INTEGRATED WASTE MANAGEMENT BOARD

RIGID PLASTIC PACKAGING CONTAINER RECYCLING RATE REPORT

JUNE 1993

STATE OF CALIFORNIA

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NOTE: Legislation (SB 63, Strickland, Chapter 21, Statutes of 2009) signed into law by Gov. Arnold Schwarzenegger eliminated the California Integrated Waste Management Board (CIWMB) and its six-member governing board effective Dec. 31, 2009.

CIWMB programs and oversight responsibilities were retained and reorganized effective Jan. 1, 2010, and merged with the beverage container recycling program previously managed by the California Department of Conservation.

The new entity is known as the Department of Resources Recycling and Recovery (CalRecycle) and is part of the California Natural Resources Agency. It is no longer part of the California Environmental Protection Agency (Cal/EPA).

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Option 3: Use AB 939 Reported Diversion Data

NOTE TO READER

Public Resources Code Section 42310 mandates the California Integrated Waste Management Board (Board) on January 1 of each year, commencing in 1993, to publish annual reports that document recycling rates for polyethylene terephthalate (PETE) rigid plastic packaging containers (RPPCs) and non-PETE RPPCs. To comply with that mandate, the Board has published the following report entitled *Rigid Plastic Packaging Container Recycling Rate Report* (the Report), as prepared by Board staff.

As this was the initial effort in performing the annual recycling rate study, Board staff had to rely on existing data sources that are commonly available to the general public and government agencies. The Board notes that use of these data sources was problemmatic in that categories and methods for extracting information did not align with the statutory definition of an RPPC. In addition, available information was not California-specific, nor was it considered highly accurate. Another problem encountered was that the statutory due date for the report is January first of each year; however, data related to this subject are not available until mid-year.

In an attempt to provide a "readable" document, the report briefly describes the methods used to calculate recycling rates and expresses the primary concerns with each of the methods. Because of concerns regarding various data sources, the Report examines a range of different recycling rates, estimates the most "reasonable rate," and presents a recommended method for obtaining data for future reports. The appendix provides a more thorough analysis of the recycling rates and offers complex calculations and a complete analysis of the implications of using existing data sources. In this appendix, the specific shortcomings relating to individual data sources and methods used to extrapolate RPPC recycling rates are provided in detail.

It should be emphasized that while the methodologies used to obtain the rate estimates are uncertain, the estimates arrived at are consistent with industry estimates based on national data. For example, the Report estimates that the 1991 recycling rate for all RPPCs regardless of resin type was between eight and ten percent. In their *1992 Post-Consumer Plastics Recycling Rate Study*, the American Plastics Council estimates that the 1991 bottle and rigid container recycling rate was 11 percent.

Acknowledging the shortcomings with existing available data sources, Board staff have initiated and intend to continue discussions with industry associations to arrive at a mutually acceptable methodology for determining annual California-specific RPPC recycling rates. In addition,because of delays in obtaining data, the Board suggests that current law be amended (PRC Section 42310) to specify May 31 as an alternative publication date for the report.

B. Denominator: Non-PETE RPPC Tonnage Generated

Option 1: Extrapolate National Resin Sales to California Based on Population

Option 2: Use U.S. EPA Generation Data in Conjunction with Resin Sales Data

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Option 2: Extrapolate SPI Recycling Data to California Based on Population

Option 3: Use AB 939 Reported Diversion Data

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B. Denominator: PETE RPPC Tonnage Sold

Option 1: Extrapolate National Resin Sales to California Based on Population

Option 2: Use U.S. EPA Generation Data in Conjunction with National Resin Sales Data

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I. Introduction

A. Rigid Plastic Packaging Containers

Senate Bill (SB) 235, the Rigid Plastic Packaging Container Act of 1991, mandates the California Integrated Waste Management Board (CIWMB) to publish an annual report documenting resin-specific recycling rates for rigid plastic packaging containers (RPPCs).[1] The recycling rates must be reported separately for those containers composed of polyethylene terephthalate (PETE) and for those containers not composed of PETE ("non-PETE").[2]

Section 42301 of SB 235 defines an RPPC as *"any plastic package having a relatively inflexible finite shape or form, with a minimum capacity of eight fluid ounces or its equivalent volume and a maximum capacity of five fluid gallons or its equivalent volume, that is capable of maintaining its shape while holding other products, including, but not limited to, bottles, cartons, and other receptacles, for sale or distribution in the state"*.

The ambiguity of the statutory definition becomes apparent when it is applied to actual types of plastic packaging. While regulations to implement SB 235 will formally clarify the RPPC definition, these regulations will not be approved until 1994. Staff consulted with affected parties to develop an interim working definition. This working definition adds the phrase *"capable of multiple re-closure"* to the existing definition for ease of RPPC identification and program administration.

Only those containers that meet this working definition are included in recycling rate calculations. Examples of such containers include items such as bottles, tubs, jars, and pails. Also included are food service items such as hinged containers and cups. Items not considered RPPCs under the working definition include bracing, crates, trays, blister packs and containers with peel-off lids and no other means of closure.

B. Report Scope

This report fulfills SB 235's current requirement to publish recycling rates for PETE and non-PETE RPPCs. However, legislation to alter the manner in which SB 235 recycling rates are calculated and reported has been introduced. In anticipation of modifications to the recycling rate provisions, specifically replacing the non-PETE rate with one that includes all resins, an aggregate recycling rate also is presented. All tonnage estimates are based on data from calendar years 1990 and 1991, as 1992 data are not yet available.

Because California-based statistics are not maintained for RPPC sales or diversion, numbers used to calculate recycling rates in this report are extrapolated from available sources.[3] Available data are limited and often not reported in categories consistent with SB 235's requirements. For example, container data are often compiled separately for highly recyclable products (i.e., PETE soft drink containers and HDPE milk jugs), while statistics for the balance of container types are reported in aggregate. Separating a resin type from general container data or specific containers from general plastic container data is difficult and not precisely accurate.

To compensate for the fact that no individual data source presented information entirely consistent

with SB 235's parameters, staff accessed multiple data sources. This resulted in multiple estimates for generation and recycling of PETE and non-PETE RPPCs. To convey the variation between the sources, a range of recycling rates is presented. The limits associated with each data source and extrapolation are discussed in the appendix.

To comply with SB 235's mandate to publish annual recycling rates and due to insufficient information regarding RPPC recycling and generation, a range of rates was developed. It is critical that PETE and non-PETE recycling rates contained in future reports be as accurate as possible. Methods that may be used in the future to obtain more accurate information are provided in Section III, Future Directions. In the interim, information in this report can be used by product manufacturers to determine the degree of progress necessary to meet SB 235's 1995 recycling rate provisions.

II. Calculating Recycling Rates

A. Recycling Rate Formula

Section 42310 (b) and (c) establish the recycling rates that the CIWMB must publish for non-PETE and PETE RPPCs respectively. To comply with SB 235 using recycling rates, non-PETE RPPCs must be recycled at a rate of 25 percent and PETE RPPCs must be recycled at a rate of 55 percent. Given the recycling rate definition provided in Section 42301, staff have established the following mathematical equation to be used in determining RPPC recycling rates:

$$\textit{Recycling Rate}^{4,5} = \frac{\textit{RPPC Tonnage Recycled}}{\textit{RPPC Tonnage Generated}}$$

The subsequent two subsections will provide options for estimating the numerator and denominator of the PETE and non-PETE recycling rates. All data are based on the stated source, but have been manipulated to conform as closely as possible to the RPPC working definition. As stated previously, derivations and assumptions associated with all data sources are provided in a detailed back-up report; only the sources and tonnage estimates will be contained in the matrices found in this document.

B. Non-PETE RPPC Recycling Rates

The formula for calculating non-PETE RPPC recycling rates is as follows:

$$\textit{Recycling Rate} = \frac{\textit{Non-PETE Tonnage Recycled}}{\textit{Non-PETE Tonnage Generated}}$$

Existing sources to estimate the numerator, *non-PETE RPPC tonnage recycled*, include:

- Extrapolate U.S. EPA Diversion Data to California Based on Population.
- Extrapolate Recycling Data from the Society of the Plastics Industry (SPI) to California Based on Population.
- Use AB 939 Reported Diversion.

Existing sources to estimate the denominator, *non-PETE RPPC tonnage generated*, include:

- Extrapolate *Modern Plastics* Resin Sales to California Based on Population.[6]
- Use U.S. EPA Generation Data in Conjunction with *Modern Plastics* Resin Sales Data.
- Use AB 939 Plastic Generation Statistics in Conjunction with *Modern Plastics* Resin Sales Data.
- Use Statistics Maintained by the California Department of Food and Agriculture (CDFA) in Conjunction with *Modern Plastics* Sales Data.

The estimates of non-PETE recycling and generation are presented in Table 1, *Summary of non-PETE RPPC Diversion and Generation in 1990 and 1991*. In 1990 non-PETE recycled estimates ranged from 5,904 tons to 18,345 tons. In 1991 only one estimate of almost 18,989 tons recycled exists. In terms of generation, 1990 non-PETE estimates range from 225,709 tons to 367,352 tons. In 1991 the range of tonnage-generated estimates was between 330,907 tons and 367,352 tons.

Table 2, *Non-PETE RPPC Recycling Rate Range for 1990 and 1991*, shows the range of recycling rates based on the estimates in Table 1. The high end of the recycling rate range is obtained by coupling the

high recycled estimate with the low generation estimate; the low end of the recycling rate range is obtained by coupling the low recycled estimate with the high generation estimate. The range for 1990 is 1.6 percent to 8.1 percent. In 1991 the range is between 5.2 percent and 5.7 percent.

Table 2 shows the range of non-PETE recycling rates given available data. Table 3, Non-PETE Recycling

Table 1

Summary of Non-PETE RPPC Diversion and Generation in 1990 and 1991 (Tons)

	1990	1991
NUMERATOR: Recycled		
Option 1: Extrapolate U.S. EPA Diversion Date	5,904	N/A
Option 2: Extrapolate SPI Recycling Data	10,500	18,989
Option 3: Use AB 939 Reported Diversion	18,345	N/A
DENOMINATOR: Generated		
Option 1: Extrapolate Modern plastics Resin Sales Data (compensated for 1% resin loss)	366,617	367,352
pre-assembled container category	328,660	330,907
line item summation		
Option 2: Use EPA Data in Conjunction with Modern Plastic Resin Sales Data	257,872	N/A
Option 3: Use AB 939 Plastic Generation Data with Modern Plastics Resin Sales Data	277,170	N/A
pre-assembled container category	248,457	N/A
line item summation		
Option 4: Use Statistics Maintained by the CDFA in Conjuction with EPA Data	225,709	N/A

Table 2

Non-PETE RPPC Recycling Rate Range for 1990 and 1991

	1990	1991
NUMERATOR		
Maximum	18,345 tons	18,989 tons
Minimum	5,904 tons	18,989 tons
DENOMINATOR		
Maximum	366,617 tons	367,352 tons
Minimum	225,709 tons	330,907 tons
RECYCLING RATE		
High Estimate	8.1%	5.7%
Low Estimate	1.6%	5.2%

Rate Estimate, presents what in staff's estimation constitutes the most reasonable rate given existing data sources.

Because all data sources for the numerator require various and conflicting assumptions to accommodate only RPPCs, no one option is more accurate than another. Therefore, staff recommend that an average of the numerator options be used to determine the amount of non-PETE RPPCs recycled. An average should minimize extremes with respect to understating or overstating recycling. The average of the three options for deriving the amount of non-PETE RPPCs recycled is 11,583 tons in 1990 and 18,989 tons in 1991.

Staff recommend Option 1, Extrapolate *Modern Plastics* Resin Sales Data, be used in this and subsequent reports to determine the amount of non-PETE RPPCs generated. An extrapolation of resin sales is recommended because the data from this source are more specific to RPPCs and resin type than the other options. In addition, affected parties indicated that this methodology would provide a sufficiently accurate estimate of non-PETE RPPC generation. The average of the pre-assembled container category and the line item summation should be used to determine generation. This average was 347,639 tons in 1990 and 349,130 tons in 1991.

Table 3

Non-PETE RPPC Recycling Rate Estimates

	1990	1991
NUMERATOR: Average of sources	11,583 tons	18,989 tons
DENOMINATOR: Average of Modern Plastics line item summation and the pre-assembled container category	347,639 tons	349,130 tons
RECYCLING RATE	3.3%	5.4%

Based on the above recommendations, the estimated non-PETE RPPC recycling rate for 1990 is 3.3 percent. This figure increased to 5.4 percent in 1991. A more accurate methodology for determining recycling rates will be presented in Section III, Future Directions.

C. PETE RPPC Recycling Rates

The formula for calculating PETE RPPC recycling rates is as follows:

$$\text{Recycling Rate} = \frac{\text{PETE RPPC Tonnage Recycled}}{\text{PETE RPPC Tonnage Generated}}$$

The numerator, *PETE RPPC tonnage recycled*, can be estimated by using one of the following options:

- Extrapolate U.S. EPA Diversion Data to California Based on Population.
- Extrapolate SPI Recycling Data to California Based on Population.
- Use AB 939 Reported Diversion.
- Use California Department of Conservation

DOC) Data in Conjunction with SPI Recycling Data.

The denominator, *PETE RPPC tonnage generated*, can be estimated by using one of the following options:

- Extrapolate *Modern Plastics* National Resin Sales to California Based on Population.
- Use U.S. EPA Generation Data in Conjunction with *Modern Plastics* Resin Sales Data.
- Use AB 939 PETE Container Waste Generation Statistics.
- Use DOC Data in Conjunction with *Modern Plastics* Resin Sales.

