

Appendix C

Stationary Prime Diesel-Fueled Engine Survey

TABLE OF CONTENTS

<u>Contents</u>	<u>Page</u>
I. Introduction and Background.....	C-1
II. Survey Response	C-3
III. Survey Results.....	C-4
A. Engine Manufacturers.....	C-4
B. Applications and Location	C-5
C. Horsepower and Model Year	C-6
D. Hours of Operation.....	C-8
E. Emission Controls.....	C-9
IV. Survey Package.....	C-11

Tables and Figures

Table 1: Applications	C-5
Table 2: Model Year and Horsepower Ranges (by Horsepower)	C-7
Table 3: Model Year and Horsepower Ranges (by Model Year)	C-8
Table 4: Average Hours of Operation by Application.....	C-8
Table 5: DPFs, DOCs, and SCRs on Stationary Prime Engines	C-10
Figure 1: Facility Survey Responses.....	C-3
Figure 2: Engine Manufacturers and Models	C-4
Figure 3: Engine Applications by District	C-5
Figure 4: Horsepower Ranges	C-6
Figure 5: Model Year Distribution	C-7
Figure 6: Hours of Operation Ranges	C-9

I. Introduction and Background

In March 2003, the Air Resources Board (ARB or Board) conducted the Stationary Prime Diesel-Fueled Engine Survey (survey or Prime Survey). The survey was again conducted in June 2003 for facilities/companies residing within the Bay Area Air Quality Management District. The intent of the survey was to obtain a representative sampling of how stationary prime diesel-fueled engines are operated in California and the applications for which they operated. The information gathered would enable us to determine how many engines would potentially be affected by the proposed airborne toxic control measure (ATCM) for stationary compression-ignition engines and would also aid in enhancing our statewide inventory of stationary diesel-fueled engines.

Using contact information obtained from the local air quality management and air pollution control districts' (districts) permit data, the survey was distributed to approximately 560 private companies and facilities and public entities, including county, city, state, and federal agencies throughout California. The Prime Surveys distributed in March included a requested due date of April 11, 2003, and those distributed in June requested a return date of June 30, 2003. The survey was also available on the ARB web site and an e-mail notice was sent to the approximately 750 subscribers of the stationary diesel risk reduction e-mailing list. A copy of the cover letter and the actual survey can be found in Section IV of this Appendix.

As of this writing, 59 Prime Surveys were returned with data for 171 diesel-fueled engines. Several surveys were received for engines that use natural gas as a fuel, and those were not included in our survey analysis.

The Prime Survey requested engine owners/operators to submit the following information for each applicable engine:

- engine location (address)
- engine make (manufacturer)
- model
- serial number
- model year
- rated horsepower
- control equipment (i.e., diesel particulate filter, oxidation catalyst, etc.)
- fuel type
- fuel usage rate (i.e., number of gallons per week, month, or year)
- application or general use
- typical load
- average total hours operated per year
- normal hours of operation

