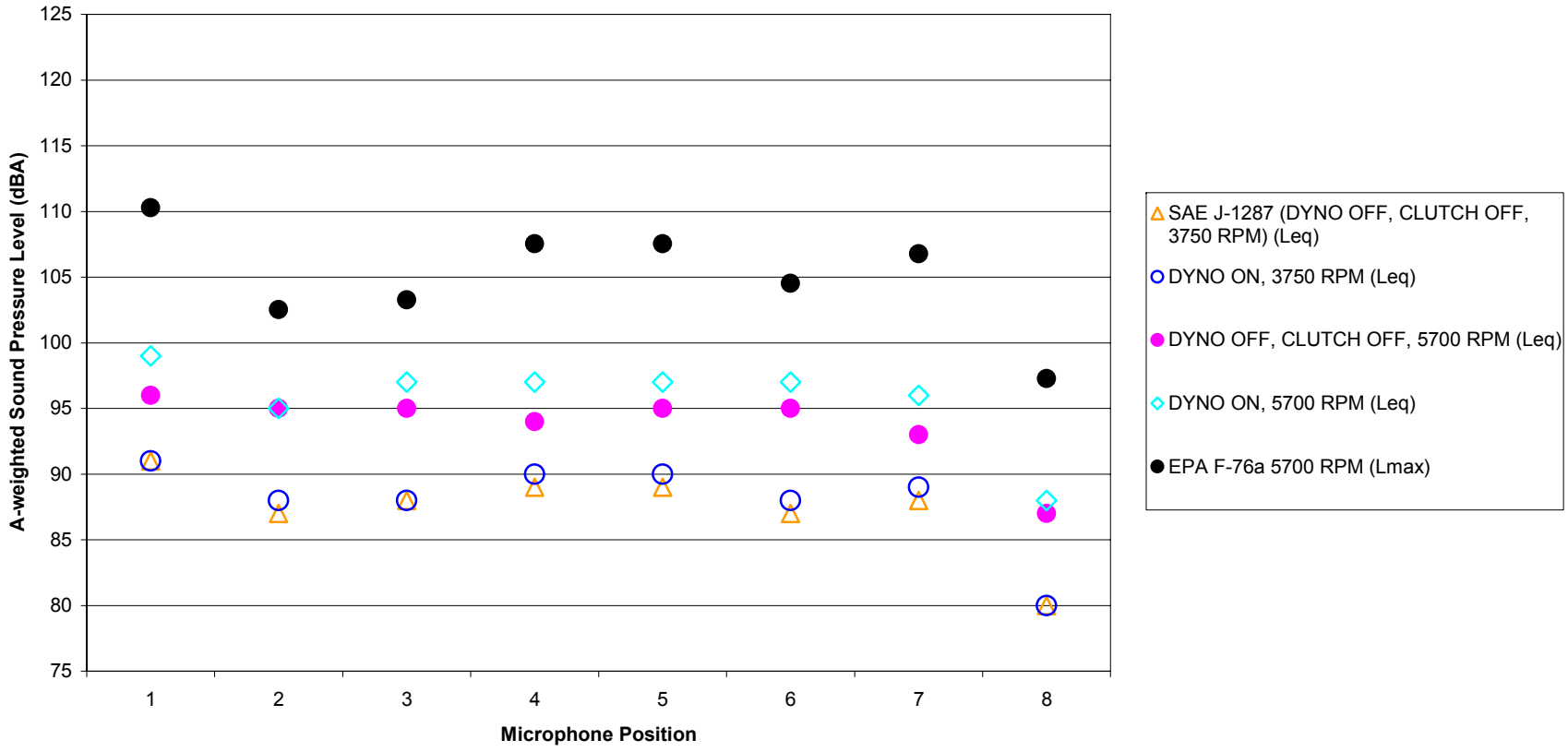


Figure D-12. Honda XR400R with Noise Reduction Muffler Dynamometer Noise Measurements

Table D-3 shows the differences between the measured noise levels from the two test procedures for each vehicle. Table D-3a indicates 11-18 decibel differences for motorcycles and 9-16 decibel differences for ATVs among the eight microphone positions and two procedural RPMs. The magnitude and range of noise level differences suggest the F-76a and J-1287 procedures are uncorrelated. The lack of correlation is probably due to the absence of engine load during the J-1287 test, although the measurement RPM may also be part of the cause.

As shown in Table D-3b, with the F-76a RPM was substituted for the J-1287 RPM (in the J-1287 test), the differences in noise levels for ATVs are significantly less than those in Table D-3a but only slightly less than those in Table D-3a for motorcycles. Although the range in differences in Table D-3b is less than those in Table D-3a, any simple correlation between the test procedures is precluded.

Table D-3. Variations in Measured Decibel Differences Conducted on Different Vehicles Between SAE J-1287 and Federal EPA F-76a Dynamometer Test Procedures

(a) Each Standard's RPM

Type	Vehicle	Difference in Measured Noise Levels (J-1287 Minus F-76a; dBA) at Microphone Position							
		1	2	3	4	5	6	7	8
Motorcycle	HONDA CRF450R	-22	-22	-22	-25	-26	-27	-26	-25
	HONDA CRF450R W/ NR MUFFLER	-18	-13	-13	-16	-17	-17	-19	-15
	2002 YAMAHA YZ250	-11	-8	-9	-12	-10	-10	-11	-10
	2002 YAMAHA YZ250 W/ NR MUFFLER	-12	-7	-9	-11	-10	-9	-11	-9
	HONDA XR400R	-19	-15	-16	-17	-18	-17	-16	-15
	HONDA XR400R W/ NR MUFFLER	-19	-16	-15	-19	-19	-18	-19	-17
	Range of Difference	11	15	13	14	16	18	15	16
ATV	2000 ATV HONDA TRX400EX	-20	-15	-15	-17	-19	-16	-18	-18
	2000 ATV HONDA TRX400EX W/ NR MUFFLER	-17	-13	-12	-15	-14	-12	-15	-14
	2004 ATV KAWASAKI KFX700	-4	-6	-4	-3	-5	-6	-5	-2
	2004 ATV KAWASAKI KFX700 W/ NR MUFFLER	-6	-6	-5	-4	-6	-6	-6	-5
	Range of Difference	16	9	11	14	14	10	13	16

(b) EPA F-76a RPM only

Type	Vehicle	Difference in Measured Noise Levels (J-1287 Minus F-76a; dBA) at Microphone Position							
		1	2	3	4	5	6	7	8
Motorcycle	HONDA CRF450R	n/a	0	0	0	0	0	0	0
	HONDA CRF450R W/ NR MUFFLER	-14	-8	-9	-12	-13	-12	-13	-11
	2002 YAMAHA YZ250	-1	2	1	-1	0	-1	-2	1
	2002 YAMAHA YZ250 W/ NR MUFFLER	-2	0	-1	-2	-1	0	0	0
	HONDA XR400R	-15	-9	-8	-10	-12	-10	-11	-8
	HONDA XR400R W/ NR MUFFLER	-14	-8	-8	-14	-13	-10	-14	-10
	Range of Difference	14	11	10	14	13	12	14	12
ATV	2000 ATV HONDA TRX400EX	-10	-6	-6	-3	-7	-5	-9	-9
	2000 ATV HONDA TRX400EX W/ NR MUFFLER	-10	-5	-4	-9	-6	-4	-10	-6
	2004 ATV KAWASAKI KFX700	-4	-6	-5	-4	-5	-6	-7	-4
	2004 ATV KAWASAKI KFX700 W/ NR MUFFLER	-5	-5	-4	-3	-4	-6	-5	-3
	Range of Difference	6	1	2	6	3	2	5	6

D.4 Investigation of Alternate Measurement Positions

The study included a linear regression analysis of the correlation between the measured noise at microphone positions 1 through 7 with the measured noise at microphone position 8 for each vehicle/muffler combination. The intent of this analysis was to determine if a measurement position other than the SAE J-1287 position might provide a better measure of the overall vehicle noise level and a better relationship to the Federal EPA F-76a pass-by test.

For example, Figures D-13 through D-19 indicate the regression analyses results with their calculated correlation coefficients and standard deviations for a Honda CRF-450R. Table D-4 summarizes the average correlation coefficients and standard deviations for the tested motorcycles, ATVs, and a combination of the two. A high correlation coefficient and a low standard deviation indicate a better match between the noise levels. The values in the table highlighted in bold indicate the best correlation coefficients and standard deviations from this analysis.

Table D-4. Correlation of Measured Noise

Microphone Positions 1 Through 7 With Microphone 8

	MIC	1	2	3	4	5	6	7
Average Correlation Coefficient	M/Cs	0.9745	0.9711	**0.9885**	0.9853	0.9860	0.9857	0.9824
	ATVs	0.8597	0.9096	0.9230	0.9017	0.9111	0.8878	**0.9341**
	ALL	0.9286	0.9465	0.9623	0.9519	0.9560	0.9466	**0.9631**
Average Standard Deviation	M/Cs	1.1271	0.8191	**0.6075**	0.7479	0.7567	0.7214	0.8823
	ATVs	1.4957	0.8052	**0.6909**	1.0490	0.7847	1.0462	0.9335
	ALL	1.2745	0.8135	**0.6408**	0.8683	0.7679	0.8513	0.9028

* Bold values indicate highest correlation and lowest standard deviation

RANK ORDER		1ST	2ND	3RD	4TH	5TH	6TH	7TH
Highest Correlation Coefficient	M/Cs	Mic 3	Mic 5	Mic 6	Mic 4	Mic 7	Mic 1	Mic 2
	ATVs	Mic 7	Mic 3	Mic 5	Mic 2	Mic 4	Mic 6	Mic 1
	ALL	Mic 7	Mic 3	Mic 5	Mic 4	Mic 6	Mic 2	Mic 1
Lowest Standard Deviation	M/Cs	Mic 3	Mic 6	Mic 4	Mic 5	Mic 2	Mic 7	Mic 1
	ATVs	Mic 3	Mic 5	Mic 2	Mic 7	Mic 6	Mic 4	Mic 1
	ALL	Mic 3	Mic 5	Mic 2	Mic 6	Mic 4	Mic 7	Mic 1

From the table, it is evident each microphone position correlated well with the far-field microphone position 8 (i.e., correlation co-efficients ≥ 0.9 and standard deviation ≤ 1.5). While only two decimal places are significant, the data is shown to four decimal places in order to compare the various measurement locations. Microphone positions 3 and 7 correlated best with the far-field microphone (Mic 8), with microphone position 5 correlating better than the remaining positions. Microphone 1, the SAE J-1287 position, recorded the worst correlation. However, microphone 7 is the mirror image of the SAE J-1287 position, located on the same side of the vehicle as the far-field microphone (Mic 8). Both microphone positions 3 and 5, measuring a higher correlation, are also located on this side of the vehicle. This ranking of strong to weak correlation may have been influenced by the location of the far-field microphone (Mic 8) on the left side of the vehicles. This was further investigated in the field vehicle testing phase of the study.

