Attachment 2

RPPC Recycling Rate Methodology Evaluation

Prepared for the
California Integrated Waste Management Board

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DRAFT FOR STAFF REVIEW

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Introduction 1

Criteria Definition 3

Methodologies to Calculate the RPPC Numerator 4

Approach #1: Surveying RPPC Reclaimers, End-Users, and Exporters 5

Approach #2: Surveying RPPC Processors 13

Approach #3: Adjusting 1995 RPPC Recycling Data 17

Comparison of Numerator Methodologies 21

Methodologies to Calculate the RPPC Denominator 21

Approach #1: Conduct Waste Composition Study 24

Approach #2: Pro-Rate National Resin Sales Data to California 27

Approach #3: Extrapolate 1996 RPPC Generation Using 1995 Data 30

Comparison of Denominator Methodologies 33

RPPC Recycling Rate Methodology Evaluation

An Evaluation of Six Methods Recommended by the Interested Parties and CIWMB Staff

Introduction

This report describes six methodologies that can be used as part of California's rigid plastic packaging container (RPPC) recycling rate calculation. Three of the methodologies can be used to determine the total quantity of RPPCs recycled in California, or the numerator. The other three methodologies apply to the denominator, or the total quantity of RPPCs generated in the state of California.

Senate Bill 235 requires the Board to adopt a method to estimate an aggregate recycling rate for all rigid plastic packaging containers sold in California. In addition, the statute requires the CIWMB to annually publish the rate calculated using the methodology. If the recycling rate for all RPPCs exceeds 25%, product manufacturers can use the recycling rate as an option to comply with the requirements of the California RPPC programs.

This report identifies potential options that the CIWMB can use to estimate the aggregate recycling rate and is intended to help the CIWMB determine which approach should be used to calculate the rate for 1996 and beyond.

It is generally accepted that the recycling rate calculation can be expressed as:

$$\text{RPPC Recycling Rate} = \frac{\text{Quantity of RPPCs Recycled}}{\text{Quantity of RPPCs Generated}}$$

It is also assumed that the quantity generated is equal to the quantity disposed plus quantity recycled. Some portion of the RPPC stream is also reused, and therefore does not show up in the disposed or recycled figures. This quantity is difficult to measure and assumed to be inconsequential as the balance

between new RPPCs being reused and old RPPCs being discarded after reuse are thought to cancel each other out.

The following assumptions guided the evaluation of the potential methodologies:

- CIWMB can complete the RPPC recycling rate calculation without consultants.
- Staff has a fixed budget for calculating the rate. This budget is currently set at $10,000 per year.
- The CIWMB Board accepted the 1995 rate calculation methodology and ensuing results as good baseline data.
- The merits and demerits of all methods can be argued. The key is to find the methodology that most accurately and cost effectively calculates the rate.

In addition, the following criteria, which are fully defined in the next section, were developed by the interested parties to rank each potential methodology:

Methodology Evaluation Criteria

accurate
defensible
precise (low error rate)
affordable (cost effective)
repeatable
ability to validate

Nine preliminary options for each the numerator and denominator were first presented to interested parties at a meeting in Sacramento on January 8, 1997. Several methodologies were deemed by the group to be unfeasible or unlikely to result in accurate data. Based on the interested parties' ranking of the preliminary options, the list of options to be evaluated was limited to six (three for the numerator and three for the denominator). These six approaches are listed below and described in detail in this report.

170

Numerator Approaches

Surveying reclaimers, end-users, and exporters of California RPPCs

Surveying processors that handle California RPPCs

Adjusting the 1995 recycling data to 1996

Denominator Approaches

Conducting a waste composition study

Pro-rating national resin sales data to California and adjusting for manufacturing/process losses

Extrapolating 1996 RPPC generation using the results of the 1995 study

In the body of the report, each of the methodologies is explained, followed by an identification of the data necessary to complete the methodology, an assessment of CIWMB staff's ability to complete the work in house, and an evaluation of the methodology against each of the criteria developed by the interested parties.

Criteria Definition

The interested parties brainstormed a wide variety of criteria that would be used in the evaluation of the various methodologies and agreed on the six described below.

1. **Accuracy.** How well does the methodology measure what is intended to be measured? For the numerator, the question becomes, "How well does the methodology measure the true quantity of RPPCs recycled in California?" For the denominator, the question becomes, "How well does the methodology measure the true quantity of RPPCs generation in California?"

2. **Defensibility.** Will the methodology produce results that can be defended by CIWMB staff as being appropriate to all stakeholders?

3. **Precision.** How well did the methodology estimate the mean? For example, in calculating the RPPC recycling rate, two methods may produce results of 25%. One method has a confidence interval of 24% - 26%, while another method has a confidence interval of 20% - 30%. The method with the smaller confidence interval is more precise.

4. **Affordability.** How much will it cost, or how many staff hours are required, to complete the methodology? In some cases, the exact costs are not known, but can be expressed relative to the cost of other methodologies.

5. **Repeatability.** Can CIWMB staff repeat the methodology in future years? The ability for a methodology to meet this criteria can depend on such factors as data availability and straightforwardness.

6. **Ability to validate.** Can individual pieces of data necessary to complete the methodology be validated? Generally, more confidence can be placed on those methodologies in which individual data points can be verified. Another measure of ability to validate is how well the result compares with benchmarks.

The interested parties considered "accuracy," "defensibility," and "precision" to be the criteria that carry the most weight in evaluating the methodologies.

Methodologies to Calculate the RPPC Numerator

Three approaches to calculating the numerator were evaluated. These approaches include:

1. *Surveying reclaimers, end-users, and exporters of California RPPCs*
2. *Surveying processors that handle California RPPCs*
3. *Adjusting the 1995 recycling data to 1996*

This section of the report describes each of the three methodologies separately. For each methodology, the approach is described including possible variations of the methodology and a brief discussion of the advantages and disadvantages of each variation. This is followed by:

- A discussion of ***data needs***. What data are needed to complete the methodology and how accessible are these data?
- An assessment of the ***feasibility of CIWMB staff to complete the methodology*** in-house.
- And, an evaluation of the methodology using the ***evaluation criteria*** developed by the interested parties.

Approach #1: Surveying RPPC Reclaimers, End-Users, and Exporters

This methodology involves surveying reclaimers, end-users, and exporters that handle post-consumer plastics that originate in California and determining the quantity of California RPPCs this group handles. This group includes plastics reclaimers, defined as those entities who wash, flake, or grind post-consumer plastics; end-users who manufacture a product using recovered plastics that have not gone through the reclamation process; and exporters of RPPCs.

Surveying reclaimers, end-users, and exporters is generally thought to be easier to accomplish than surveying at other points in the recycling chain. This group represents that last point in the recycling chain, and therefore double counting is not an issue. For example, exporters generally do not sell their material to other exporters. Also, it is generally assumed that the number of entities operating at this level is considerably smaller than at the collection or processing point. (Although in reality, the number of exporters handling California materials can exceed 1,000 in any given year.)