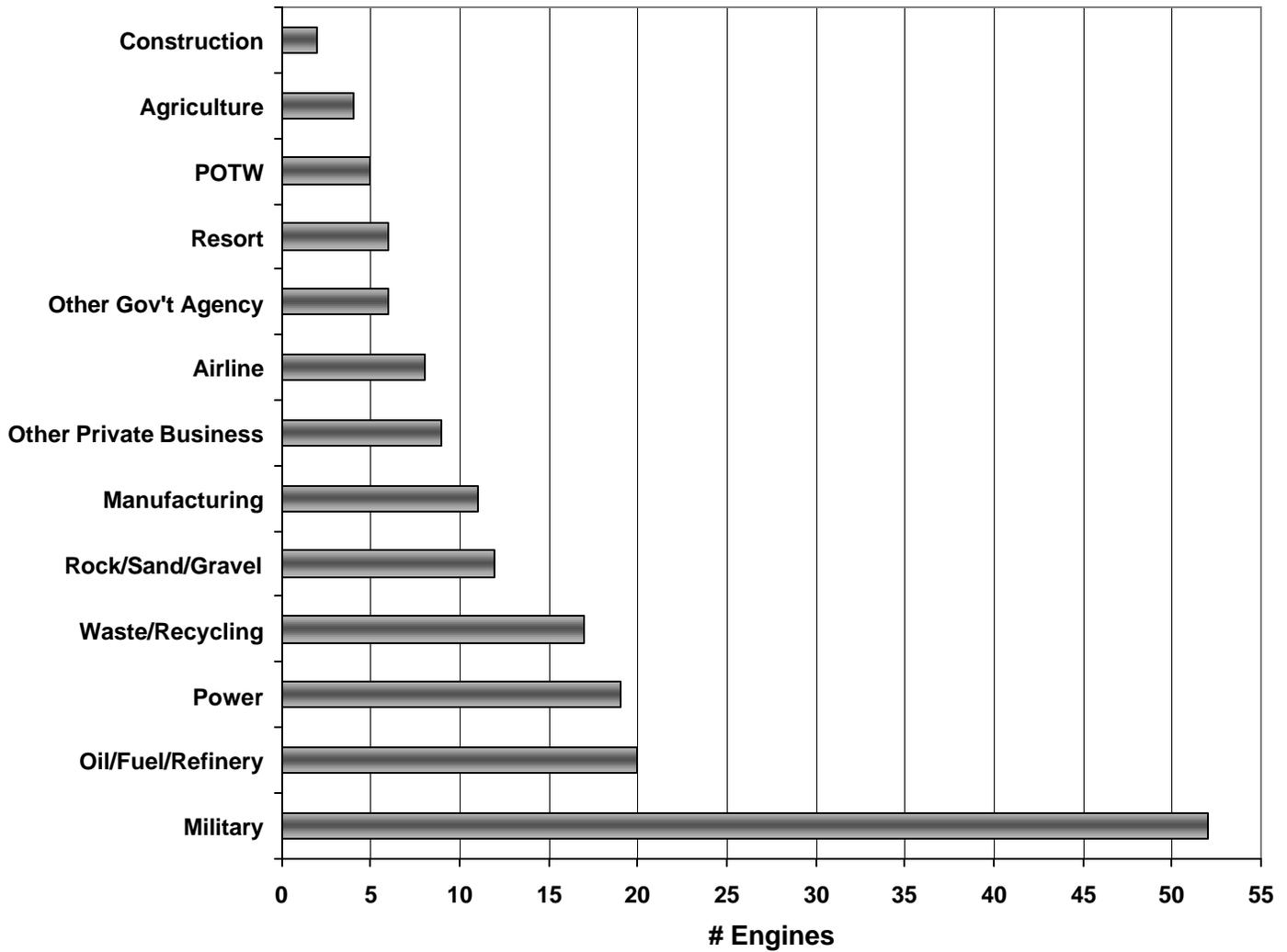
In requesting the survey, the ARB stated that specific survey responses or the names of businesses would not be published but that the data from the survey would be analyzed and discussed in public workshops and reports.

The 171 engines included in the returned surveys represent approximately __ percent of the current estimated stationary prime diesel-fueled engine statewide inventory. Information regarding the statewide inventory can be found in Chapter __.

II. Survey Response

As stated in section I, the Prime Survey was distributed to 560 private and public facilities. Figure C-1 below shows the types of facilities that responded to the survey and their corresponding response rates.

Figure C-1: Facility Survey Responses



The "Waste/Recycling" category includes landfills and garbage collecting or sorting facilities as well as recycling centers. The "Other Private Businesses" includes auto wrecking facilities, shipping container facilities, and other miscellaneous business types. The "Agriculture" category includes food growing and production facilities, wineries, and meat processing facilities. Of the total responses, 63 percent were from private companies/facilities and 37 percent were from public agencies (county, city, state, and federal).

