Options for Measuring Diversion

An Evaluation of What, Why, and How Jurisdictions Measure Source Reduction, Recycling, and Composting

prepared for the

Alameda County Source Reduction and Recycling Board

submitted by

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January 21, 2002

This report was prepared by

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in response to a contractual assignment managed by

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January 22, 2002

Tom Padia
Source Reduction and Recycling Director
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Dear Tom:

Please find enclosed the final draft of the report "Options for Measuring Diversion".

This draft is being sent to you today via e-mail and hard copy. The hard copy is being overnighted to you for delivery on Wednesday, January 23rd.

Prior changes suggested by you have been incorporated into this draft. The draft includes relevant information obtained from the states of Florida, Minnesota, New York, North Carolina, and Oregon. The respondents from these states and officials with the states of Massachusetts, New Jersey, and Ohio, including the District of Columbia expressed an interest in receiving any public information available from this study. I can provide you with addresses for these individuals.

Please feel free to make comments or request any additional detail or clarification to enhance the report to be responsive to your expectations.

Sincerely,

Jim Greco
Owner/Principal

2.0 EXECUTIVE SUMMARY

Uniform diversion measurement methods commonly used and understood throughout the country do not exist. The U.S Environmental Protection Agency (USEPA) has developed and promoted a guide for measuring recycling [(1)] but it only addresses a part of total diversion, namely: recycling and some composting, not source reduction. Furthermore, certain segments of the solid waste stream are not included in wastes generated (e.g., construction and demolition debris).

While a uniform method does not exist, various measurement methods are used by state and local agencies to measure either recycling and/or diversion in order to assess progress in attaining goals. Most states have established goals focused upon disposal reduction and/or quantifying recycling programs implemented in the residential sector and in some parts of the commercial sector.

When devising a method for measuring "diversion", the definition of terms and the scope of measurement should be stated. For example, the following components should be defined as included or not in the measurement system:

- Diversion activity (source reduction, recycling, composting, transformation, other)
- Diversion within which waste generating sector (residences, commercial entities, industrial plants, special waste generators)
- Diversion by waste type (the definition of what is included in solid waste must be addressed). Some measurement systems only focus on municipal solid waste, which does not include industrial waste or construction and demolition debris. Special waste types like asbestos, sludge, manure, and other material types may or may not be included in what waste is being measured.
- Diversion by facility types (permitted or not permitted)

After "diversion" is defined, the purpose of diversion measurement should be determined. Diversion measurement may be practiced for determining compliance with mandated legislative and/or regulatory requirements. Or diversion measurement may be undertaken for assessing diversion program performance and tracking trends in recycling programs (e.g., residential curbside recyclables collection). Lastly, the ultimate objective of diversion measurement should be decided, namely:

- For disposal reduction in order to extend or conserve landfill capacity; or
- Materials conservation where diversion is practiced in order to reduce the consumption of natural resources.

The California Integrated Waste Management Board (CIWMB) recognizes two basic methods for measuring diversion:

1) standard adjustment methodology; and
2) generation-based quantification.

The former is the standard measurement method required of jurisdictions throughout the state for compliance determinations. The latter is an alternative method. A generation-based method depends upon quantifying both diversion and disposal every year. Since diversion includes source reduction in California (also referred to as waste prevention), it is difficult and resource-intensive to quantify source reduction impacts.

The adjustment methodology is a disposal-based measurement system. The total waste generation in a reference year (base year) is determined – then adjusted in subsequent years to derive estimated waste generation. Disposal quantification is then compared to estimated generation to determine a diversion rate.

Various methods are used in other states, categorized by Dr. Eugene Tseng in a 1993 report [(2)] for the CIWMB as:

1) generation-based quantification methodologies;
2) disposal-based quantification methodologies; and
3) credit based quantification methodologies.

Generation-based methods require the quantification of diversion and disposal. Disposal-based approaches require only the measurement of disposed wastes. Credit based systems, a quasi generation-based approach, utilize predetermined allowances for certain types of diversion activities in order to avoid measuring the diversion tons. Notable examples include the states of Minnesota and Oregon. Minnesota allows source reduction "credits" up to 3% and 5% for yard waste diversion. (Minnesota bans land disposal of yard waste.) Oregon grants local wasteshed areas (generally, counties) up to 6% credit for certain source reduction programs (e.g., waste prevention, home composting, and reuse) so long as sufficient information is provided to substantiate program implementation.

Some states also require that measurement be determined on a "per capita" basis rather than total tons so as to normalize the comparison from one period of time to another (e.g. year to year). Per capita calculations adjust for waste generation increases due to population growth.

There have been numerous attempts to estimate diversion resulting from "source reduction" activities. Source reduction may also be described as waste prevention. However, the approaches developed are dependent upon assumptions or require extensive research for comparative use. State agencies appear to be moving away from measuring source reduction because this activity is very difficult to accurately measure.