As with any survey, however, the data are only as good as those reported by the survey respondents. Given the complexity of the RPPC definition and the flow of recovered plastics through the national reclamation market, the survey instrument must be clear and the survey administrator must have a good understanding of the post-consumer plastics industry. This knowledge is an important factor in the data quality control process. An experienced survey administrator with industry experience will have a high probability of spotting incomplete or incorrect responses. For example, numerous reclaimers, end-users, and exporters consolidate materials from several states and it is difficult for them to track precisely which material came from which state. An experienced survey administrator would have an understanding of these flows and would follow-up with respondents whose figures looked inconsistent with their knowledge of these flows.

The general steps required to complete this methodology are the same as those used for the 1995 survey. In 1995, the American Plastics Council contracted with R.W. Beck to complete this survey, which involved the following steps:

- compiling a contact list of reclaimers, end-users, and exporters nationwide that could potentially handle California plastics;
- developing a survey instrument that is straightforward and clearly asks about California RPPC recovery and recycling activities;

- conducting a nationwide mail survey of reclaimers, end-users, and exporters;
- following up with survey respondents who reported handling RPPCs from California to clarify survey responses. Also, follow-up is required with those entities who are known to handle California RPPCs but who have not completed the survey;
- analyzing the survey results and eliminating any double-counting from survey totals (in theory, there should be no double counting at this level) and adjusting total recovery to account for processing losses; and
- calculating the total amount of California RPPCs recycled by this group.

The two most difficult aspects of this survey include the compilation of a comprehensive contact list (especially for exporters) and the follow-up telephone calls. Maintaining a comprehensive contact list requires remaining current on industry trends, particularly as markets fluctuate. The follow-up telephone calls can be time consuming and require multiple phone calls to the same entity. An extreme example of the importance of both of these issues involves entities that handle large volumes. Missing these entities, either through failure to identify them as a potential survey respondent or by not obtaining responses from them, will result in undercounting recovered RPPCs and drastically alter the accuracy of the survey.

There are three ways that this survey could be completed. Each are described briefly below. These three approaches include:

1. CIWMB staff conducts the entire survey in-house.
2. CIWMB contracts with the American Plastic Council's (APC) national recycling rate consultant to obtain California-specific data on RPPC recycling from all reclaimers, end-users, and exporters of plastics at the same time that national data are being collected.
3. CIWMB staff samples a portion of those reclaimers, end-users, and exporters that responded to the 1995 survey and adjusts the 1995 survey results by the percentage change reported by those sampled.

Variation 1: CIWMB Survey of Reclaimers, End-Users, and Exporters
The CIWMB staff would conduct the reclaimer, end-user, exporter survey in-house using the methodology that was used for the 1995 reclaimer/end-user/exporter survey. In 1995, this survey was one of three surveys conducted to calculate the California RPPC recycling rate numerator.

174

To complete this survey, CIWMB staff would need to develop a contact list and survey instrument, and construct a database or spreadsheet for data entry and analysis. As a starting point, CIWMB staff could obtain copies of the contact list and survey instrument developed by R.W. Beck for the 1995 survey. These would need to be modified by CIWMB staff. The contact list would require annual updates for 1996 and each year thereafter to ensure that new reclaimers, end-users, and exporters are surveyed. CIWMB staff would need to modify the survey instrument to properly identify the CIWMB as the surveying entity and fully disclose confidentiality, or lack thereof, clauses. CIWMB staff would also need to establish a relationship with these entities to facilitate data collection activities. The survey would be conducted nationwide, as numerous national entities handle California materials.

Advantages of CIWMB Surveying Reclaimers, End-Users, and Exporters

- *CIWMB staff would have access to primary data and would conduct the analysis itself, thereby increasing its ability to explain the results.* If this work is done by a contractor, CIWMB staff must rely on the contractor's credibility and word without being able to verify the work.

- *CIWMB staff will gain a large amount of first-hand knowledge of the reclamation and end-use markets through the survey.* By tracking the industry and establishing relationships with the reclaimers, end-users, and exporters, staff will gain knowledge about plastic recycling issues that goes beyond the survey itself. This could have important secondary benefits for state market and economic development programs.

Disadvantages of CIWMB Surveying Reclaimers, End-Users, and Exporters

- *It is uncertain whether staff can guarantee confidentiality of individual survey responses.* Obtaining business information from individual respondents is often predicated on confidentiality agreements to ensure that proprietary data are not be made public. Some agencies, such as the Clean Washington Center, have been able to protect company-specific data.

- *Reclaimers, end-users, and exporters may not share information with CIWMB staff.* Since the CIWMB will be perceived as the "regulator," obtaining voluntary survey responses may be problematic.

- *Staff will have to devote considerable time to maintaining a comprehensive contact list.* Maintaining such a list requires an understanding of the players in the industry and how materials move to markets under varying market conditions. There are undoubtedly

reclaimers, end-users, and particularly exporters that will continue to go unrecognized.

Variation 2: Partner with National Survey to Obtain California Data
The American Plastics Council (APC) conducts an annual survey of reclaimers, end-users, and exporters to estimate the national recycling rate for a variety of plastic types (such as bottles and containers). APC contracts with a firm, most recently R.W. Beck, to complete this survey. CIWMB could ask APC to supplement its survey to obtain California-specific information on RPPC recovery and recycling. CIWMB would necessarily have to pay the difference in cost associated with the additional data collection activities.

Advantages of Partnering with National Survey

- *APC hires an experienced and qualified consultant.* This experience and qualification translates into credibility. Also, the consultant probably would achieve a higher response rate than CIWMB staff due to established relationships.

- *This methodology would be less disruptive and confusing to reclaimers/end-user/exporters.* They would only have to complete one survey instead of multiple surveys, and they would only be getting follow-up phone calls from one entity. However, the California definition of RPPCs may be confusing since it is different from the categories that are reported on the national survey.

- *This approach worked in past.* This is essentially the approach that was used in 1995, and the results of the reclaimer, end-user, and exporter survey were consistent (although lower than) with the other two survey results.

Disadvantages of Partnering with National Survey

- *Certain stakeholders may perceive this approach to be a conflict of interest.* APC's sponsorship of the national survey may discredit the survey results of the California-specific survey, as some groups may perceive APC to be unfairly representing the regulated community.

- *CIWMB staff cannot independently verify the results of the survey.* CIWMB staff must take the consultant's word for the accuracy or thoroughness of the survey without access to any of the data due to confidentiality concerns.

- *The schedule for the national study and the California study may be different.* The results of the national survey would take precedence over

176

the California results. There may be little that CIWMB can do to control the schedule other than by paying a premium price for the service.

Variation 3: Sample Subset of Reclaimers, End-Users, and Exporters
This approach involves taking a sample of those reclaimers, end-users, and exporters surveyed in 1995, surveying them to determine the quantity of RPPCs they recovered and recycled in 1996, and adjusting the results of the 1995 reclaimer/end-user/exporter survey at the same rate of changes as reported by this sample. For example, if the sample group reported an overall increase of 10% in the quantity handled, then the 1995 results would be increased by 10% to determine the 1996 recycling quantity. On the other hand, if the sample group reported a decrease of 10% in the quantity handled, then the 1995 results would be decreased by 10% to determine the 1996 recycling quantity.