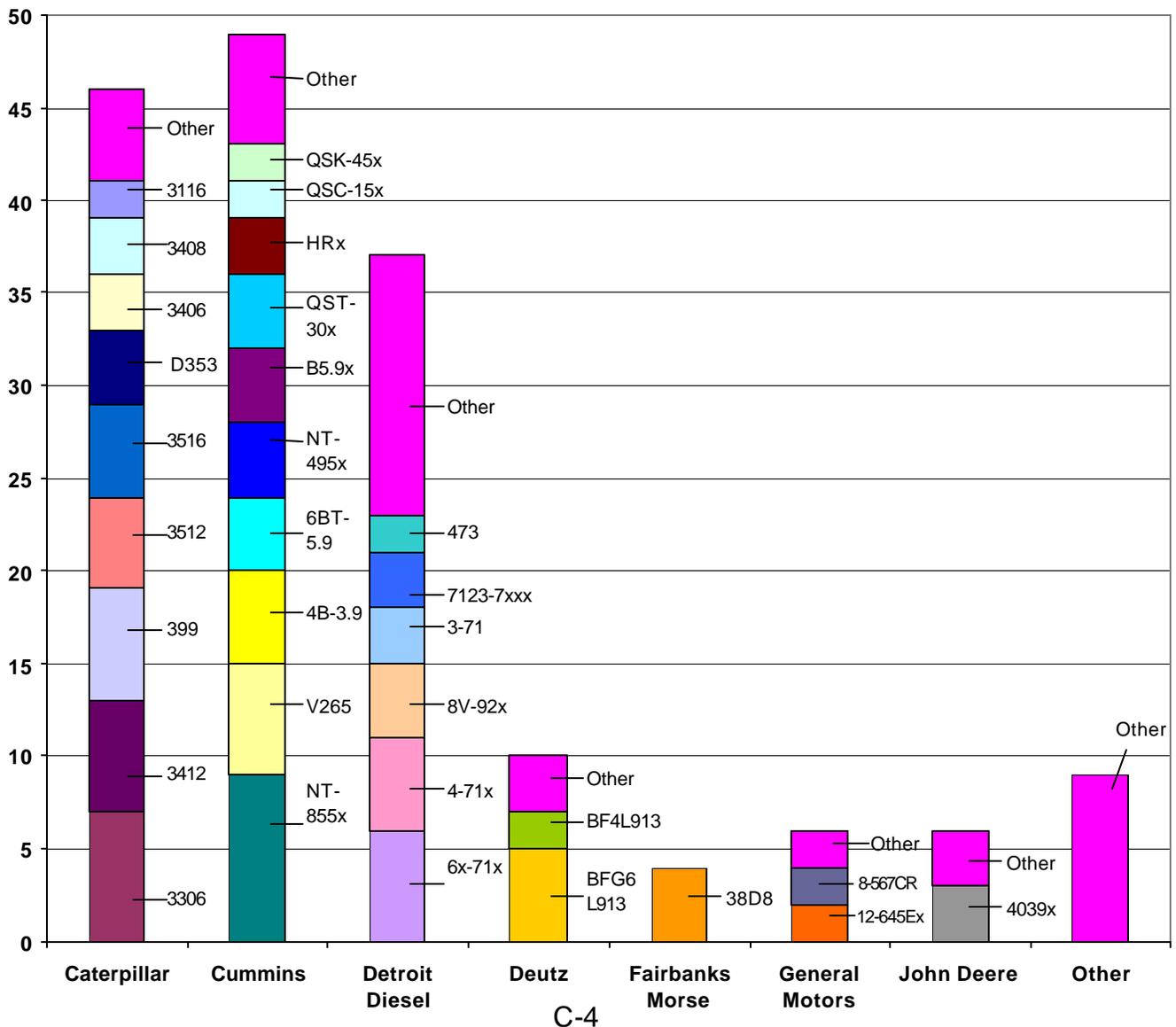
III. Survey Results

The figures and tables in this section represent the results of the key data fields from the Prime Survey. Not all records had data for every field, so null values were not included in averages or population numbers.

A. Engine Manufacturers

As shown in Figure C-2, the most prominent engine manufacturers of stationary diesel-fueled engines from the Prime Survey were Caterpillar, Cummins, and Detroit Diesel, totaling 77 percent of the engines. Engine models varied significantly and are also presented in the chart below. Included in the "Other/Unknown" category were manufacturers that represented fewer than 4 engines each, such as Case, Allis-Chalmers, Isuzu, and Perkins, to name a few. The "Other/Unknown" category comprised approximately eight percent of the engines.