The most effective measurement methods are premised upon:

- disposal trend analysis: comparing disposed material quantities from one year to another; and
- "per capita", "per employee", or "per equivalent per capita" indicators.

"Per capita/per employee" indicators attempt to normalize the quantity of material measured or estimated and provide more of an "apples-to-apples" comparison from year to year.

The most novel are the "diversion credit" initiatives, which acknowledge source reduction program implementation activities without quantifying their impact.

3.0 INTRODUCTION

California municipalities are required by law [3] (AB 939) to measure progress toward achieving diversion goals. Statutory goals were established, namely 50% for the year 2000. Nothing in the law prohibits a city or county from implementing source reduction, recycling, and composting activities designed to exceed this goal.

The Alameda County Waste Reduction and Recycling Act [4] (Measure D) requires that the Alameda County Source Reduction and Recycling Board (Board) establish a date to reduce, recycle, and compost at least 75%, by weight, of all discarded materials generated within Alameda County. Whereas Measure D required periodic auditing to determine compliance with a mandated "recycling plan" and the degree of progress being made toward goal attainment, there was not a requirement for a specified measurement methodology. Measure D does reference the California Integrated Waste Management Act, and states that it is the intent of Measure D to be consistent with the diversion goals of the state [Subsection 64.040 (A) (1)].

AB 939 authorized the CIWMB to develop a standard methodology and guidelines to be used by cities, counties, and regional agencies to determine (measure) achievement of the goal. This is stated in Public Resources Code (PRC) Section 41780.1 (c). The method is described as the adjustment methodology [5] because it adjusts waste generation from a reference year (base year) to a reporting year due to impacts from population and other demographic and economic activity, which can affect the generation of waste.

AB 939 requires each municipality to prepare and implement a plan, which describes how the goal can be achieved. The plan is called a Source Reduction and Recycling Element (SRRE). It is based upon diversion of solid waste normally generated from disposal facilities through source reduction, recycling, and composting activities.

The member agencies, which comprise the Alameda County Waste Management Authority, have measured diversion using the CIWMB adjustment methodology. However, this method often leads to inaccurate results. The Recycling Board is interested in knowing how other jurisdictions (in California and out-of-state) measure diversion.

4.0 METHODOLOGY

California Waste Associates (CWA) researched the web and various literature sources for information about diversion measurement. A number of organizations with extensive constituencies were initially contacted, namely:

- CIWMB
- U. S. Environmental Protection Agency (EPA)
- National Recycling Coalition (NRC)
- California Resource Recovery Association (CRRA)
- Solid Waste Association of North America (SWANA)
- California Refuse Removal Council (CRRC)
- Environmental Industries Association (EIA)
- Association of State and Territorial Solid Waste Management Officials (ASTSWMO)

Identity information for these organizations is provided in Appendix A. A number of individuals active in these organizations were contacted, including:

- Nancy Carr, CIWMB
- Chris Schmidle, CIWMB
- Eugene Tseng, EcoTelisis (CIWMB contractor for waste diversion measurement)
- John Davis, California Resource Recovery Association
- Chaz Miller, Environmental Industries Association
- John Skinner, Solid Waste Association of North America
- Sean Edgar, California Refuse Removal Council Northern District
- Paul Ryan, California Refuse Removal Council Southern District
- Liz Citrino, Humboldt County

A number of reports were identified, obtained, and reviewed which provided information regarding diversion measurement or some component of diversion quantification, such as:

- Measuring Recycling – A Guide for State and Local Governments, Office of Solid Waste and Emergency Response, U.S. EPA, Publication EPA530-R-97-011, September, 1997.
- Analysis of Trends in Municipal Solid Waste Generation 1972 to 1987, Final Report, Franklin Associates, Ltd., January, 1992.
- Nationwide Diversion Rate Study – Quantitative Effects of Program Choices on Recycling and Green Waste Diversion: Beyond Case Studies, Final Report, Skumatz Economic Research Associates, Inc., July, 1996.
- Measuring Source Reduction:Variable Rates/PAYT as an Example, Skumatz Economic Research Associates, Inc., May 11, 2000.
- Business Waste Prevention Quanitfication Methodologies, Business Users Guide, Office of Municipal and Industrial Solid Waste, U.S. EPA, and University of California Los Angeles Extension, Recycling and Municipal Solid Waste Management Program, November, 1996.
- Business Guide for Reducing Solid Waste, Office of Solid Waste and Emergency Response, U.S. EPA, Publication EPA/530-K-92-004, November, 1993.
- Summary of Recycling and Reduction Compliance Quantification Methodologies, Unpublished Notebooks Retained by the CIWMB, S.B. 2494 Study for the Development of the Adjustment Methodology, Nancy Carr.
- The State of Garbage in America, 12th Annual Biocycle Nationwide Survey, *Biocycle* Magazine, April, 2000 and November, 2000.
- Revised Draft Report to the Legislature, A Comprehensive Analysis of the Integrated Waste Management Act Diversion Rate Measurement System, (referred to as the "SB 2202 Report", CIWMB, October 26, 2001.
- Measuring Waste Prevention, Metro Region of Portland, Robin Chung, METRO Intern.