The estimates of PETE recycling and generation are presented in Table 4, *Summary of PETE RPPC Diversion and Generation in 1990 and 1991*. In 1990 estimates of the amount of PETE recycled ranged from 12,000 tons to 15,378 tons. The 1991 estimates increased to between 17,573 tons and 21,535 tons. With respect to generation, 1990 estimates range from a low of 59,019 tons to a high of 86,487 tons. The range of generation estimates for 1991 was between 61,721 tons and 82,130 tons.

Table 5, *PETE RPPC Recycling Rate Range for 1990*

Table 4

Summary of PETE RPPC Recycling and Generation in 1990 and 1991 (Tons)

	1990	1991
NUMERATOR: Recycled		
Option 1: Extrapolate U.S. EPA Data	12,000	N/A
Option 2: Extrapolate SPI Recycling Data	13,601	17,573
Option 3: Use AB 939 Reported Diversion	15,378	N/A
Option 4: Use DOC Data in Conjunction with SPI Recycling Data	12,154	21,535
DENOMINATOR: Generated		
Option 1: Extrapolate Modern Plastics Resin Sales (compensated for 1% resin loss)		
pre-assembled container category	71,280	82,130
line item summation	64,687	72,468
Option 2: Use EPA Data	69,600	N/A
Option 3: Use AB 939 PETE Container Generation Statistics	86,487	N/A
Option 4: Use DOC Data in Conjunction with Modern	59,019	61,721

Table 5

PETE RPPC Recycling Rate Ranges for 1990 and 1991		
	1990	1991
NUMERATOR		
Maximum	15,387 tons	21,535 tons
Minimum	12,000 tons	17,573 tons
DENOMINATOR		
Maximum	86,487 tons	82,130 tons
Minimum	59,019 tons	61,721 tons
RECYCLING RATE		
High Estimate	26.1%	34.9%
Low Estimate	13.9%	21.4%

Table 6

PETE RPPC Recycling Rate Estimates		
	1990	1991
NUMERATOR: DOC and SPI	12,154 tons	21,535 tons
DENOMINATOR: DOC and *Modern Plastics*	59,019 tons	61,721 tons
RECYCLING RATE	20.6%	34.9%

and 1991, shows the range of recycling rates based on the estimates in Table 5. The high end of the recycling rate range is obtained by coupling the high recycled estimate with the low generation estimate; the low end of the recycling rate range is obtained by coupling the low recycled estimate with the high generation estimate. Table 4 shows the range of PETE RPPC recycling rates for 1990 is 13.9 percent to 26.1 percent. PETE recycling rates for 1991 fall between 21.4 percent and 34.9 percent.

Table 5 shows the range of PETE recycling rates given available data. Table 6, PETE Recycling Rate Estimate, presents what in staff's estimation constitutes the most reasonable rate given existing data sources.

Staff recommend Option 4, Use DOC Data in Conjunction with SPI Recycling Data, to determine the amount of PETE RPPCs recycled. Because the DOC tracks recycling of beverage containers as part of the AB 2020 program, recycling statistics for PETE beverage containers are highly accurate.

Table 7

Aggregate RPPC Recycling Rate Range for 1990 and 1991		
	1990	1991
NUMERATOR		
Maximum	33,723 tons	40,524 tons
Minimum	17,904 tons	36,562 tons
DENOMINATOR		
Maximum	453,104 tons	449,482 tons
Minimum	284,728 tons	392,628 tons
RECYCLING RATE		
High Estimate	11.8%	10.3%
Low Estimate	4.0%	8.1%

Likewise, for the purposes of determining PETE RPPC generation, staff recommended the option based on DOC data. Option 4, Use DOC Data in Conjunction with *Modern Plastics* Resin Sales Data, is more accurate than the others because the DOC closely tracks the sale of PETE beverage containers as part of the AB 2020 program.

Based on the recommended numerator and denominator, the estimated PETE RPPC recycling rate for 1990 was 20.6 percent. This figure increased in 1991 to 34.9 percent. As stated previously, a more accurate methodology will be presented in Section III, Future Directions.

D. Aggregate Recycling Rates (PETE + Non-PETE)

Senate Bill 235 does not currently provide an aggregate recycling rate or require the CIWMB to calculate such a rate (i.e., a recycling rate for all resins, both PETE and non-PETE). Because introduced legislation to amend SB 235 would require an aggregate rate to be calculated, such a rate is presented in this document. Table 7, *Aggregate RPPC Recycling Rate Range for 1990 and 1991*, shows the range of aggregate recycling rates and is based on information from the previous two subsections pertaining to non-PETE and PETE recycling rates.

The maximum numerator and denominator for all RPPCs is obtained by adding the maximum PETE and non-PETE numerators and denominators. The minimum numerator and denominator for all RPPCs is obtained by adding the minimum PETE and non-PETE numerators and denominators. The aggregate recycling rate for 1990 is estimated to be between 4.0 percent and 11.8 percent. In 1991, the range is between 8.1 percent and 10.3 percent.

A more precise aggregate recycling rate is obtained by summing the PETE and non-PETE estimates in Tables 3 and 6. Based on these two tables, the most reasonable estimates for RPPC recycling in 1990 and 1991 are 23,737 tons and 39,524 tons respectively. Generation estimates for those same years are 406,658 tons and 410,851 tons respectively. These recycling and generation figures correspond to recycling rates of 5.8 percent in 1990 and 9.8 percent in 1991.

III. Future Directions

Due to time and resource constraints, it was necessary to rely on existing data to develop PETE and non-PETE recycling rate estimates. These estimates address the 1990 and 1991 calendar years. Entities that engage in annual updates of recycling figures (i.e., SPI) are in the process of publishing their data for the 1992 calendar year. Incorporating that information into this report would have resulted in delay. In addition to this time factor, other issues must be addressed regarding the methods presented for deriving recycling rates.

Estimates of recycling rates vary dramatically depending on the data source used to obtain the estimate. To conform to the RPPC working definition, each of the cited sources were subjected to various assumptions of unknown validity. Thus, the resulting recycling rates are based on the best available data. In the future more accurate data sources for recycling rate numerators and denominators will be developed. Future rate determinations will require developing new methodologies and additional resources. Generally, the more accurate the data, the more complex and costly the methodology. Staff's objective is to recommend a methodology of sufficient accuracy and minimal cost.

In recognition of the limits associated with available data sources, alternative options to obtain data for future reports are presented in this Section. Alternatives are presented and staff's recommended option is briefly analyzed.

Staff identified the following alternatives for estimating RPPC recycling in the future:

- Use Modified DOC Reporting Procedures.
- Survey California Plastic Processors.
- Use AB 2494 Reported Data.

Staff recommend the CIWMB consult with the DOC to pursue modifying the DOC's plastic processor reporting procedures to obtain RPPC recycling data. If it is not feasible to modify DOC reporting, the CIWMB should initiate an independent plastic processor survey. Finally, reporting methodologies for AB 2494 should be developed in a manner so that they may be utilized for SB 235 purposes, as well. However, because the AB 2494 reporting procedures are still being developed, it would be premature to recommend their use.

Staff identified the following alternatives for estimating RPPC generation in the future:

- Waste Sort Extrapolations,
- Sales Reports from Product Manufacturers or Retailers, and
- Retail Shelf Surveys.

Due to the substantial resources required to implement any of the above alternatives, none were recommended. The U.S. EPA and AB 939 data used for the estimates in the previous Section are not recommended because they are not updated annually as SB 235 requires.

It is recommended that national resin sales from the publication *Modern Plastics* be extrapolated to determine RPPC generation in California. The extrapolation should be performed on a per capita basis, so the result will be proportional to the amount of the U.S. population that resides in the state. To improve the accuracy of the estimates,

information maintained by the DOC for soft drink bottles can be substituted for the *Modern Plastics'* soft drink bottle estimate. The extrapolation of *Modern Plastics* data can be performed using either the pre-aggregated container category or a line item accounting method, neither of which is precisely accurate. Because neither is clearly preferable, it is recommended that an average of the two be used to estimate RPPC generation in California.

Appendix A

I. INTRODUCTION

A. Rigid Plastic Packaging Containers

Senate Bill (SB) 235, the Rigid Plastic Packaging Container Act, requires rigid plastic packaging containers (RPPCs) to achieve one of four compliance options. One of these options is a resin-specific recycling rate. The accuracy of these rates is important because once these standards are met, all RPPCs are in compliance with the law.

The California Integrated Waste Management Board (Board) is mandated to publish an annual report documenting these resin-specific recycling rates for RPPCs.[1] The recycling rates must be reported separately for those containers composed of polyethylene terephthalate (PETE) and for those containers not composed of PETE ("non-PETE").[2]

Section 42301 of SB 235 defines an RPPC as *"any plastic package having a relatively inflexible finite shape or form, with a minimum capacity of eight fluid ounces or its equivalent volume and a maximum capacity of five fluid gallons or its equivalent volume, that is capable of maintaining its shape while holding other products, including, but not limited to, bottles, cartons, and other receptacles, for sale or distribution in the state."*

Before defining how RPPC recycling rates are calculated, it is necessary to understand what an RPPC is. The ambiguity of the statutory definition becomes apparent when it is applied to actual types of plastic packaging. Although regulations to implement SB 235 will refine the RPPC definition, these regulations will not be drafted until 1994. In the interim, it was necessary to develop a more focused working definition. To assist in establishing this working definition, representatives of sectors impacted by SB 235 were consulted. Persons representing the following constituencies attended two meetings to discuss this and related issues: resin, container and product manufacturers; distributors and retailers; local government officials; environmental groups; and recyclers and reprocessors.

General consensus was reached at these meetings to add the phrase *"capable of multiple re-closure"* to the existing definition. This phrase eliminates packaging items not capable of any closure such as bracing, crates, and trays as well as items not capable of multiple re-closure such as blister packaging. Examples of the containers for which recycling rates are determined in this report include items such as bottles, tubs, jars, and pails. Also included in the RPPC working definition are food service items such as hinged containers and cups.

B. Report Scope

This report fulfills the requirement in Section 42310 to publish PETE and non-PETE RPPC recycling rates.[4] Staff are aware of proposed amendments to SB 235 that would modify the manner in which recycling rates are calculated. These amendments would require the Board to calculate an aggregate recycling rate that combines both PETE and non-PETE resins. As these amendments have not yet been codified, this report addresses the current requirements for non-PETE and PETE recycling rates. However, in anticipation of an aggregate recycling rate, such a rate is presented. All estimates are based on data from calendar years 1990 and 1991, as 1992 data are not yet available.

Because California statistics are not maintained for RPPC sales or diversion activities, most numbers used to calculate recycling rates in this report are extrapolated from relevant, available sources, not original research.[3] Available data are limited and often not reported in categories consistent with the requirements set forth in SB 235. For example, container data are often compiled separately for highly recyclable products (i.e., PETE soft drink containers and HDPE milk jugs), while statistics for the balance of container types are reported in aggregate. Separating a resin type from general container data or containers from general plastic product data is difficult and not precisely accurate.

Because no single data source addressed all aspects of recycling rates as established in SB 235, it was necessary to access multiple sources. Because none of these sources provides data as accurately as desired, a range of recycling rates based on the various sources is presented. The full range of limits associated with each extrapolation and its data source are discussed.

Since a definitive recycling rate cannot be determined based on existing data, recommendations for achieving a higher level of accuracy in future reports are made at the conclusion of this report.

C. Report Organization

Section II addresses specific statutory requirements related to this report, the formula used to determine recycling rates, the units by which rates are calculated, and the status of exempt RPPCs.

Sections III and IV present options to determine non-PETE and PETE RPPC recycling rates. Methods and sources to calculate both the numerator and denominator for each recycling rate are discussed and the following specific points are addressed:

- Data source methodology,
- Differences between source categories and those categories required for SB 235 recycling rates,
- Assumptions applied to source data to obtain California-specific RPPC estimates, and
- Estimated RPPC recycling or generation in California based on that source.

Section V combines the PETE and non-PETE rates to obtain an overall RPPC recycling rate. This report concludes in Section VI with a review of recommendations to develop more accurate methods to determine recycling rates and a discussion of suggested statutory amendments.

II. Calculating Recycling Rates

A. Statutory Standards and Definitions

Senate Bill 235 establishes both a recycling rate definition and a standard that must be met to comply with the law using the recycling rate option. The recycling rate standards are established in Section 42310 (b) and (c). For RPPCs to comply with the aggregate recycling rate provisions, they must achieve whichever of the following standards is appropriate:

- *Have a recycling rate of 25 percent if* (the RPPC's) *primary material is not PETE, based on annual reports published by the Board on and after January 1, 1993.*

- *Have a recycling rate of 55 percent if* (the RPPC's) *primary material is PETE, based on annual reports published by the Board on and after January 1, 1993.*

Aggregate recycling rates are defined by Public Resources Code Section 42301 as one of the following:

- *The proportion, as measured by weight, volume, or number, that all rigid plastic packaging containers, notwithstanding the size limitations set forth in subdivision (d), in the aggregate, sold, or offered for sale in the state are being recycled in a given calendar year.*

- *The proportion, as measured by weight, volume, or number, that a PETE rigid plastic packaging container sold or offered for sale in the state is being recycled in a given calendar year.*

It is clear that inconsistencies exist between the recycling rate standards and the definitions. The first definition refers to an aggregate RPPC recycling rate regardless of resin type, but there is no recycling rate standard for RPPCs regardless of resin type. Because the author's office has stated that it was their intent to include such a recycling rate, an aggregate rate (regardless of resin type) will be derived in this document.