In 1995, 48 reclaimers, end-users, and exporters reported handling RPPCs from California. The small size of the initial population lowers the probability that the sampling (which would be of an even small number) will result in precise results. On the national level, R.W. Beck reports that year-to-year trends of individual reporters do not parallel aggregated trends. The individual trends are influenced by such factors as investment decisions and equipment (e.g. a reclaimer with a line that can switch from PET to HDPE is better able to react to market conditions). Therefore, if this approach is used, a sample size of 15-20 may not accurately describe the overall trend.

To implement this methodology, CIWMB staff would have to coordinate with R.W. Beck. Individual company data from the 1995 survey cannot be released by R.W. Beck due to confidentiality agreements made with the survey respondents. However, CIWMB staff could take a random sample of the 1995 respondents, ask R.W. Beck for the aggregate reported in 1995 by these respondents, and compare the aggregated 1996 data to the 1995 data to determine the percentage change.

<u>Advantages of Sampling Reclaimers/End-Users/Exporters</u>

- *The small sample size makes the survey and follow-up calls manageable by CIWMB staff.* Having to obtain information from 15-20 entities as opposed to surveying over 200 (including those who did not handle RPPCs in 1995) makes this approach more feasible for staff to conduct. Staff would have to work closely with R.W. Beck to obtain aggregated 1995 data.

- *Non-reporting reclaimers, end-users, and exporters will not necessarily undermine the survey sample results.* The sample will be taken from

reclaimers, end-users, and exporters who reported in 1995. Staff will not have to follow up with non-respondents, greatly reducing the amount of effort required to complete this survey.

- *This approach builds on the CIWMB Board's acceptance of the 1995 rate and methodology.*

Disadvantages of Sampling Reclaimers/End-Users/Exporters

- *This approach may suffer from sampling bias or errors in original data.* The respondents sampled may not be representative of the entire population. And, if the 1995 data were not accurate, the inaccuracy will never be corrected. There is the possibility that such an error could compound over time.

- *CIWMB staff will need to coordinate with R.W. Beck or obtain two years worth of data from respondents.* Confidentiality issues may impede CIWMB staff's ability to effectively do both.

- *This method may not account for changes in market structure.* The number of reclaimers, end users, and exporters may change, which would not be captured in a sample. For example, in future years, even if reclaimers active in 1995 reclaim the same amount of plastics, the number of firms could potentially have increased by 10%, increasing the total volume of plastics recycling. Alternatively, surveyed firms might report a 20% increase in plastics recycling, but this could be due to fewer reclaimers being active instead of an increase in total volume.

Data Needs

Comprehensive list of reclaimers, end-users, and exporters who handle serving California. The contact list for APC's National Post-Consumer Plastics Recycling Rate Study, maintained by R.W. Beck, contains detailed national information on reclaimers and end-users. CIWMB may be able to obtain this data through APC. Export data can be purchased from the Port Import Export Research Service ("PIERS"). (This data tracks individual exports and includes information on the exporting entity and materials being exported.) Information from these lists can be merged and expanded as CIWMB staff locates new potential survey respondents.

Reclaimer, end-user, and exporter recovery and recycling volumes. The availability and accuracy of the final data is dependent on the willingness of survey recipients to respond and the accuracy with which they respond. CIWMB has little to no control over this source of error.

178

Feasibility of CIWMB Staff to Complete Work

Reclaimers, end-users, and exporters of post-consumer plastics are often reluctant to report quantity information. This reluctance is based in part on the competitive nature of the business vis-à-vis virgin resins, the time necessary to report the information, and fears that confidential business information will made available to competitors. These entities are often more willing to share this information if they have an established relationship with the survey administrator and can trust that the company-specific data will remain confidential.

Whether a survey is conducted by CIWMB staff, or by a consultant, some entities will refuse to participate. With time, CIWMB staff may be able to build personal relationships with potential survey respondents, but the issue of ensuring confidentiality may never be fully satisfied. The exact extent to which reclaimers, end-users, and exporters are less likely to provide data to the CIWMB than to a consultant is unknown.

Variation #3 above, the option of surveying a sample of the respondents from last year's survey, is the most feasible for CIWMB staff to complete primarily because the sample size is more manageable and would not impede staff's ability to complete other CIWMB work simultaneously. However, staff may still encounter problems associated with the ability to ensure data confidentiality.

Evaluation Criteria

- **Accuracy.** The accuracy of this method is completely dependent on the verity of data reported by the responding reclaimers, end-users, and exporters. Also, the accuracy is dependent on how successful the surveyor was at obtaining responses from **all** players, since this survey is essentially a census survey. A number of exporters refused to respond to the 1995 survey, and it is unclear what impact this had on the final result. Aside from non-respondents who really do handle California RPPCs, there is no evidence that respondents intentionally report inaccurately, so there is no reason to suspect that a respondent's estimates are systematically high or low.

  Variation #2 is the most accurate of the three variations described, largely due to the experience of the national contractor. Variation #3 is the least accurate, in large part due to the small size of the population.

179

- **Defensibility.** The CIWMB Board approved the 1995 recycling rate range and methodology that was used to calculate the rate. The result of the reclaimer/end-user/exporter survey was averaged with the results of two other recycling surveys to calculate the numerator. (The reclaimer/end-user/exporter survey yielded the lowest recycling total.) This methodology is accepted nationally, and the main contention with this approach is the ability to obtain responses from exporters. A complete survey would be more defensible than surveying a sample of last year's respondents, particularly if the rate were not met.

  Variation #2 is the most defensible, because it is essentially a repeat of last year's study. The defensibility of variations #1 and #3 are roughly equal.

- **Precision.** The assumption with this type of survey is that respondents are providing honest answers and that the total quantity calculated from the responses is precise. The true margin of error for a census survey (variations #1 and #2), however, cannot be measured. Annual fluctuations in the total volume reported may be due to reporting error rather than actual variation in total recycling volumes.

  If extrapolations are made for non-respondents, as was done in 1995, a precision level can be placed around that estimate. In 1995, the margin of error associated with non-respondent exporter extrapolation was relatively large. However, the precision level applies only to the extrapolated quantities, which represented less than 8% of the recycled tonnage.

  The precision of variation #3 can be measured, but due to the small sample size we can predict that this would be the least precise option.

- **Affordability.** R.W. Beck was paid $28,665 to complete the 1995 reclaimer/end-user/exporter survey and to prepare additional analysis that was requested by the Recycling Rate Advisory Committee (RRAC). R.W. Beck devoted approximately 300 hours to completing the survey. This cost does not include time spent by Cascadia assisting R.W. Beck with obtaining data from exporters. One would expect that it would take CIWMB staff longer to complete the survey, particularly the first year. Variation #3 is the most affordable, and it is estimated that CIWMB staff could complete this sample in 80 hours.

- **Repeatability.** Either a survey or a sample can be repeated yearly with similar levels of accuracy. Variation #2 is dependent on another entity's work program, and this could potentially impact CIWMB's ability to partner with the national survey in future years. Similarly, variation #1 may be impacted by other CIWMB priorities.