The most referenced report identified by individuals, who were contacted, was the U. S. EPA document on "Measuring Recycling" [(1)]. This report advocated a "recycling" measurement methodology and called for consistency among states and localities by recommending elements of standardization for measurement. The methodology, however, only measures a segment of diversion activities (only standard recycling activities and not source reduction) and a portion of the waste stream (municipal solid waste excluding industrial waste).

The most valuable meetings scheduled by CWA were with the CIWMB's Nancy Carr and Chris Schmidle and Dr. Eugene Tseng. Carr and Schmidle oversaw the project undertaken by the CIWMB in 1993 pursuant to the passage of the AB 2494 legislation amending AB 939. That project resulted in the development of the diversion measurement system adopted in 1994 and utilized by the CIWMB currently. The methodology is referred to as the uniform adjustment method. Dr. Tseng was the principal

investigator for that project. Background information for the methodology was presented in the previously cited report, Summary of Recycling and Reduction Compliance Quantification Methodologies [(2)], which included a listing of 40 states, the District of Columbia, and the province of Ontario in Canada. The listing reported on survey results about state diversion goals and quantification methodologies. The summary and listing are included in Appendix B.

Review of the listing revealed some measurement issues, which suggested further analysis, namely:

(1) **Florida**. Choice of a generation-based quantification for recycling rate or a disposal-based per capita rate reduction comparison adjusted for population, special events, and transformation credits.
(2) **Minnesota**. Generation-based quantification for recycling with per capita adjustments for rural counties.
(3) **New York**. Generation-based with adjustments using factors developed by Franklin Associates.
(4) **North Carolina**. Disposal-based quantification for per capita rate change.
(5) **Oregon**. Generation-based quantification recycling/reduction rate.

The responsible state agencies were contacted by phone and their websites reviewed afterwards. Identity information for these state programs and their websites are included in Appendix C. Survey results are discussed in Sections 7.0 and 10.0.

5.0 DEFINING DIVERSION

GENERAL OVERVIEW

"Diversion" is defined in the California PRC in Section 40124 as:

> "activities which reduce or eliminate solid waste from solid waste disposal…"

"Solid waste", as stated in PRC 40191, means:

> "all putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, dewatered, treated, or chemically fixed sewage sludge which is not hazardous, manure, vegetable or animal solid and semisolid wastes, and other discarded solid and semisolid wastes."

There are also exclusions for what is not viewed as solid waste, namely: hazardous, radioactive, and medical waste.

PRC 40192 defines "solid waste disposal" as:

> "the final disposition of solid wastes onto land, into the atmosphere, or into the waters of the state"

The AB 939 statute includes qualifying statements about solid waste disposal, most notably, that only landfill and transformation facilities, which are permitted by the CIWMB, are considered solid waste disposal facilities. This leads to acknowledgement that solid wastes disposed at facilities, which are not CIWMB-permit concurred is not considered disposed when determining a jurisdiction's diversion rate.

Thus, California jurisdictions are guided, by statute and regulations, about what counts as waste and whether it is considered diverted or disposed. This guidance may be misleading to the general public and responsible jurisdictions which are genuinely seeking to divert and measure wastes which are generated.

There generally is a common baseline understanding about calculating a diversion rate for a defined demographic area, namely:

Diversion Rate % = (Diversion Quantity divided by Waste Generation Quantity) x 100

with waste generation defined as the sum of diversion quantities and disposal quantities.

The difficulty in comparing diversion rates among areas is that jurisdictions, businesses, and other groups:

1) utilize different definitions for the same words; and/or
2) measure only subsets of diversion (e.g., residential recycling and not other recycling); and/or
3) find it difficult to accurately measure source reduction and total waste generation.

This prompted the U.S. EPA "Measuring Recycling" study in order to promote uniformity with respect to measuring "recycling" (a subset of diversion) and derive a recycling rate. These measurement issues also prompted the CIWMB to develop a measurement system. The CIWMB/Tseng AB 2494 study mentioned earlier included a survey of state agencies quantified recycling and waste reduction to assess progress and compliance, where applicable. As noted earlier, a "Summary of Recycling and Reduction Compliance Quantification Methodologies" utilized by state agencies is included in Appendix A.