Additionally, unlike the recycling rate definition for all RPPCs, the recycling rate for PETE RPPCs does not include the reference *"regardless of size."* As a result, it is unclear in the second definition whether containers outside the RPPC size constraints of eight ounces and five gallons should be included in the PETE RPPC recycling rate calculations. Because the recycling rate definition for all RPPCs states that the rate is regardless of size, and because it is not possible to separate recycled PETE RPPCs by size given current reporting methods, the PETE recycling rate, too, will be calculated regardless of size.

B. Formula for Calculating Recycling Rates

The general formula for calculating recycling rates is as follows:

$$\text{Recycling Rate} = \frac{\text{RPPC Tonnage Recycled}}{\text{RPPC Tonnage Generated}}$$

C. Units for Calculating Recycling Rates

Senate Bill 235 provides for recycling rates to be calculated by either weight, volume, or number. Regardless of the unit used to calculate these rates, they must be consistent and California based.

Using the volume or number of RPPCs to determine recycling rates is not possible due to a lack of available data. Also, to establish such rates in the future would be problematic. The volume occupied by plastic containers depends on the degree of their

compaction. Because compaction practices vary within the recycling industry, the use of volumetric units may lead to inconsistent recycling rates. Using the number of RPPCs as a unit for measuring recycling rates is impractical because RPPC generation and diversion statistics are not reported in this manner.

To develop recycling rates using volume, the CIWMB would need to mandate compaction densities. To develop recycling rates using number of RPPCs it would be necessary for product manufacturers to report to the CIWMB the number of RPPCs sold in California, or the CIWMB would have to obtain RPPC sales information from retailers, wholesalers, and distributors. Implementing either methodology would be complex and burdensome.

Because existing statistics for generation, recycling, and landfilling of plastics are documented by weight, recycling rates in this report will be based on tonnage. Weight-based calculations are consistent with measurement methods used by the private sector and AB 939 reporting requirements. Furthermore, when industry representatives were consulted regarding which units should be used, they advised that weight is the only practical unit for determining recycling rates.

D. Status of Exempt Containers

Language in SB 235 specifies RPPCs that are exempt from all of the statute's requirements. These include RPPCs that hold the following items: drugs, medical food, medical devices, infant formula and hazardous and toxic products regulated by the Federal Insecticide, Fungicide, and Rodenticide Act. These containers are defined as RPPCs, but they are exempt from compliance.

Senate Bill 235 does not state whether exempt RPPCs should be included or excluded from the recycling rate calculations. At present, excluding exempt RPPCs from the calculation is not feasible because generation and diversion statistics for these types of containers are not maintained by any public or private entity. No attempt was made to exclude exempt RPPCs from the recycling rate calculations because estimating the amount of these containers would be complex and costly.

Furthermore, as discussed earlier, SB 235 states that *all* RPPCs, regardless of size, are included in calculations of aggregate recycling rates. This inclusion of containers that by definition are not considered RPPCs (because they are outside the size parameters), lends credence to the notion that containers exempt from statute, but defined as RPPCs, also should be included in recycling rate calculations.

III. Non-PETE RPPC Recycling Rates

The formula for calculating non-PETE RPPC recycling rates is as follows:

$$\text{Recycling Rate} = \frac{\text{Non-PETE Tonnage Recycled}}{\text{Non-PETE Tonnage Generated}}$$

Options for deriving the numerator and denominator are discussed below. These results are summarized in Table A-4, *Summary of non-PETE RPPC Diversion and Generation in 1990 and 1991*, and Table A-5, *Non-PETE RPPC Recycling Rate Range for 1990 and 1991*. Both tables are located at the end of this section. Analysis and conclusions regarding the most accurate option for determining the non-PETE RPPC recycling rate is presented in Subsection D, Non-PETE RPPC Recycling Rate Conclusions.

A. Numerator: Non-PETE RPPC Tonnage Recycled

The numerator, *non-PETE RPPC tonnage recycled*, can be calculated by using one of the following options:

- Extrapolate U.S. EPA Diversion Data to California Based on Population.
- Extrapolate Recycling Data from the Society of the Plastics Industry (SPI) to California Based on Population.
- Use AB 939 Reported Diversion.

Numerator Option 1: Extrapolate U.S. EPA Diversion Data to California Based on Population

The United States Environmental Protection Agency (EPA) conducts national waste generation and diversion studies with assistance from the consulting firm Franklin Associates, *Ltd.* These studies have occurred periodically over the past 20 years and the results are regularly summarized in the document *"Characteristics of Municipal Solid Waste in the United States."* The most recent version of this study addresses the 1990 waste stream and is subtitled *1992 Update.*

Data from this study can be extrapolated to California based on population. To perform this extrapolation, national diversion figures have been multiplied by the proportion of the U.S. population that resides in California. In 1990 Californians accounted for 12.0 percent of the total U.S. population.[7]

Generally, the EPA diversion data is obtained from industry sources, such as SPI. These sources track diversion by material and/or product type. The data is manipulated by the EPA to eliminate figures that include recycling of in-house (postindustrial) scrap.

The EPA study divides plastic container data into the following categories: soft drink bottles (PETE), milk bottles (HDPE), and other containers (all resins, including PETE and HDPE). These reporting categories differ from those necessary for the resin-specific rates required by SB 235. The EPA category "other containers" includes non-PETE containers other than milk jugs and custom PETE RPPCs (i.e., PETE RPPCs that are not soft drink bottles). Also, retail food service containers such as hinged containers and cups are considered RPPCs under the SB 235 working definition, but are classified under the non-durable goods category, not as containers, according to the EPA.

Several assumptions have been made to extrapolate results from the EPA study to California. A discussion and brief analysis of these assumptions follows:

• Per capita diversion of non-PETE RPPCs in California is consistent with per capita diversion in the nation.

This may or may not be accurate. Without performing research specific to California, there is no means to know if this assumption is accurate.

• Diversion of RPPCs not included in EPA container figures (retail food service containers such as hinged containers and cups) is negligible.

Generally, this assumption is accurate. These food service items are primarily made out of rigid and foamed polystyrene. Secondary markets for polystyrene are not stable or well developed, nor is polystyrene commonly collected in California recycling programs.

• Diversion of custom PETE RPPCs included in the EPA's "other container" category is negligible; therefore, the "other container" category is attributed to non-PETE containers.

With respect to the year 1990, other sources show that nationwide and California custom PETE container recycling was minimal.[8] *However, over the past few years it has become increasingly common for California recycling programs to collect PETE containers. Consequently, PETE container recycling (both soft drink bottles and custom containers) has increased at a rapid rate. Thus, while this assumption holds for the year 1990, it may be less accurate for subsequent years.*

• Statistics reported in the EPA study are for "diversion," not "recycling." Using their data unadjusted implies that diversion and recycling are equivalent.

The EPA distinguishes between recycling and diversion because some recycling processes result in the generation of by-products that themselves require disposal. For example, paper reprocessing results in generation of a sludge-like material that requires disposal. Unlike paper recycling, plastic reprocessing typically does not result in the generation of by-products that require disposal. Therefore, with respect to RPPCs, the terms diversion and recycling can be used interchangeably with a modicum of confidence.

Calculations:

Performing the required calculations yields a recycling estimate for 1990 of 5,904 tons of non-PETE RPPCs in California. To obtain this estimate, first the nationwide EPA estimates for recycling of milk jugs and other containers were added together (27,600 tons milk jugs + 21,600 tons other containers = 49,200 tons). Next, to extrapolate nationwide recycling to California, the nationwide figure was multiplied by the proportion of the U.S. population residing in California (49,200 tons x .12 = 5,904). The result, 5,904 tons, is an estimate of non-PETE RPPC recycling in California.

Numerator Option 2: Extrapolate SPI Recycling Data to California Based on Population

The Society of the Plastics Industry, Inc. (SPI) conducts nationwide plastics recycling studies with the assistance of R.W. Beck and Associates. The most recent study addresses the calendar years 1990 and 1991 and is summarized in the document *"Post-Consumer Plastics Recycling Rate Study."* As with the EPA studies, this effort, too, is ongoing. Annual reports for the preceding two years are published approximately every April. Thus, the

report due in April 1993 will contain information for the calendar years 1991 and 1992.

Data from the study can be extrapolated based on the proportion of the U.S. population that resides in California. In 1990 Californians accounted for 12.0 percent of the total U.S. population; this figure increased slightly in 1991 to 12.2 percent.

The SPI study data was obtained through a nationwide telephone survey of plastic reclaimers. To mitigate the problem of double counting scrap that is passed between processors before being used in a new product, only processors selling material for "end-use" were surveyed. The term "end-use" implies that subsequent to sale, the material was used to make a final product, and was not sold to an intermediary or broker.

Because many firms specialize in the production and/or reclamation of some but not all resins, survey participation rates varied depending on resin type. No attempt was made to compensate for non-participating firms.

Data for the SPI study were reported in more than 25 categories. Recycled tonnage was reported by resin type, and aggregate numbers (i.e., not resin specific) were separated into packaging and non-packaging categories. Within the packaging category, subcategories for various packaging types are provided. Although reporting by resin type is consistent with SB 235's provisions, the packaging categories established by SPI are not always consistent with the RPPC working definition. For example, the category "other packaging" often includes non-rigid packaging such as bags and films.

Several assumptions have been made to extrapolate results from the SPI study to California. A discussion and brief analysis of these assumptions follows:

- Per capita diversion of non-PETE RPPCs in California is consistent with national per capita diversion.

This may or may not be true. Without performing research specific to California, there is no means to know if this assumption is accurate.

- Although some firms did not respond to the survey, this does not result in substantial understatement of tonnage recycled.

The raw data on which the SPI study is based is considered proprietary. Without access to the back-up proprietary data, there is no means to determine the validity of this assumption.

- Diversion of non-RPPCs included in SPI's "other packaging" category is negligible. Therefore, the amounts presented in this category are attributed to non-PETE RPPCs.

As stated with respect to the previous assumption, it is not possible to determine the validity of this assumption without access to back-up data. However, the non-RPPC items included in the "other packaging" category are primarily flexible films made of HDPE and PP, and PS food service items. None of these items are characterized by particularly strong secondary markets, so it may be safe to assume that diversion for the years 1990 and 1991 was marginal.

Calculations:

Performing the required calculations results in a non-PETE RPPC recycling estimate of 10,500 tons in 1990 and 18,989 tons in 1991. To obtain these figures, nationwide numbers from the SPI study

were converted from millions of pounds to tons and then prorated to California based on population. Pounds were converted to tons by dividing by 2,000, and prorating was achieved by multiplying nationwide tonnage by the percent of the U.S. population that resides in California; this figure was 12.0 percent in 1990 and 12.2 percent in 1991.

The SPI data is reported in many categories, including several not subject to SB 235's mandates, so their data must be adjusted to remove non-RPPCs when possible. Table A-1, *Estimated Non-PETE RPPC Tonnage Recycled in 1990 and 1991 Based on SPI's "Post-Consumer Plastics Recycling Rate Study,"* shows a line item accounting for the various packaging components that were used to develop the estimate of non-PETE RPPCs recycled. Packaging components are classified by resin and product type. When possible, only packaging that would be included in the working definition of an RPPC is included; however, as stated above, due to

Table A-1

Estimated Non-PETE RPPC Tonnage Recycled in 1990 and 1991 Based on SPI's "Postconsumer Plastics Recycling Rate Study"

Plastic/Product Type	1990 Tons Diverted	1991 Tons Diverted
HDPE Total	**9,612**	**17,110**
Natural Bottles	3,450	8,095
Pigmented Bottles	1,710	5,636
Base Cups	2,940	2,635
Other Packaging[9]	1,537	744
PVC Total	**90**	**98**
Bottles	90	98
LDPE Total	**0**	**6**
Bottles[10]	0	6
PP Total	**24**	**317**
Bottles	24	79
Other Packaging[11]	0	238
PS Total	**774**	**1,458**
Packaging[12]	774	1,458
Grand Total	**10,500**	**18,989**

the subcategory of "other packaging" that includes both RPPCs and non-RPPCs, total consistency with regard to SB 235 is not possible.

Numerator Option 3: Use AB 939 Reported Diversion Data

Assembly Bill 939 requires cities and counties to report waste diversion (source reduction, recycling, and composting) by material category for 1990. As of March 11, 1993, 495 out of 525 jurisdictions, representing 98.4 percent of California's population, had reported this information. Data gathered as a result of AB 939 mandates pertain strictly to the 1990 calendar year. Furthermore, because localities are not required to submit this information annually to the Board, this source is static.[13]

Jurisdictions were allowed to use the following four categories to report diverted plastic: HDPE containers (e.g., milk jugs), PETE containers (soft drink bottles and custom containers), film plastic, and other plastic. Recycling of non-PETE RPPCs in 1990 can be approximated by using the HDPE container category.

Some jurisdictions aggregated subcategories prior to reporting. For example, as opposed to reporting all four subcategories, a jurisdiction may report the aggregate amount of HDPE and PETE containers diverted. When this occurs, the CIWMB cannot determine what portion of the diverted material is PETE or HDPE; therefore, total tonnage is allocated to the "other plastic" category.[14]

Even if each subcategory were used, the resulting data would not correspond to the exact parameters established in SB 235. Recycled non-PETE RPPCs made from resins other than HDPE are quantified in the "other plastic" category. These containers should be removed from the "other plastic" category and added to diverted HDPE containers; however, because the data were aggregated prior to reporting, the amount of diverted RPPCs made from resins other than PETE or HDPE cannot be determined.

Several assumptions are associated with using AB 939 mandated report data as the foundation for an estimate of non-PETE RPPC recycling. A discussion and brief analysis of these assumptions and other concerns follows:

- Because AB 939 tracks diversion, which includes both source reduction and recycling, using diversion to estimate RPPC recycling implies that source reduction is negligible.