- **Ability to validate.** Results form this method could be cross-checked with other available data sources. However, responses from individual respondents cannot be confirmed. To the extent possible, the follow-up calls could be used to verify responses which seem out of line or which are inconsistent with expected responses. Variation #1 is the most easily validated of the three variations listed, simply because CIWMB staff would have access to all primary data necessary to complete this approach.

Approach #2: Surveying RPPC Processors

This methodology involves surveying processors (primarily MRFs) who handle RPPCs in California. It is generally assumed that materials collected in California are also processed in California, except if directly exported. Processors are defined as being those entities who sort and/or bale plastics; processors usually sell their materials to reclaimers or to end-users.

The general steps required to complete this methodology are the same as those used for the 1995 MRF/Processor survey. In 1995, the American Plastics Council contracted with Cascadia Consulting Group to complete this survey, which involved the following steps:

- compiling a contact list of processors in California that handle plastics;
- developing a survey instrument that is straightforward and clearly asks about RPPC recovery activities as well as to whom material was sold to, in order to eliminate double counting;
- sending surveys to processors;
- following up with survey respondents who reported handling RPPCs to clarify survey responses. Also, follow-up is required with those entities who are known to process RPPCs but who have not completed the survey;
- analyzing the survey results and eliminating any double-counting from survey totals, and adjusting total recovery to account for processing losses; and
- calculating the total amount of California RPPCs recycled by this group.

In 1995, a total of 249 processors were identified that potentially handled RPPCs. Of these, 103 processors reported RPPC data and several processors refused to participate or incorrectly completed the survey. The sheer volume of participants and the fact that double counting must be tracked and eliminated makes this survey potentially more difficult than the reclaimer,

181

end-user, and exporter survey. However, it is generally easier, particularly for agency staff, to establish relationships with in-state processors than with out-of-state reclaimers. It is difficult to gauge this trade-off.

Many of the same issues (RPPC definition, consolidation of materials) that exist with the reclaimer, end-user, and exporter survey apply to the processor survey as well. In particular, the results of the survey are only as good as the data reported by the processors. There is a risk of processors refusing to respond. Last year, four of the state's largest processors refused to participate in the survey primarily because the survey was too time consuming.

For this evaluation, we assume that CIWMB staff would conduct the survey in-house, although this work could be contracted out.

Advantages of Processor Survey

- *Processors are more likely to cooperate with CIWMB information requests than are reclaimers, end-users, and exporters.* This is primarily because the processors are located in state and must comply with California laws and permit requirements. CIWMB staff could also obtain the assistance of local program coordinators to obtain this information.

- *There is less probability of error due to consolidation of materials from other states.* The processors surveyed are all located in state and handle materials from municipal, private, and commercial programs. Therefore, it is less likely that materials would be reported incorrectly.

- *The contact list is easier to maintain.* The state already has a relatively complete list of processors that operate within California due to permitting requirements. Maintaining such a list would require little extra effort on the part of CIWMB staff.

Disadvantages of Processor Survey

- *It is uncertain whether staff can guarantee confidentiality of individual survey responses.* Obtaining business information individual respondents is often predicated on confidentiality agreements to ensure that proprietary data will not be made public. Some agencies, such as the Clean Washington Center, have been able to protect company-specific data.

- *Tracking and eliminating double-counting can be problematic.* In some instances bales are split, transferred to another processor, split again, and so forth. Tracking these transfers accurately requires careful clarification from the delivering processor as well as the receiving processor. And the analytic tool (database or spreadsheet) must be designed with these considerations in mind.

- *Processors who handle mixed bales of plastics often have difficulties identifying the contents and final destination of those bales.* This decreases the accuracy and defensibility of the processor survey.

Data Needs

Comprehensive list of processors in California. In 1995, databases from DOC, CIWMB, APC, and R.W. Beck were merged to obtain a complete listing of potential processors. For the most part, the DOC and CIWMB databases were complete.

Processor recovery volumes. The availability and accuracy of the final data is dependent on the willingness of survey recipients to respond and the accuracy with which they respond. CIWMB has little to no control over this source of error.

Yield loss factor. Due to the definition of recycling in California, it is necessary to further adjust the data reported by the processors to reflect the fact that not all materials recovered end up being recycled. In 1995, the yield loss factors obtained from the reclaimer/end-user/exporter survey were applied to the processors.

Feasibility of CIWMB Staff to Complete Work

CIWMB staff are capable of conducting a survey of all processors to obtain RPPC recycling data, but the time commitment necessary to thoroughly complete the survey and follow up calls with processors may be prohibitive. Other factors affecting the ability of CIWMB staff to complete the processor survey include providing respondents with confidentiality assurances and unwillingness of processors to report information. CIWMB possibly could require processors to report this information as part of their ability to obtain operating permits.

For roughly the same level of effort, CIWMB staff would obtain a higher response rate from processors than from reclaimers, end-users, and exporters if the survey was conducted in-house. While there may be more processors to survey, CIWMB staff already has an established relationships with some processors and would have an easier time establishing relationships with other in-state processors than with national reclaimers.

Evaluation Criteria

- **Accuracy.** The accuracy of a processor survey depends on how truthfully the respondents answer the survey. As with the reclaimer/end-user/exporter survey, there is no indication that processors intentionally mis-report. However, there were several large non-respondents in last year's survey. Also, some quantity may not have been counted due to the inability of processors to identify the portion of bales that contained RPPCs.

- **Defensibility.** The CIWMB Board accepted the 1995 recycling rate range and methodology used to calculate the rate. The processor survey was the most thorough of the surveys, and, after adjustments for non-respondents, yielded the highest quantity of RPPCs recycled. If this were the only survey conducted, some interested parties might request that CIWMB conduct additional research about yield loss factors and the content of mixed bales before accepting this methodology.

- **Precision.** Again, since this is a census survey, no margin of error can be measured. However, the assumption is that respondents report accurately. As with the reclaimer survey, the precision of estimates of quantities recycled by non-respondents can be measured. The margin of error was minimized last year by making stratified extrapolations (one estimated quantity for large non-respondents; another estimated quantity for other non-respondents). The error rate associated with last year's processor extrapolations is lower than the exporter extrapolation due to the larger number of processor respondents and the use of a stratified extrapolation.

- **Affordability.** The exact costs of the processor survey are unknown, since Cascadia was responsible for 3 separate surveys: the processor survey, the collector survey, and the municipal survey data analysis. Additionally, Cascadia provided assistance to R.W. Beck for the reclaimer/end-user/exporter survey. In all, 680 hours were spent on all four components. It is estimated that 300 hours were spent completing the processor survey.

- **Repeatability.** The survey could be completed annually and would likely be easier to complete as staff became experienced in conducting the survey.

- **Ability to validate.** Results from this method could be cross-checked with other available data sources. However, responses from individual respondents cannot be confirmed. To the extent possible, the follow-up calls could be used to verify responses which seem out of line or which are inconsistent with expected responses.