DIVERSION BY ACTIVITY

The CIWMB developed a definition for "diversion alternative" pursuant to AB 939 in the California Code of Regulations [(3)] (CCR) Section 18720 (a) (19) to mean:

> "any activity, existing or occurring in the future, which has been, is, or will be implemented, by a jurisdiction which could result in or promote the diversion of solid waste, through source reduction, recycling or composting, from solid waste landfills or transformation facilities."

The regulations further identify components (CCR Article 6.2) of diversion of activities or management methods (source reduction, recycling, composting, and special waste). Consequently, California jurisdictions measuring diversion must consider more than recycling and composting activities. This is noteworthy in light of the EPA report which encourages uniform measurement of recycling (including composting) but does not include source reduction and special waste diversion programs.

Included in Appendix D is Table B from the EPA report which specifies the scope of activities which are included in the standard municipal solid waste (MSW) recycling definition.

Measure D includes definitions for source reduction, recycling, and composting programs. They are:

> "***Source Reduction Program***" shall mean a program that results in a net reduction in the generation of discarded materials, including, but not limited to, a program to reduce the use of non-recyclable materials and hazardous waste; replace disposable materials and products with

reusable materials and products; reduce packaging; reduce the amount of plant debris generated; reduce the amount of household hazardous waste generated; establish refuse collection rate structures with incentives to reduce the amount of refuse that generators produce- increase the efficiency of the use of paper, cardboard, glass, metal, plastic, and other materials in the manufacturing process; and/or maintain public education programs to accomplish any of these ends; but shall not be construed to include any steps taken after the material is discarded.

"***Recycling Programs***" shall mean Buy-Back Programs, Commercial Recycling Programs, Composting Programs, Construction and Demolition Debris Recycling Programs, Drop-Off Programs, Recyclable Material Recovery Programs, Recycled Product Market Development Programs, Recycled Product Purchase Preference Programs, Recycling Education Programs, Residential Recycling Programs, Salvage Programs, Source Reduction Programs, and/or research and planning to implement any of said programs.

"***Composting Program***" shall mean a program to collect, purchase, receive, process, and/or market compostable materials, or co-compost said compostable materials with manures, dairy discards, or fish processing discards, with the aim of producing a nontoxic finished product usable as a compost, soil amendment, landfill cover, or potting soil.

There was no definition or description for "Special Waste Diversion".

Diversion activities to be included in a California diversion measurement methodology include:

- Source Reduction;
- Recycling;
- Composting; and
- Special Waste.

Although the AB 939 statute allows California jurisdictions to claim as diversion transformed solid waste up to a specified level (10% of waste generation), incineration (which includes transformation) is prohibited in unincorporated Alameda County. The Court of Appeals decision upholding Measure D modified the purview of certain applications of he County Charter amendment to only "unincorporated" areas of the County. Thus, no transformation is considered as diversion in the unincorporated area of the County.

DIVERSION BY SECTOR (OR SOURCE)

The CIWMB regulations [CCR 18722 (i)] specify that solid waste generation, diversion, and disposal shall be identified by the source of generation within the jurisdiction, namely:

- residential;
- commercial;
- industrial; and
- other sources.

and also by waste category and type.

Diversion sources to be included in a California diversion measurement methodology include solid wastes generated from residential, commercial, industrial, and other sources.

WASTE TYPES INCLUDED IN DIVERSION MEASUREMENT

The categories and types of solid waste are depicted in Table 5-1. Table 5-1 also includes commentary pertinent to the EPA definition of what is included in the definition of municipal solid waste (MSW) that is used in determination of the EPA recycling rate. See Appendix E for a listing of the material types included by EPA in the standard definition of MSW. Material types included in the California diversion measurement methodology include the categories and types listed in Table 5-1.

Table 5-1. CIWMB Waste Categories and Types

Waste Category	Waste Type	Covered Under EPA MSW Definition?
Paper	Corrugated	Yes
	Mixed Paper	Yes
	Newspaper	Yes
	High Grade Ledger Paper	Yes
	Other Paper	Yes
Plastics	HDPE	Yes
	PET	Yes
	Film Plastics	Yes
	Other Plastics	Yes
Glass	Refillable Glass Beverage	Yes
	Cal Redemption Value	Yes
	Other Recyclable Glass	Yes
	Other Non-recyclable Glass	Yes
Metals	Aluminum Cans	Yes
	Bi-metal Containers	Yes
	Ferrous Metal/Tin Cans	Yes
	Non-ferrous Metals/Al Scrap	Yes; no Construction & Demolition (C&D) metals
	White Goods	Yes
	Other Metals	Not specified
Yard Waste		Yes
Other Organics	Food Waste	Yes except for commercial food processing
	Tires and Rubber Products	Only from autos and trucks; not buses or other
	Wood Wastes	Yes except for C&D debris (lumber, tree stumps)
	Agricultural Crop Residues	No
	Manure	Not specified
	Textiles and Leather	Yes
	Other Miscellaneous	Not specified
Other Wastes	Inert Solids	No
	HHW	Yes
Special Wastes	Ash	No
	Sewage Sludge	No
	Industrial Sludge	No
	Asbestos	Not specified
	Auto Shredder Waste	Not specified
	Auto Bodies	Not specified
	Other Special Wastes	Not specified

FACILITY TYPES

AB 939 excludes from the diversion measurement methodology solid wastes, which are disposed of at disposal facilities in California, which do not have a solid waste facility permit (SWFP). Consequently, C&D debris disposed of at an inerts landfill which is not required to obtain a SWFP does not count as disposal and hence are not recognized as a generated wastes.