While source reduction is at the top of the waste management hierarchy, it is difficult to quantify. Because jurisdictions reporting diversion for AB 939 purposes are required to quantify diversion, many choose to do this without quantifying source reduction efforts in their diversion calculations. Although staff did not review all submitted reports, it can be assumed that reported diversion approximates actual recycling.

- The amount of recycled containers made from non-PETE resins other than HDPE are negligible.

Data in the previous option, "Extrapolate SPI Recycling Data to California Based on Population," shows that recycling of resins other than PETE and HDPE accounted for less than ten percent of non-PETE container recycling.

- The amount of HDPE containers included in the "other plastic" category are negligible.

It is known that 11 counties did not use the HDPE container category for reporting. Thus, diversion of HDPE containers is included in the "other plastic" category. Only one of these counties, San Diego, is significantly populated and urbanized. The remaining ten counties include Amador, Calaveras, Fresno, Glenn, Madera, Marin, San Benito, San Luis Obispo, Siskiyou, and Yolo. Excluding data from these counties understates diversion of HDPE to an unknown extent.

Calculations:

Based on AB 939 mandated reporting, 18,345 tons of HDPE containers were diverted in California in 1990. As previously stated, it is not possible to estimate diversion of RPPCs made from resins other than PETE or HDPE using AB 939 data.

B. Denominator: Non-PETE RPPC Tonnage Generated

The denominator, *non-PETE RPPC tonnage generated,* can be calculated by using one of the following options:

- Extrapolate National Resin Sales to California Based on Population.
- Use EPA Data.
- Use AB 939 Plastic Generation Statistics in Conjunction with Resin Sales Data.
- Integrate Statistics Maintained by California State Agencies With *Modern Plastics* Sales Data.

Denominator Option 1: Extrapolate National Resin Sales to California Based on Population

National resin sales are published annually in the January edition of *Modern Plastics,* a magazine published by McGraw-Hill. Report methodology is established by the Society of Plastics Industries (SPI) and is conducted by the firm Ernst & Young. To have year-end totals ready for the January publication, fourth quarter sales are based on projections. These projections are adjusted in the following year's edition. Thus, the January 1993 issue included sales for 1992 (incorporating a projected fourth quarter) and the adjusted sales for 1991.

Sellers of resin report monthly sales in the following ways (units are millions of pounds): by resin type; by amount sold for various applications, within a resin type; and by the amount sold in major resin markets including packaging and containers. Monthly sales reported by each company are cross checked with the company's sales for the previous month and with sales for the same month, one year prior. Totals are not adjusted for non-reporting resin sellers.

To estimate non-PETE RPPC generation in California, nationwide non-PETE RPPC resin sales had to be converted to tons, then prorated to California based on population. In 1990, 12.0 percent of the nation's population resided in California, and in 1991 12.2 percent of the U.S. population lived in the state.

The packaging and container statistics assembled by *Modern Plastics* identify the amount of each resin type sold for producing containers, closures, coatings, and films. Estimates of non-PETE RPPC generation can be obtained either by using the pre-assembled *Modern Plastics* container category and excluding PETE container sales or by performing a line item summation of all non-PETE resin applica-

tions that fall within the SB 235 working RPPC definition.

If the pre-assembled *Modern Plastics* container category is used to estimate non-PETE RPPC generation, there is no means to determine what specific packaging items were considered for inclusion in the container category. Hence, containers that are considered RPPCs may be excluded from the calculations while containers not considered RPPCs may be included. If the line item summation sales method is used, the "other packaging" categories include some non-RPPC applications.

Assumptions that must be made to extrapolate the sales data (using either the "pre-assembled" or "line-item" data published in *Modern Plastics*) include the following:

- California's per capita non-PETE RPPC generation patterns are consistent with the nation's.

Without undertaking a specific study, the validity of this assumption is unknown.

- Non-reporting resin sellers account for a negligible portion of the non-PETE RPPC market.

Survey representatives have stated that participation in the annual survey varies by resin type and that most large resin sellers participate; however, the proportion of actual sales accounted for is unknown. To the extent that resin sales go unreported, the recycling rate will be inflated (if the numerator remains constant and the denominator decreases, the overall recycling rate increases).

- Resin export and the import of products packaged in RPPCs does not impact the equivalency of resin sales and RPPC generation.

The United States is a net exporter of resin and a net importer of plastic products.[15] *The amount of resin exported specifically for RPPC manufacture and the amount of products imported that are contained in RPPCs cannot be determined. As a result, the impact of these export and import activities on the "sold-equals-generated" assumption also is unknown.*

- If the pre-aggregated container category is used, it must be assumed that non-RPPCs that are included in the category and RPPCs that are not included in the category are negligible.

The exact components of this category are unknown, so the validity of the assumption cannot be determined.

- If non-PETE RPPC generation is estimated by a line item count, it must be assumed that the amount of non-RPPCs included in the "other packaging" categories is negligible.

There is no means to absolutely verify this assumption; however, it is likely that the amount of non-RPPC packaging included is not substantial when compared to total non-PETE RPPC resin sales.

Calculations:

As stated, *Modern Plastics* maintains data on millions of pounds of resin used in producing packaging and containers. If the *Modern Plastics* container category, excluding PETE resin (6,172 million pounds in 1990 and 6,083 million pounds in 1991) is converted to tons (dividing by 2,000 equals 3.1 million tons in 1990 and 3.0 million tons in 1991) and prorated to California based on population

(multiplying by .12 in 1990 and .122 in 1991), total California generation of non-PETE RPPCs in 1990 was 370,320 tons and in 1991 was 371,063 tons.

An estimated one percent resin loss occurs during the manufacturing process.[16] Compensating for this loss results in slightly lower estimates of non-PETE RPPC generation of 366,617 tons in 1990 and 367,352 tons in 1991.

Table A-2, *Estimated Non-PETE RPPC Tonnage Generated in 1990 and 1991 Based on Modern Plastics Data 1992*, provides an estimate of non-PETE RPPC generation in California based on a line item accounting of non-PETE RPPC resin sales as reported in *Modern Plastics*. Based on this line item aggregation, 331,980 tons of non-PETE RPPCs were generated in California in 1990 and 334,249 tons were generated in 1991.

To obtain these estimates, data were first converted to tons (divide reported pounds by 2000 pounds per tons) and then prorated to California based on population (multiply nationwide tonnage by .12 and .122, the proportion of the U.S. population residing in California in 1990 and 1991). Finally all non-PETE RPPC line item entries were summed. The result is the non-PETE RPPC generation estimate.

An estimated one percent resin loss occurs during the container manufacturing process. Adjusting for this loss results in slightly lower figures for non-PETE RPPC generation of 328,660 tons in 1990 and 330,907 tons in 1991.

Denominator Option 2: Use U.S. EPA Generation Data in Conjunction with Resin Sales Data

As stated with respect to diversion (see Numerator: Option 1), the EPA conducts periodic waste characterization studies, the results of which can be prorated to California based on population. The most recent results of these studies are for the 1990 calendar year and are summarized in the publication *"Characteristics of Municipal Solid Waste in the United States: 1992 Update."*

A materials flow methodology is used by the EPA to determine waste generation. Time series data on domestic production of materials and products were compiled and serve as the basis for these estimates. Adjustments were made to compensate for imports, exports, permanent diversion from the municipal waste stream, and product lifetime.

The EPA study divides plastic container data into the following categories: soft drink bottles (PETE), milk bottles (HDPE), and other containers (all resins, including PETE and HDPE). These reporting categories differ from those necessary for the resin specific rates required by SB 235. The EPA category "other containers" includes custom PETE RPPCs (i.e., PETE RPPCs that are not soft drink bottles). Also, retail food service containers such as hinged containers and cups are considered RPPCs under the SB 235 working definition, but are classified under the non-durable goods category, not as containers, according to the EPA.

Several assumption have been made to extrapolate results from the EPA study to California. A discussion and brief analysis of these assumptions follows:

- Per capita generation of non-PETE RPPCs in California must be consistent with per capita generation in the nation.

This may or may not be true. Without performing research specific to California, there is no means to know if this assumption is accurate.

Table A-2

Estimated Non-PETE RPPC Tonnage Generated in 1990 and 1991 Based on Modern Plastics Data, 1992		
Resin Type	**1990 Tons Sold**	**1991 Tons Sold**
HDPE Total	**229,380**	**232,623**
liquid food	58,260	59,048
household chemicals	55,500	55,998
motor oil	14,040	12,444
pharmaceutical, cosmetics	13,320	13,908
drums	9,720	12,627
tight head pails	4,800	5,002
other blow molding	8,040	8,784
pails	27,780	29,402
dairy tubs	9,300	8,997
ice cream containers	5,760	5,612
beverage bottle bases	7,800	7,320
other food containers	3,900	3,660
paint cans	1,980	1,952
other injection molding	9,180	7,869
LDPE Total	**5,280**	**5,002**
blow molding	5,280	5,002
PP Total	**29,580**	**32,025**
Consumer Packaging	5,280	5,185
Containers	12,120	12,688
Other Injection Moldings	12,060	14,152
PS Total	**51,900**	**50,325**
Rigid Packaging	5,100	5,185
Dairy Containers	8,820	8,662
Vending and Portion Cups	15,300	15,555
Egg Cartons	3,600	3,355
Hinged Containers	7,500	6,100
Cups (non-thermoformed)	2,400	2,440
Cups and Containers (expanded bead PS)	9,180	9,028
PVC total	**13,440**	**11,895**
blow molding bottles	13,440	11,895
Other Resin[17]	2,400	2,379
Grand total non-PETE	**331,980**	**334,249**

• EPA data excludes generation of retail food service containers (e.g., hinged containers and cups) from the container category. Thus, use of EPA data requires the assumption that such container generation is negligible.

According to the Modern Plastics estimate, almost 20,000 tons of polystyrene hinged containers and cups were generated in California in 1990 (see Table A-2). This accounted for approximately six percent of total non-PETE RPPC generation. This six percent deficit will be compensated for in the "Calculations" discussion that follows.

• EPA data includes generation of custom PETE containers in the "other container category." Thus, use of EPA data requires the assumption that generation of PETE custom containers is negligible.

Custom PETE RPPC sales are growing rapidly (based on Modern Plastics statistics). In 1990, they accounted for almost 45 percent of the PETE RPPC market, while in 1991, that figure increased to slightly more than 50 percent. To say that this is an insignificant component is misleading. To compensate, custom PETE generation will be subtracted from the non-PETE RPPC estimate presented in the "Calculations" discussion that follows.

Calculations:

The EPA estimates that overall 400,000 tons of HDPE milk jugs were generated in 1990 and 1.8 million tons of "other containers" were generated. The sum of these two categories is the amount of non-soft drink containers generated in the nation. To prorate this figure to California, nationwide figures (2.2 million tons) must be multiplied by the proportion of the country's population that resides in California (12 percent in 1990). Based on these calculations, an estimated 264,000 tons of non-soft drink bottle RPPCs were generated in California.

As stated previously, PETE custom containers (i.e., PETE containers that are not soft drink bottles) are included in the "other container" category. To improve the accuracy of the non-PETE RPPC generation estimate, these containers should be removed from the calculations.

The amount of PETE custom containers that are included in the "other container" category can be estimated using *Modern Plastics* sales ratios (see Denominator: Option 1 for a discussion of the assumptions associated with using *Modern Plastics* data). According to *Modern Plastics* data, in 1990 custom PETE container resin sales occurred at approximately 45 percent the amount of PETE soft drink sales. Therefore, an estimate of PETE custom containers can be obtained by multiplying soft drink container sales (estimated to be 48,000 tons in California based on EPA data) by 45 percent. This results in a custom PETE estimate of 21,600 tons. This amount should be subtracted from the above non-soft drink bottle RPPC estimate to obtain an estimate of non-PETE RPPCs generated. The result of this calculation is 242,400 tons.

This figure still needs to be adjusted to compensate for food service RPPCs (i.e., hinged containers and cups) that the EPA considers non-durable goods as opposed to plastic containers. As stated previously, based on *Modern Plastics* data, polystyrene hinged containers and cups accounted for approximately six percent of total non-PETE RPPC generation. Adjusting the 242,400 ton estimate to account for an additional six percent RPPC generation results in a final estimate of 257,872 tons of non-PETE RPPCs generated in 1990.

Denominator Option 3: Use AB 939 Plastic Generation Statistics in Conjunction with National Resin Sales Data

The California plastic waste generation statistics obtained from AB 939 required reporting can be used in conjunction with resin sales ratios to establish an estimate of RPPC sales. Waste generation is not reported in terms of non-PETE RPPCs, but can be estimated by multiplying tons of plastic generated in California by the ratio of the resin used in non-PETE RPPC applications to total resin sales. *Modern Plastics* sales statistics can be used to establish the ratio.

Plastic waste generation data for 1990 can be obtained from AB 939 mandated reports. However, as previously stated, AB 939 does not require annual updates of solid waste generation studies, so this source cannot continue to be used in the future.

The assumptions previously discussed for the use of *Modern Plastics* data (see Denominator: Option 1) also apply to this option. In addition, the following assumption have been made:

- It is assumed that plastic resin sales and plastic generation are equivalent.

The velocity with which materials that are "sold" enter the waste stream and are considered "generated" varies. Items such as packaging containers have a short life span and quickly become waste. Other items with plastic components such as appliances and cars enter the waste stream after many years of use by the consumer. Thus, while it can be said with some confidence that RPPC sales are equivalent to generation, for plastics in general this may not be true.

Calculations:

The *Modern Plastics* sales ratio can be established by using either the pre-aggregated container category or by performing a line item accounting of all non-PETE RPPC applications.