Figure C-2: Engine Manufacturers and Models



B. Applications and Location

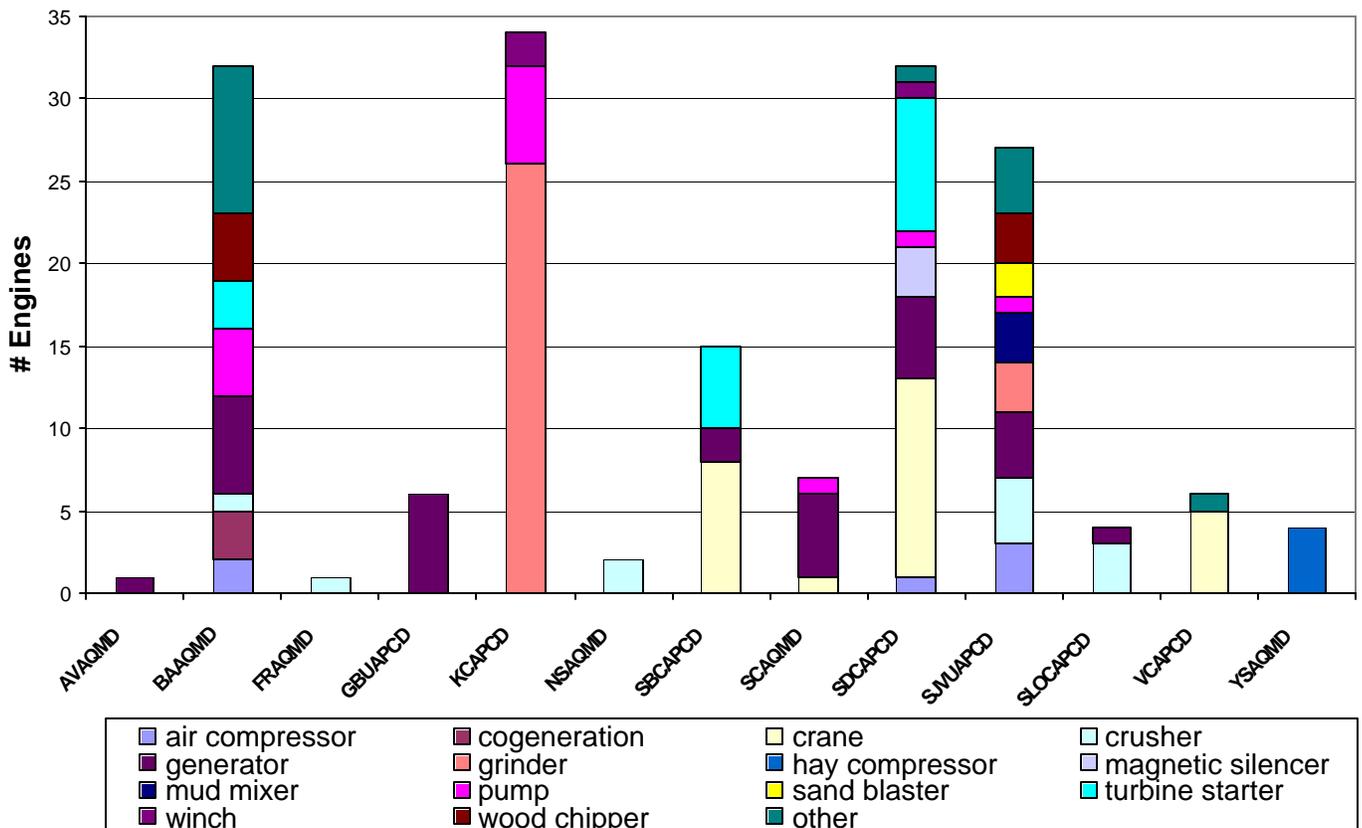
As shown in Figure C-2, the types of facilities that use stationary prime engines vary greatly. There are also a wide variety of applications for which prime engines are used. Table C-1 lists the number of engines in each application. Similar applications were sometimes grouped into a single category (i.e., rock crushers, concrete crushers, and jaw crushers were grouped under "crushers"). The "other" category includes single engine applications (such as blower, hydraulic pipe press, and lab knock engine, to name a few), that could not be easily grouped into specific categories.

Figure C-3 shows the applications as they are distributed throughout the districts. Not all districts are represented, since survey data was not received for engines in every district. Therefore, the chart below is not necessarily representative of the distribution of stationary prime engines throughout the State.

Table C-1: Applications

HP Range	# Engines
air compressor	6
cogeneration	3
crane	26
crusher	11
generator	56
grinder	3
hay compressor	4
magnetic silencer	3
mud mixer	3
pump	13
sand blaster	2
turbine starter	16
winch	3
wood chipper	7
other	15