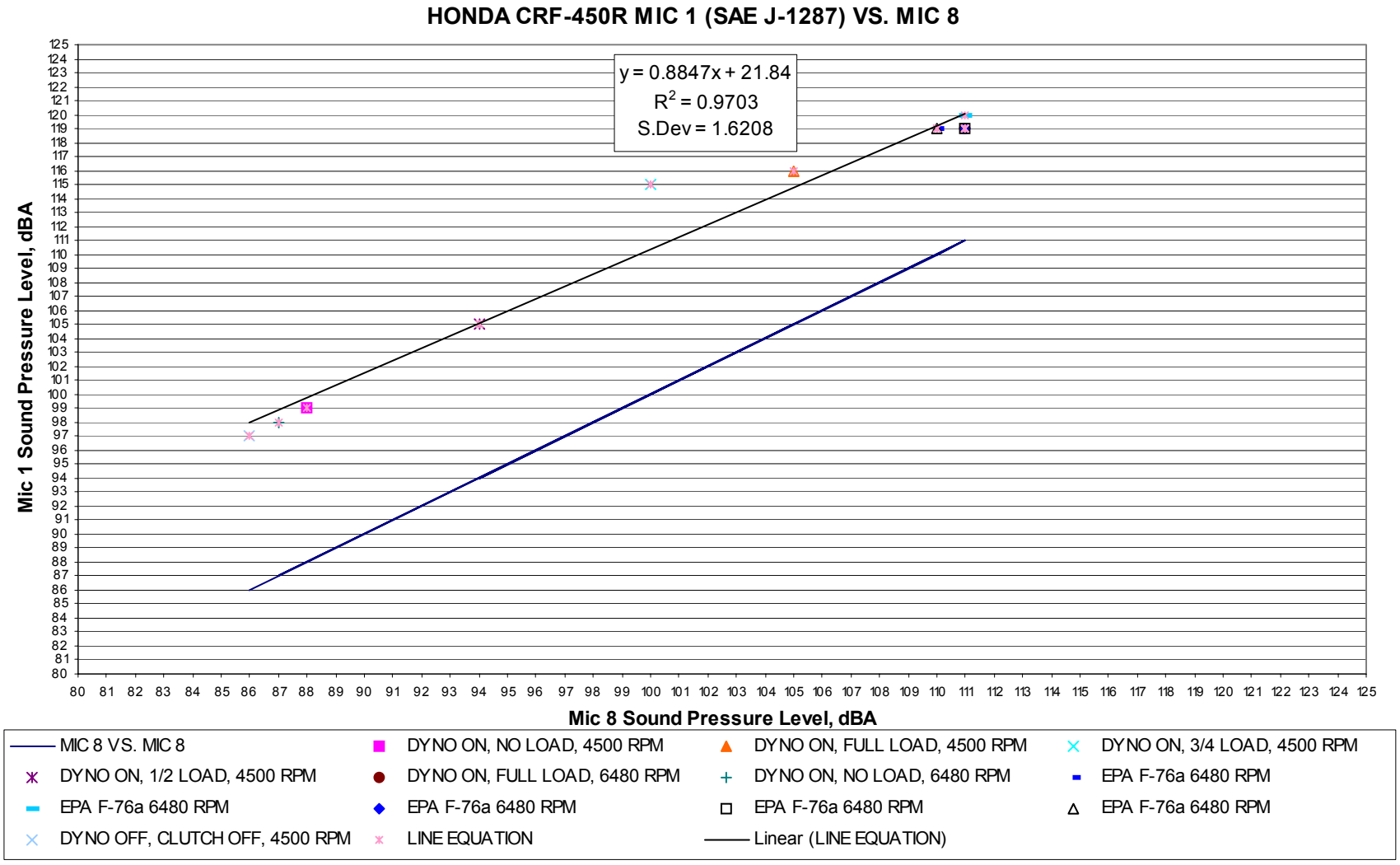


Figure D-13. Regression Analysis, Microphone 1 and Microphone 8 Positions

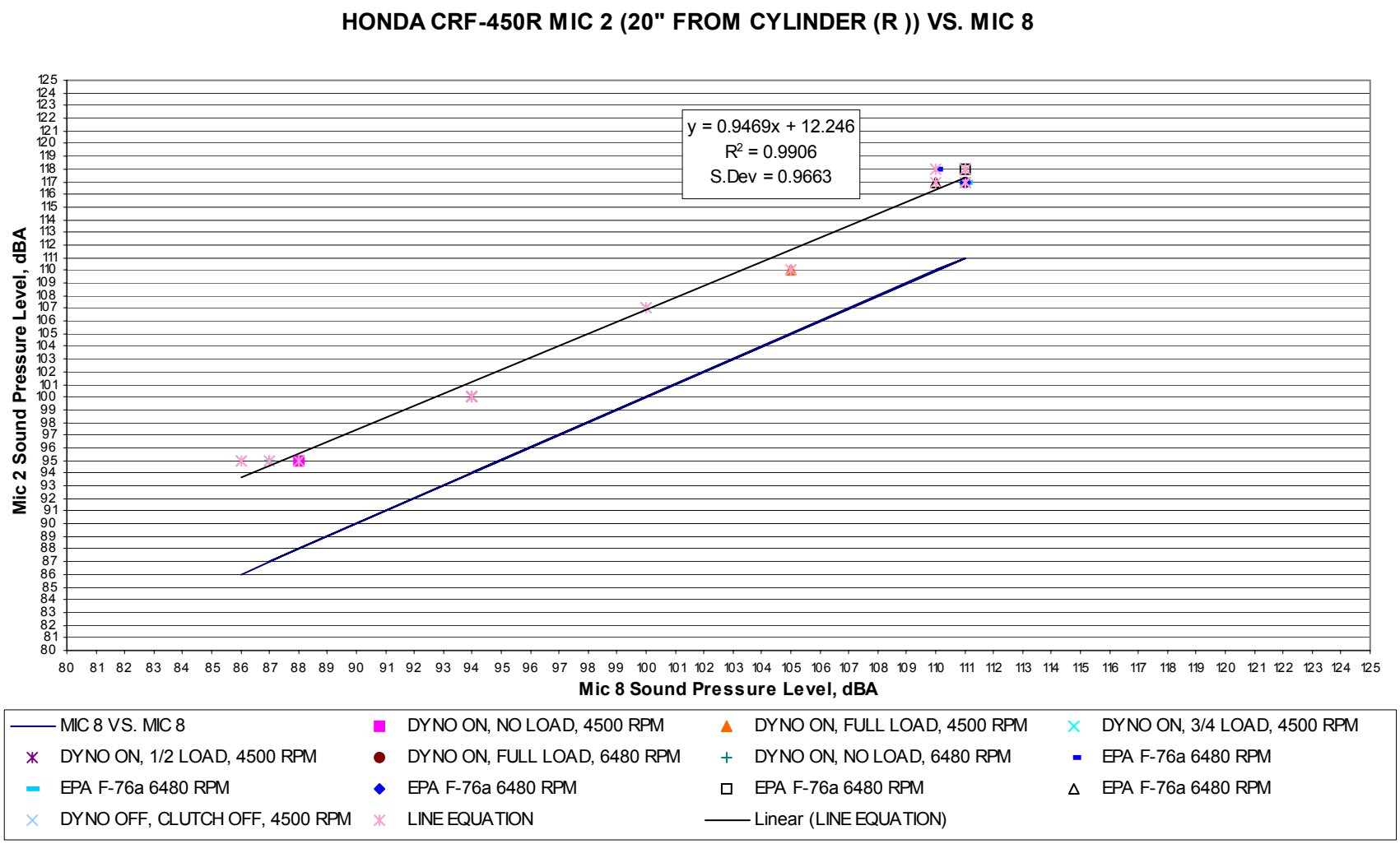


Figure D-14. Regression Analysis, Microphone 2 and Microphone 8 Positions

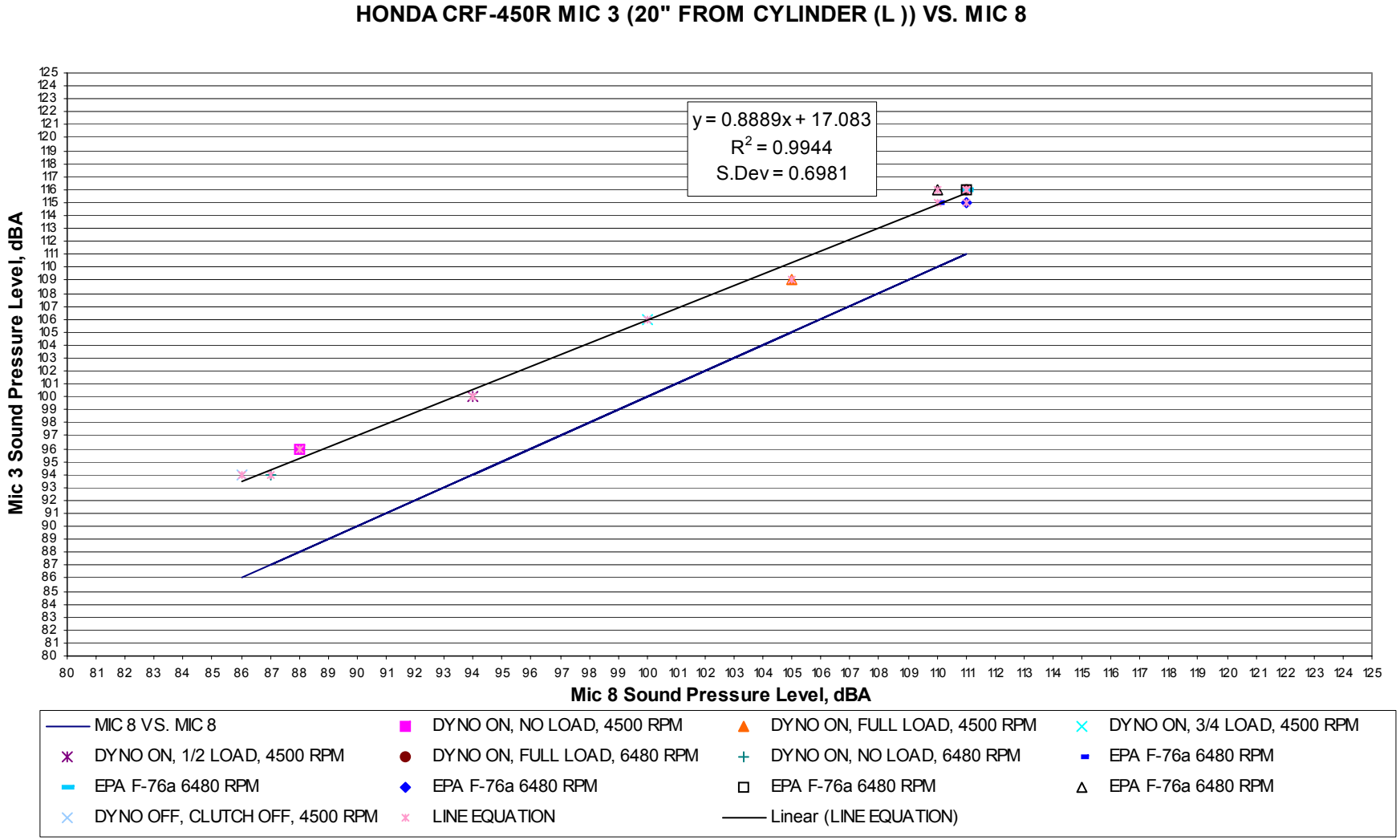


Figure D-15. Regression Analysis, Microphone 3 and Microphone 8 Positions

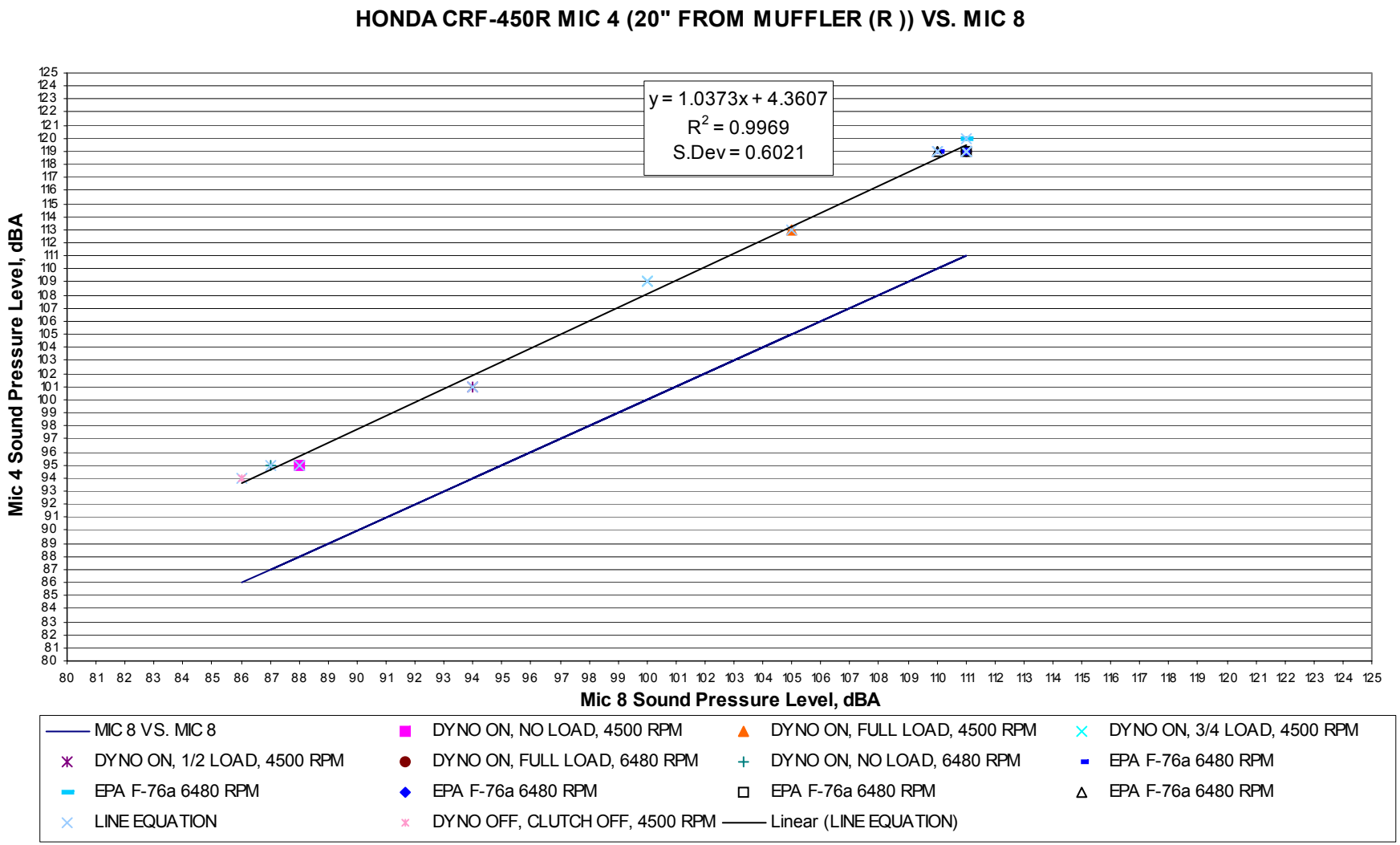


Figure D-16. Regression Analysis, Microphone 4 and Microphone 8 Positions

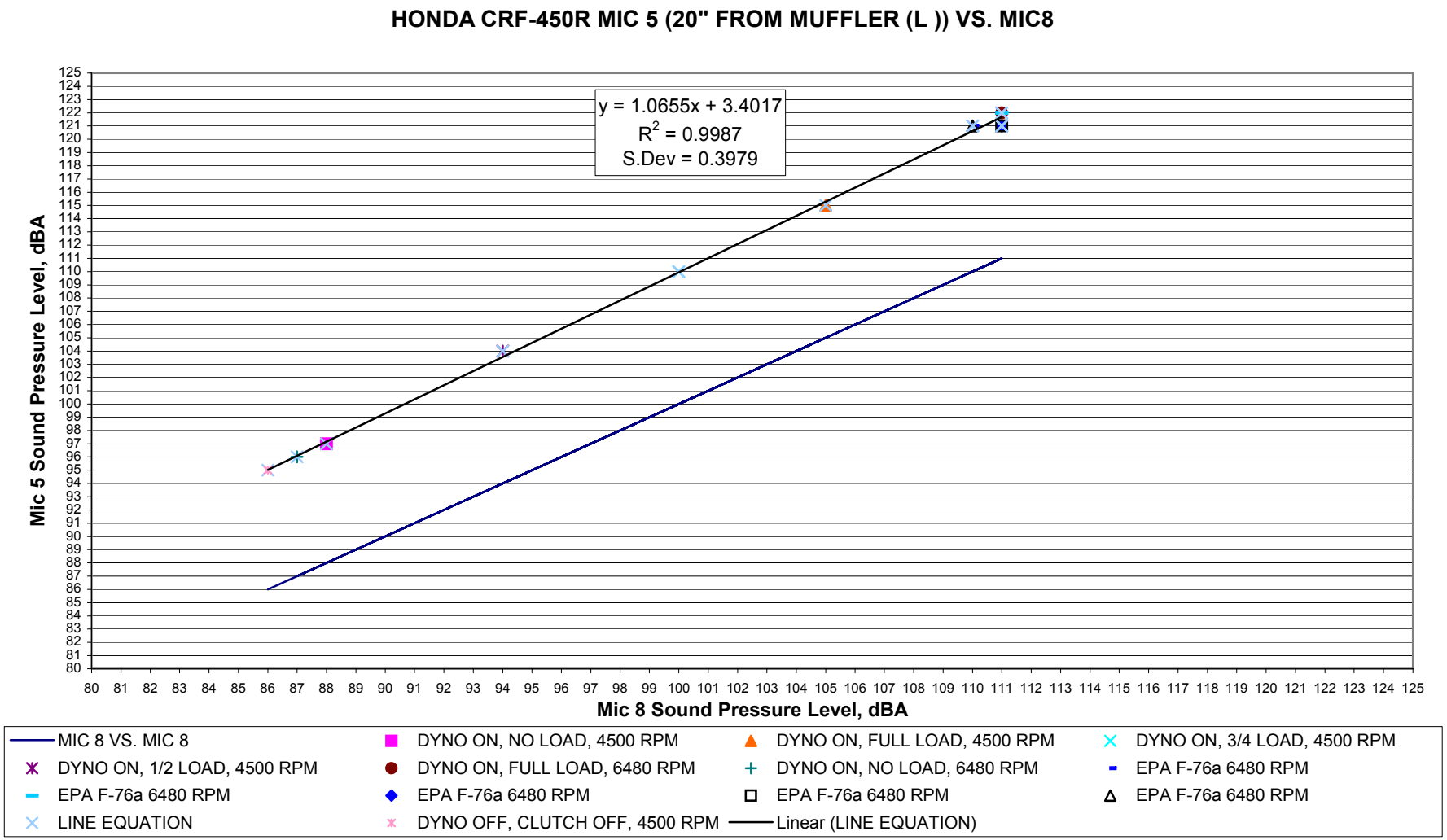


Figure D-17. Regression Analysis, Microphone 5 and Microphone 8 Positions

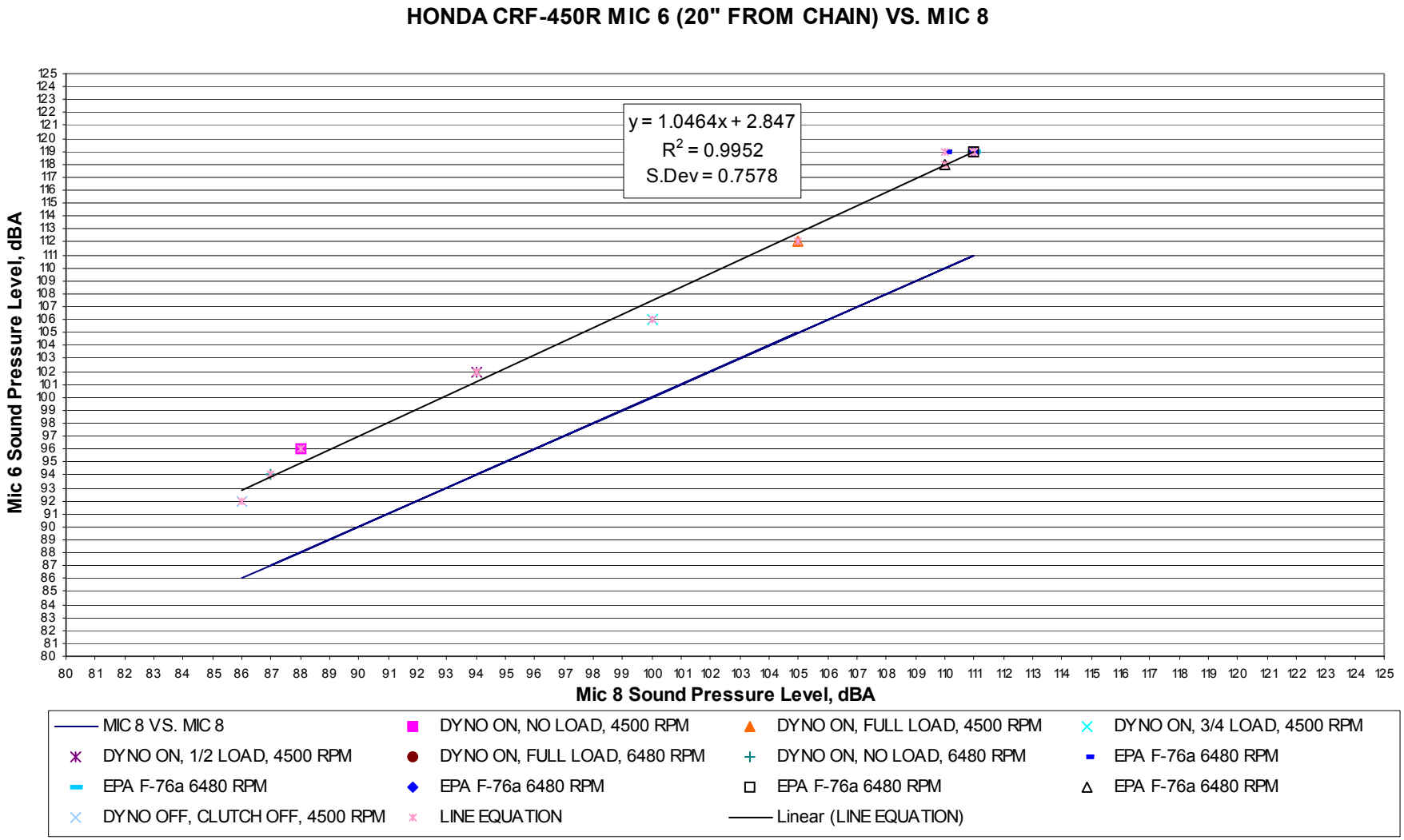


Figure D-18. Regression Analysis, Microphone 6 and Microphone 8 Positions

HONDA CRF-450R MIC 7 (SYMETRIC OF SAE J-1287) VS. MIC 8

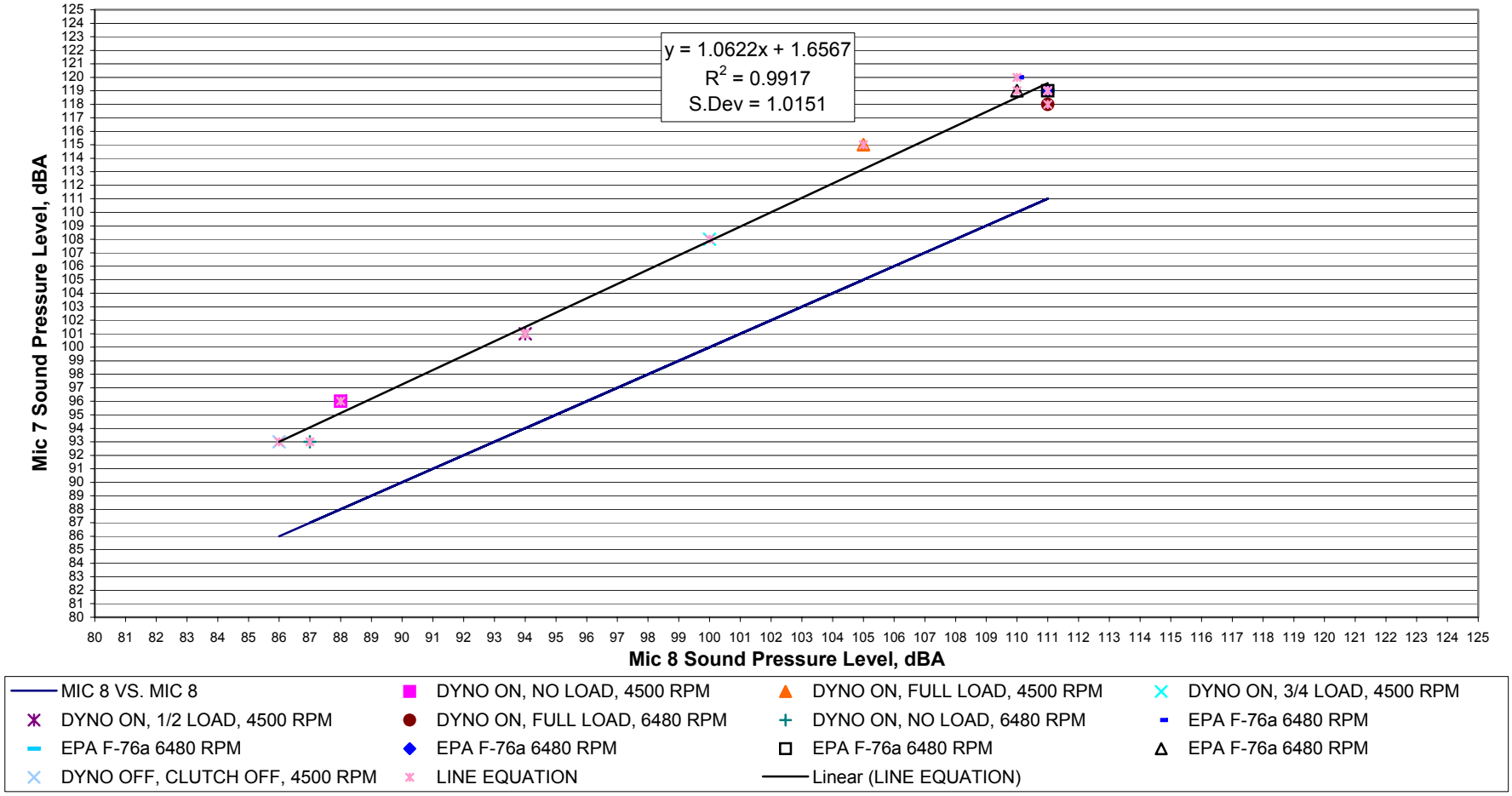


Figure D-19. Regression Analysis, Microphone 7 and Microphone 8 Positions

APPENDIX E

Field Noise Measurement Data for Cable Airport Testing

							Sound Pressure Level Measured in A-weighted decibels (dBA)							
			VEHICLE CHARACTERISTICS				ISO		EPA	SAE	Right Side			
TEST DATE	MAKE	MODEL	STROKE	COOLING	COMPETITION	EXHAUST SYSTEM	362	5130	F-76a	J-1287	20 Inches from Cylinder	20 Inches from Muffler	5 Feet from Motorcyle	10 Feet from Motorcyle