Using the pre-aggregated container category to determine resin used in non-PETE RPPCs, total non-PETE RPPC sales in California in 1990 are estimated to be 277,170 tons. This estimate is obtained by using the following ratio and performing the calculations in the following formula:

$P \times r_1$ = estimate of non-PETE RPPC sales in 1990

Where:

P = AB 939 reported tons of non-PETE plastic waste generated in 1990 = 2,752,887

$$r_1 = \frac{\text{resin used in non-PETE RPPCs}}{\text{total resin sales}} = \frac{6{,}172 \text{ million pounds}}{61{,}301 \text{ million pounds}} = .10068$$

$P \times r_1$ = 2,752,887 tons x .10068 = 277,170 tons

Using the line item accounting method to determine resin used in non-PETE RPPCs, total non-PETE RPPC sales in California in 1990 are estimated to be 248,457 tons. This estimate is obtained by using the same formula as was used above, but substituting the line item estimate for non-PETE RPPC resin sales for the pre-aggregated container category estimate. The calculations required to obtain the estimate of non-PETE RPPC sales are as follows:

$P \times r_1$ = estimate of non-PETE RPPC sales in 1990

Where:

P = AB 939 reported tons of non-PETE plastic waste generated in 1990 = 2,752,887

resin used in non-

$$r_1 = \frac{\text{PETE RPPCs}}{\text{total resin sales}} = \frac{5.533 \text{ million pounds}}{61{,}301 \text{ million pounds}} = .09026$$

$P \times r_1$ = 2,752,887 tons x .09026 = 248,457 tons

Denominator Option 4: Use Statistics Maintained by California State Agencies in Conjunction with U.S. EPA Data

In reviewing activities of other state agencies, it is apparent that only the California Department of Food and Agriculture (DFA) tracks non-PETE containers used to hold milk. The DFA monitors the amount of milk (except non-fat) sold in various types and sizes of containers. Statistics are kept only for the month of October, so October figures must be multiplied by 12 to obtain annual consumption. Sales for HDPE milk jugs can be adjusted to reflect this data.

The DFA conducts annual surveys of California milk distributors every October to determine the amount of milk sold in that month. The 1990 survey accounts for a sample of approximately 99.9 percent of all market whole milk and low-fat milk market sales in California. The 1991 survey sampled approximately 96.9 percent of all whole and low-fat milk sales in California. Historically, sales of non-fat milk have not been tracked, but the DFA estimates sales of non-fat milk account for about a seven percent market share. Statistics are kept by container material and size.[16]

Statistics from the DFA can be used to establish the amount of milk sold in HDPE containers and the tonnage of HDPE used to contain the milk. Because HDPE milk jugs are only one component of non-PETE RPPCs, another source must be used to determine the balance of RPPCs generated. Only the EPA keeps plastic container data using the milk jug category, so the DFA milk jug estimate will be substituted for the EPA milk jug estimate to approximate total non-PETE RPPC generation.

The EPA data are available only for the 1990 calendar year, so total non-PETE generation can only be determined for that year, not 1991. However, the DFA study is annual, so if an alternative data source can be developed that contains the category "milk jugs," the DFA information can continue to be used.

Because EPA data is used to estimate generation of non-PETE RPPCs that are not milk jugs, the assumptions that were made in discussing the EPA data are applicable (see Denominator: Option 2). In addition, the following assumptions must be made:

- Milk sales are only tracked for the month of October; if annual sales are estimated by multiplying October figures by 12, then it is assumed October milk consumption is typical.

Officials at the DFA felt that it was reasonable to estimate annual sales by multiplying October sales by 12. Consumption varies throughout the year, and according to DFA statistics, May is the peak month and January the low month for milk sales, while October sales fall in the middle.

- Historically, non-fat milk sales have not been tracked by the DFA, so the amount of plastic relative to paper cartons or glass bottles and the sizes of plastic containers used to package non-fat milk is unknown. It has been assumed that the proportion of non-fat milk packaged in plastic is identical to the proportion of other milk packaged in plastic. Likewise, the proportion of non-fat milk sold in various sizes is assumed to be identical to other types of milk.

C. Range of Non-PETE Recycling Rates

Table A-4, *Summary of Non-PETE RPPC Recycling and Generation in 1990 and 1991*, shows the estimated non-PETE RPPC tonnage diverted and generated in 1990 and 1991 for each of the options presented. Estimated recycling rates are established by selecting a numerator and denominator from among the presented alternatives. The estimated recycling rate will vary depending on which methodology is used; however, a range can be established within which all possible numerator and denominator pairings will fall.

Table A-4

Summary of NON-PETE RPPC Recycling and Generation in 1990 and 1991 (Tons)

	1990	1991
NUMERATOR: Recycled		
Option 1: Extrapolate U.S. EPA Diversion Data to California Based on Population	5,904	N/A
Option 2: Extrapolate SPI Recycling Data California Based on Population	10,500	18,989
Option 3: Use AB 939 Reported Diversion	18,345	N/A
DENOMINATOR: Generated		
Option 1: Extrapolate National Resin Sales to California Based on Population (compensated for .1% resin loss)		
pre-assembled container category	366,617	367,352
line item summation	328,660	330,907
Option 2: Use EPA Data in Conjunction with Resin Sales Data	257,872	N/A
Option 3: Use AB 939 Plastic Generation Statistics in Conjunction with Resin Sales Data		
pre-assembled container category	277,170	N/A
line item summation	248,457	N/A
Option 4: Use Statistics Maintained by California State Agencies in Conjunction with EPA Data	225,709	N/A

Again, without conducting a study, there are no data available to substantiate these assumptions; however, it seems unlikely that persons consuming non-fat milk would have different packaging preferences relative to persons consuming low-fat or whole milk.

Calculations:

Summing the DFA based estimate for milk jugs (31,709 tons in 1990) and the EPA based estimate for non-PETE "other containers" (194,000 tons in 1990), yields a non-PETE RPPC generation estimate of 225,709 tons in 1990. Table A-3, *Estimated Tonnage of HDPE Milk Containers Sold in 1990 and 1991 Based on Statistics Maintained by the DFA,* shows the numbers used to obtain estimates of HDPE milk jugs sold in California in 1990 and 1991.

The DFA reports the number of gallons of milk sold in quart, half-gallon, and gallon containers. These statistics have been converted to quarts and half-gallons as appropriate. The last row in Table A-3 adjusts milk RPPC tonnage to compensate for non-fat sales that have historically not been tracked by the DFA. This adjustment is based on the DFA estimate that non-fat milk sales account for approximately seven percent of total milk sales. Also included are HDPE milk jug generation statistics for 1991.

Table A-3

Estimated Tonnage of HDPE Milk Containers Sold In 1990 and 1991 Based on Statistics Maintained By the DFA

	1990	1991
Quarts		
October sales in quart containers	365,484 quarts	2,218 quarts
container weight	.066 lbs	.066 lbs
October tonnage	12.1 tons	.1 tons
annual tonnage (October x12)	145 tons	1 ton
Half-Gallons		
October sales in half-gallon	4,072,198 half gallons	3,009,504 half gallons
containers weight	.099lbs	.099 lbs
October tonnage	202 tons	149 tons
annual tonnage (October x 12)	2,419 tons	1,788 tons
Gallons		
October sales in gallon containers	33,995, 895 gal.	36,507,830 gal.
Container weight	.132 lbs	.132 lbs.
October tonnage	2244 tons	2409.5 tons
annual tonnage (October x 12)	26,925 tons	28,914 tons
Total Annual Tonnage	29,489	30,703
Total Annual Tonnage Adjusted to Include 7% Non-Fat Milk Sales	31,709	33,014

The high end of the non-PETE RPPC recycling rate range can be obtained by using the maximum estimate for the numerator and the minimum estimate for the denominator. The low end of the range is obtained by using the minimum estimate for numerator and the maximum estimate for the denominator. Table A-5, *Non-PETE RPPC Recycling Rate Range for 1990 and 1991*, shows the range of the non-PETE RPPC recycling rate for 1990 as 1.6 percent to 8.1 percent. The range for 1991 is between 5.2 percent and 5.7 percent.

D. Non-PETE RPPC Recycling Rate Conclusions

Each data source available to calculate the non-PETE recycling rate numerator or denominator involves assumptions that have been presented and discussed. The implications of these assumptions cannot be resolved at this time; thus, the accuracy of estimated recycling rates is less than desired. Still, given SB 235's mandate to publish the non-PETE recycling rate, it is necessary to propose a methodology and present an estimate. In light of this mandate and less than perfect information regarding non-PETE RPPC recycling and generation, a range of recycling rates was developed.

Table A-5

Non-PETE RPPC Recycling Rate Range for 1990 and 1991

	1990	1991
NUMERATOR		
Maximum	18,345 tons	18,989 tons
Minimum	5,904 tons	18,989 tons
DENOMINATOR		
Maximum	366,617 tons	367,352 tons
Minimum	225,709 tons	330,907 tons
RECYCLING RATE		
High Estimate	8.1%	5.7%
Low Estimate	1.6%	5.2%

Methods that may be used in the future to obtain information requiring fewer or more reasonable assumptions are provided in Section VI, Future Directions. In the interim, it is important to establish the rate that is most reasonable so product manufacturers know the degree of progress, if not the exact amount, that must be made in the next few years if they are to meet SB 235's recycling rate provisions.

It is staff's estimation that no single option available to determine the numerator (recycled) is particularly accurate. Because all data sources for the numerator require various and conflicting assumptions to accommodate only RPPCs, no one option is more accurate than another for the purposes of this report. Therefore, staff recommend that an average of the numerator options be used to determine the

amount of non-PETE RPPCs recycled. An average should minimize extremes with respect to understating or overstating diversion. The average of the three options for deriving the amount of non-PETE RPPCs diverted is 11,583 tons in 1990 and 18,989 tons in 1991.

Staff recommend that Option 1, *Extrapolate National Resin Sales to California Based on Population*, be used in this and subsequent reports for determination of the denominator (generated). An extrapolation of national resin sales is recommended because the data from this source are more specific to RPPCs and resin type than the other options. In addition, the Technical Advisory Committee, referred to in the Introduction, suggested that extrapolating national resin sales to California based on population would provide an accurate estimate of generation. Either the pre-assembled container category or the line item summation can be used to determine generation, or as with the numerator, an average of the two can be determined. The average of the two (347,639 tons in 1990 and 349,130 tons in 1991) will be used to calculate the non-PETE RPPC recycling rate.

The estimated non-PETE RPPC recycling rate for 1990 is 3.3 percent. This figure increased slightly in 1991 to 5.4 percent. Due to time lags in data compilation and the fact that much of the data are not updated annually, there simply are not sufficient alternatives to present a more current recycling rate. The CIWMB has in excess of one year to develop a more up to date and adequate method for gathering the required information (see Section VI, Future Directions, for recommendations).

IV. PETE RPPC Recycling Rates

The formula for calculating PETE RPPC recycling rates is as follows:

$$\text{Recycling Rate} = \frac{\text{PETE RPPC Tonnage Recycled}}{\text{PETE RPPC Tonnage Generated}}$$

Options for deriving the numerator and denominator are discussed below. These results are summarized in Table A-8, *Summary of PETE RPPC Recycling and Generation in 1990 & 1991*, and Table A-9, *PETE RPPC Recycling Rate Range for 1990 and 1991*. Both tables are located at the end of this section. Analysis and conclusions regarding the most accurate option for determining the PETE RPPC recycling rate is presented in Subsection D, PETE RPPC Recycling Rate Conclusions.

A. Numerator: PETE RPPC Tonnage Recycled

The numerator, *PETE RPPC tonnage recycled*, can be calculated by using one of the following options:

- Extrapolate U.S. EPA Diversion Data to California Based on Population.
- Extrapolate SPI Recycling Data to California Based on Population.
- Use AB 939 Reported Diversion.
- Integrate Statistics Maintained by California State Agencies with *Modern Plastics* Sales Data.

Numerator Option 1: Extrapolate U.S. EPA Diversion Data to California Based on Population

Similar to the estimate for non-PETE RPPC recycling, recycling of PETE RPPCs can be extrapolated from the EPA study. The EPA conducts national waste generation and diversion studies with assistance from the consulting firm Franklin Associates, *Ltd.* These studies have occurred periodically over the past 20 years and the results are regularly summarized in the document *"Characteristics of Municipal Solid Waste in the United States."* The most recent version of this study, the *1992 Update*, addresses the year 1990.

Data from this study can be extrapolated to California based on population. To perform this extrapolation, national diversion figures have been multiplied by the proportion of the U.S. population that resides in California. In 1990 Californians accounted for 12.0 percent of the total U.S. population.

Generally, the EPA diversion data is obtained from industry sources, such as SPI. These sources track diversion by material and/or product type. The data are manipulated by the EPA to eliminate figures that include recycling of in-house (postindustrial) scrap.

The EPA study divides plastic container data into the following categories: soft drink bottles (PETE), milk bottles (HDPE), and other containers (all resins, including PETE and HDPE). These reporting categories differ from those necessary for the resin specific rates required by SB 235. The EPA category "other containers" includes custom PETE RPPCs (i.e., PETE RPPCs that are not soft drink bottles). Also, retail food service containers such as hinged containers and cups are considered RPPCs under the SB 235 working definition, but are classified under the non-durable goods category, not as containers, according to the EPA.

Several assumptions have been made to extrapolate results from the EPA study to California. A discussion and brief analysis of these assumptions follows:

• Per capita diversion of PETE RPPCs in California is consistent with per capita diversion in the nation.

This may or may not be accurate. Without performing research specific to California, there is no means to know if this assumption is accurate.