6.0 PURPOSE OF DIVERSION MEASUREMENT

OVERVIEW

Jurisdictions measure diversion because it is mandated by government policy and/or there is a need or interest in tracking diversion for a purpose. AB 939 requires each city, county, or member agency of a regional agency to determine the amount of reduction in solid waste disposal. One of the findings and declarations made by the Legislature in AB 939 was that:

> "The reduction, recycling, or reuse of solid waste generated in the state will, in addition to preserving landfill capacity in California, serve to conserve water, energy, and other natural resources within this state, and to protect the state's environment."

Measure D states that the "discarded materials" retain value as natural resources and should be recycled.

DISPOSAL REDUCTION/CAPACITY PRESERVATION

If the sole purpose of diversion measurement is to reduce disposal, disposal reduction should be the measured quantity – measured from year to year. Goal performance can be assessed by the reduction in quantities of materials disposed. For this purpose, diversion would not need to be quantified and a diversion rate would not need to be calculated.

MATERIALS CONSERVATION

There is a correlation between materials diverted and materials conserved. Many material types, which are diverted, are used as a feedstock for making new products – resulting in less virgin materials being consumed. Tracking the effectiveness of diversion programs to accomplish materials conserved requires quantifying diverted materials. Quantities of materials diverted save the consumption of virgin materials and preserves natural resources.

SUMMARY

Thus, disposal reduction strategies lead to disposal-based measurement methods, whereas materials conservation goals suggest generation-based measurement methodologies.

7.0 METHODS FOR MEASURING DIVERSION

CALIFORNIA METHODS

The two methods for measuring diversion which are acceptable for use by California municipalities are the:

1) Standard Adjustment Methodology; and the
2) Generation-based Method

Standard Adjustment Methodology

This method was mandated by AB 2494 in order to make calculating a diversion rate simpler for ascertaining compliance with the diversion goals. Prior to AB 2494, jurisdictions were expected to quantify diversion, track disposal, and thereby derive generation as the sum of the two. However, because it was difficult to quantify diversion, the legislature passed AB 2494, which included a requirement to develop a uniform adjustment methodology. The adjustment methodology would "adjust the waste generation amount" for a jurisdiction in a previously established base year (e.g. 1990) in order to determine the waste generation level in a targeted year (e.g. 2000). Knowing an estimated waste generation level, the jurisdiction would subtract its reported disposal tonnage from the estimated generation to obtain the amount of wastes diverted. Dividing waste generation by diversion and multiplying by 100 results in the calculated diversion rate.

The adjustment methodology is a disposal-based measurement system.

There has been much concern throughout the state and at the CIWMB about the accuracy of estimating waste generation in years beyond the base year. The question is posed for each Alameda County municipality regarding the accuracy of these rates of growth. Do they accurately reflect the growth in the generated waste stream resulting from population growth, housing growth, increased economic activity, and changing consumer practices.

The CIWMB adjustment methodology utilizes default values for population, employment, taxable sales transactions, and the consumer price index (CPI) to "adjust" waste generation. The source databases for the default adjustment factors are:

- Population: California Department of Finance, Demographic Research Unit
- Employment: California Economic Development Department, Labor Market Information Division
- Taxable Sales Transactions: California State Board of Equalization, Research and Statistics Division; CIWMB, Waste Analysis Branch
- CPI: California Department of Industrial Relations, Division of Labor Statistics

Alternate adjustment factors are allowed but use of values other then the CIWMB default values have to be demonstrated as being more accurate or more applicable.

Generation-Based Method

This method requires quantifying diversion and disposal tonnage in a given year. Summing the two yields waste generation. Disposal tons are already being reported through the CIWMB Disposal Reporting System. Diversion can be either quantified by actually obtaining the weights of diverted materials (e.g., a curbside recycling program, buyback center reports compiled by the Department of Conservation Division of Recycling, etc.) or using a methodology to estimate diverted tonnage by activity. The CIWMB has developed a Diversion Study Guide [(7)] for use by jurisdictions in quantifying diversion.

This method can be used every year by jurisdictions to demonstrate progress toward achieving diversion goals or it can be used to establish a new base year (e.g., the year 2001) for use in the adjustment methodology for post-2001 years.