4/5/2004	HONDA	CRF-250X	4	Water	NO	PC496 PERFORMANCE MUFFLER	95	94	91	95	90	93	87	81
4/5/2004	HONDA	CRF-250X	4	Water	NO	STOCK	88	90	81	90	90	89	85	79
4/5/2004	HONDA	XR-80R	4	AIR	NO	STOCK	84	84	81	84	85	82	78	71
4/5/2004	HONDA	CR-85R	2	Water	YES	FMF SHORTY	101	97	95	97	96	93	89	84
4/5/2004	HONDA	XR-400R	4	AIR	NO	HONDA MODIFIED TIP	99	95	88	95	89	92	86	81
4/5/2004	HONDA	XR-400R	4	AIR	NO	STOCK	89	89	84	89	88	86	82	78
4/5/2004	HONDA	XR-400R	4	AIR	NO	FMF "Q"	95	91	90	91	89	88	84	79
4/5/2004	HONDA	XR-400R	4	AIR	NO	PROCIRCUIT T4	101	98	93	98	92	95	90	83
4/5/2004	HONDA	CRF-450R	4	Water	YES	STOCK	106	99	96	99	96	93	88	85
4/5/2004	KTM	200 EXC	2	Water	NO	STOCK	93	87	89	87	85	86	81	75
4/5/2004	SUZUKI	RM250	2	Water	YES	FMF TURBINE CORE 2	99	94	92	95	94	93	85	82
4/5/2004	YAMAHA	YZ-125	2	Water	YES	FMF SHORTY	103	96	97	98	95	92	88	85
4/5/2004	YAMAHA	YZ-125	2	Water	YES	STOCK	101	93	94	93	95	93	87	82
4/5/2004	YAMAHA	YZ-250	2	Water	YES	FMF "Q"	97	94	92	95	98	94	90	95
4/5/2004	YAMAHA	YZ-250	2	Water	YES	STOCK	99	95	94	95	98	94	89	83
4/5/2004	YAMAHA	YZ-250F	4	Water	YES	BIG GUN RACE	102	104	96	104	98	100	94	89
4/5/2004	YAMAHA	WR250	2	Water	NO	FMF "Q"	98	98	93	99	94	93	89	85