• Diversion of PETE RPPCs not included in EPA container figures (retail food service containers such as hinged containers and cups) is negligible.

Generally, this assumption is accurate. These food service items are primarily made out of rigid and foamed polystyrene.

• Diversion of custom PETE RPPCs included in the EPA's "other container" category is negligible.

With respect to the year 1990, other sources show that nationwide and California custom PETE container recycling was minimal.[6] *However, over the past few years it has become increasingly common for California recycling programs to collect PETE containers. Consequently, PETE container recycling (both soft drink bottles and custom containers) has increased at a rapid rate. Thus, while this assumption holds for the year 1990, it may be less accurate for subsequent years. Thus, recycling will be understated.*

• Statistics reported in the EPA study are for "diversion," not "recycling." Using their data unadjusted implies that diversion and recycling are equivalent.

The EPA distinguishes between recycling and diversion because some recycling processes result in the generation of by-products that themselves require disposal. For example, paper reprocessing results in generation of a sludge-like material that requires disposal. Unlike paper recycling, plastic reprocessing typically does not result in the generation of by-products that require disposal. Therefore, with respect to RPPCs, the terms diversion and recycling can be used interchangeably with a modicum of confidence.

Calculations:

Performing the required calculations for 1990 data yields 12,000 tons of PETE RPPCs recycled in California. To obtain this figure, the nationwide EPA estimate for diversion of soft drink bottles (100,000 tons) was extrapolated to California by multiplying by .12 (the proportion of the U.S. population residing in California in 1990).

Numerator Option 2: Extrapolate SPI Recycling Data to California Based on Population

As with the estimate for non-PETE RPPC recycling, the SPI study, "*Post-Consumer Plastics Recycling Rate Study,*" can be used to estimate recycling of PETE RPPCs in California. SPI conducts nationwide plastics recycling studies with the assistance of the firm R.W. Beck and Associates. The most recent study addresses the calendar years 1990 and 1991. As with the EPA studies, this effort, too, is on going. Annual reports for the preceding two years are published approximately every April. Thus, the report due in April 1993 will contain information for the calendar years 1991 and 1992.

Data from the study can be extrapolated to California based on population. To perform this extrapolation, national recycling figures must be multiplied by the proportion of the U.S. population that resides in California. In 1990 Californians accounted for 12.0 percent of the total U.S. population; this figure increased slightly in 1991 to 12.2 percent.

The information presented in the SPI study was obtained through a nationwide telephone survey of plastic reclaimers. To mitigate the problem of double counting scrap that is passed between processors before being used in a new product, only processors selling material for "end-use" were surveyed. The term "end-use" implies that subsequent to sale, the material was used to make a product; it was not sold to an intermediary broker.

Because many firms specialize in the production and/or reclamation of specific resins, not all resins, survey participation rates varied depending on resin type. No attempt was made to compensate for non-participating firms.

Data for the SPI study were reported in more than 25 categories. Recycled tonnage was reported by resin type, and aggregate numbers were separated into packaging and non-packaging categories. Within the packaging category, subcategories for various packaging types are provided. The reporting categories are consistent with the needs established in SB 235 for PETE RPPC recycling rates. The SPI study separates PETE containers into two categories, soft drink bottles and custom containers.

Even though the data categories are consistent with SB 235 PETE RPPC recycling rate requirements, several assumptions still must be made to extrapolate results from the SPI study to California. A discussion and brief analysis of these assumptions follows:

- Per capita diversion of PETE RPPCs in California is consistent with national per capita diversion.

This may or may not be true. Without performing research specific to California, there is no means to know if this assumption is accurate. California, like many states, has a bottle bill, so this encourages container return. Whether Californian's are more likely than their U.S. counterparts to redeem containers is unknown.

- The lack of response to the survey by some firms did not result in substantial understatement of tonnage recycled.

The raw data on which the SPI study is based is considered proprietary. Without access to the back-up data, there is no means to determine the validity of this assumption.

Calculations:

Performing the required calculations results in a PETE RPPC recycling estimate of 13,601 tons in 1990 and 17,573 tons in 1991. To obtain these figures, nationwide numbers from the SPI study have been converted from millions of pounds to tons and then were prorated to California based on population. Pounds were converted to tons by dividing by 2,000, and prorating was achieved by multiplying nationwide tonnage by the percent of the U.S. population that resides in California; this figure was 12.0 percent in 1990 and 12.2 percent in 1991. Table A-6, *Estimated PETE RPPC Tonnage Recycled in 1990 and 1991 Based on SPI's "Post-Consumer Plastics Recycling Rate Study,"* shows estimated PETE RPPC diversion.

Numerator Option 3: Use AB 939 Reported Diversion Data

As stated with respect to non-PETE RPPCs, AB 939 required reports can be used to estimate PETE RPPC diversion as well. Assembly Bill 939 requires cities and counties to report waste diversion (source

Table A-6

Estimated PETE RPPC Tonnage Recycled in 1990 and 1991 Based on SPI's "Post-Consumer Plastics Recycling Rate Study"		
Plastic/Product Type	**1990 Tons Diverted**	**1991 Tons Diverted**
Custom Bottles	126	552
Soft Drink Bottles	13,475	17,021
PETE Total	13,601	17,573

reduction, recycling, and composting) by material category for 1990. As of March 11, 1993, 495 out of 525 jurisdictions, representing 98.4 percent of California's population, had reported this information. Data gathered as a result of AB 939 mandates pertain strictly to the 1990 calendar year. Furthermore, because localities are not required to submit this information annually to the Board, this source is static.

Jurisdictions were allowed to use the following four subcategories to report diverted plastic materials: HDPE containers (e.g., milk jugs), PETE containers (soft drink bottles and custom containers), film plastic, and other plastic. Recycling of PETE RPPCs in 1990 can be approximated by using the PETE container category.

Some jurisdictions aggregated subcategories prior to reporting. For example, as opposed to reporting all four subcategories, a jurisdiction may have reported that "X" tons of HDPE and PETE containers were diverted. When this occurred, the CIWMB could not determine what portion of the diverted material was PETE or HDPE; therefore, total tonnage was allocated to the "other plastic" category.

Several assumptions are associated with using data gathered from AB 939 mandated reports as the foundation for an estimate of PETE RPPC recycling. A discussion and brief analysis of these assumptions and other concerns follows:

- Because AB 939 tracks diversion, which includes both source reduction and recycling, using diversion to estimate recycling implies that source reduction is negligible.

While source reduction is at the top of the waste management hierarchy, it is difficult to quantify. Because jurisdictions reporting diversion for AB 939 purposes are required to quantify diversion, many chose not to include source reduction efforts in their diversion calculations. Thus, although staff did not review all submitted AB 939 reports for the purposes of this document, in general, due to difficulties in quantifying source reduction, it can be assumed that reported diversion approximates actual recycling.

- Counties failing to report PETE container diversion actually did not divert any material.

It is known that six counties did not report diversion of PETE containers, but did report diversion of "other plastic." These six counties include Amador, Calaveras, Fresno, Imperial, San Benito, and San Diego. Due to the redemption value associated with PETE soft drink bottles, it is unlikely that no diversion of these containers occurred. Therefore, it seems likely that a portion of the "other plastic" category includes PETE RPPCs, and that the PETE container diversion rate is understated in these reports.

Only San Diego County is both densely populated and significantly urbanized, two criteria that enhance recycling opportunities. Thus, although there is no means to determine what portion of the "other plastic" diversion is attributable to PETE containers, it is likely that excluding the data from these counties does not grossly understate diversion.

Calculations:

Based on AB 939 mandated reporting, an estimated 15,378 tons of PETE containers were recycled.

Numerator Option 4: Integrate Statistics Maintained by California State Agencies with SPI Recycling Data

The Department of Conservation monitors sales and returns of plastic beverage containers regulated by AB 2020, the Beverage Container Recycling and Litter Reduction Act. Statistics are maintained and published by container count. Year-end summaries of sales and recycling are published by the DOC in June of the following year. Thus, the report documenting 1992 will be published in June 1993.

The PETE RPPC market is comprised of two types of containers, soft drink bottles and custom containers. (These containers are called beverage containers and postfilled containers in AB 2020 terminology.) The DOC information can be used to calculate tons of beverage containers recycled. The DOC also reports the number of postfilled containers (i.e., custom containers) that are returned for recycling, but are not currently regulated by AB 2020. However, unlike beverage bottles at about seven per pound, there is no standard weight for postfilled containers, so the DOC information regarding the number of postfilled containers cannot be converted to pounds, and, therefore, cannot be used to establish diverted tonnage of custom PETE RPPCs.

Because there is no means of determining tons of PETE custom containers diverted using DOC data, another source must be used to determine PETE custom container diversion. The SPI study separates recycling of PETE containers by soft drink bottles and custom containers, so it will be used to estimate custom container recycling.

In addition to the assumptions made with respect to using the SPI study to extrapolate PETE recycling to California (see Numerator: Option 2), the following additional assumption had to be made with respect to the DOC data:

- It must be assumed that reporting by DOC certified processors captures all PETE beverage container recycling in California.

To obtain the California Redemption Value associated with beverage container recycling, recyclers must sell their material to DOC certified processors. For this reason virtually all CRV material is handled by DOC certified processors who report tonnage to the DOC. Therefore, it is likely that the amount of PETE beverage containers recycled, but not accounted for in the DOC statistics, is minimal.

Calculations:

If the DOC beverage bottle data (12,028 tons in 1990 and 20,983 tons in 1991) is combined with the SPI estimate of custom PETE RPPC diversion (126 tons in 1990 and 552 tons in 1991), then all PETE RPPCs are accounted for. This results in total PETE diversion of 12,154 tons in 1990 and 21,535 tons in 1991.

B. Denominator: PETE RPPC Tonnage Generated

The denominator, *PETE RPPC tonnage generated,* can be calculated by using one of the following options:

- Extrapolate National Resin Sales to California Based on Population.
- Use EPA Data.
- Use AB 939 PETE Container Waste Generation Statistics.
- Integrate Statistics Maintained by California State Agencies and the Federal Government.

Denominator Option 1: Extrapolate National Resin Sales to California Based on Population

As stated previously with respect to calculating the non-PETE recycling rates denominator, data published in *Modern Plastics* can be used to extrapolate RPPC generation. National resin sales are published annually in the January edition of *Modern Plastics,* a magazine published by McGraw-Hill. Report methodology is established by SPI and is conducted by the firm Ernst & Young. To have year end totals ready for the January publication, fourth quarter sales are based on projections. These projections are adjusted in the following year's edition. Thus, the January 1993 issue included sales for 1992 (incorporating a projected fourth quarter) and the adjusted sales for 1991.

Sellers of resin report monthly sales in the following ways (units are millions of pounds): by resin type; by amount sold for various applications, within a resin type; and by the amount sold in major resin markets including packaging and containers. Monthly sales reported by each company are cross checked with the company's sales for the previous month and with sales for the same month, one year prior. Totals are not adjusted for non-reporting resin sellers.

To estimate PETE RPPC generation in California, nationwide PETE RPPC resin sales had to be converted to tons, then prorated to California based on population. In 1990, 12.0 percent of the nation's population resided in California, and in 1991 12.2 percent of the U.S. population lived in the state.

The packaging and container statistics assembled by *Modern Plastics* identify the amount of each resin type sold for producing containers, closures, coatings, and films. Estimates of PETE RPPC generation can be obtained either by using the pre-assembled *Modern Plastics* container category and including only PETE resin sales or by performing a line item summation of PETE resin applications that fall within the SB 235 working RPPC definition.

If the pre-assembled *Modern Plastics* container category is used to estimate PETE RPPC generation, there is no means to determine what specific packaging items were considered for inclusion in the container category. Hence, containers that are considered RPPCs may be excluded from the calculations while containers that are not considered RPPCs may be included.

If line item PETE RPPC sales are used to estimate generation, the line item categories include soft drink bottles and custom containers, and sheeting. The sheeting category presents problems because it includes both RPPCs and non-RPPCs. Resin sales for containers such as cups and food trays, both potentially RPPCs according to the working definition (these items are included if they are capable of multiple re-closure), are contained in the sheeting category. Also included are resin sales for non-RPPC applications such as blister packaging (not capable of multiple re-closure). Because there is no means to separate the RPPCs from the non-RPPCs, this category will not be included in the PETE generation calculations. All sheeting applications (of which only a portion are actual RPPCs) represent approximately an additional eight percent PETE resin sales.

Assumptions that must be made to extrapolate the sales data using either the pre-assembled or line item data published in *Modern Plastics* include the following:

- California's per capita PETE RPPC generation is consistent with the nation's.

Without undertaking a specific study, the validity of this assumption is unknown.

- Non-reporting resin sellers account for a negligible portion of the PETE RPPC market.

Survey representatives have stated that participation in the annual survey varies by resin type and that most large resin sellers participate; however, the proportion of actual sales accounted for is unknown.

- Resin export and the import of products packaged in RPPCs does not impact the equivalency of resin sales and RPPC generation.

The United States is a net exporter of resin and a net importer of plastic products.[14] *The amount of resin exported specifically for RPPC manufacture and the amount of products imported that are contained in RPPCs cannot be determined. As a result, the impact of these export and import activities on the "sold-equals-generated" assumption also is unknown.*

- If the pre-aggregated container category is used, it must be assumed that non-RPPCs that are included in the category and RPPCs that are not included in the category are negligible.

The exact components of this category are unknown, so the validity of the assumption cannot be determined.

- If PETE RPPC generation is estimated by a line item count, it must be assumed that the two categories, soft drink bottles and custom containers, account for all PETE RPPCs.

Although it is known that using these two categories excludes some RPPCs, there is no means of determining the extent to which generation will be understated.