Conducting a diversion study and establishing a new base year are resource-consuming activities but conducting such a study does provide a jurisdiction with greater awareness about the source reduction, recycling, composting, and special waste diversion activities within the community.

OUT OF STATE METHODS

The EPA report and state survey summary included in Appendix B indicates that the efforts undertaken in California have exceeded what other states have done and what EPA has developed regarding protocols for measuring total diversion. At the time the survey was taken during the early 1990's, many states were planning to develop regulations or guidelines for measuring progress in achieving diversion goals.

The diversion goals established by states with a defined quantification methodology are presented in Table 7-1.

Table 7-1. Select State Diversion Goals [(2)]

State	Goal	Target Year	What is Measured?
Connecticut	40%	2000	Reduction by recycling, composting, and source reduction.
D.C.	45%	1994	Reduction by recycling, composting, and source reduction.
Florida	30%	1994	Not stated. To be further researched.
Georgia	25%	1996	Disposal reduction from a baseline reference.
Hawaii	50%	2000	Through source reduction, recycling, composting, bioconversion.
Illinois	25%	2000	Recycling rate.
Iowa	50%	2000	Through source reduction and recycling from a 1988 baseline.
Kentucky	25%	1997	Measured at disposal site from 1993 baseline.
Louisiana	25%	1992	Based on actual volume or weight.
Maine	50%	1994	Recycling rate.
Maryland	20%	1994	Recycling.
Massachusetts	56%	2000	Generation-based using disposal, recycling, composting, incineration data supplied by municipalities.
Minnesota	45%	1996	Recycling goal with a credit for source reduction.
Mississippi	25%	1996	Not stated. To be further researched.
Missouri	40%	1998	Generation rate reduction.
Nebraska	50%	2002	Volume disposed in landfills.
New Hampshire	40%	2000	Weight reduction in waste stream on a per capita basis.
New Jersey	50%	1996	Recycling.
New Mexico	50%	2000	Disposal reduction using 4 ppd.
New York	50%	1997	Recycling & reduction; weight recovered/disposed & recovered.
North Carolina	40%	2001	Disposal reduction from baseline year.
North Dakota	40%	2000	Reduction in volume into landfills.
Ohio	25%	1994	Of waste generated statewide.
Oregon	50%	2000	Recovery rate.
Pennsylvania	25%	1997	Recycling.
South Carolina	55%	1997	Reduction and recycling.
Tennessee	25%	1995	Disposal-based; waste disposal per capita.
Texas	40%	1994	SR and recycling using 1991 baseline levels.
Virginia	25%	1995	Recycling.
Ontario, Canada	50%	2000	Disposal-based; waste disposal per capita.

There is a general reluctance to estimate or forecast waste generation and calculate diversion rates when the error margin is great. There seems to be more attention on measuring activities from year-to-year on either a per capita basis or disposal reduction basis.

Of the 41 states (including the District of Columbia) identified in the Eugene Tseng/CIWMB survey, only the following 25 states had developed quantification methodologies, as of late 1993:

Generation Based (17)	**Disposal Based (11)**
* *Florida*	* Connecticut
* Hawaii	* District of Columbia
* Illinois	* *Florida*
* Iowa	* Georgia
* *Louisiana*	* Kentucky
* Maine	* *Louisiana*
* Massachusetts	* New Mexico
* Minnesota	* North Carolina
* Missouri	* South Carolina
* Nebraska	* Tennessee
* New Hampshire	* Texas
* New Jersey	
* New York	
* Ohio	
* Oregon	
* Pennsylvania	
* Virginia	

Two states, *Florida* and *Louisiana*, allow either method, as does California. Nine states (Georgia, Iowa, Minnesota, Missouri, New Hampshire, New Mexico, North Carolina, Ohio, and Tennessee) incorporate a per capita rate in their methodologies. California does not require any "per capita" calculation, but the CIWMB does calculate "per capita" and "per employee" rates for comparative indicator assessment.

No state has developed a methodology as extensive as the California adjustment methodology. Many stats allow adjustments based upon population.

The following political entities identified use of adjustment factors in diversion measurement methods:

1) Connecticut (population)
2) District of Columbia (population, households, special events)
3) Florida (population, special events, transformation credit)
4) Maryland (population)
5) Massachusetts (population, tourism, import/export)
6) Minnesota (statewide estimates for generation and recycling of specific materials banned from disposal)
7) Missouri (population, unusual circumstances)
8) New Hampshire (population)
9) North Carolina (population, good faith effort)
10) Ohio (population, non-recyclable waste from industry)
11) South Carolina (population)

12) Tennessee (population)
13) Texas (population, changes in economic activity)
14) West Virginia (population, unusual circumstances, migrant population)
15) Ontario, Canada (population)

A number of these states incorporated per capita computations in the measurement system.