184

Approach #3: Adjusting 1995 RPPC Recycling Data

The CIWMB Board adopted a range of 23.3% to 25.9% and resolved that the 1995 methodology be used as a basis for determining the recycling rate in future years. In 1995, Cascadia determined that 156.43 million pounds, or 78,215 tons, of RPPCs were recycled by averaging the results of three separate surveys which measured recycling levels at different points (collection, processing, and reclamation). The survey results were all in a range of 152.6 million pounds to 164.0 million pounds. Two different benchmarks estimated 1995 RPPC recycling at 156.6 million pounds and 158.3 million pounds.

An appropriate adjustment factor should capture changes in plastics recycling activities from year to year, such as collection infrastructure and market conditions. The methodology described below attempts to capture these factors by combining three components of California's plastics recycling activities:

1. Adjusting PET data using annual California CRV redemption *totals (1996 PET Sub-Total in formula below)*;
2. Adjusting private recycler data[1] to reflect annual changes in collection infrastructure totals (*1996 Private Sub-Total in formula below*); and
3. Adjusting municipal curbside data to reflect annual changes in curbside plastic collection trends totals (*1996 Muni Sub-Total in formula below*).

CIWMB staff would complete the following formula to determine the quantity of RPPCs recycled in 1996. Individual components of the formula are detailed below:

1996 RPPCs Recycled = 1996 PET Sub-Total + 1996 Private Sub-Total + 1996 Muni Sub-Total

Adjust PET Data Using Annual CRV Redemption Totals

Total PET recycled would be adjusted by applying the rate of change from 1995 to 1996 for CRV redemption totals (as reported by DOC) to the total quantity of PET RPPCs recycled in 1995 (35,585 tons after adjustments for yield loss). The formula for making this calculation is:

[1] Private recyclers were defined in 1995 to be non-municipal collection programs such as drop-off and buy-back programs. This group is represented by a mix of private businesses and non-profit organizations.

185

$$\text{1996 PET Sub-Total} = \frac{\text{1996 CRV Total}}{\text{1995 CRV Total}} \times \text{35,585 tons (1995 PET Sub-Total)}$$

Adjust Private Recycler Data

The second portion of this adjustment reflects changes in the collection infrastructure. Based on the results of the 1995 study, non-municipal programs handled 31.16% of non-PET RPPCs recycled, or 13,285 tons after adjustments for yield loss.

DOC maintains collection program data which is updated frequently as part of administering the CRV program. At this step of the adjustment, it would be necessary to obtain data on the total number programs handling RPPCs for the following program types: collection programs (CP's), redemption centers (RC's), and redemption centers at supermarket sites (RCSS's). (In 1995, DOC provided Cascadia with this data.) The total number of sites handling RPPCs for each of these program types would be multiplied by the average per site tonnage, minus PET tonnage obtained in the 1995 survey. The average per site tonnage would also have to be adjusted to incorporate yield losses.

1996 Private Sub-Total = (Number of CP sites × average non-PET lbs per CP site) + (Number of RC sites × average non-PET lbs per RC site) + (Number of RCSS sites × average non-PET lbs per RCSS site)

Adjust Municipal Plastics Collection Data

The quantity of RPPC recycling originating from municipal programs would be adjusted through a similar process as the PET adjustment. In 1995, it was estimated that municipal programs recycled a total of 29,345 tons RPPCs (adjusted for yield loss). This quantity would be multiplied by the percent change in municipal plastics collection activity as determined by a survey of municipal programs.

To determine the rate of change in plastics recycling levels of municipal programs, CIWMB staff would survey municipal collection programs that collect plastics. This survey would be much simpler and shorter than the 1995 survey, asking simply for the quantity of plastics collected in 1995 and the quantity of plastics collected in 1996. If desired, the CIWMB could also request additional program and resin specific information.

The aggregated survey data would then be plugged into the following formula to obtain the portion of RPPCs recycled by municipal programs.

$$\text{1996 Muni Sub-Total} = \frac{\text{1996 Muni Plastics Collected}}{\text{1995 Muni Plastics Collected}} \times \text{29,345 tons (1995 Muni RPPC's Recycled)}$$

Advantages of Adjusting 1995 Recycling Data

- *This approach is straightforward and involves little primary data collection.* Essentially, staff would be making a series of calculations after updated DOC and municipal data were made available. Therefore, the time necessary to complete this approach is manageable by staff and is quite affordable when compared with the other approaches.

- *This approach uses a blend of adjustment factors that reflect changes in the RPPC recycling infrastructure and market conditions.* The adjustment factors rely on California-specific data points instead of national or regional trends.

- *The approach is consistent with CIWMB Board's resolution that the 1995 recycling rate methodology be used as a basis for determining adjustment factors.* This approach is consistent with the 1995 methodology and uses the results from specific portions of the study for making future estimates.

Disadvantages of Adjusting 1995 Recycling Data

- *This approach may not accurately reflect changes in the recycling infrastructure.* For example, a decrease in the number of private recyclers may not necessarily mean that fewer RPPCs are being collected but that several collection programs have been consolidated.

- *This approach results in an aggregated estimate of recycling from which resin splits need to be estimated.* This is adequate for determining the aggregate RPPC recycling rate, but may not be appropriate for determining individual product manufacturer's compliance.

Data Needs

1995 Recycling Data. CIWMB staff can obtain the necessary data to complete this method from Cascadia.

DOC Collection Program Data. In 1995, the number of CP's, RC's, RCSS's and RV totals was provided to Cascadia by DOC staff member Michael Harris.

187

Municipal Curbside Collection Data. 1995 and 1996 plastics recycling quantity data will have to be obtained from a representative sample of municipal programs.

Feasibility of CIWMB Staff to Complete Work

It is highly feasible for CIWMB staff to complete this method in-house. CIWMB staff would need to coordinate with DOC staff to ensure timely transfer of necessary data and to obtain data from curbside programs. Once the data are obtained, CIWMB staff would then complete a straightforward formula. Little primary data collection effort or contract administration would be necessary.

Evaluation Criteria

- **Accuracy.** The accuracy of this approach cannot be determined. In 1995, the PET results obtained independently by Cascadia tracked well with the DOC totals (79.2 million pounds versus 79.7 million pounds). This approach is more accurate in the short term than the long term, since there is a possibility that errors compound from year to year.

- **Defensibility.** This approach is defensible from the position that the CIWMB Board approved the 1995 baseline data and the approach is easy to explain. Also, if CIWMB makes a concerted effort to obtain curbside program data, the defensibility of this approach may be enhanced.

- **Precision.** The precision of this method cannot be measured. However, because it involves extrapolation, it is obviously less precise than other methods which are based on primary data collection.

- **Affordability.** This option is the most affordable of the methods. Since this approach involves little primary data collection, CIWMB staff could calculate the new recycling data quickly, once DOC data are made available and verified.

- **Repeatability.** This calculation could be done every year, is easily documented, and therefore does not require much institutional memory to be recorded by staff.

- **Ability to validate.** Results from this method could be cross-checked with other available data sources. Individual program specific data can also be verified as described above.