Calculations:

As stated, *Modern Plastics* maintains data on millions of pounds of resin used in producing packaging and containers. If the *Modern Plastics* container category, including only PETE resin (1,204 million pounds in 1990 and 1,360 million pounds in 1991), is converted to tons (dividing by 2,000 equals 600,000 tons in 1990 and 680,000 tons in 1991) and prorated to California based on population (multiplying by .12 in 1990 and .122 in 1991), total California

generation of PETE RPPCs in 1990 was 72,000 tons and in 1991 was 82,960 tons.

An estimated one percent resin loss occurs during the manufacturing process. Compensating for this loss results in slightly lower estimates of non-PETE RPPC generation of 71,280 tons in 1990 and 82,130 tons in 1991.

Table A-7, *Estimated PETE RPPC Tonnage Generated in 1990 and 1991 Based on Modern Plastics Data 1992*, provides an estimate of PETE RPPC generation in California based on a line item accounting of PETE RPPC resin sales as reported in *Modern Plastics*. Based on this line item aggregation, 65,340 tons of PETE RPPCs were generated in California in 1990 and 73,200 tons were generated in 1991.

To obtain these estimates, data was first converted to tons (divide reported pounds by 2000 pounds per tons) and then prorated to California based on population (multiply nationwide tonnage by .12 and .122, the proportion of the U.S. population residing in California in 1990 and 1991). Finally all PETE RPPC line item entries were summed. The result is the PETE RPPC generation estimate.

An estimated one percent resin loss occurs during the container manufacturing process. Adjusting for this loss results in slightly lower figures for PETE RPPC generation of 64,687 tons in 1990 and 72,468 tons in 1991.

Denominator Option 2: Use EPA Data

As stated with respect to diversion (see Numerator: Option 1), the EPA conducts periodic waste characterization studies, the results of which can be prorated to California based on population. The most recent results of these studies are for the 1990 calendar year and are summarized in the publication *"Characteristics of Municipal Solid Waste in the United States: 1992 Update."*

A materials flow methodology is used by the EPA to determine waste generation. Time series data on domestic production of materials and products were compiled and serve as the basis for these estimates. Adjustments were made to compensate for imports, exports, permanent diversion from the municipal waste stream, and product lifetime.

Table A-7

Estimated PETE RPPC Tonnage Sold in 1990 and 1991 Based on Modern Plastics Data, 1992

PETE RPPCS	1990 Tons Sold	1991 Tons Sold
Soft drink bottles	45,240	48,373
Custom containers	20,100	24,827
Grand Total PETE	**65,340**	**73,200**

The EPA study divides plastic container data into the following categories: soft drink bottles (PETE), milk bottles (HDPE), and other containers (all resins, including PETE and HDPE). These reporting categories differ from those necessary for the resin specific rates required by SB 235. The EPA category "other containers" includes custom PETE RPPCs (i.e., PETE RPPCs that are not soft drink bottles). Also, retail food service containers such as hinged containers and cups are considered RPPCs under the SB 235 working definition, but are classified under the non-durable goods category, not as containers, according to the EPA.

Several assumptions have been made to extrapolate results from the EPA study to California. A discussion and brief analysis of these assumptions follows:

- Per capita generation of PETE RPPCs in California must be consistent with per capita generation in the nation.

This may or may not be accurate. Without performing research specific to California, the accuracy of this assumption cannot be determined.

- Sales of RPPCs not included in the EPA container figures (i.e., retail food service containers such as hinged containers and cups) are negligible.

Retail food service containers are primarily made from polystyrene, so not including them in PETE generation should not result in a grossly understated estimate.

- Generation of custom PETE RPPCs included in the EPA's "other container" category are negligible.

Custom PETE RPPC sales are growing rapidly. In 1990, they accounted for almost 45 percent of the PETE RPPC market, while in 1991, that figure increased to slightly more than 50 percent. To say that this is an insignificant component is misleading. An attempt to compensate for this problem will be presented in the "Calculations" discussion below.

Calculations:

The EPA estimates that nationwide 400,000 tons of PETE soft drink bottles were generated in 1990. To prorate this figure to California, nationwide figures (400,000 tons) must be multiplied by the proportion of the country's population that resides in California (12.0 percent in 1990). Based on these calculations, an estimated 48,000 tons of PETE soft drink bottles were generated in California.

As stated previously, PETE custom containers (i.e., PETE containers that are not soft drink bottles) are included in the "other container" category. The amount of PETE custom containers that are included in the "other container" category can be estimated using *Modern Plastics* sales ratios (see Denominator: Option 1 for a discussion of the assumptions associated with using *Modern Plastics* data). According to *Modern Plastics* data, in 1990 custom PETE container resin sales occurred at approximately 45 percent the amount of PETE soft drink sales. An estimate of PETE custom containers can be obtained by multiplying soft drink container sales (estimated to be 48,000 tons in California based on EPA data) by 45 percent. The resulting product is 21,600 tons. This is the estimate of PETE custom containers. It should be added to the above estimate of soft drink bottles to obtain an estimate of total PETE RPPCs generated. The

result of this calculation, 69,600 tons, is the estimated PETE RPPC generation in 1990.

Denominator Option 3: Use AB 939 PETE Container Generation Statistics

The California PETE container generation statistics obtained from required AB 939 reporting can be used to establish an estimate of PETE RPPC sales. However, because AB 939 does not require annual updates of solid waste generation studies, this source cannot continue to be used in the future. As of March 11, 1993, the CIWMB had compiled information for 495 out of 525 jurisdictions that represent 98.5 percent of the state's population.

Assumptions associated with using this data source include the following:

- Counties reported the line item diversion and disposal of PETE containers.

Three counties (San Diego, Calaveras, and Imperial) did not report PETE container disposal and six counties did not report PETE container diversion (Amador, Calaveras, Fresno, Imperial, San Benito, and San Diego). Because generation is based on disposal and diversion, it is likely that PETE generation is slightly understated.

Calculations:

PETE containers are reported as a subcategory within the overall plastic category. The compiled AB 939 data show that 86,487 tons of PETE containers were generated in 1990.

Denominator Option 4: Integrate Statistics Maintained by California State Agencies

The Department of Conservation monitors sales and returns of plastic beverage containers regulated by AB 2020, the Beverage Container Recycling and Litter Reduction Act. Statistics are maintained and published by container count. Year-end summaries of sales and recycling are published by the DOC in June of the following year. Thus, the report documenting 1992 will be published in June 1993.

The PETE RPPC market is comprised of two types of containers, soft drink bottles and custom containers. (These containers are called beverage containers and postfilled containers in AB 2020 terminology.) The DOC information can be used to calculate tons of beverage containers generated. Because there is no means of determining tons of PETE custom containers generated using DOC data, another source must be used to determine PETE custom container diversion. The *Modern Plastics* data separate PETE resin sales by soft drink bottles and custom containers, so it will be used to estimate custom container generation.

In addition to the assumptions made with respect to using the *Modern Plastics* data to extrapolate PETE custom container generation to California (see Denominator: Option 1), the following additional assumption had to be made with respect to the DOC data:

- It must be assumed that reporting by DOC reports captures all PETE beverage container sales in California.

Due to the California Redemption Value associated with beverage container sales and recycling, these containers are closely tracked by the DOC. Therefore, it is likely that their statistics are accurate.

Calculations:

Based on DOC figures, 39,120 tons of PETE beverage containers were sold in 1990 and 37,142 tons were sold in 1991. When added to the custom container estimates

derived in *Option 1* from *Modern Plastics* and adjusted for the estimated one percent resin loss that occurs during manufacturing (19,899 in 1990 and 24,579 tons in 1991), total PETE RPPC sales for 1990 are 59,019 tons and total sales for 1991 are 61,721 tons.

C. Range of PETE RPPC Recycling Rates

Table A-8, *Summary of PETE RPPC Recycling and Generation in 1990 and 1991*, shows the estimated PETE RPPC tonnage diverted and generated in 1990 and 1991 for each of the options presented. Estimated recycling rates are established by selecting a numerator and denominator from among the presented alternatives (a recommended methodology will be presented in Subsection D). The estimated recycling rate will vary depending on which methodology is used; however, a range can be established within which all possible numerator and denominator pairings will fall.

The highest PETE RPPC recycling rate can be obtained by using the maximum estimate for the numerator and the minimum estimate for the denominator. The low rate is obtained by using the minimum estimate for numerator and the maximum estimate for the denominator. Table A-9, *PETE RPPC Recycling Rate Range for 1990 and 1991*,

Table A-8

Summary of PETE RPPC Recycling and Generation in 1990 and 1991

	1990	1991
NUMERATOR: Recycled		
Option 1: Extrapolate U.S. EPA Data to California Based on Population	12,000 tons	N/A
Option 2: Extrapolate SPI Recycling Data to California Based on Population	13,601 tons	17,573 tons
Option 3: Use AB 939 Reported Diversion	15,378 tons	N/A
Option 4: Integrate Statistics Maintained by California State Agencies with SPI Recycling Data	12,154 tons	21,535 tons
DENOMINATOR: Generated		
Option 1: Extrapolate National Resin Sales to California Based on Population (compensated for 1% resin loss)	71,280 tons	82,130 tons
pre-assembled container category	64,687 tons	72,468 tons
line item summation		
Option 2: Use EPA Data	69,600 tons	N/A
Option 3: Use AB 939 PETE Container Generation Statistics	86,487 tons	N/A
Option 4: Integrate Statistics Maintained By California State Agencies with Resin Sales Data	59,019 tons	61,721 tons

Table A-9

PETE RPPC Recycling Rate Range for 1990 and 1991		
	1990	1991
NUMERATOR		
Maximum	15,378 tons	21,535 tons
Minimum	12,000 tons	17,573 tons
DENOMINATOR		
Maximum	86,487 tons	82,130 tons
Minimum	59,019 tons	61,721 tons
RECYCLING RATE		
High Estimate	26.1%	34.9%
Low Estimate	13.9%	21.4%

shows the high and low range of the PETE RPPC recycling rate. In 1990 the PETE recycling rate ranged from 13.9 percent to 26.1 percent and in 1991 the PETE recycling rate ranged from 21.4 percent to 34.9 percent.

D. PETE RPPC Recycling Rate Conclusions

Each data source available to calculate the PETE recycling rate numerator or denominator involves assumptions that have been presented and discussed. Although the implications of many of these assumptions cannot be resolved at this time, staff recommend Option 4, Integrate Statistics Maintained by California State Agencies with SPI Recycling Data, to determine the numerator and Option 4, Integrate Statistics Maintained by California State Agencies with Resin Sales Data, to determine the denominator.

These options are partially based on DOC data for sales and recycling of PETE beverage containers. These figures are tracked closely by the DOC as part of the AB 2020 program. Because beverage containers accounted for half of all PETE RPPC sales in 1991 (according to the resin sales ratios established using *Modern Plastics* data), use of DOC data in conjunction with another source for determining custom PETE RPPC generation and recycling results in data of sufficient accuracy. Thus, the PETE RPPC recycling rate established using these sources is the most accurate given available data.

Based on the recommended numerator and denominator, the estimated PETE RPPC recycling rate for 1990 was 20.6 percent. This figure increased in 1991 to 34.9 percent. Due to time lags in data compilation and the fact that much of the data are not updated annually, there simply are not sufficient alternatives to present a more current recycling rate. The CIWMB has in excess of one year to develop a more up to date and adequate method for gathering the required information relating to PETE custom containers (see Section VI, Future Directions, for recommendations).

V. Aggregate Recycling Rates (PETE + NON-PETE)

Currently there is no provision for an aggregate recycling rate (i.e., the recycling rate for all resins, both PETE and non-PETE is calculated together); however, as will be discussed in the following section, it is anticipated that such a rate will need to be calculated in the future. Based on the information provided in the discussion of PETE and non-PETE recycling rate ranges, a range for the aggregate recycling rate can be established. To establish an aggregate rate, the PETE and non-PETE RPPC diversion and sales must be summed. Thus, the maximum numerator and denominator for all RPPCs is obtained by adding the maximum PETE and non-PETE numerators and denominators. And the minimum numerator and denominator for all RPPCs is obtained by adding the minimum PETE and non-PETE numerators and denominators.

As with the PETE and non-PETE RPPC rates, a recycling rate range can be developed. The high end of the range is calculated by using the maximum numerator and minimum denominator. The low end of the range is calculated by using the minimum numerator and the maximum denominator. Table A-10, *Aggregate RPPC Recycling Rate Range for 1990 and 1991*, shows the range of aggregate recycling rates based on the sum of the information provided in the previous PETE and non-PETE RPPC discussion.

Table A-10

Aggregate RPPC Recycling Rate Range for 1990 and 1991

	1990	1991
NUMERATOR		
Maximum	33,723 tons	40,524 tons
Minimum	17,904 tons	36,562 tons
DENOMINATOR		
Maximum	453,104 tons	449,482 tons
Minimum	284,728 tons	392,628 tons
RECYCLING RATE		
High Estimate	11.8%	10.3%
Low Estimate	4.0%	8.1%

VI. Future Directions

Presented in this subsection are alternative options, not previously discussed, that the CIWMB could develop to obtain the information necessary to establish RPPC recycling rates. The alternatives are briefly analyzed and recommendations for determining recycling rates in future years are made. This subsection also addresses present efforts to amend SB 235; the general direction of these efforts, and their corresponding impact on determining recycling rates, will be discussed.