Additional information was obtained from five states: Florida, Minnesota, New York, North Carolina, and Oregon. Summaries of the information obtained are included in Appendices F through I. Noteworthy features for consideration by the Recycling Board are:

- **Florida** established recycling goals for material types (aluminum cans, glass, newspaper, plastic bottles, and steel cans at a minimum and other material types added on). The state includes construction and demolition waste, yard trash, white goods, tires, and process fuel (e.g., biomass) in the measured waste stream as special waste. No more than half of the 30% goal can be attributed to special waste diversion. It calculates a "disposal per capita" rate, which is tracked from 1990, and a recycling rate by quantifying recyclables divided by waste generation (recyclables plus disposal quantities). See Appendix F for more information. [8]

- **Minnesota** has developed a defined generation-based diversion rate calculation method in addition to a per capita reduction in the amount of waste generated in the state by the year 2000 based on the amount of municipal solid waste generated in 1993. Recycling rates are calculated on a county-by-county basis, then summed to derive a statewide rate. The rate calculating formula includes:

  a) materials collected for recycling;
  b) problem materials banned, by statute, from disposal that are recycled;
  c) county-reported mixed municipal solid waste managed and land-disposed;
  d) problem materials banned, by statute, from disposal that are not recycled;
  e) yard waste credit; and
  f) source reduction credit.

  Credits for yard waste can reach 5%; for source reduction, 3%. These credits are earned by demonstrating certain activities. The recycling rate formula and credit checklist are presented in Appendix G. [9]

- **New York** requires local "planning units" to use a generation-based calculation formula to derive a "waste reduction/reuse rate". Waste generation is provided by the planning units in form of either actual measurement, estimates, or other manner. Generation is required by type of waste (e.g., municipal solid waste, C & D, non-hazardous industrial waste, and sewage sludge). The methodology appears to be based upon good judgment by the planning units. See Appendix H for additional commentary. [10]

- **North Carolina** employs a disposal based measurement system. Reports are received from disposal facilities in and out-of-state. The tons disposed in a given fiscal year are divided by the population in the year to derive a per capita disposal rate, which is compared to a base year, Fiscal Year 1990-91. The statewide goal is a 40% reduction in the disposal per capita rate by 2001. [11]

- **Oregon** established a generation-based measurement method premised upon quantifying the amount of recovered material and quantities of solid waste disposed. The quantification is done on a "wasteshed" (generally a county) basis. Wastesheds have different goals varying from 8% for one rural county (Lake) to 52% for the metropolitan Portland area. Legislation passed I 1997 allowed wastesheds to earn credits for three types of source reduction programs (waste prevention, reuse, and home composting). A 2% credit may be earned for each program area possibly earning the wasteshed 6% additional points depending upon program implementation criteria. Information is provided in Appendix I. [(12)]

Conclusions drawn from the review of these and some other state diversion measurement initiatives are:

(1) states have struggled with quantifying source reduction activities and either neglected to address source reduction in its measurement system or allowed some type of credit for certain source reduction programs when implementation criteria have been met.

(2) many states have incorporated a "per capita" element in the measurement system.

(3) many states have quantified recycling activities only where quantities can be measured, thereby not including all of an area's waste generation.

(4) states continue to track disposal and require reporting by disposal facilities (within and out-of-state) to monitor disposal trends.

And, despite emphasis by the U.S. EPA on encouraging use of its uniform recycling measurement method, states continue to develop, revise, and utilize a variety of diversion measurement and disposal reduction reporting methods, as desired by their governing bodies to fulfill local needs and established policies.

APPLICATION OF ALTERNATIVE METHODS TO ALAMEDA COUNTY

Disposal-Based Alternatives. An analysis of disposal trending and per capita's based upon population only was done on a countywide basis for Alameda County. Table 7-2 presents the calculations of disposal reduction performance. The disposal tons were taken from the CIWMB disposal reporting database accessed via CIWMB website. It is likely that the reported disposal tonnage for Alameda jurisdictions may have been revised. This analysis did not take that into account nor was the author aware if the base year (1990) disposal quantities have been revised.

With no adjustments – considering the change in disposed tons from year to year and also from the base year disposal – countywide disposal reduction was 29%. This does not mean that a diversion rate of 29% was realized. It merely measures the reduction in 2000, from 1990 levels, of discarded materials, which were disposed. This is a useful and real-world measure if disposal tonnage can be accurately measured.

Table 7-3 takes the analysis a step farther to derive a "per capita" rate premised upon population and employment. Some states have viewed employees, correctly, as discarded material generators and factored the generating personnel (employees) into the measurement method to further normalize the trending due to growth. Table 7-3 shows that a 28% disposal reduction was realized on a "per capita plus" basis.