							Sound Pressure Level Measured in A-weighted decibels (dBA)							
			VEHICLE CHARACTERISTICS				ISO		EPA	SAE	Right Side			
TEST DATE	MAKE	MODEL	STROKE	COOLING	COMPETITION	EXHAUST SYSTEM	362	5130	F-76a	J-1287	20 Inches from Cylinder	20 Inches from Muffler	5 Feet from Motorcyle	10 Feet from Motorcyle
8/11/2004	HONDA	CRF-250X	4	Water	NO	STOCK	85	86	75	88	89	87	81	78
8/11/2004	HONDA	CRF-250X	4	Water	NO	MODIFIED STOCK	94	94	85	96	92	92	86	82
8/11/2004	HONDA	CRF-250X	4	Water	NO	YOSHIMURA QUIET	92	93	85	93	92	93	85	80
8/11/2004	HONDA	CRF-250X	4	Water	NO	FMF "Q"	91	90	83	91	91	89	82	79
8/11/2004	HONDA	CRF-450R	4	Water	YES	FMF "Q"	97	92	87	93	94	92	86	84
8/11/2004	SUZUKI	RM250	2	Water	YES	FMF SHORTY	93	94	89	94	95	94	86	80
8/11/2004	SUZUKI	RM250	2	Water	YES	STOCK	94	94	89	96	97	95	88	83
8/11/2004	YAMAHA	YZ-125	2	Water	YES	STOCK	97	96	89	95	97	96	88	84
8/11/2004	YAMAHA	YZ-125	2	Water	YES	FMF TURBINE CORE 2	94	91	89	91	94	91	85	79
8/11/2004	YAMAHA	YZ-250	2	Water	YES	FMF SHORTY	93	95	95	96	99	97	90	85
8/11/2004	YAMAHA	YZ-250	2	Water	YES	FMF "Q"	93	92	89	93	99	96	90	84
10/13/2004	YAMAHA	TTR-230	4	AIR	NO	STOCK	86	88	81	88	--	--	78	71
10/13/2004	HONDA	CRF-150F	4	AIR	NO	STOCK	84	84	80	86	--	--	78	70
10/13/2004	YAMAHA	WR-250F	4	Water	NO	STOCK (Broken air box)	94	86	89	86	--	--	84	77
10/13/2004	KTM	525EXC	4	Water	NO	STOCK	--	--	97	95	--	--	--	--

APPENDIX F

Field Noise Measurement Data for Jawbone Canyon, Hollister Hills SVRA, and Hungry Valley SVRA

Table F-2. Jawbone Canyon (BLM) Vehicle Testing Data

Vehicle	Year	Engine Size (cc)	2-Stroke	4-Stroke	M/C	ATV	Noise Level (dBA)	No Maint	<15 Hrs	>20 Hrs	Greater than 97.5 dBA
January 3, 2004											
Honda	2001	250	YES		YES		91.0			YES	
Yamaha	2004	250	YES		YES		92.0		YES		
Suzuki	1997	250	YES		YES		95.0			YES	
Honda	2002	650		YES	YES		98.0			YES	YES
Yamaha	2002	426		YES	YES		96.0		YES		
Yamaha	2004	250		YES	YES		100.0		YES		YES
Honda	2002	400		YES	YES		94.0	YES			
Honda	2002	650		YES	YES		98.5			YES	YES
Honda	2003	450		YES	YES		96.5		YES		
Honda	2002	450		YES	YES		96.5			YES	
Yamaha	1998	400		YES	YES		105.0			YES	YES
Yamaha	2002	85	YES		YES		91.0			YES	
Yamaha	2003	250	YES		YES		91.0		YES		
Honda	2000	650		YES	YES		96.5			YES	
ATK	1997	260	YES		YES		96.0			YES	
Kawasaki	2002	250	YES		YES		92.0		YES		
KTM	2004	450		YES	YES		95.0		YES		
Honda	1983	200		YES	YES		95.0			YES	
Suzuki	2003	400		YES		YES	87.0	YES			
Kawasaki	1994	80	YES		YES		94.0			YES	
Honda	2003	230		YES	YES		81.0	YES			
Honda	2003	50		YES	YES		89.0		YES		
Honda	2003	150		YES	YES		81.0	YES			
Honda	1997	80	YES		YES		94.0			YES	
Yamaha	2001	125	YES		YES		91.0		YES		
Yamaha	2002	426		YES	YES		100.0		YES		YES
Bombardier	2004	650		YES		YES	95.0		YES		
Yamaha	2003	250	YES		YES		95.0		YES		
Yamaha	2003	660		YES		YES	98.0		YES		YES
Yamaha	2002	426		YES	YES		104.0		YES		YES
Honda	2001	250	YES		YES		92.0		YES		
Honda	2003	90		YES		YES	89.0	YES			
Kawasaki	2001	300		YES	YES		97.0		YES		
Suzuki	2003	400		YES		YES	90.0	YES			
Honda	2004	450		YES	YES		94.0		YES		
Honda	1988	250	YES		YES		94.0			YES	
Suzuki	2003	400		YES		YES	95.5		YES		
Yamaha	2001	250		YES	YES		104.0			YES	YES
Honda	2000	250	YES		YES		94.0			YES	
Honda	2002	650		YES	YES		93.0	YES			
Kawasaki	1995	500	YES		YES		95.0		YES		

Table F-2. Jawbone Canyon (BLM) Vehicle Testing Data (*concluded*)

Vehicle	Year	Engine Size (cc)	2-Stroke	4-Stroke	M/C	ATV	Noise Level (dBA)	No Maint	<15 Hrs	>20 Hrs	Greater than 97.5 dBA
January 3, 2004											
Honda	2002	650		YES	YES		98.0		YES		YES
Honda	2002	650		YES	YES		95.0	YES			
Honda	2003	450		YES	YES		97.0		YES		
Kawasaki	2002	300		YES	YES		92.0		YES		
Yamaha	2000	400		YES	YES		104.0			YES	YES
January 4, 2004											
Honda	2002	400		YES	YES		98.5			YES	YES
KTM	2002	400		YES	YES		95.0			YES	
KTM	2002	400		YES	YES		95.0		YES		
Honda	2001	650		YES	YES		95.0		YES		
Honda	2001	650		YES	YES		91.0		YES		
Honda	1988	100		YES	YES		84.0			YES	
KTM	1999	200	YES		YES		85.0			YES	
KTM	2003	450		YES	YES		94.0			YES	
Averages			29.7%	70.6%	89.1%	11.1%	94.0	14.8%	46.4%	38.9%	20.4%
	79.6%	Pass				Passing vehicles average	92.6				
	20.4%	Fail				Failing vehicles average	100.7				

Table F-2. Hollister Hills SVRA Vehicle Testing Data

Vehicle	Year	Engine Size (cc)	2-Stroke	4-Stroke	M/C	ATV	Noise Level (dBA)	No Maint	<15 Hrs	>20 Hrs	Greater than 97.5 dBA
January 17, 2004											
Yamaha	2003	426		YES	YES		103.7				YES
Yamaha	2001	660		YES		YES	100.8				YES
Honda	2002	400		YES	YES		100.0				YES
Honda	1984	500	YES		YES		99.0				YES
Honda	2002	450		YES	YES		95.6				
KTM	2001	200	YES		YES		91.3				
Honda	2003	450		YES	YES		97.4				
Honda	2002	450		YES	YES		96.9				
Yamaha	2002	250		YES	YES		104.9				YES
Yamaha	2000	426		YES	YES		98.3				YES
Honda	2003	400		YES	YES		94.8				
Suzuki	2003	380		YES		YES	99.9				YES
Yamaha	2001	426		YES	YES		98.0				YES
Yamaha	2001	426		YES	YES		108.0				YES
Suzuki	2004	125		YES	YES		85.0				
Honda	1994	250	YES		YES		94.5				
Honda	2003	450		YES	YES		97.4				
Yamaha	2001	250		YES	YES		104.9				YES
Honda	2003	230		YES	YES		94.8				
Honda	2004	450		YES	YES		96.5				
Honda	2001	125	YES				91.3				
Yamaha	2003	250	YES		YES		94.4				
Yamaha	2003	250		YES	YES		94.9				
Suzuki	2003	400		YES		YES	92.3				
Yamaha	2003	85	YES		YES		93.0				
Suzuki	2004	250	YES		YES		96.0				
Yamaha	2003	250		YES	YES		107.3				YES
Yamaha	1992	350		YES		YES	93.3				
Yamaha	2003	450		YES	YES		96.8				
Yamaha	2001	80	YES		YES		96.8				
Yamaha	1998	400		YES	YES		106.9				YES
Honda	2000	400		YES	YES		95.5				
Honda	2000	400		YES	YES		103.2				YES
Honda	2004	450		YES	YES		97.4				
Honda	1986	250		YES	YES		92.5				
Honda	2001	400		YES	YES		101.6				YES

Table F-2. Hollister Hills SVRA Vehicle Testing Data (*concluded*)

Vehicle	Year	Engine Size (cc)	2-Stroke	4-Stroke	M/C	ATV	Noise Level (dBA)	No Maint	<15 Hrs	>20 Hrs	Greater than 97.5 dBA
January 18, 2004											
Suzuki	2001	125	YES		YES		93.5				
Honda	1994	250		YES	YES		90.4				
Yamaha	2002	426		YES	YES		97.2				
Yamaha	2001	426		YES	YES		102.1				YES
Yamaha	1998	400		YES	YES		96.5				
Yamaha	1991	125		YES		YES	95.0				
Honda	2000	600		YES	YES		100.8				YES
Honda	2004	450		YES	YES		103.0				YES
Honda	2002	450		YES	YES		103.8				YES
Honda	2000	600		YES	YES		93.8				
Honda	1980	500	YES		YES		97.3				
Yamaha	2003	250		YES	YES		97.2				
Suzuki	2000	250	YES		YES		93.5				
Suzuki	2000	400		YES	YES		96.5				
Honda	2001	250	YES		YES		96.8				
Yamaha	2003	250	YES		YES		95.5				
Kawasaki	1990	250	YES		YES		93.6				
Yamaha	1999	350		YES		YES	98.0				YES
Yamaha	2000	400		YES	YES		95.9				
Kawasaki	2000	300		YES	YES		96.5				
Yamaha	2002	426		YES	YES		101.3				YES
Yamaha	2000	426		YES	YES		97.5				
KTM	2001	520		YES	YES		102.5				YES
Honda	1992	500	YES		YES		98.4				YES
Yamaha	2004	450		YES		YES	88.5				
Suzuki	2000	400		YES	YES		96.4				
Yamaha	1998	80	YES		YES		93.6				
Yamaha	1982	175	YES		YES		96.6				
Honda	1988	500	YES		YES		97.8				YES
Honda	2003	150		YES	YES		91.5				
Yamaha	2003	250		YES	YES		96.5				
Yamaha	2001	125	YES		YES		89.5				
Honda	2004	450		YES	YES`		95.1				
Honda	1997	250	YES		YES		93.3				
Suzuki	1989	250	YES		YES		99.4				YES
Averages:			30%	70%	90%	10%	98.0				34%
	66%	Pass	Passing vehicles average				94.6				
	34%	Fail	Failing vehicles average				101.8				

Table F-3. Hungry Valley SVRA Vehicle Testing Data

Vehicle	Year	Engine Size (cc)	2-Stroke	4-Stroke	M/C	ATV	Noise Level (dBA)	No Maint	<15 Hrs	>20 Hrs	Greater than 97.5 dBA
January 24, 2004											
Yamaha	2001	250		YES	YES		96.5				
Honda	2002	250	YES		YES		93.0				
Honda	1989	125	YES		YES		98.6				YES
Honda	1989	250	YES		YES		93.0				
Honda	2001	70		YES	YES		79.0				
Yamaha	1985	200	YES		YES		88.0				
Suzuki	2003	400		YES		YES	89.0				
Honda	2002	250	YES		YES		91.0				
KTM	2003	300	YES		YES		89.0				
Honda	2001	600		YES	YES		83.0				
Honda	1994	650		YES	YES		94.5				
Honda	1992	500	YES		YES		97.2				
Kawasaki	1992	125	YES		YES		102.0				YES
Honda	2003	125	YES		YES		100 .0				YES
Honda	1987	500	YES		YES		99.0				YES
Honda	2004	230		YES	YES		80.2				
Honda	2003	650		YES	YES		92.0				
Yamaha	2003	250	YES		YES		94.4				
Yamaha	1997	350		YES		YES	96.5				
Honda	1986	250	YES		YES		103.0				YES
Yamaha	1980	465	YES		YES		110.0				YES
Suzuki	1997	160		YES		YES	87.0				
Yamaha	2002	125		YES	YES		89.0				
Kawasaki	2000	650		YES	YES		99.0				YES
Honda	1989	350	YES			YES	109.0				YES
Yamaha	2003	250		YES	YES		99.0				YES
Kawasaki	2004	110		YES	YES		94.9				
Yamaha	2000	250	YES		YES		98.0				YES
Honda	2002	80		YES	YES		84.0				
Honda	2002	650		YES	YES		92.8				
Honda	1997	250	YES		YES		98.0				YES

Table F-3. Hungry Valley SVRA Vehicle Testing Data (*continued*)

Vehicle	Year	Engine Size (cc)	2-Stroke	4-Stroke	M/C	ATV	Noise Level (dBA)	No Maint	<15 Hrs	>20 Hrs	Greater than 97.5 dBA
January 25, 2004											
Yamaha	2003	450		YES	YES		96.5				
Yamaha	2003	450		YES	YES		94.0				
Yamaha	2003	450		YES	YES		94.5				
Yamaha	2003	450		YES	YES		93.5				
Honda	2002	450		YES	YES		96.0				
Yamaha	1998	250	YES		YES		95.0				
Yamaha	2004	450		YES	YES		95.5				
KTM	2004	450		YES	YES		98.5				YES
Yamaha	2004	450		YES	YES		94.5				
Yamaha	1999	80	YES		YES		100.0				YES
Suzuki	2003	85	YES		YES		89.0				
Yamaha	1985	350		YES		YES	99.5				YES
Suzuki	1980	400	YES		YES		98.0				YES
Honda	2001	80	YES		YES		97.0				
Honda	1985	125	YES		YES		99.5				YES
Honda	2001	400		YES	YES		100.5				YES
Yamaha	2001	125	YES		YES		98.5				YES
KTM	2003	450		YES	YES		94.5				
KTM	2003	525		YES	YES		97.5				
Yamaha	2002	250		YES	YES		100.0				YES
Yamaha	2001	426		YES	YES		102.0				YES
KTM	2002	450		YES	YES		95.1				
Suzuki	2002	85	YES		YES		94.5				
Honda	2002	400		YES	YES		101.0				YES
Honda	2004	450		YES	YES		94.5				
Yamaha	1996	250	YES		YES		95.0				
Kawasaki	1998	250	YES		YES		93.0				
Yamaha	2002	250		YES	YES		103.0				YES
Honda	2002	400		YES	YES		97.0				
Suzuki	2003	400		YES		YES	97.6				YES
Yamaha	2002	660		YES		YES	99.0				YES
Honda	1994	650		YES	YES		97.1				YES
Yamaha	2002	660		YES		YES	103.0				YES
Honda	1979	250		YES	YES		100.5				YES
Honda	2003	80			YES		85.0				
Yamaha	2003	125		YES			89.6				
Yamaha	2002	250		YES	YES		93.0				
Honda	2001	100		YES	YES		85.0				
Honda	2002	400		YES	YES		86.5				
Yamaha	2003	660		YES		YES	102.0				YES
Suzuki	1988	250	YES		YES		96.0				YES