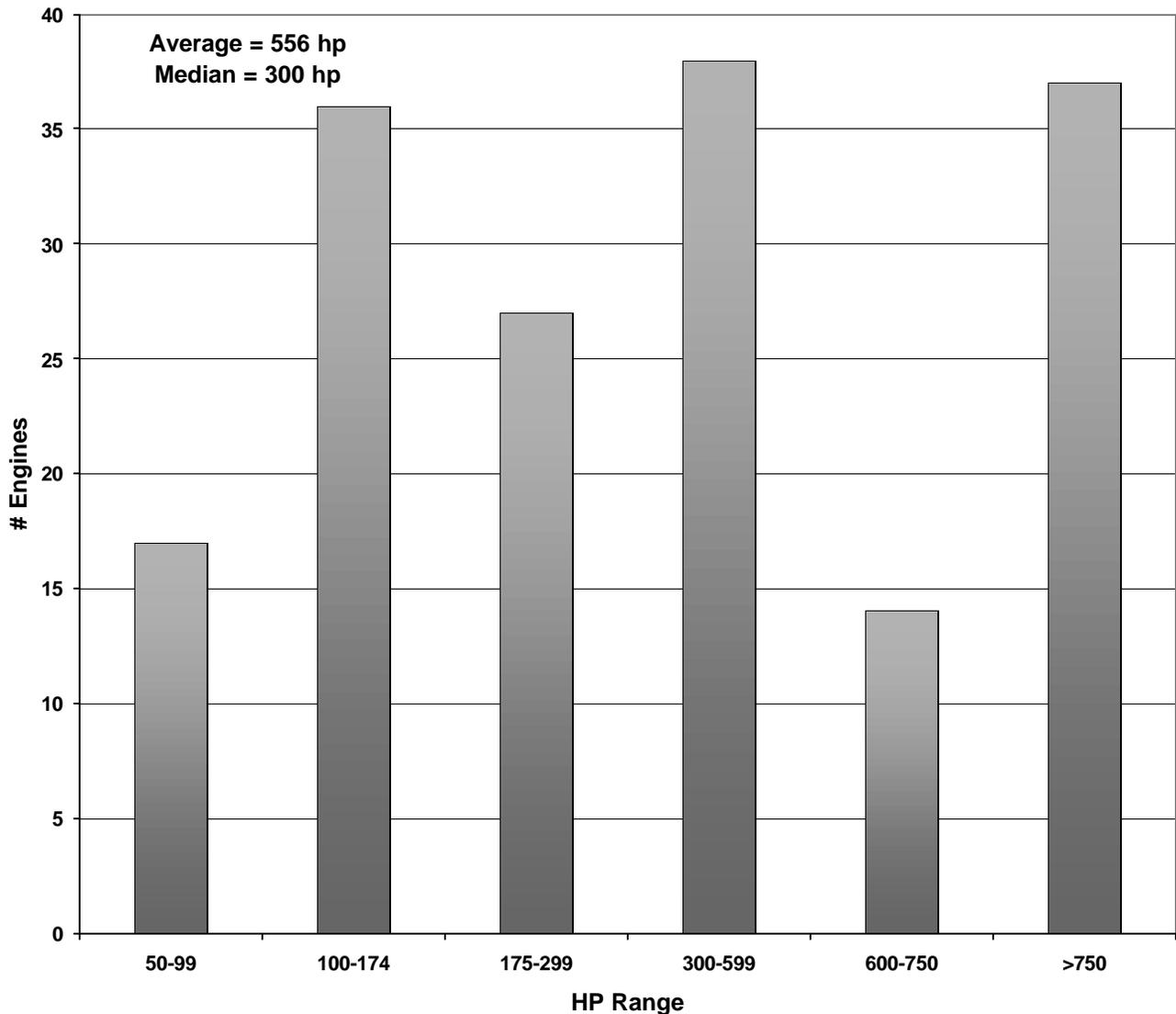
Figure C-3: Engine Applications by District



C. Horsepower and Model Year

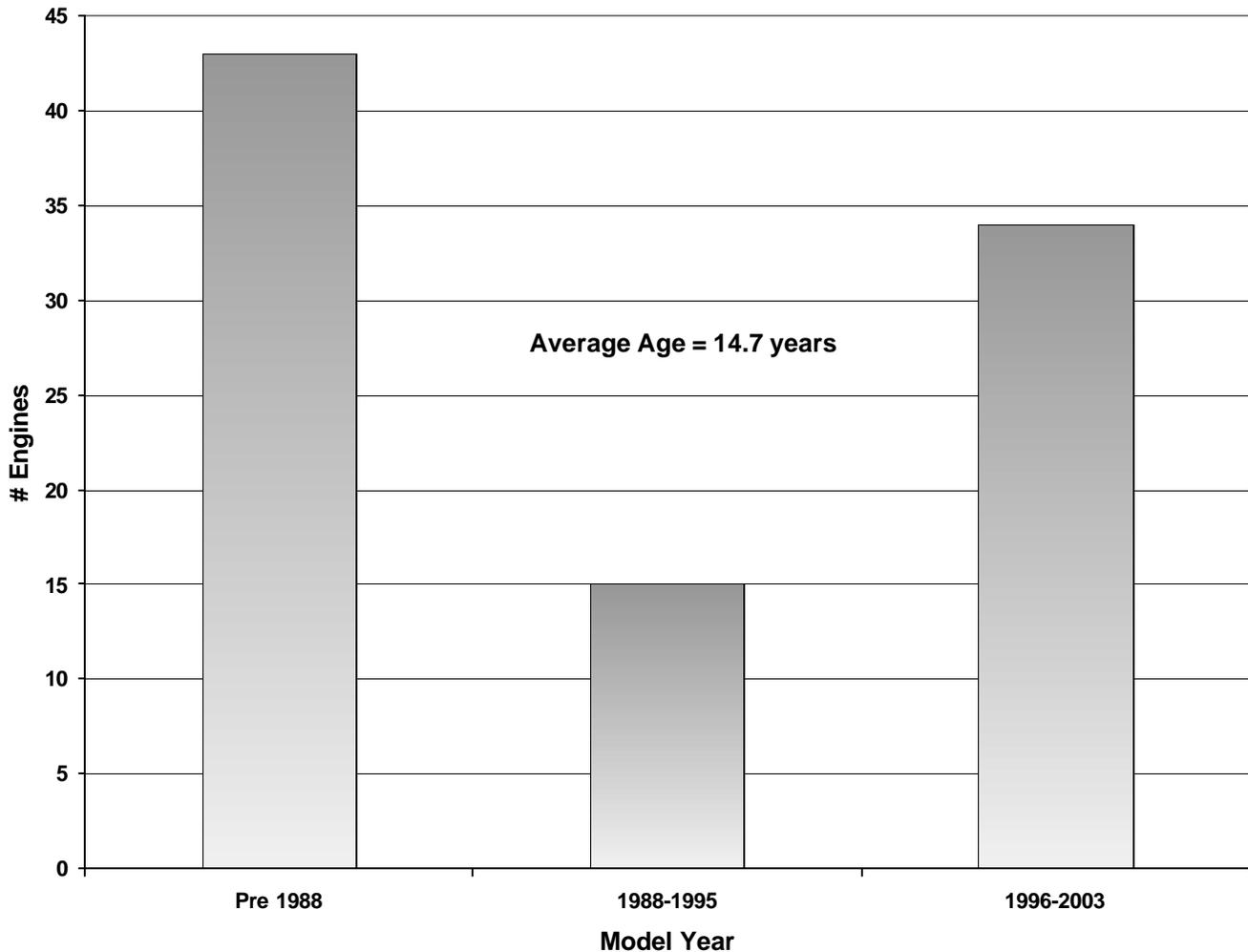
Figure C-4 shows the number of Prime Survey engines in each specified horsepower range. The engines ranged from under 50 horsepower to over 2,000 horsepower. The most populated categories were 300 to 599 horsepower, greater than 750 horsepower, and 100 to 174 horsepower, representing 66 percent of the survey engines. Our survey targeted engines greater than or equal to 50 horsepower, so while we received some data for the smaller engines, they were not included in the figure below or in the average or median horsepower ratings.