A. Recommendations for Alternative Methods to Calculate Recycling Rates

Due to time and resource constraints, it was necessary to rely on existing data to develop PETE and non-PETE recycling rate estimates. These estimates address the 1990 and 1991 calendar years, not 1992 as might be expected. Entities that engage in annual updates of recycling figures (i.e., SPI) are in the process of publishing their data for the 1992 calendar year. Incorporating that information into this report would have resulted in delay. In addition to this time factor, other issues must be addressed with respect to the methods presented for deriving recycling rates.

Estimates of recycling rates vary dramatically depending on the data source used to obtain the estimate. To conform to SB 235 parameters, each of the cited sources first had to be subjected to various assumptions of unknown validity. Thus, the resulting recycling rates are less accurate than desired. Developing new, more accurate data sources for recycling rate numerators and denominators would result in a more accurate estimate of the RPPC recycling rates. Another issue to consider is that the U.S. EPA and the AB 939 data are not updated annually. Because SB 235 requires an annual recycling rate report, these two sources cannot be used for future reports.

The need to develop more accurate methods to estimate RPPC recycling and generation in California is apparent. A general discussion and analysis of alternatives for obtaining RPPC recycling and generation figures is presented below. This discussion concludes with recommended methods for obtaining RPPC recycling and generation figures.

1. Recycling Rate Numerator (recycled)

Alternatives for calculating the tonnage of non-PETE and PETE RPPCs recycled in California were presented in Sections III(A) and IV(A) of this document. These alternatives included (1) Extrapolate U.S. EPA Diversion Data to California Based on Population, (2) Extrapolate SPI Recycling Data to California Based on Population; (3) Use AB 939 Reported Diversion Data, and (4) Integrate Statistics Maintained by California State Agencies with SPI Recycling Data. In addition to these previously discussed options, three alternative options exist for obtaining the necessary information. These options include the following:

- Use Modified DOC Reporting Procedures.
- Survey California Plastic Processors.
- Use AB 2494 Reported Data.

Use Modified DOC Reporting Procedures:

More than 60 California plastic processors are certified by the DOC under the AB 2020 program. As part of this program, they are required to submit monthly reports to the DOC that document the

amount of AB 2020 plastic scrap handled. All of these processors accept PETE RPPCs regulated by AB 2020, and many accept non-PETE RPPCs and PETE RPPCs not regulated by AB 2020.

Because plastic scrap regulated by AB 2020 has the highest value of all postconsumer plastics and because DOC reimbursement for processing costs is contingent on certification, most postconsumer plastic handlers will be certified by the DOC. Thus, access to these entities would result in the Board's ability to track virtually all plastic scrap diverted in California.

With a slight modification, the DOC's reporting requirements would provide an additional source for obtaining diversion statistics. This modification would require the DOC monthly survey to include provisions for reporting all RPPC diversion, not only AB 2020 PETE containers and other PETE containers. Reporting would need to be in weight units, not determined by container count, to be compatible with the recycling rate denominator.

Survey California Plastic Processors:

The CIWMB could engage in its own survey of plastic processors. It is anticipated that the information obtained from this survey would be equivalent to that obtained by modifying current DOC reporting procedures. However, such an undertaking would essentially be a duplication of DOC efforts and would result in increasing the private sector's reporting burden. In the interest of minimizing public and private sector efforts in obtaining RPPC recycling information, this option is not recommended.

Use AB 2494 Reported Data:

Another alternative the Board could pursue to improve RPPC diversion estimates is to incorporate an RPPC category into the AB 2494 reporting methods that Board staff are currently developing. However, unlike the DOC reports, reporting requirements associated with AB 2494 are essentially voluntary and of unknown frequency. Because AB 2494 reporting by recyclers is voluntary, this option is inferior. Reporting through AB 2494 channels could serve as a crosscheck against other data sources, and, therefore, should not be altogether discounted.

Recommended Approach:

For the purpose of obtaining RPPC recycling information, the CIWMB should consult with the DOC to modify the DOC's plastic processor reporting procedures. If it is not feasible to modify DOC reporting, the CIWMB should initiate an independent plastic processor survey. Reporting methodologies for AB 2494 purposes should be developed in a manner so that they may be utilized by the Board as a crosscheck to estimate RPPC recycling, but not used as the primary information source.

2. Recycling Rate Denominator (generated)

Alternatives for calculating the tonnage of non-PETE and PETE RPPCs generated in California were presented in Sections III(B) and IV(B) of this document. These alternatives included (1) Extrapolate National Resin Sales to California Based on Population, (2) Use U.S. EPA Generation Data in Conjunction with Resin Sales Data, (3) Use AB 939 Plastic Generation Statistics, and (4) Use Statistics Main-

tained by California State Agencies in Conjunction with U.S. EPA Data or National Resin Sales. In addition to these previously discussed options, three alternative options exist for obtaining the necessary information. These options include the following:

- Waste Sort Extrapolations,
- Sales Reports from Product Manufacturers or Retailers, and
- Retail Shelf Surveys.

Waste Sort Extrapolations:

Rather than rely on outside entities for the data required to estimate RPPC sales, the CIWMB could commission annual waste sorts. Container disposal figures could then be added to diversion estimates to obtain total RPPC sales in California. Waste sorts provide a high level of control over methodology; thus, the sort could be conducted using the exact SB 235 definition of an RPPC. Waste sorts would need to be performed annually to provide up-to-date information and account for variations in RPPC disposal. In addition, the accuracy of waste sorts is a function of the number, location, frequency and timing of sampling, so accuracy would vary, with more accurate data also being more costly.

Sales Reports from Product Manufacturers or Retailers:

The CIWMB could require all products sold in California that are contained in RPPCs to be reported. This would entail product manufacturers submitting to the CIWMB both the RPPC weight and the number of product units sold in California for each of their RPPC lines. It is anticipated that there are several thousand product manufacturers that must comply with SB 235. The amount of time required by CIWMB staff to obtain and compile the data and the corresponding expense make this option undesirable. Furthermore, many manufacturers claim that given complex product distribution systems, they are unable to determine the exact sales of a product line in any given state. Thus, developing the tracking systems required to obtain California-specific data would be a substantial undertaking.

Requiring retail outlets, as opposed to product manufacturers, to submit RPPC sales information would eliminate the need to develop a system to track RPPCs through distribution channels. However, reporting at the retail level would necessitate a parallel tracking mechanism. Also, as evidenced by the implementation of the "snack tax," it would be necessary to develop and thoroughly disseminate an exhaustive list of products sold in RPPCs.

According to information obtained using Standard Industrial Classification (SIC) codes, there are more than 22,000 grocery and convenience store outlets in the state (SIC code 5411). In addition to grocery stores, specialty stores selling items such as beauty supplies and automotive products, as well as bakeries and liquor stores, would all be affected by any retail reporting requirements. Additionally, reporting through retailers would not provide information regarding RPPC weights. The CIWMB would either need to develop a standard RPPC weight or contact product manufacturers. As with reporting at the level of the product manufacturer, reporting by retail outlets would be costly and burdensome for both the private and public sectors.

Retail Shelf Surveys:

A final alternative for developing estimates of RPPC generation in California is based on retail shelf surveys. In performing initial research related to SB 235, CIWMB staff conducted shelf surveys at two retail outlets, a grocery store, and a variety store. The purpose of this exercise was to identify the number and type of RPPCs used to package products sold at those stores.

It would be impractical to attempt to modify shelf surveys to estimate the tonnage of RPPCs generated in California. Because it is not possible to conduct shelf surveys at all retail outlets, a methodology would be needed to account for the different product stocking that occurs at various similar stores (grocery store "X" versus grocery store "Y") as well as the variation in stocking at dissimilar stores (e.g., a grocery store versus an automotive supply store). Virtually all types of retail stores carry products packaged in RPPCs, so surveys would need to be conducted at many types of stores.

It took several weeks for CIWMB staff to conduct the shelf survey for the sole purpose of identifying RPPC lines. Sales levels and container weights would need to be accounted for when determining RPPC tonnage; this would result in an even greater time commitment.

Recommended Approach:

Due to the substantial resources required to implement any of the above analyzed alternatives, none were recommended. Options based on U.S. EPA and AB 939 data cannot be recommended because they are not updated annually as SB 235 requires. Therefore, it is recommended that the per capita extrapolation of national resin sales from the publication *Modern Plastics* be used to determine RPPC generation. The extrapolation should be performed on a per capita basis, so the result will be proportional to the amount of the U.S. population that resides in California. [See Sections III(B) and IV(B) for a discussion of assumptions.] To improve the accuracy of the estimates, information maintained by the DOC for soft drink bottles can be substituted for the *Modern Plastics'* soft drink bottle estimate. The extrapolation of *Modern Plastics* data can be performed using either the pre-aggregated container category or a line item accounting method, neither of which is precisely accurate. Because neither is clearly preferable, it is recommended that an average of the two be used to estimate RPPC generation in California.

B. Proposed Amendments to Current Statutory Language

When consulting with affected parties, CIWMB staff were made aware of inconsistencies between SB 235's statutory language, the expectations of parties engaged in the legislative process, and the intent of the author's office. Two Senate Bills intended to remedy these inconsistencies have been introduced, one by SB 235's author, Senator Hart, (SB 951), the other by Senator Boatwright (SB 466). Although these Bills address multiple aspects of SB 235, only those proposed amendments that directly relate to the calculation of the PETE and non-PETE recycling rates will be discussed in this document.

In its current state (March 5, 1993, version), SB 951, the Hart amendments, would not modify the PETE and non-PETE recycling rates. The Board would continue to be required to publish annual

reports documenting recycling rates for these RPPCs. There is no provision for an aggregate recycling rate that would combine both PETE and non-PETE RPPCs.

Unlike the current Hart amendments, SB 466, the Boatwright amendments (amended in Senate April 12, 1993), would create an aggregate recycling rate. The CIWMB would still need to publish the PETE RPPC recycling rate, but there would be no requirement to publish a non-PETE RPPC recycling rate. The Boatwright amendments also propose an exemption from the compliance requirements for all RPPCs that hold food and cosmetics. Both commodities are currently regulated by SB 235 unless they are specifically a drug, medical food, or infant formula. Although these items would be exempt from compliance, they would be included in the calculation of the aggregate recycling rate.

ENDNOTES

[1] Section 42310 (b) and (c).

[2] Primarily the following six resins are used in manufacturing RPPCs and have been incorporated into container coding systems. The numbers and acronyms used by coding systems to identify the resins are provided as well:

(1) PETE: polyethylene terephthalate (also abbreviated PET)

(2) HDPE: high density polyethylene

(3) V: polyvinyl chloride (also abbreviated PVC)

(4) LDPE: low density polyethylene

(5) PP: polypropylene

(6) PS: polystyrene

[3] Reporting guidelines established by AB 939 only address plastic containers comprised of HDPE or PETE resins.

[4] The terms "sales" and "recycled" are established in the definition of a recycling rate in SB 235 (Section 42301). For the purposes of this report, the term "generated" is used interchangeably with the term "sales". The assumption implicit to equating the two terms is that RPPCs sold in California are disposed (and therefore generated) in California and vice-versa. While not strictly accurate, staff had no means to estimate the impact of container migration on tonnage estimates. Also the term "generation" is consistent with terminology established in AB 939.

[5] Senate Bill 235 provides that recycling rates may be calculated on the basis of weight, volume, or number. Because waste management data are traditionally compiled on the basis of weight, all recycling rates calculated in this document will be weight based.

[6] *Modern Plastics* is a periodical published by McGraw-Hill. January issues contain a summary of annual resin sales by product application.

[7] Economic Report of the Governor, July 1992.

[8] *Post-Consumer Plastics Recycling Rate Study (Calendar Years 1990 and 1991)*, Society of the Plastics Industry and *Biannual Report of Redemption and Recycling Rates (January 1, 1992 - June 30, 1992)*, California Department of Conservation.

[9] "Other Packaging" includes tubs and containers, film packaging, retail bags, and other miscellaneous packaging. Non-retail bags were included as Other Packaging in the 1990 estimates and as Non-Packaging in the 1991 estimates.

[10] New 1991 Categories not used in 1990.

[11] Other Packaging includes tubs/containers, flexible packaging, and other miscellaneous packaging.

[12] Includes rigid (non-foam) packaging, rigid foam packaging, protective packaging, food services packaging, and other miscellaneous packaging.

[13] Assembly Bill 2494 modifies AB 939's provisions and requires periodic reporting of waste disposal and diversion. The law itself is ambiguous with respect to issues such as reporting frequency, material types by which reporting will occur, and entities required to report. Board staff have recently begun developing regulations to implement AB 2494, but at this point it would be premature to speculate regarding whether the information generated will be useful for establishing RPPC recycling rates.

[14] One county (Imperial County) did not report diversion of PETE containers but reported diversion of HDPE containers and other plastic. Six counties (Glenn, Madera, Marin, San Luis Obispo, Siskiyou, and Yolo Counties) did not report diversion of HDPE containers, but did report diversion of PETE containers and other plastics. Five counties (Amador, Calaveras, Fresno, San Benito, and San Diego Counties) did not report diversion of either PETE or HDPE containers, but did report diversion of other plastics.

[15] *Contribution of Plastics to the U.S. Economy.* Society of the Plastics Industry, Inc., 1992.

[16] Franklin Associates, 1992.

[17] "Other Resin" includes Acrylonitrile Butadiene Styrene (ABS), Cellulosics, Polycarbonate (PC), and Styrene Acrylonitrile (SAN) resins.

[18] The following statistics were used to convert milk sales in plastic containers to tonnage of RPPCs used to contain milk:

Average quart container = 120 grams or .265 pounds

Average half gallon containers = 75 grams or .165 pounds

Average gallon container = 60 grams or .132 pounds.

[19] *Contribution of Plastics to the U.S. Economy.* Society of the Plastics Industry, Inc., 1992.