Table F-3. Hungry Valley SVRA Vehicle Testing Data (*concluded*)

Vehicle	Year	Engine Size (cc)	2-Stroke	4-Stroke	M/C	ATV	Noise Level (dBA)	No Maint	<15 Hrs	>20 Hrs	Greater than 97.5 dBA
January 25, 2004											
Kawasaki	1994	80	YES		YES		99.0				YES
Honda	1989	125	YES		YES		97.0				
Averages:			39%	61%	86%	14%	95.0				41%
	59%	Pass	Passing vehicles average				90.2				
	41%	Fail	Failing vehicles average				100.6				

APPENDIX G

Details of Attitudinal Survey

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G.1 Survey Design

There are ten steps involved in conducting an attitudinal survey. They are:

1. Clearly define the goals of the survey and determine the schedule and budget.
2. Identify the population to be interviewed in the study.
3. Determine the sample size and sample selection procedure.
4. Choose the type of survey to be conducted.
5. Design the questionnaire.
6. Pretest the questionnaire.
7. Select and train interviewers.
8. Implement the survey.
9. Process the collected information.
10. Analyze the data and prepare a final report.

The first two steps were largely predetermined by the requirements of the Request for Proposal and the discussions that followed. The processes by which the remaining steps were carried out are described in the following sections.

G.1.1 Sample Size and Sample Selection Procedure

Most surveys are designed to determine information about a specific population based upon questionnaires administered to a small subset of that population, called the sample. The larger the sample size relative to the total population, the more accurate the results of the analysis. Therefore, the choice of sample size is usually based on the desired accuracy of the study balanced against the resources available.

In this project there were five different populations studied:

- OHV site staff;
- OHV site neighbors;
- OHV site enthusiasts;
- Environmental groups; and
- Vehicle and after-market manufacturers.

The populations of OHV site staff, neighbors, and enthusiasts consist of all such individuals in the State of California. To sample these populations, surveys were conducted at three OHV sites geographically distributed throughout the state. At each of these sites, questionnaires were administered to the site staff and the neighbors. Questionnaires were administered to a random sample of enthusiasts at each of these sites on days of high-volume use. The actual ratio of sample to population for site enthusiasts will vary from one site to the other.

The population of environmental groups consists of the environmental organizations belonging to the California OHV Stakeholders Roundtable and additional groups recommended by the OHMVR Division.

Sixteen manufacturers of OHV equipment who market their products in California were surveyed. Questionnaires were administered to all such manufacturers that could be identified.

The list of the groups receiving and responding to survey questionnaires is shown in Table G.1-1.

G.1.2 Type of Survey

Three different methods are generally used to collect survey information: mailed surveys; telephone surveys; and in-person interviews. The design of a questionnaire depends heavily on which survey method is to be used.

G.1.2.1 Mailed Surveys

In mailed surveys, a printed questionnaire is sent to predetermined potential respondents, who are asked to complete the questionnaire on their own and return it by mail. The advantages of a mailed survey are:

- It has a lower cost than other methods since it is not necessary to employ and train interviewers or to pay travel and/or telephone charges;
- It is convenient for the respondent, since the questionnaire can be completed at the respondent's leisure;
- Since there is no contact with an interviewer the respondent may feel the responses given are more anonymous and, therefore, may be more forthcoming; and
- Each respondent receives exactly the same questionnaire so no bias can be inadvertently introduced by an interviewer.

The disadvantages of a mailed survey are:

- There is usually a lower response rate than other methods;
- A relatively long time period must be allowed for the return of questionnaires;
- The response may be biased toward better educated individuals since individuals with reading or language deficiencies often do not respond to mailed surveys; and
- Questions that require detailed probing by an interviewer or which must be asked in a specific order are precluded.

G.1.2.2 Telephone Surveys

A telephone survey consists of an interview over the telephone between a trained interviewer and a selected respondent. The advantages of a telephone survey are:

- Data can be collected more rapidly than in mailed surveys or in-person interviews;
- The cost of a telephone survey is less than in-person interviews;
- Questions can be asked in the exact order intended; and
- The interviewer can probe to clarify an answer or elicit a more detailed response.

The disadvantages of a telephone survey are:

- The interviewer has less control than with an in-person interviewer, since the respondent may hang up at any time;
- No visual aids, such as maps, pictures, or charts, can be used as components of the questions; and
- The sample may be biased, since only people with telephones can be contacted.

G.1.2.3 In-Person Surveys

An in-person survey allows an interviewer to obtain information directly from a respondent in a personal interview. The advantages of an in-person survey are:

- The interviewer can clarify misunderstood questions, probe for more detail, and use visual aids;
- The interviewer can ask the questions in precisely the order intended;
- More complex questions, such as those involving detailed instructions or lengthy lists of alternative responses, can be included in the questionnaire; and
- Much more complicated questionnaires can be used, such as those in which the response to, or attitude about, one question is used to determine the course of future questioning.

The disadvantages of an in-person survey are:

- The cost may be high because of travel time and interviewer training;
- Bias may be introduced because of the inadvertent reaction of an interviewer to a response;
- Potential respondents may be more reluctant to participate in a personal interview than in a mail or telephone survey;
- Respondents may feel less anonymous than in a mail or telephone survey and, therefore, may be less forthcoming in their responses.

G.1.2.4 Summary

Because of the different geographical distribution of each of the five populations in this study, all three types of surveys were used so resources available for the project could be optimized. OHV site staff and enthusiasts were surveyed in person, OHV site neighbors were surveyed by telephone, and environmental groups and manufacturers were surveyed by mail.

G.1.3 Questionnaire Design

Because of the differences in the nature of each of the populations, a different questionnaire was designed for each. However, there were similarities between the questionnaires. In general the questionnaires for site staff, enthusiasts, and neighbors followed the pattern below:

- General questions establishing the background of the respondent (approximate age, sex, length of residence, employment, or use of OHV site, occupation, amount of time at home or at site, and leisure activities).
- General questions concerning viewpoints about the local environment (air and water quality, traffic, housing and crime issues).
- Questions relating to viewpoints about noise issues (nearby industry, road traffic, aircraft, rail traffic, boating, off-highway vehicles).
- Questions relating to noise from specific classes of off-highway vehicles.
- Questions specifically relating to the California OHV Noise Standard (awareness of the standard, awareness of implementation, public outreach, and education efforts, viewpoints about changes in the OHV noise emissions as a result of the standard, and viewpoints about the effects of the standard on their environment or sport).

Because surveys were to be administered a year after a change in the California OHV Noise Standard went into effect, it was not possible to administer two questionnaires – one before the change and another after the change. Instead, questions were included that addressed the respondent's perception of the change in noise emissions from various noise sources since January of 2003.

The questionnaire to environmental group representatives elicited the nature of the group and its objectives relative to OHV noise issues, awareness of implementation, public outreach, and education efforts regarding the California OHV Noise Standard, and viewpoints about the sufficiency of the standard and these efforts.

The questionnaire to after-market manufacturers elicited the nature of the products manufactured, the awareness of implementation, public outreach, and education efforts regarding the standard, and viewpoints about the effect the standard and these efforts have on the industry.

G.1.4 Pre-testing of Questionnaires

Drafts of the questionnaires were reviewed by all team members and by the OHMVR Division before they were finalized. The questionnaires for site staff, enthusiasts, and neighbors were administered at one OHV site for pre-testing. The results were processed and analyzed, and deficiencies identified and corrected before the questionnaires were administered at the remaining sites.

G.1.5 Processing, Analysis, and Reporting

The processed data was analyzed and a report was prepared upon completion of each of the surveys. Each report contained a summary of results and a comparison of those results with the results of previous surveys conducted at other OHV riding areas. See Table G.1-1.

Table G.1-1. Environmental and Manufacturing Groups Surveyed

Group	Contacted	Responded?
Manufacturer	American Suzuki	Yes
	Artic Cat	No
	Big Gun	No
	Bill's Pipes	No
	Bombardier	No
	FMF Racing	Yes
	Honda	No
	Husquvarna	No
	Kawasaki Motors	Yes
	KTM	No
	Polaris	No
	Polini	No
	Pro Circuit Products	Yes
	White Brothers	No
	Yamaha	No
	Yoshimura	No
Environmental	Action Coalition for Equestrians	Yes
	California Native Plant Society	No
	California Wild Heritage Campaign	No
	Center for Biological Diversity	Yes
	Center for Sierra Nevada Conservation	Yes
	Central Sierra Environmental Resource Center	Yes
	Citizens for a Vehicle Free Nipomo Dunes	Yes
	Defenders of Wildlife	Yes
	Desert Protective Council	Yes
	Eastern Sierra Audubon Society	Yes
	Forest Issues Group	Yes
	Friends of the Inyo	Yes
	Northern California Council Federation of Flyfishers	Yes
	Planning and Conservation League Foundation	Yes
	Protect American River Canyons	Yes
	Save Our Forest Association	Yes
	Sierra Club (Mother Lode Chapter)	Yes
	Sierra Foothills Audubon Society	Yes
	Snowlands Network	Yes
	The Desert Survivors	No
	The Wilderness Society	No

Response Summary

Group	Contacted	Responded
Manufacturer	16	4
Environmental	21	17
Total	37	21

APPENDIX G.2

Park Enthusiast Questionnaire

Personal Information

1. What is your gender? ___

   M = Male
   F = Female

2. What is your age? ___

   1 = less than 18
   2 = 18 to 30
   3 = 30 to 40
   4 = 40 to 50
   5 = 50 to 60
   6 = over 60

3. How long have you been driving off-highway motor vehicles?___

   1 = less than 1 year
   2 = 1 to 3 years
   3 = 4 to 6 years
   4 = over 6 years

4. On average, how often do you use this park to drive off-highway motor vehicles? ___

   1 = less that once a month
   2 = more than once a month but less than once a week
   3 = once a week
   4 = more than once a week

5. What type of off-highway motor vehicle do you drive in this park? (Check all that apply.)

   ___ Motorcycle ___ All-terrain vehicle ___ Sport utility vehicle ___ Snowmobile

6. If you drive a motorcycle, what type of motorcycle is it? (Check all that apply.)

   ___ Competition Motorcycle ___ Non-competition Motorcycle

Off-Highway Motor Vehicle Noise

By circling the appropriate number indicate whether or not you have noticed any change in noise in this park from each of the following off-highway motor vehicle noise sources since January of 2003. Circle 0 if the source is not present in this park.

	Significantly Quieter	Slightly Quieter	No Change	Slightly Noisier	Significantly Nosier	Source Not Present
7. Motorcycles	1	2	3	4	5	0
8. All-terrain vehicles (ATVs)	1	2	3	4	5	0
9. Sport utility vehicles (SUVs)	1	2	3	4	5	0
10. Snowmobiles	1	2	3	4	5	0

Off-Highway Motor Vehicle Noise Standard

11. Are you aware of the current Off-Highway Motor Vehicle Noise Standard? ___
If no, skip to question 14.
Y=Yes
N=No

12. What is the noise limit specified in the standard for off-highway motor vehicles manufactured after January 1, 1986? _____ dBA

13. How effective do you feel that the noise standard has been? ___
1 = Not at all effective
2 = Somewhat effective
3 = Very effective

14. Are you familiar with current methods by which this standard is enforced? ___
If no, skip to question 16.
Y = Yes
N = No

15. How effective do you feel these methods have been? ___
1 = Not at all effective
2 = Somewhat effective
3 = Very effective

16. Are you familiar with current public outreach and educational efforts regarding the standard?
If no, skip to question 18.
___
Y = Yes
N = No

17. How effective do you feel these efforts have been? ___
1 = Not at all effective
2 = Somewhat effective
3 = Very effective

18. How has the noise standard and its implementation changed your enjoyment of the sport? ___
1 = Made it less enjoyable
2 = No change
3 = Made it more enjoyable