Comparison of Numerator Methodologies

Table 1 compares how well each of the methodologies meet the evaluation criteria and the feasibility of CIWMB staff to complete the work in-house. This comparison is based on qualitative factors and ranks each methodology against each other. For example, it is more feasible for CIWMB staff to adjust the 1995 recycling data than it is for CIWMB staff to complete a reclaimer survey in-house. Table 1A, on the next page, provides additional detail of this comparison.

Table 1. Quick Comparison of Numerator Methodologies

Evaluation Criteria	Survey Reclaimers #1	#2	#3	Survey Processors	Adjust 1995 Recycling Data	Approach that Best Meets Criteria
Accuracy	2	3	1	2	2	Survey Reclaimers (#2)
Defensibility	3	2	2	3	2	Survey Processors
Precision	3	3	2	3	2	Survey Processors
Affordability	2	2	3	2	3	Adjust 1995 Data
Repeatability	3	2	3	3	3	Adjust 1995 Data
Ability to Validate	3	2	2	3	2	Survey Processors
Feasibility of CIWMB Staff to Complete	1	1	3	2	3	Adjust 1995 Data

key: 3 = fully meets criteria; 2 = does not fully meet criteria; 1 = fails to meet criteria

Methodologies to Calculate the RPPC Denominator

As with the description of the alternative methods for calculating the numerator, three approaches to calculating the denominator were evaluated. These approaches include:

1. *Conducting a waste composition study*
2. *Pro-rating national resin sales data to California and adjusting for manufacturing/process losses*
3. *Extrapolating 1996 RPPC generation using the results of the 1995 study*

This section of the report describes each of the three methodologies separately. For each methodology, the approach is described, including possible variations of the methodology and a brief discussion of the advantages and disadvantages of each variation. This is followed by:

- A discussion of ***data needs***. What data are needed to complete the methodology and how accessible are these data?
- An assessment of the ***feasibility of CIWMB staff to complete the methodology*** in-house.

Table 1A. Comparison of Numerator Methodologies

Evaluation Criteria	CIWMB Staff Survey Reclaimers	Partner with National Survey	Survey Sample of 1995 Respondents	Survey Processors	Adjust 1995 Recycling Data
Accuracy	Depends on response rate. Will be hard for CIWMB staff to obtain cooperation if confidentiality cannot be guaranteed and due to lack of experience conducting surveys.	Depends on response rate National contractor more likely to obtain cooperation due to experience and confidentiality agreement.	Selected sample may not be representative of industry trends.	Depends on response rate. CIWMB staff likely to achieve higher response rate from processors than from reclaimers.	Adjustment factor may not properly take into account industry dynamics.
Defensibility	Staff will have access to primary data and will be able to articulate its procedures.	Staff will have to take contractors' word for accuracy and thoroughness of survey.	Stakeholders that do not agree with results may find a way to critique this approach after the fact.	Staff will have access to primary data and will be able to articulate its procedures.	Stakeholders that do not agree with results may find a way to critique this approach after the fact. Relatively easy to explain.
Precision	Not measurable; assumed that respondents are truthful in responses.	Not measurable; assumed that respondents are truthful in responses.	Measurable for the sample group but not for projection as a whole. More margin of error than complete survey.	Not measurable; assumed that respondents are truthful in responses.	Least precise method, although 1995 results for PET tracked well with DOC figures.
Affordability	Requires dedicated staff time over 3-month period; approximately 300 hours plus mail and phone expenses.	Requires contract with APC or national contractor plus staff management of contract (could be close to 100 hours).	Requires considerably less time, although exact amount unknown.	Requires dedicated staff time over 3-month period; approximately 300 hours plus mail and phone expenses.	Requires considerably less time, although exact amount unknown.
Repeatability	Staff could repeat every year.	May be difficult to contract every year with government cut backs.	Staff could repeat every year.	Staff could repeat every year.	Staff could repeat every year.
Ability to Validate	Staff would have access to primary data, so could verify individual data points.	Staff would not have access to primary data so could not verify individual data points.	Staff must rely on R.W. Beck's cooperation to obtain 1995 aggregates for sampled respondents, but cannot independently verify these without asking respondents directly.	Staff would have access to primary data, so could verify individual data points.	Staff would verify individual program specifics on a yearly basis.
Feasibility of CIWMB Staff to Complete	Most likely would not achieve good response rate until staff became experienced and established relationships with reclaimers. Confidentiality issues also decreases feasibility.	Staff would have to manage a contract, which in itself can be time consuming.	Much more manageable piece of work for staff to complete in-house.	Staff would be in a better position of obtaining responses from processors than from reclaimers but would still need to establish a relationship with survey recipients.	Manageable and straightforward.

- And, an evaluation of the methodology using the ***evaluation criteria*** developed by the interested parties.

Approach #1: Conduct Waste Composition Study

This approach involves conducting a waste composition study to determine the percentage of RPPCs being disposed in California. The CIWMB's approved waste characterization methodology would be used as the protocol for designing the sampling plan and guiding field work. The percentage of RPPCs would then be applied to total waste disposal (including incineration and exports) to determine the total quantity of RPPCs disposed.

To calculate the denominator, or quantity of RPPCs generated, the total quantity of RPPCs disposed would be added to the total RPPCs recycled. The total quantity of RPPCs recycled would be obtained through one of the methodologies described in the numerator section. This approach was used to calculate the 1995 RPPC recycling rate.

Advantages of Conducting a Waste Composition Study

- *This approach directly measures the quantity of RPPCs being disposed in California.* The impetus of the minimum rate law was to divert RPPCs from disposal facilities into recycling markets, and the waste composition approach is the only approach that seeks to measure directly what is being disposed.

- *There is a methodology approved by CIWMB to guide the design and execution of waste sampling.* This methodology sets forth parameters that attempt to ensure that the results of sampling are statistically valid and can be used to determine statewide totals.

- *Measuring RPPCs could be combined with broader waste composition analysis*, providing the state with additional information about its waste stream. In 1995, the waste composition study only sorted for RPPCs. In future years, the state could conduct a more comprehensive waste composition study at little additional cost, but with a large return on investment in terms of additional data regarding the types of materials being disposed in California.

192

Disadvantages of the Waste Composition Approach

- *This approach is time-consuming and therefore costly.* A precise statewide waste composition study requires sampling at multiple sites across the state throughout the year. The cost for a precise and valid study could exceed $200,000. Also, CIWMB staff is not trained to perform waste composition studies, so this work would most likely be contracted.

- *To measure 1996 RPPC disposal, it would have been necessary to conduct sampling throughout 1996.* Conducting a waste composition study in 1997 to measure 1996 disposal does not accurately measure 1996 disposal patterns.

- *Total disposal figures are compiled by the Board of Equalization(BOE) and the accuracy of the figures cannot be verified easily.* The accuracy of the final figures hinges both on the sampling process itself and the accuracy of the disposal figures. It is assumed that the disposal figures are relatively accurate since they are based on disposal facility revenues. Also, it is necessary to ensure that export and incineration data are included in the BOE figure.