Figure C-4: Horsepower Ranges



Model year data was received for 92 of the 171 engines and sorted into three model year groups: pre-1988, 1988 to 1995, and 1996-2003. The corresponding data is presented in Figure C-5.

Figure C-5: Model Year Distribution



Tables C-2 and C-3 show the survey engine population for horsepower ranges based on their corresponding model year ranges. Table C-2 displays the engines by horsepower while Table C-3 displays the engines by model year. There were 78 engines rated over 50 horsepower that did not have model year data, while only one engine had no horsepower data.

Table C-2: Model Year and Horsepower Ranges (by Horsepower)

Age Range	Total	No HP Data	50-99	100-174	175-299	300-599	600-750	>750
No Age Data			8	26	14	13	3	14
1996-2003	34		5	8	1	8	4	8
1988-1995	15			2	4	4	4	1
pre-1988	43	1	4		8	13	3	14

Table C-3: Model Year and Horsepower Ranges (by Model Year)

HP Range	Total	No Age Data	1996-2003	1988-1995	pre-1988
No HP Data					1
50-99	17	8	5		4
100-174	36	26	8	2	
175-299	27	14	1	4	8
300-599	38	13	8	4	13
600-750	14	3	4	4	3
>750	37	14	8	1	14

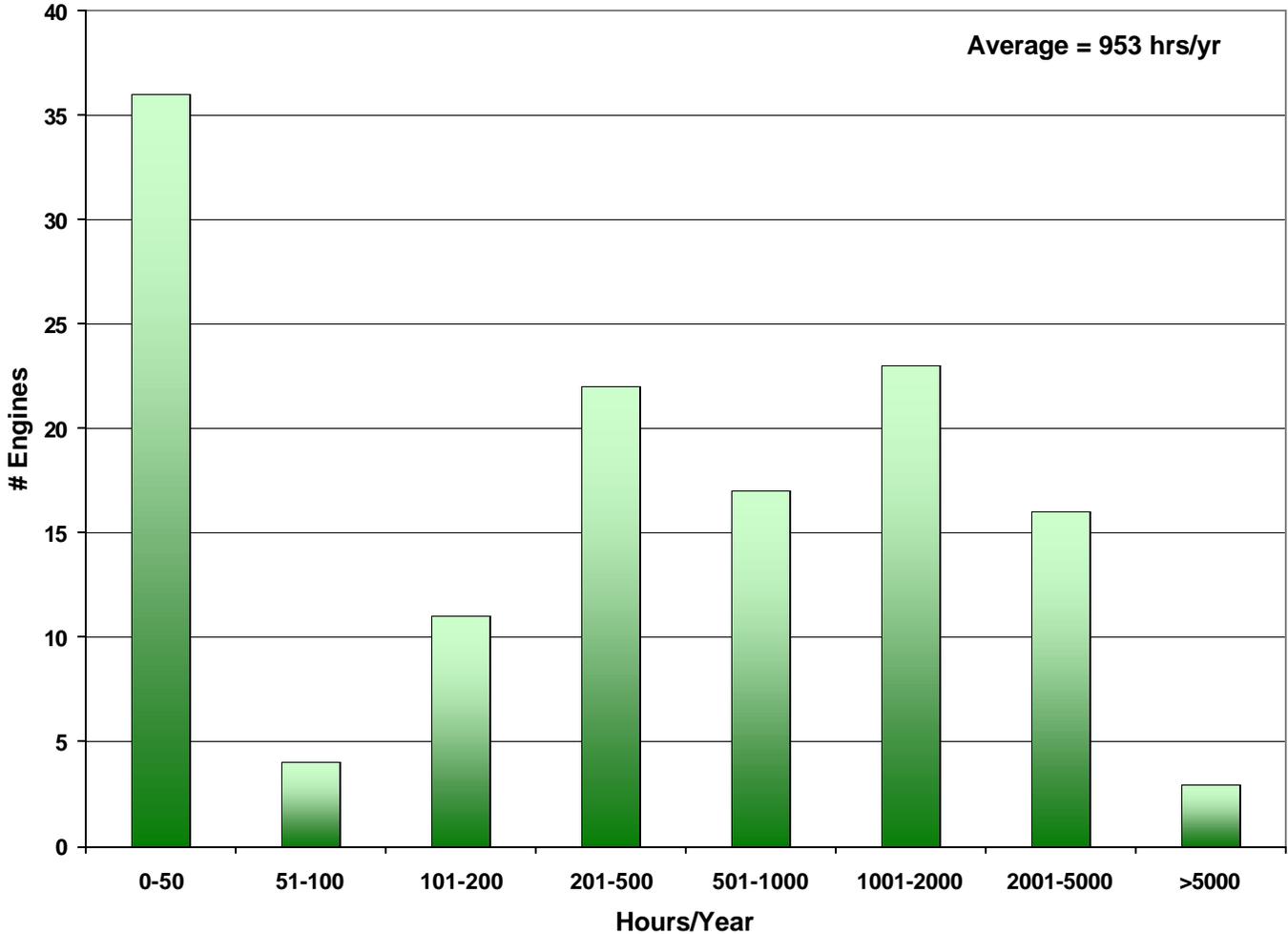
D. Hours of Operation

The Prime Survey requested the average total hours of annual operation for each engine. Hours for prime engines can vary from a few hours per year to several thousand and can also vary based on the type of application. The average number of annual hours reported from the surveys was 953, with 132 engines reporting hours of operation data. More than 61 percent of all engines had annual hours exceeding 200 per year, while 27 percent were operated 50 hours or less per year. Table C-4 shows the average annual hours for each application, while the survey-wide hours of operation data is presented in Figure C-6.

Table C-4: Average Hours of Operation by Application

Application	Average Annual Hours
air compressor	334
cogeneration	5501
crane	1024
crusher	1114
generator	1563
grinder	798
hay compressor	1482
magnetic silencer	8
mud mixer	517
pump	46
sand blaster	313
turbine starter	22
winch	<50
wood chipper	869
other	852

Figure C-6: Hours of Operation Ranges



E. Emission Controls