APPENDIX G.3

Park Enthusiast Survey Analysis

	Jawbone Canyon		Hollister Hills		Hungry Valley		Average
	Percent	Number	Percent	Number	Percent	Number	Percent
1. What is your gender?							
Male	82.5	47	85.5	388	85.0	289	85.1
Female	17.5	10	14.5	66	15.0	51	14.9
Total		57		454		340	
2. What is your age?							
less than 18	0.0	0	0.0	0	0.0	0	0.0
18 to 30	10.3	6	27.8	126	40.4	138	31.6
30 to 40	44.8	26	36.6	166	36.3	124	37.0
40 to 50	36.2	21	31.3	142	20.8	71	27.4
50 to 60	6.9	4	4.2	19	2.6	9	3.7
over 60	1.7	1	0.2	1	0.0	0	0.2
Total		58		454		342	
3. How long have you been driving off-highway motor vehicles?							
less than 1 year	3.4	2	8.5	38	22.3	76	13.7
1 to 3 years	10.3	6	17.6	79	22.6	77	19.1
4 to 6 years	3.4	2	17.2	77	11.4	39	13.9
over 6 years	82.8	48	56.7	254	43.7	149	53.2
Total		58		448		341	
4. On average, how often do you use this park to drive off-highway motor vehicles?							
less than once a month	63.8	37	36.7	151	42.1	143	40.9
more than once a month but less than once a week	29.3	17	42.7	176	44.4	151	42.5
once a week	3.4	2	14.8	61	10.6	36	12.2
more than once a week	3.4	2	5.8	24	2.9	10	4.4
Total		58		412		340	
5. What type of off-highway motor vehicle do you drive in this park?							
Motorcycle	55.3	42	78.3	407	66.6	287	71.7
All-terrain vehicle	38.2	29	18.3	95	28.8	124	24.1
Sport utility vehicle	6.6	5	3.5	18	4.4	19	4.1
Snowmobile	0.0	0	0.0	0	0.2	1	0.1
Total		76		520		431	
6. What type of motorcycle do you drive in this park?							
Competition motorcycle only	31.0	13	22.4	95	11.9	40	18.5
Non-competition motorcycle only	50.0	21	57.8	245	77.9	261	65.8
Both competition and non-competition motorcycles	19.0	8	19.3	82	9.9	33	15.4
Don't know what type my motorcycle is	(1)	0	0.5	2	0.3	1	0.4
Total		42		424		335	

	Jawbone Canyon		Hollister Hills		Hungry Valley		Average
	Percent	Number	Percent	Number	Percent	Number	Percent
7. Change in motorcycle noise.							
Significantly quieter	19.3	11	18.7	79	5.6	19	13.3
Slightly quieter	12.3	7	28.6	121	19.1	65	23.5
No Change	63.2	36	48.5	205	65.1	222	56.4
Slightly noisier	1.8	1	3.1	13	6.7	23	4.5
Significantly noisier	1.8	1	1.2	5	3.5	12	2.2
Source not present	1.8	1	0.0	0	0.0	0	0.1
Total		57		423		341	
8. Change in ATV noise							
Significantly quieter	15.8	9	12.7	52	4.2	14	9.4
Slightly quieter	15.8	9	28.8	118	13.4	45	21.4
No Change	64.9	37	54.4	223	72.8	244	62.8
Slightly noisier	1.8	1	2.7	11	6.6	22	4.2
Significantly noisier	1.8	1	1.0	4	2.7	9	1.7
Source not present	0.0	0	0.5	2	0.3	1	0.4
Total		57		410		335	
9. Change in SUV noise							
Significantly quieter	8.8	5	7.1	27	2.5	8	5.2
Slightly quieter	7.0	4	12.1	46	7.1	23	9.6
No Change	73.7	42	50.9	194	78.8	256	64.5
Slightly noisier	0.0	0	2.6	10	1.8	6	2.1
Significantly noisier	1.8	1	0.8	3	0.9	3	0.9
Source not present	8.8	5	26.5	101	8.9	29	17.7
Total		57		381		325	
10. Change in snowmobile noise							
Significantly quieter	3.6	2	0.8	3	0.0	0	0.7
Slightly quieter	0.0	0	4.1	15	0.3	1	2.2
No Change	3.6	2	12.5	46	2.7	8	7.8
Slightly noisier	0.0	0	1.9	7	0.7	2	1.3
Significantly noisier	3.6	2	0.3	1	0.3	1	0.6
Source not present	89.1	49	80.4	295	95.9	281	87.4
Total		55		367		293	
11. Are you aware of the current Off-Highway Motor Vehicle							
Noise Standard							
Yes	75.9	44	89.1	400	57.9	198	75.6
No	24.1	14	10.9	49	42.1	144	24.4
Total		58		449		342	

	Jawbone Canyon		Hollister Hills		Hungry Valley		Average
	Percent	Number	Percent	Number	Percent	Number	Percent
12. What is the noise limit specified in the standard for off-highway motor vehicles manufactured after January 1, 1986?							
904			0.4	1			0.2
230			0.4	1			0.2
110			0.4	1	1.5	2	0.7
108					0.8	1	0.2
106			0.4	1			0.2
104					0.8	1	0.2
102			1.8	5	0.8	1	1.4
101	3.4	1	9.3	26	4.5	6	7.5
100					0.9	1	0.2
99					1.5	2	0.5
98	17.2	5	13.6	38	14.4	19	14.1
97			2.5	7	3.0	4	2.5
96	62.1	18	48.0	134	49.2	65	49.3
95			1.1	3	4.5	6	2.0
94			6.1	17	4.5	6	5.2
93			2.2	6	0.8	1	1.6
92	3.4	1	8.6	24	3.0	4	6.6
91			0.7	2	0.8	1	0.7
90			1.4	4	3.8	5	2.0
87			0.4	1			0.2
86	3.4	1	0.4	1			0.5
85			0.4	1			0.2
80			1.1	3	0.8	1	0.9
75					0.8	1	0.2
70			0.4	1	0.8	1	0.5
61					0.8	1	0.2
60			0.4	1	0.8	1	0.5
40	3.4	1					0.2
14					0.8	1	0.2
8			0.4	1			0.2
7	3.4	1					0.2
5	3.4	1					0.2
0					0.8	1	0.2
Total		29		279		132	
13. How effective do you feel that the noise standard has been?							
Not at all effective	29.5	13	24.0	93	39.9	83	29.6
Somewhat effective	36.4	16	48.3	187	45.2	94	46.5
Very effective	34.1	15	27.6	107	14.9	31	23.9
Total		44		387		208	

	Jawbone Canyon		Hollister Hills		Hungry Valley		Average
	Percent	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
14. Are you familiar with current methods by which this standard is enforced?							
Yes	60.3	35	74.9	329	40.4	138	59.8
No	39.7	23	25.1	110	59.6	204	40.2
Total		58		439		342	
15. How effective do you feel these methods have been?							
Not at all effective	20.6	7	17.2	59	33.1	50	22.0
Somewhat effective	55.9	19	43.7	150	45.7	69	45.1
Very effective	23.5	8	39.1	134	21.2	32	33.0
Total		34		343		151	
16. Are you familiar with current public outreach and educational efforts regarding the standard?							
Yes	32.8	19	37.1	165	21.6	74	30.5
No	67.2	39	62.9	280	78.4	268	69.5
Total		58		445		342	
17. How effective do you feel these efforts have been?							
Not at all effective	11.8	2	19.0	34	37.4	34	24.4
Somewhat effective	70.6	12	51.4	92	34.1	31	47.0
Very effective	17.6	3	29.6	53	28.6	26	28.6
Total		17		179		91	
18. How has the noise standard and its implementation changed your enjoyment of the sport?							
Made it less enjoyable	20.7	12	24.2	107	19.9	68	22.2
No change	70.7	41	60.9	270	63.6	217	62.7
Made it more enjoyable	8.6	5	14.0	66	16.4	56	15.1
Total		58		443		341	

APPENDIX G.4

Park Staff Questionnaire

Personal Information

1. What is your gender? ___

   M = Male
   F = Female

2. What is your age? ___

   1 = less than 18
   2 = 18 to 30
   3 = 30 to 40
   4 = 40 to 50
   5 = 50 to 60
   6 = over 60

3. How long have you worked for the park? ___

   1 = less than 1 year
   2 = 1 to 3 years
   3 = 4 to 6 years
   4 = over 6 years

4. How long have you been in your present position on the park staff?___

   1 = less than 1 year
   2 = 1 to 3 years
   3 = 4 to 6 years
   4 = over 6 years

5. What is your job title? _____

Off-Highway Motor Vehicle Noise

By circling the appropriate number indicate whether or not you have noticed any change in noise in your park from each of the following off-highway motor vehicle noise sources since January of 2003. Circle 0 if the source is not present in your park.

	Significantly Quieter	Slightly Quieter	No Change	Slightly Noisier	Significantly Nosier	Source Not Present
6. Motorcycles	1	2	3	4	5	0
7. All-terrain vehicles (ATVs)	1	2	3	4	5	0
8. Sport utility vehicles (SUVs)	1	2	3	4	5	0
9. Snowmobiles	1	2	3	4	5	0

Off-Highway Motor Vehicle Noise Standard

10. How effective do you feel that the 2003 OHMV noise standard has been? ___
    1 = Not at all effective
    2 = Somewhat effective
    3 = Very effective

11. What changes in the standard would you recommend?
    _____
    _____
    _____
    _____

12. How effective do you feel 2003 noise enforcement methods have been? ___
    1 = Not at all effective
    2 = Somewhat effective
    3 = Very effective

13. What changes in these methods would you recommend?
    _____
    _____
    _____
    _____

14. How effective do you feel current public outreach and educational efforts regarding the standard have been have been? ___
    1 = Not at all effective
    2 = Somewhat effective
    3 = Very effective

15. What changes in these efforts would you recommend?
    _____
    _____
    _____

APPENDIX G.5

Park Staff Survey Analysis

1. What is your gender?	Number	Percent
Male	19	86.4 %
Female	3	13.6 %
Total	22	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

2. What is your age?	Number	Percent
less than 18	3	14.3 %
18 to 30	7	33.3 %
30 to 40	4	19.0 %
40 to 50	7	33.3 %
50 to 60	0	0.0 %
over 60	0	0.0 %
Total	21	100.0 %

Missing Cases = 1, Response Percent = 95.5 %

3. How long have you worked for the park?	Number	Percent
less than 1 year	6	27.3 %
1 to 3 years	9	40.9 %
4 to 6 years	2	9.1 %
over 6 years	5	22.7 %
Total	22	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

4. How long have you been in your present position on the park staff?	Number	Percent
less than 1 year	6	33.3 %
1 to 3 years	7	38.9 %
4 to 6 years	1	5.6 %
over 6 years	4	22.2 %
Total	18	100.0 %

Missing Cases = 4, Response Percent = 81.8 %

5. Change in motorcycle noise.	Number	Percent
Significantly Quieter	8	36.4 %
Slightly Quieter	6	27.3 %
No Change	8	36.4 %
Slightly Noisier	0	0.0 %
Significantly Nosier	0	0.0 %
Source Not Present	0	0.0 %
Total	22	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

6. Change in ATV noise.	Number	Percent
Significantly Quieter	6	27.3 %
Slightly Quieter	8	36.4 %
No Change	7	31.8 %
Slightly Noisier	1	4.5 %
Significantly Nosier	0	0.0 %
Source Not Present	0	0.0 %
Total	22	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

7. Change in SUV noise.	Number	Percent
Significantly Quieter	0	0.0 %
Slightly Quieter	0	0.0 %
No Change	22	100.0 %
Slightly Noisier	0	0.0 %
Significantly Nosier	0	0.0 %
Source Not Present	0	0.0 %
Total	22	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

8. Change in Snowmobile noise.	Number	Percent
Significantly Quieter	0	0.0 %
Slightly Quieter	0	0.0 %
No Change	0	0.0 %
Slightly Noisier	0	0.0 %
Significantly Nosier	0	0.0 %
Source Not Present	22	100.0 %
Total	22	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

9. How effective do you feel that the 2003

OHMV noise standard has been?	Number	Percent
Not at all effective	1	4.5 %
Somewhat effective	12	54.5 %
Very effective	9	40.9 %
Total	22	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

10. What changes in the standard would you recommend?

Jawbone Canyon
(a) More Training classes to train people, more testing equipment.
(b) Equipment and more classes.
(c) Training.
(d) Train people.
(e) More equipment.
(f) None.
(g) None.

Hollister
(a) Continue sound testing enforcement and enforcement in GP track.
(b) More staff.
(c) None.
(d) None.
(e) Manufacturers should comply with standards.
(f) Not enough staff during the week to enforce standard.
(g) None.
(h) None.
(i) Eventually go lower.
(j) Assign one Ranger for enforcing (hard to catch the loud motorcycles).
(k) More enforcement.
(l) None.

Hungry Valley
(a) Eventually lower to 90 go lower in a few years.
(b) More enforcement.
(c) Assign one ranger for enforcing (hard to catch the loud motorcycles).

11. How effective do you feel 2003 noise enforcement methods have been?

	Number	Percent
Not at all effective	0	0.0 %
Somewhat effective	11	50.0 %
Very effective	11	50.0 %
Total	22	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

12. What changes in these methods would you recommend?

Jawbone
(a) Units out in field more testing, special events. State needs not to look how many citations are issued opposed to education.
(b) More checking – volunteer.
(c) Outreach – more special events.
(d) None.
(e) None.
(f) Better equipment.
(g) Better chekamothor system. 1 test RPM for all motors. Do not differentiate between competitive and non. Change EPA legal or closed course specific motorcycle.

Hollister
(a) Greater availability of staff for sound testing during operational hours.
(b) More staff.
(c) More training in people enforcing. More training in terms of types of exhausts.
(d) Use more staff to enforce methods. Integrated equipment in order to be done by 1 man not 2.
(e) Dealers should comply, more pipes. There is loud equipment available.
(f) They do a good job.
(g) None, it's good.
(h) More public awareness information.
(i) None.
(j) None.
(k) None.
(l) None.

Hungry Valley
(a) none.
(b) none.
(c) none.

13. How effective do you feel current public outreach and educational efforts regarding the standard have been have been?

	Number	Percent
Not at all effective	1	4.5 %
Somewhat effective	17	77.3 %
Very effective	4	18.2 %
Total	22	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

14. What changes in these efforts would you recommend?

Jawbone
(a) Setting out more outreach booths at events. Citations for gross offenders (no mufflers). Opose to the ones with mufflers but comply.
(b) More outreach.
(c) None.
(d) ---
(e) None.
(f) More education to users.
(g) Dealers to educate the buyers. Hearsay-test easy to pass.