Table 7-2. Alameda Countywide Disposal Trend Analysis and Per Capita Disposal Reductions

Year	Disposal	% Change	Population	Per Capita		% Change
	(tons)	(yr to yr)		(pp/year)	(pp/day)	(yr to yr)
1990	2,084,079		1,276,702	3,265	8.9	
1995	1,583,322		1,344,200	2,360	6.5	
1996	1,511,188	-4.6%	1,356,300	2,228	6.1	-5.4%
1997	1,593,881	5.5%	1,381,700	2,307	6.3	3.5%
1998	1,671,661	4.9%	1,408,100	2,374	6.5	2.9%
1999	1,733,255	3.7%	1,438,500	2,427	6.6	1.5%
2000	1,676,470	-3.3%	1,454,300	2,306	6.3	-4.3%
		% Reduction				**% Reduction**
		(from 1990)				(from 1990)
2000	1,676,470	-19.6%	1,454,300	2,306	6.3	-29.4%

Table 7-3. Alameda Countywide Disposal Trend Analysis and "Per Capita Plus" Derivation (Population plus Employment)

Year	Disposal	% Change	Population	Employment	Pop plus Emp	Per Capita Plus		% Change
	(tons)	(yr to yr)				(pp/yr)	(ppd)	(yr to yr)
1990	2,084,079		1,276,702	655,800	1,932,502	2,157	5.9	
1995	1,583,322		1,344,200	642,700	1,986,900	1,594	4.4	
1996	1,511,188	-4.6%	1,356,300	646,900	2,003,200	1,509	4.1	-5.3%
1997	1,593,881	5.5%	1,381,700	667,100	2,048,800	1,556	4.3	3.1%
1998	1,671,661	4.9%	1,408,100	680,900	2,089,000	1,600	4.4	2.9%
1999	1,733,255	3.7%	1,438,500	697,500	2,136,000	1,623	4.4	1.4%
2000	1,676,470	-3.3%	1,454,300	718,100	2,172,400	1,543	4.2	-4.9%
		% Less						**% Less**
		(from 90)						(from 90)
2000	1,676,470	-19.6%	1,454,300	718,100	2,172,400	1,543	4.2	-28.5%

Although these results may be viewed as disappointing because the measurement system in California seeks to determine a diversion rate in excess of 50% and in Alameda County approaching 75%, it addresses a different mindset. Real disposal reduction accurately measured will:

- conserve available permitted disposal capacity; and
- minimize potential adverse environmental impacts from landfilling.

However, this disposal-based methodology alone, does not address the need to conserve natural resources nor recovers the residual value in discarded materials. Coupled with a generation-based measurement incentive, this methodology can be a useful tool to communicate the need to divert more AND dispose of less.

Generation-Based Alternative. The ideal generation-based measurement system is approached when diverted materials are quantified as completely as possible. The difficulty is knowing all of the diversion activities being practiced and estimated reasonably the impact on diverted quantities from those activities. Although many efforts have been made to quantify source reduction (waste prevention), the cost-effectiveness to conduct this quantification is still questionable. However, Alameda jurisdictions should still continue to:

1) Increase awareness of ongoing diversion activities in all sectors of the residential, commercial, agricultural, and industrial sectors; and

2) Strive to record quantities either weighed, measured, or estimated to approach a quantification of the total discarded material stream being diverted from disposal.

3) Consider developing a source reduction credit methodology. This recommendation is meant to recognize the impacts resulting from effective waste prevention (source reduction) programs without allocating extensive resources to survey or otherwise quantify source reduction diversion amounts.

Lastly, each Alameda County jurisdiction should calculate its individual disposal reduction "per capita" and "per capita plus" results.

8.0 OBSERVATIONS AND RECOMMENDATIONS

The Recycling Board should consider:

1) Tracking disposal tonnage from year to year, noting the change between years. Although growth will increase the amount of discarded materials, real progress can be achieved by reducing the disposal of discarded materials in spite of growth. This, in effect, will reduce the need for disposal capacity expansion and the risks associated with disposal facilities.

2) Require the managers of facilities (transfer stations, landfills), which receive discarded materials to observe and track the manner in which discarded materials are delivered. This leads into characterization of the disposed (discarded) waste stream, which, I understand, has likely been already accomplished. However, CWA suggest that increased responsibility, perhaps with incentives, be placed upon the facility managers to strive to target increased potentially recoverable and reusable materials. These "observation" programs can also lead to route modifications for reducing the contamination of potentially recoverable materials.

3) Increasing the quantification of diverted materials, where practical.

4) Utilize a combination of disposal trend analysis with per capita computations for measuring the effectiveness of disposal reduction.

5) Use a generation-based method to quantify diversion tonnage – coupled with disposal quantities to calculate diversion rates.

Too many current methodologies for estimating source reduction are based on broad assumptions, which are questionable. Furthermore, CWA believes that the efforts to estimate impacts due to projections and extrapolation are not well founded.

9.0 REFERENCES

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