Data Needs

Total MSW Disposed in California. The data are provided by BOE. This figure needs to be adjusted for exports and incineration.

Total RPPCs Recycled. The denominator is a measure of total RPPCs generated. To complete the recycling rate calculation using the waste composition approach, it is also necessary to add the quantity of RPPCs recycled to the quantity of RPPCs disposed.

Landfill and Population Data. Designing a sampling plan that delivers accurate and precise results requires an understanding of the state's landfill and population distribution.

Field Data. Over the course of the sampling period, adequate samples must be taken and the data recorded.

Feasibility of Staff to Complete Work

It would not be feasible for CIWMB staff to complete this work without the assistance of a qualified consultant, simply because existing staff is not trained

193

to conduct waste composition studies and the amount of field and analytic work required would prevent staff from completing other work assignments.

Criteria Evaluation

- **Accuracy.** The accuracy of this approach depends in large part on the design of the sampling plan. A truly representative sample is essential. Using the State's approved waste characterization protocol will ensure accurate field procedures and aggregation of data.

- **Defensibility.** This approach should be defensible since it is the only methodology that directly measures what is being disposed and it follows a protocol that has been approved by the Board. Industry also approves of this approach. Because this approach is complex, it is difficult to explain and can be misinterpreted.

  Several interested parties took exception to this approach in 1995, arguing that the sampling was not representative and that not all RPPCs were sampled.

- **Precision.** The precision of this method can be measured, and is related to the number of samples taken. (More samples generally increase precision levels.) In 1995, there was 90% confidence that the actual percentage of RPPCs in California's waste stream was within plus or minus 0.05% of the calculated estimate.

- **Affordability.** A statewide waste composition study can be completed for $200,000 to $250,000. Again, this cost would not be significantly different if the waste composition were conducted for a comprehensive spectrum of materials. The majority of costs stem from mobilizing field crew, as opposed to the number of categories sorted.

  In 1995, the total number of hours worked to complete the waste composition study included: 40 hours for designing the sampling plan; 1,890 hours of field work (gatekeeping and sorting); and 250 hours of data analysis.

- **Repeatability.** A waste composition study could be repeated every year, but it is doubtful that the State would want to finance such a project on an annual basis. It is more plausible that such a study would be conducted every three to five years.

- **Ability to validate.** Results form this method could be cross-checked with other available data sources. Total MSW disposed is difficult to verify without conducting an audit of BOE records or landfills.

Approach #2: Pro-Rate National Resin Sales Data to California

This approach would determine the quantity of RPPCs generated in the State of California by adjusting SPI national resin sales data to determine California RPPC generation. This estimate would also make adjustments to account for the fact that there are losses between the resin production stage and final RPPC sales in California.

CIWMB staff was directed by the Board to evaluate the validity of using national resin sales data as a benchmark for RPPC generation, against which the 1995 study data could be compared. Staff concluded that the data to complete this work accurately were not readily available to CIWMB staff. Six issues and potential sources of error were identified. These include:

1. The definition of RPPCs is inconsistent with resin sales categories.
2. Resin sold is not necessarily used to manufacture RPPCs, and when it is, not all RPPCs make it to market due to a variety of factors.
3. The market penetration of various products sold in RPPCs differs from state to state.
4. Some RPPCs are reused by consumers and not discarded in the same year as they are purchased.
5. The national resin sales data do not necessarily include post-consumer resin used in container manufacturing.
6. The national sales data do not include imports of products contained in RPPCs.

<u>Advantages of Adjusting National Resin Sales Data</u>

- *National resin sales data are collected consistently by SPI.* The data collection methodology employed by SPI's contractor for obtaining resin sales data is based on auditing principles.

195

Disadvantages of Pro-Rating National Resin Sales Data

- *Extensive CIWMB staff involvement would be necessary to implement this approach thoroughly.* In addition to extensive data collection, staff would need to perform complicated statistical analyses and modeling exercises.
- *This approach relies on national data on raw material sales to infer California-specific information on product, and associated packaging, sales.* The data necessary to make the appropriate adjustments are not readily available. In some cases, such as measuring reuse, the measurement may be near impossible to obtain.
- *CIWMB staff is already on record as stating that this approach is not appropriate.* The defensibility of this approach is marginal given this fact.

Data Needs

National Resin Sales Data. National resin sales data are available from SPI, but these data include some exports and Canadian production figures.

RPPC/Non-RPPC Split. In order to use the national resin sales data, it would be necessary to determine the split between resin sold for use in RPPCs versus other applications.

Reuse/Storage Data. Obtaining information on the level of reuse and storage of RPPCs would be impossible. However, this factor could be ignored if it were assumed that the replacement factor of old reused RPPCs being discarded and new RPPCs being reused are equal.

California Prorating Factor. Prorating national resin sales data on a per capita and per non-durable sales basis are the two most common methods used to estimate California's share of national resin sales. However, this method does not take into account market penetration issues.

Manufacturing/Distribution Resin Loss Factor. Obtaining manufacturing and distribution loss data would involve a survey of over 2,000 container manufacturers and product distributors. Most important, however, is that these losses are usually the results of mistakes as opposed to normal business practices. And, one cannot predict when mistakes will occur.

Postconsumer Resin Used in RPPC Production. To be accurate, the amount of postconsumer resin used in producing RPPCs sold in California needs to be determined. Again, determining the portion of RPPCs sold in California would require extensive data collection and analysis.

Imported RPPCs. Products imported in RPPCs would have to be identified and the weight of those containers determined.

Feasibility of Staff to Complete Work

CIWMB staff has already concluded that it would not be feasible for them to complete this work for benchmarking purposes within appropriate level of error. If this approach was not acceptable for benchmarking purposes, it is highly unlikely that it would be considered appropriate for determining compliance.

Criteria Evaluation

- **Accuracy.** As noted above, there are six major areas of concern that call into question the accuracy of this approach. The national resin sales data are based on voluntary reporting on the part of resin producers and no effort is made to estimate resin sales of non-respondents.
- **Defensibility.** This approach would most likely not be defensible given that CIWMB staff is already on record stating that this approach is not even good enough for benchmarking purposes.
- **Precision.** The precision of this method cannot be measured. The potential for significant error is introduced at each point where adjustments must be made.
- **Affordability.** This approach, if thoroughly completed, would require significant dedicated staff time. It would most likely not be as expensive as a waste composition study.
- **Repeatability.** This methodology is repeatable, but the time requirements associated with completing this methodology would necessitate that a staff person be dedicated to this task. The repeatability of this approach also hinges on the consistency of the national resin sales data collection process.
- **Ability to validate.** Results form this method could be cross-checked with other available data sources.

197

Approach #3: Extrapolate 1996 RPPC Generation Using 1995 Data

There are several ways that the results of the 1995 study could be used to extrapolate 1996 results, including:

- applying the 1995 RPPC percent to the total 1996 disposal (including incineration and exports). This approach is not appropriate, because it does not take into account that changes that may have influenced the percentage of RPPCs in the waste stream.

- adjusting generation based on the percentage change in some macro-economic measure such as taxable sales or non-durable retail sales. This approach is not appropriate, because these measures are more indicative of macro-level economic activity rather than RPPC recycling activities.