Hollister
(a) Information manufacture at dealers. DMV focusing on quiz or exam regarding noise standards.
(b) People selling motorcycles to educate buyer on standard.
(c) More outreach in popular publications.
(d) Manufacture labeling, more sound check, more outreach (educational), media coverage, advertising.
(e) Magazines or DMV.
(f) More staff.
(g) Find ways to encourage users to read literatures.
(h) The users do not read in order to be more useful.
(i) More publications-help of motorcycle publications.
(j) Manufacture and after market exhaust need to be more.
(k) People have to get tickets to enforce the law.
(l) Signs outside the park entrance.
(m) None.

Hungry Valley
(a) Manufactor and after market exhaust need to give more information.
(b) Post a few signs outside the park entrance for visitors to see.
People have to get tickets to enforce the law.

APPENDIX G.6

Neighbor Questionnaire

Personal Information

1. What is your gender? ___

   M = Male
   F = Female

2. What is your age? ___

   1 = less than 18
   2 = 18 to 30
   3 = 30 to 40
   4 = 40 to 50
   5 = 50 to 60
   6 = over 60

3. How long have you lived in your present residence? ___

   1 = less than 1 year
   2 = 1 to 3 years
   3 = 4 to 6 years
   4 = over 6 years

Neighborhood Issues

On a scale of 1 to 5, with 1 being not at all concerned and 5 being extremely concerned, indicate your level of concern about each of the following neighborhood issues by circling the appropriate number.

		Not at all concerned				Extremely concerned
4.	Traffic	1	2	3	4	5
5.	Schools	1	2	3	4	5
6.	Quality of housing	1	2	3	4	5
7.	Crime	1	2	3	4	5
8.	Noise	1	2	3	4	5
9.	Air quality	1	2	3	4	5
10.	Water quality	1	2	3	4	5

Neighborhood Noise

On a scale from 1 to 5, with 1 being not at all annoyed and 5 being extremely annoyed, rate your annoyance to noise in your neighborhood from each of the following noise sources by circling the appropriate number. Circle 0 if the source is not present in your neighborhood.

		Not at all annoyed				Extremely Annoyed	Source not present
11.	Aircraft	1	2	3	4	5	0
12.	Railroads	1	2	3	4	5	0
13.	Boating	1	2	3	4	5	0
14.	Nearby businesses/industries	1	2	3	4	5	0
15.	Road Traffic:						
	a. Automobiles	1	2	3	4	5	0
	b. Sport utility vehicles (SUVs)	1	2	3	4	5	0
	c. Trucks	1	2	3	4	5	0
	d. Motorcycles	1	2	3	4	5	0
16.	Off-Highway Motor Vehicles:						
	a. Motorcycles	1	2	3	4	5	0
	b. All-terrain vehicles (ATVs)	1	2	3	4	5	0
	c. Sport utility vehicles (SUVs)	1	2	3	4	5	0
	d. Snowmobiles	1	2	3	4	5	0

By circling the appropriate number indicate whether or not you have noticed any change in noise in your neighborhood from each of the following noise sources since January of 2003. Circle 0 if the source is not present in your neighborhood.

	Significantly Quieter	Slightly Quieter	No Change	Slightly Noisier	Significantly Nosier	Source Not Present
17. Aircraft	1	2	3	4	5	0
18. Railroads	1	2	3	4	5	0
19. Boating	1	2	3	4	5	0
20. Nearby businesses/industries	1	2	3	4	5	0
21. Road Traffic:						
a. Automobiles	1	2	3	4	5	0
b. Sport Utility Vehicles (SUVs)	1	2	3	4	5	0
c. Trucks	1	2	3	4	5	0
d. Motorcycles	1	2	3	4	5	0
22. Off-Highway Motor Vehicles:						
a. Motorcycles	1	2	3	4	5	0
b. All-terrain vehicles (ATVs)	1	2	3	4	5	0
c. Sport Utility Vehicles (SUVs)	1	2	3	4	5	0
d. Snowmobiles	1	2	3	4	5	0

Off-Highway Motor Vehicle Noise Standard

23. Are you aware of the current Off-Highway Motor Vehicle Noise Standard? ___
If no, skip to question 26.
Y=Yes
N=No

24. What is the noise limit specified in the standard for off-highway motor vehicles manufactured after January 1, 1986? _____ dBA

25. How effective do you feel that the noise standard has been? ___
1 = Not at all effective
2 = Somewhat effective
3 = Very effective

26. Are you familiar with current methods by which this standard is enforced? ___
If no, skip to question 28.
Y = Yes
N = No

27. How effective do you feel these methods have been? ___
1 = Not at all effective
2 = Somewhat effective
3 = Very effective

28. Are you familiar with current public outreach and educational efforts regarding the standard?
If no, skip to question 30.
___
Y = Yes
N = No

29. How effective do you feel these efforts have been? ___
1 = Not at all effective
2 = Somewhat effective
3 = Very effective

30. How effective do you feel that the noise standard and its implementation have been in reducing noise from off-highway vehicles? ___
1 = Not at all effective
2 = Somewhat effective
3 = Very effective

APPENDIX G.7

Neighbor Survey Analysis

	Jawbone Canyon		Hollister Hills		Average
	Percent	Number	Percent	Number	Percent
1. What is your gender?					
Male	53.8%	56	53.4%	31	53.7%
Female	46.2%	48	46.6%	27	46.3%
		104		58	
2. What is your age?					
less than 18	0.0%	0	0.0%	0	0.0%
18 to 30	4.9%	5	13.8%	8	8.1%
30 to 40	8.7%	9	22.4%	13	13.7%
40 to 50	32.0%	33	17.2%	10	26.7%
50 to 60	41.7%	43	20.7%	12	34.2%
over 60	12.6%	13	25.9%	15	17.4%
		103		58	
3. How long have you lived in your present residence?					
less than 1 year	6.9%	7	3.5%	2	5.7%
1 to 3 years	15.7%	16	21.1%	12	17.6%
4 to 6 years	27.5%	28	14.0%	8	22.6%
over 6 years	50.0%	51	61.4%	35	54.1%
		102		57	
4. How concerned are you with traffic?					
not at all concerned	76.0%	79	48.3%	28	66.0%
2	11.5%	12	22.4%	13	15.4%
3	6.7%	7	10.3%	6	8.0%
4	3.8%	4	8.6%	5	5.6%
extremely concerned	1.9%	2	10.3%	6	4.9%
		104		58	
5. How concerned are you with schools?					
not at all concerned	75.0%	78	75.9%	44	75.3%
2	10.6%	11	13.8%	8	11.7%
3	6.7%	7	1.7%	1	4.9%
4	3.8%	4	3.4%	2	3.7%
extremely concerned	3.8%	4	5.2%	3	4.3%
		104		58	
6. How concerned are you with quality of housing?					
not at all concerned	66.0%	68	70.7%	41	67.7%
2	16.5%	17	19.0%	11	17.4%
3	9.7%	10	3.4%	2	7.5%
4	2.9%	3	3.4%	2	3.1%
extremely concerned	4.9%	5	3.4%	2	4.3%
		103		58	
7. How concerned are you with crime?					
not at all concerned	62.5%	65	79.3%	46	68.5%
2	25.0%	26	10.3%	6	19.8%
3	8.7%	9	5.2%	3	7.4%
4	1.9%	2	3.4%	2	2.5%
extremely concerned	1.9%	2	1.7%	1	1.9%
		104		58	

		Jawbone Canyon		Hollister Hills		Average
		Percent	Number	Percent	Number	Percent
8. How concerned are you with noise?						
	not at all concerned	63.5%	66	63.8%	37	63.6%
	2	20.2%	21	20.7%	12	20.4%
	3	7.7%	8	5.2%	3	6.8%
	4	1.9%	2	6.9%	4	3.7%
	extremely concerned	6.7%	7	3.4%	2	5.6%
			104		58	
9. How concerned are you with air quality?						
	not at all concerned	63.5%	66	72.4%	42	66.7%
	2	21.2%	22	15.5%	9	19.1%
	3	5.8%	6	5.2%	3	5.6%
	4	4.8%	5	1.7%	1	3.7%
	extremely concerned	4.8%	5	5.2%	3	4.9%
			104		58	
10. How concerned are you with water quality?						
	not at all concerned	62.5%	65	55.2%	32	59.9%
	2	25.0%	26	25.9%	15	25.3%
	3	7.7%	8	5.2%	3	6.8%
	4	0.0%	0	5.2%	3	1.9%
	extremely concerned	4.8%	5	8.6%	5	6.2%
			104		58	
11. How annoyed are you with aircraft noise?						
	not at all annoyed	79.8%	83	31.0%	18	62.3%
	2	11.5%	12	1.7%	1	8.0%
	3	4.8%	5	3.4%	2	4.3%
	4	1.0%	1	0.0%	0	0.6%
	extremely annoyed	1.9%	2	0.0%	0	1.2%
	source not present	1.0%	1	63.8%	37	23.5%
			104		58	
12. How annoyed are you with railroad noise?						
	not at all annoyed	40.4%	42	55.2%	32	45.7%
	2	0.0%	0	5.2%	3	1.9%
	3	1.0%	1	3.4%	2	1.9%
	4	0.0%	0	0.0%	0	0.0%
	extremely annoyed	0.0%	0	0.0%	0	0.0%
	source not present	58.7%	61	36.2%	21	50.6%
			104		58	
13. How annoyed are you with boating noise?						
	not at all annoyed	9.6%	10	8.6%	5	9.3%
	2	0.0%	0	0.0%	0	0.0%
	3	1.0%	1	0.0%	0	0.6%
	4	0.0%	0	0.0%	0	0.0%
	extremely annoyed	0.0%	0	0.0%	0	0.0%
	source not present	89.4%	93	91.4%	53	90.1%
			104		58	

	Jawbone Canyon		Hollister Hills		Average
	Percent	**Number**	**Percent**	**Number**	**Percent**
14. How annoyed are you with business/industrial noise?					
not at all annoyed	63.5%	66	77.6%	45	68.5%
2	3.8%	4	1.7%	1	3.1%
3	1.0%	1	3.4%	2	1.9%
4	0.0%	0	0.0%	0	0.0%
extremely annoyed	1.0%	1	1.7%	1	1.2%
source not present	30.8%	32	15.5%	9	25.3%
		104		58	
15a. How annoyed are you with automobile noise?					
not at all annoyed	68.0%	70	58.6%	34	64.6%
2	21.4%	22	29.3%	17	24.2%
3	7.8%	8	3.4%	2	6.2%
4	1.9%	2	1.7%	1	1.9%
extremely annoyed	1.0%	1	6.9%	4	3.1%
source not present	0.0%	0	0.0%	0	0.0%
		103		58	
15b. How annoyed are you with on-road SUV noise?					
not at all annoyed	65.0%	67	69.0%	40	66.5%
2	21.4%	22	19.0%	11	20.5%
3	9.7%	10	6.9%	4	8.7%
4	1.0%	1	3.4%	2	1.9%
extremely annoyed	2.9%	3	1.7%	1	2.5%
source not present	0.0%	0	0.0%	0	0.0%
		103		58	
15c. How annoyed are you with on-road truck noise?					
not at all annoyed	68.9%	71	74.1%	43	70.8%
2	19.4%	20	8.6%	5	15.5%
3	7.8%	8	10.3%	6	8.7%
4	1.9%	2	5.2%	3	3.1%
extremely annoyed	1.9%	2	1.7%	1	1.9%
source not present	0.0%	0	0.0%	0	0.0%
		103		58	
15d. How annoyed are you with on-road motorcycle noise?					
not at all annoyed	49.5%	51	48.3%	28	49.1%
2	24.3%	25	22.4%	13	23.6%
3	9.7%	10	15.5%	9	11.8%
4	11.7%	12	8.6%	5	10.6%
extremely annoyed	3.9%	4	5.2%	3	4.3%
source not present	1.0%	1	0.0%	0	0.6%
		103		58	

	Jawbone Canyon		Hollister Hills		Average
	Percent	Number	Percent	Number	Percent
16a. How annoyed are you with off-highway motorcycle noise?					
not at all annoyed	50.5%	51	55.2%	32	52.2%
2	19.8%	20	19.0%	11	19.5%
3	16.8%	17	10.3%	6	14.5%
4	6.9%	7	6.9%	4	6.9%
extremely annoyed	5.9%	6	8.6%	5	6.9%
source not present	0.0%	0	0.0%	0	0.0%
		101		58	
16b. How annoyed are you with off-road ATV noise?					
not at all annoyed	58.4%	59	60.3%	35	59.1%
2	17.8%	18	19.0%	11	18.2%
3	13.9%	14	8.6%	5	11.9%
4	5.9%	6	3.4%	2	5.0%
extremely annoyed	4.0%	4	8.6%	5	5.7%
source not present	0.0%	0	0.0%	0	0.0%
		101		58	
16c. How annoyed are you with off-road SUV noise?					
not at all annoyed	67.6%	69	70.7%	41	68.8%
2	17.6%	18	12.1%	7	15.6%
3	7.8%	8	6.9%	4	7.5%
4	2.9%	3	3.4%	2	3.1%
extremely annoyed	2.9%	3	6.9%	4	4.4%
source not present	1.0%	1	0.0%	0	0.6%
		102		58	
16d. How annoyed are you with off-road snowmobile noise?					
not at all annoyed	2.9%	3	12.1%	7	6.3%
2	0.0%	0	0.0%	0	0.0%
3	1.0%	1	0.0%	0	0.6%
4	0.0%	0	0.0%	0	0.0%
extremely annoyed	0.0%	0	0.0%	0	0.0%
source not present	96.1%	98	87.9%	51	93.1%
		102		58	
17. Change in aircraft noise?					
significantly quieter	3.0%	3	0.0%	0	1.9%
slightly quieter	1.0%	1	1.8%	1	1.3%
no change	90.1%	91	31.6%	18	69.0%
slightly noisier	5.0%	5	3.5%	2	4.4%
significantly noisier	0.0%	0	0.0%	0	0.0%
source not present	1.0%	1	63.2%	36	23.4%
		101		57	