Approximately 52 percent of the engines responding to the survey have some kind of emission controls, most aiming to reduce NOx, such as ignition timing retard (ITR), fuel injection, and turbocharging and aftercooling and Selective Catalytic Reduction (SCR). While ITR reduces NOx emissions by shortening the time available for combustion and lowering cylinder temperature and pressure, it generally increases HC, CO, PM, and fuel consumption for the same reasons. ITR is usually used in conjunction with other strategies (such as turbocharging and aftercooling) to counteract those increases. Several engines had particulate matter (PM) control technologies, such as diesel particulate filters (DPFs) and diesel oxidation catalysts (DOCs). Table C-5 shows the engines that reported DPFs, DOCs, and SCRs, which are the most effective emission control technologies commercially available for stationary compression-ignition engines.

Table C-5: DPFs, DOCs, and SCRs on Stationary Prime Engines

Application	Control	Hours/Yr
rock crusher	DOC	2500
wood chipper	DOC	2000
electric power generation	DPF	1000
electric power generation	DPF	614
TRU generator	DPF	1465
wood chipper	DPF, DOC	1000
gantry crane	DPF, SCR	2723
gantry crane	DPF, SCR	1075
gantry crane	DPF, SCR	2498
gantry crane	DPF, SCR	3761
gantry crane	DPF, SCR	3050
gantry crane	DPF, SCR	2948
electric power generation	SCR	1860
electric power generation	SCR	1860
electric power generation	SCR	1860
electric power generation	SCR	1860
electric power generation	SCR	1860
electric power generation	SCR	1860

IV. Survey Package



Winston H. Hickox
Agency Secretary

Air Resources Board

Alan C. Lloyd, Ph.D.
Chairman

1001 I Street • P.O. Box 2815 • Sacramento, California 95812 • www.arb.ca.gov



Gray Davis
Governor

March 17, 2003

Dear Madam/Sir:

Air Resources Board Survey on Stationary Prime Engines

We are writing to ask you to fill out the enclosed Air Resources Board (ARB) survey on stationary prime engines (those that are not used for emergency/stand-by purposes and remain in one location at the facility for more than 12 months). The short survey asks questions regarding the engine's location, specifications, fuel usage, application, and operational hours. Below are answers to some questions you may have regarding the survey.