The most feasible approach that we identified involves two steps. First, the total RPPC generation from the 1995 study would be compared to the 1995 national resin sales data. Second, the ratio obtained from this comparison would then be applied to 1996 resin sales data to obtain an estimate of 1996 California RPPCs generated.[2] The figures would be calculated as follows:

$$\text{Step 1: Ratio} = \frac{\text{1995 California RPPC Generation}}{\text{1995 National Resin Sales}}$$

$$\text{Step 2: 1996 California RPPC Generation} = \text{Ratio} \times \text{1996 National Resin Sales}$$

The national resin sales data as reported in Modern Plastics would be used to calculate this ratio. The sales data would be comprised of a grouping of resin applications roughly approximating the RPPC definition. This grouping, once defined, would remain constant from year to year. Table 2, on the following page, provides 1995 data for one such grouping of resin applications.

The calculated ratio of California RPPC generation to national resin sales for this grouping of resin applications would be 8.53%. To calculate 1996 California RPPC generation, the 1996 national resin sales for the same grouping of applications would be multiplied by 8.53%. This ratio would have to be calculated again if a different grouping of resin applications was chosen to be more representative of the RPPC definition, or if a different data set was chosen. For example, year-end SPI data could be used. However, SPI data are not reported according to resin application. Choosing the appropriate grouping may be more difficult using SPI data than Modern Plastics data.

[2] This method is different from Approach #2: Pro-Rate National Sales Data. Unlike Approach #2, this approach relies on the results of the 1995 study to determine what the relationship between national sales data and California generation is. In Approach #2, California RPPC generation is deduced from national data, without collecting any California specific data.

Advantages of Extrapolating 1996 RPPC Generation Using 1995 Data

- *This approach is straightforward and can easily be repeated by CIWMB staff.* Staff also would not need to make separate estimates of RPPC disposal.

- *The option of using the ratio of 1995 California RPPC Generation to a grouping of 1995 national resin sales takes into account changes in product applications.* For example, if use of PET in soda bottles increases, this will be reflected by an increase in the national sales data, and therefore will also be reflected as an increase in the California estimate.

Table 2. 1995 National Resin Sales Data for Various Resin Applications Approximating the Definition of RPPC s

Limited Resins and Applications (Approximates Definition of RPPCs)	1995 National Sales (m lbs)	1995 CA RPPC Generation
PET Bottles	2,309	
HDPE Blow Molding Bottles and Injection Molding Pails and Tubs and Containers	3,296	
PVC Bottles	171	
L/LDPE Blow Molding	84	
PP Blow Molding and Injection Molding Rigid Packaging	1,252	
PS Molding Rigid Packaging and Blow Molded Items; and Extrusion Dairy Containers and Egg Cartons and	353	
TOTAL (m lbs)	7,464	637
TOTAL (tons)	3,732,000	318,300
Percentage of 1995 National Sales	100%	8.53%

source: Modern Plastics, January 1997

Disadvantages of Extrapolating 1996 RPPC Generation Using 1995 Data

- *This approach does not rely on primary data collected in California and therefore may be more difficult to defend than methods involving primary data collection.* The relationship between California generation and national sales data may not be constant from year to year.

199

- *Modern Plastics data are published before yearly totals are available from SPI.* Generally, the trends reported by Modern Plastics are accurate, but they may not be accurate enough for determining compliance.

Data Needs

Total RPPC Generation from 1995 Study. In 1995, California RPPC generation was measured to be 318,300 tons.

National Resin Sales Data. SPI national resin sales data or, for purposes of simplicity, Modern Plastics data could be used. 1995 Modern Plastics data are included above.

Feasibility of Staff to Complete Work

The straightforwardness of this approach makes it easy for CIWMB staff to complete this work in-house. No complex modeling or data collection is necessary.

Criteria Evaluation

- **Accuracy.** Since this approach involves extrapolation, it is necessarily not going to be as accurate as methods involving primary data collection.
- **Defensibility.** The approach may be difficult to defend, since it relies on data that CIWMB staff has no control over. However, the approach is straightforward and can be explained.
- **Precision.** The precision of this method cannot be measured.
- **Affordability.** This approach is quite affordable and would require minimum staff effort.
- **Repeatability.** This methodology is repeatable and would be easy to document for future calculations.
- **Ability to validate.** Results from this method could be cross-checked with other available data sources. Independent data points could not be validated without significant effort on the part of staff.

Comparison of Denominator Methodologies

Table 3 below compares how well each of the methodologies meet the evaluation criteria and the feasibility of CIWMB staff to complete the work in-house. This comparison is based on qualitative factors and ranks each methodology against each other. For example, it is more feasible for CIWMB staff to adjust the 1995 generation data than it is for CIWMB staff to complete a waste composition study in-house. Table 3A provides additional detail of this comparison.

Table 3. Quick Comparison of Denominator Methodologies

Evaluation Criteria	Waste Composition Study	Adjust National Data	Extrapolate 1996 RPPC Generation	Approach that Best Meets Criteria
Accuracy	3	1	2	Waste Composition
Defensibility	3	1	2	Waste Composition
Precision	3	1	2	Waste Composition
Affordability	1	2	3	Extrapolate 1996 Data
Repeatability	1	1	3	Extrapolate 1996 Data
Ability to Validate	3	1	2	Waste Composition
Feasibility of CIWMB Staff to Complete	1	2	3	Extrapolate 1996 Data

key: 3 = fully meets criteria; 2 = does not fully meet criteria; 1 = fails to meet criteria

201

202

Table 3A. Comparison of Denominator Methodologies

Evaluation Criteria	Conduct Waste Composition Study	Adjust National Resin Sales Date	Extrapolate 1996 RPPC Generation
Accuracy	If sampling plan is well designed, accuracy is high.	Accuracy depends on ability to adjust national data to compensate for manufacturing losses and to reflect differences in the California sales of RPPC packaging.	Reflects changes in packaging mix at national level, but does not necessarily account for changes in California.
Defensibility	Results of the 1995 study were debated but the methodology was ultimately accepted by the CIWMB.	Staff is on record as stating that this approach could not be used to benchmark the 1995 RPPC recycling rate.	Is straightforward and can be explained. Relies on 1995 data, which have been approved.
Precision	Margin of error was very low in 1995 study; however, almost 900 samples were sorted.	Cannot be measured	Cannot be measured.
Affordability	Costs would likely exceed $200,000.	Will require extensive staff effort to collect and analyze adjustment data.	Most affordable of options, would require little staff time.
Repeatability	Politically difficult to justify on an annual basis.	Data needed to make adjustments may be difficult to collect annually.	Staff could repeat every year and approach is easy to document.
Ability to Validate	Staff would have access to primary data, so could verify individual data points.	Difficult if not impossible to validate.	Relies on national data, which is collected using accounting-based principals.
Feasibility of CIWMB Staff to Complete	Staff is not trained to conduct waste composition studies and this effort would require an excessive number of hours.	Staff could complete in-house.	Easy for staff to complete in-house.