	Jawbone Canyon		Hollister Hills		Average
	Percent	**Number**	**Percent**	**Number**	**Percent**
18. Change in railroad noise?					
significantly quieter	2.0%	2	0.0%	0	1.3%
slightly quieter	0.0%	0	0.0%	0	0.0%
no change	38.6%	39	61.4%	35	46.8%
slightly noisier	0.0%	0	0.0%	0	0.0%
significantly noisier	0.0%	0	0.0%	0	0.0%
source not present	59.4%	60	38.6%	22	51.9%
		101		57	
19. Change in boating noise?					
significantly quieter	0.0%	0	0.0%	0	0.0%
slightly quieter	0.0%	0	0.0%	0	0.0%
no change	10.9%	11	12.3%	7	11.4%
slightly noisier	0.0%	0	1.8%	1	0.6%
significantly noisier	0.0%	0	0.0%	0	0.0%
source not present	89.1%	90	86.0%	49	88.0%
		101		57	
20. Change in noise from business/industries?					
significantly quieter	2.9%	3	7.0%	4	4.4%
slightly quieter	1.0%	1	0.0%	0	0.6%
no change	64.7%	66	77.2%	44	69.2%
slightly noisier	2.0%	2	0.0%	0	1.3%
significantly noisier	0.0%	0	1.8%	1	0.6%
source not present	29.4%	30	14.0%	8	23.9%
		102		57	
21a. Change in on-road automobile noise?					
significantly quieter	3.0%	3	0.0%	0	1.9%
slightly quieter	2.0%	2	1.8%	1	1.9%
no change	84.2%	85	77.2%	44	81.6%
slightly noisier	10.9%	11	17.5%	10	13.3%
significantly noisier	0.0%	0	3.5%	2	1.3%
source not present	0.0%	0	0.0%	0	0.0%
		101		57	
21b. Change in on-road SUV noise?					
significantly quieter	4.0%	4	0.0%	0	2.5%
slightly quieter	0.0%	0	3.5%	2	1.3%
no change	89.1%	90	71.8%	41	82.9%
slightly noisier	5.9%	6	22.8%	13	12.0%
significantly noisier	1.0%	1	1.8%	1	1.3%
source not present	0.0%	0	0.0%	0	0.0%
		101		57	

	Jawbone Canyon		Hollister Hills		Average
	Percent	**Number**	**Percent**	**Number**	**Percent**
21c. Change in on-road truck noise?					
significantly quieter	4.0%	4	0.0%	0	2.5%
slightly quieter	0.0%	0	3.5%	2	1.3%
no change	79.2%	80	73.7%	42	77.2%
slightly noisier	13.9%	14	19.3%	11	15.8%
significantly noisier	2.0%	2	3.5%	2	2.5%
source not present	1.0%	1	0.0%	0	0.6%
		101		57	
21d. Change in on-road motorcycle noise?					
significantly quieter	4.0%	4	0.0%	0	2.5%
slightly quieter	0.0%	0	16.1%	9	5.7%
no change	73.3%	74	51.8%	29	65.6%
slightly noisier	18.8%	19	30.4%	17	22.9%
significantly noisier	4.0%	4	1.8%	1	3.2%
source not present	0.0%	0	0.0%	0	0.0%
		101		56	
22a. Change in off-road motorcycle noise?					
significantly quieter	2.0%	2	1.8%	1	1.9%
slightly quieter	2.0%	2	17.5%	10	7.6%
no change	70.3%	71	52.6%	30	63.9%
slightly noisier	21.8%	22	26.3%	15	23.4%
significantly noisier	4.0%	4	1.8%	1	3.2%
source not present	0.0%	0	0.0%	0	0.0%
		101		57	
22b. Change in off-road ATV noise?					
significantly quieter	2.0%	2	0.0%	0	1.3%
slightly quieter	2.0%	2	22.8%	13	9.5%
no change	80.2%	81	56.1%	32	71.5%
slightly noisier	12.9%	13	19.3%	11	15.2%
significantly noisier	3.0%	3	1.8%	1	2.5%
source not present	0.0%	0	0.0%	0	0.0%
		101		57	
22c. Change in off-road SUV noise?					
significantly quieter	2.0%	2	0.0%	0	1.3%
slightly quieter	1.0%	1	5.3%	3	2.5%
no change	86.1%	87	70.2%	40	80.4%
slightly noisier	6.9%	7	22.8%	13	12.7%
significantly noisier	4.0%	4	1.8%	1	3.2%
source not present	0.0%	0	0.0%	0	0.0%
		101		57	

	Jawbone Canyon		Hollister Hills		Average
	Percent	Number	Percent	Number	Percent
22d. Change in off-road snowmobile noise?					
significantly quieter	0.0%	0	0.0%	0	0.0%
slightly quieter	0.0%	0	0.0%	0	0.0%
no change	2.0%	2	12.3%	7	5.7%
slightly noisier	0.0%	0	0.0%	0	0.0%
significantly noisier	0.0%	0	0.0%	0	0.0%
source not present	98.0%	99	87.7%	50	94.3%
		101		57	
23. Are you aware of the current Off-Highway Motor Vehicle Noise Standard?					
Yes	21.6%	22	50.0%	29	31.9%
No	78.4%	80	50.0%	29	68.1%
		102		58	
24. What is the noise limit specified in the standard for off-highway motor vehicles manufactured after 1/1/86?					
89			5.3%	1	2.8%
90			5.3%	1	2.8%
91			10.5%	2	5.6%
92			21.1%	4	11.1%
93	5.9%	1			2.8%
94			21.1%	4	11.1%
95	17.6%	3			8.3%
96	58.8%	10	10.5%	2	33.3%
98	17.6%	3	26.3%	5	22.2%
		17		19	
25. How effective do you feel that the noise standard has been?					
Not at all effective	14.3%	3	7.1%	2	10.2%
Somewhat effective	81.0%	17	57.1%	16	67.3%
Very effective	4.8%	1	35.7%	10	22.4%
		21		28	
26. Are you familiar with current methods by which this standard is enforced?					
Yes	12.9%	13	36.2%	21	21.4%
No	87.1%	88	63.8%	37	78.6%
		101		58	
27. How effective do you feel these methods have been?					
Not at all effective	27.3%	3	0.0%	0	9.4%
Somewhat effective	63.6%	7	47.6%	10	53.1%
Very effective	9.1%	1	52.4%	11	37.5%
		11		21	
28. Are you familiar with current public outreach and educational efforts regarding the standard?					
Yes	7.0%	7	32.8%	19	16.5%
No	93.0%	93	67.2%	39	83.5%
		100		58	

	Jawbone Canyon		Hollister Hills		Average
	Percent	**Number**	**Percent**	**Number**	**Percent**
29. How effective do you feel these efforts have been?					
Not at all effective	0.0%	0	0.0%	0	0.0%
Somewhat effective	85.7%	6	52.6%	10	61.5%
Very effective	14.3%	1	47.4%	9	38.5%
		7		19	
30. How effective do you feel that the noise standard and its implementation have been in reducing noise from off-highway vehicles?					
Not at all effective	40.9%	38	17.1%	7	33.6%
Somewhat effective	47.3%	44	56.1%	23	50.0%
Very effective	11.8%	11	26.8%	11	16.4%
		93		41	

APPENDIX G.8

Park Stakeholder Questionnaire

Personal Information

1. What is your gender? ___

   M = Male
   F = Female

2. What is your age? ___

   1 = less than 18
   2 = 18 to 30
   3 = 30 to 40
   4 = 40 to 50
   5 = 50 to 60
   6 = over 60

3. What type of stakeholder group do you represent? ___

   1 = Governmental agency
   2 = Environmental organization
   3 = OHMV enthusiast organization
   4 = OHMV industry
   5 = Other

4. What is the name of the stakeholder group that you represent?_____
   _____

Off-Highway Motor Vehicle Noise

By circling the appropriate number indicate whether or not you are aware of any change in noise from each of the following off-highway motor vehicle noise sources since January of 2003. Circle 0 if you are not aware of changes in noise from the source.

Change	Significantly Quieter	Slightly Quieter	No Change	Slightly Noisier	Significantly Nosier	Not Aware of Any
5. Motorcycles	1	2	3	4	5	0
6. All-terrain vehicles (ATVs)	1	2	3	4	5	0
7. Sport utility vehicles (SUVs)	1	2	3	4	5	0
8. Snowmobiles	1	2	3	4	5	0

Off-Highway Motor Vehicle Noise Standard

9. Are you aware of the current Off-Highway Motor Vehicle Noise Standard? ___
If no, skip to question 11.
Y=Yes
N=No

10. How effective do you feel that the noise standard has been? ___
1 = Not at all effective
2 = Somewhat effective
3 = Very effective

11. Are you familiar with current methods by which this standard is enforced? ___
If no, skip to question 13.
Y = Yes
N = No

12. How effective do you feel these methods have been? ___
1 = Not at all effective
2 = Somewhat effective
3 = Very effective

13. Are you familiar with current public outreach and educational efforts regarding the standard? ___
If no, skip to question 15.
Y = Yes
N = No

14. How effective do you feel these efforts have been? ___
1 = Not at all effective
2 = Somewhat effective
3 = Very effective

15. From the point of view of the organization you represent, what type of change has the noise standard and its implementation brought about? ___

1 = A negative change
2 = No change
3 = A positive change

APPENDIX G.9

Park Stakeholder Survey Analysis

1. What is your gender?	Number	Percent
Male	19	82.6 %
Female	4	17.4 %
Total	23	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

2. What is your age?	Number	Percent
less than 18	0	0.0 %
18 to 30	4	17.4 %
30 to 40	4	17.4 %
40 to 50	2	8.7 %
50 to 60	10	43.5 %
over 60	3	13.0 %
Total	23	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

3. What type of stakeholder group do you represent?	Number	Percent
Governmental agency	0	0.0 %
Environmental organization	17	73.9 %
OHMV enthusiast organization	0	0.0 %
OHMV industry	5	21.7 %
Other	1	4.3 %
Total	23	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

4. What is the name of the stakeholder group that you represent?

1. Desert Protective Council
2. Defenders of Wildlife
3. Central Sierra Environmental Resource Center
4. Save Our Forest Association
5. Planning and Conservation League Foundation
6. Eastern Sierra Audubon Society
7. Center for Biological Diversity
8. Snowlands Network
9. Citizens for a Vehicle Free Nipomo Dunes PO 73, Nipomo, 93444
10. Friends of the Inyo-non profit org. dedicated to protecting public land and wildlife in E. Sierra
11. Sierra Foothills Audubon
12. Forest Issues Group PO BOX 1334, Nevada City, CA 95959

13. Do not know
14. Northern California Council Federation of Fly
15. Peer Center for Sierra Nevada Conservation
16. American Suzuki
17. Action Coalition for Equestrians
18. Mother Lode Chapter Sierra Club
19. Project American River Canyons
20. Planning & Construction League Foundation
21. Kawasaki Motors/OHV Manufacturer
22. Pro Circuit Products
23. FMF Racing

5. Change in motorcycle noise.	Number	Percent
Significantly Quieter	4	17.4 %
Slightly Quieter	3	13.0 %
No Change	2	8.7 %
Slightly Noisier	1	4.3 %
Significantly Noisier	3	13.0 %
Not Aware of Any Change	10	43.5 %
Total	23	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

6. Change in ATV noise.	Number	Percent
Significantly Quieter	2	8.7 %
Slightly Quieter	2	8.7 %
No Change	3	13.0 %
Slightly Noisier	2	8.7 %
Significantly Noisier	2	8.7 %
Not Aware of Any Change	12	52.2 %
Total	23	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

7. Change in SUV noise.	Number	Percent
Significantly Quieter	0	0.0 %
Slightly Quieter	0	0.0 %
No Change	3	13.0 %
Slightly Noisier	2	8.7 %
Significantly Noisier	3	13.0 %
Not Aware of Any Change	15	65.2 %
Total	23	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

8. Change in Snowmobile noise.	Number	Percent
Significantly Quieter	0	0.0 %
Slightly Quieter	0	0.0 %
No Change	2	8.7 %
Slightly Noisier	1	4.3 %
Significantly Noisier	2	8.7 %
Not Aware of Any Change	18	78.3 %
Total	23	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

9. Are you aware of the current Off-Highway Motor Vehicle Noise Standard?	Number	Percent
Yes	19	82.6 %
No	4	17.4 %
Total	23	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

10. How effective do you feel that the noise standard has been?	Number	Percent
Not at all effective	6	35.3 %
Somewhat effective	9	52.9 %
Very effective	2	11.8 %
Total	17	100.0 %

Missing Cases = 6, Response Percent = 73.9 %

11. Are you familiar with current methods by which this standard is enforced?

	Number	Percent
Yes	15	65.2 %
No	8	34.8 %
Total	23	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

12. How effective do you feel these methods have been?

	Number	Percent
Not at all effective	7	43.8 %
Somewhat effective	7	43.8 %
Very effective	2	12.5 %
Total	16	100.0 %

Missing Cases = 7, Response Percent = 69.6 %

13. Are you familiar with current public outreach and educational efforts regarding the standard?

	Number	Percent
Yes	15	65.2 %
No	8	34.8 %
Total	23	100.0 %

Missing Cases = 0, Response Percent = 100.0 %

14. How effective do you feel these efforts have been?

	Number	Percent
Not at all effective	4	28.6 %
Somewhat effective	10	71.4 %
Very effective	0	0.0 %
Total	14	100.0 %

Missing Cases = 9, Response Percent = 60.9 %

15. From the point of view of the organization you represent, what type of change has the noise standard and its implementation brought about?

	Number	Percent
A negative change	2	9.1 %
No change	13	59.1 %
A positive change	7	31.8 %
Total	22	100.0 %

Missing Cases = 1, Response Percent = 95.7 %