Why is the ARB requesting this information?

We are currently developing an airborne toxic control measure (ACTM) to control particulate matter emissions from stationary diesel-fueled engines. The survey responses will give us up-to-date information on how the stationary prime engines are operated. We will use the information to identify and evaluate the impacts of emission reduction strategies for stationary diesel-fueled prime engines.

Does the ARB have the legal authority to request the survey information?

Yes. State law authorizes the ARB to request and gather the information required to determine if regulations are needed to protect the public health from toxic air contaminants.

What if my business/facility does not have any stationary prime engines?

Simply include your business/facility contact information, check-mark the box at the top of the form, and return it to us.

What will the ARB do with the completed survey?

We will enter the information into a database for analysis. The results of this analysis may be discussed at future workshops and summarized in our technical documents. However, we will not publish your survey responses or the name of your business in our documents.

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Website: <http://www.arb.ca.gov>.

California Environmental Protection Agency

Printed on Recycled Paper

C-12

Madam/Sir
March 17, 2003
Page 2

When does the ARB need your survey?

Please return your survey by April 11, 2003. You may either fax it to us at (916) 327-6251, or mail it to the following address:

California Air Resources Board
Attn: SSD/EAB
P.O. Box 2815
Sacramento, CA 95812-2815

The survey is also available in electronic format (Microsoft Word or Adobe Acrobat) on our website at <http://www.arb.ca.gov/diesel/primesurvey.htm>. Surveys completed electronically can be e-mailed to lwilliam@arb.ca.gov.

Who should I contact if I have questions regarding the survey?

You may contact Mr. Alex Santos at (916) 327-5638 or via e-mail at asantos@arb.ca.gov, or Ms. Lisa Williams at (916) 327-1498 or via e-mail at lwilliam@arb.ca.gov.

We would like to thank you in advance for responding to this survey.

Sincerely,

/s/

Daniel E. Donohoue, Chief
Emissions Assessment Branch

Enclosure

cc: Mr. Alex Santos
Air Resources Engineer
Emissions Assessment Branch

Ms. Lisa Williams
Air Resources Technician
Emissions Assessment Branch

Business/Facility Name: _____
Address: _____
City: _____ Zip: _____
Contact Name: _____ Phone: (____) _____
E-mail Address: _____

Stationary Prime Engine Survey

- If your business/facility does not have any prime engines, please mark this box, fill in the contact information above, check any boxes that apply, and return this form.
- If you are a "small business" (100 employees or less and annual gross receipts of \$10,000,000 or less per Cal. Gov. Code Sec. 14837(d)(1)), please mark this box.
- If you have visited our website (<http://www.arb.ca.gov/diesel/dieselrrp.htm>) or are aware of our activities regarding stationary diesel engines, please mark this box.

Instructions:

1. Please fill in your contact information above and check any applicable boxes.
2. Please limit your responses to stationary prime engines only. A stationary prime engine is any engine that is not used for emergency/stand-by purposes (i.e., is not a back-up generator, fire pump, etc.) and remains in one location at the facility for more than 12 months.
3. If the engine location is not a physical address, please specify approximate location (i.e., south end of Main Street in Bakersfield).
4. If the engine has emission control equipment installed, please use the following letters:
 A = Diesel Particulate Filter (DPF) C = Diesel Oxidation Catalyst (DOC) E = Turbo-Charged and/or After-Cooled
 B = Ignition Timing Retard (ITR) D = Selective Catalytic Reduction (SCR) F = Other – *please specify*
5. Please fax this survey to **(916) 327-6251**, or mail it to the address on the back of this form. If completing electronically, please e-mail to william@arb.ca.gov.

Permit # (if permitted)	Engine Location (address)	Engine Make	Engine Model	Serial #	Model Year	Rated Horse-power	Control Equip. (see #4 above)	Fuel Type	Fuel Usage Rate	Application (general use)	Typical Load (% of rated HP)	Average Total Hours Operated per Year	Normal Hours of Operation
<i>Example</i>	<i>123 Main St., Sacramento</i>	<i>Cummins</i>	<i>3451D</i>	<i>5Y45M -23F70</i>	<i>1985</i>	<i>750</i>	<i>E</i>	<i>Off-Road Diesel</i>	<i>10 gal per week</i>	<i>wood chipping</i>	<i>15 – 25%</i>	<i>1800</i>	<i>Mon-Fri 8am-5pm</i>

