Appendix A
Cost Update

Contents

Introduction

This analysis is an appendix to the Initial Statement of Reasons (ISOR) originally posted on January 18, 2019, and subsequently updated in June of 2019, for the Short-lived Climate Pollutant: Organic Waste Reduction regulations. This document includes additional analysis of the potential costs and benefits associated with the regulation. This analysis aligns the projected economic cost of the regulation with the tons and material types projected in environmental analysis *(Draft Environmental Impact Report)* of the regulations. This analysis additionally reflects new environmental and economic data that matured after the release of the Standardized Regulatory Impact Assessment in 2018. The analysis additionally aligns the cost estimates with 2019 estimates of inflation, population and employment. Finally, this analysis includes estimates of costs and savings resulting from changes to the regulation, as well as changes in methodology for estimating the costs of specific provisions in the regulation in response to comments received through the public rulemaking process.

This appendix presents several potential cost scenarios and sensitivity analyses to demonstrate the potential range of costs and benefits associated with the proposed regulation. Several scenarios projecting different levels of disposal are presented here.

This analysis demonstrates that the single largest factor impacting the cost of the proposed regulation is the projected amount of disposal that must be redirected to recovery activities. The administrative costs associated with the direct regulatory requirements (e.g. education and outreach, contamination sampling) represent less than five percent of the gross cost associated with achieving the organic waste reduction targets required by statute. See *Changes to the Regulation*. The vast majority of costs are driven by significant investments associated with establishing the infrastructure necessary for collecting, processing, and recovering the amount of material required by statute. These costs represent the minimum costs associated with recovering the tons required by statute. In other words, these are the costs that would occur under any regulatory structure that is designed to achieve the statutory targets.

Ultimately, this analysis demonstrates that, consistent with the findings in the SRIA, the cumulative economic, public health, and climate benefits associated with recovering organic waste exceed cost of the investments required. The successful implementation of the regulations will create thousands of green jobs, generate billions in economic activity and benefits, and protect Californians from immediate and long-term health and environmental impacts valued in the billions of dollars. However, these benefits cannot be achieved without substantial investments in new collection, processing, and recovery infrastructure. Consistent with statutory requirements, the regulations are designed to achieve the statutory targets in the least burdensome and most cost-effective method possible.

Updates of Cost Input Assumptions

Newly Available Data

This analysis includes primary data sources that have matured or become available after the SRIA was prepared. The SRIA relied on the best data that was available at the time. Given the newly available data, CalRecycle is presenting several new cost scenarios and cost methodologies to disclose the potential economic costs and benefits of the regulation. The primary data inputs and modifications to methodology noted here are applied to all scenarios discussed in this analysis. See *Statewide Cost Scenarios* for a summary and cost calculation of each scenario. See also *Addendum 3 Scenario detail* for a discussion on how the scenarios were developed.

2019 Department of Finance Population Projections

CalRecycle linked population projections to Department of Finance (DOF) projections that became available in 2019. The revised DOF figures project a population increase that is slightly more modest then the DOF projections available at the time the SRIA was conducted. As the disposal projections are tied to population, the revised population figures have a slight moderating impact on the total amount of material that must be recovered under each scenario from 2019-2030.

2016 and 2017 Disposal Actuals

The environmental analysis employed disposal data that was available in May 2019 (Disposal actuals through 2017). This data demonstrates a substantial statewide increase in Per Person Disposal (PPD) amounts. The increase shown in the EIR is accounted for this analysis.

2017 disposal data represents the single, sharpest, year-over-year increase in PPD (0.3) to occur since the implementation of the Disposal Reporting System, and it represents the longest period of sustained disposal growth to occur since 2002-2005. (The Disposal Reporting System has been replaced by the Recycling and Disposal Reporting System per AB 901 [Gordon, Chapter 746, Statutes of 2015]). To account for this, CalRecycle prepared several disposal projection scenarios that could occur during the analysis period (2019-2030). For each scenario, the department projected the amount of material that must be redirected from disposal in the years 2019-2030. CalRecycle applied PPD numbers to Department of Finance population projections from 2019 through 2030 to project Business As Usual (BAU) disposal for each individual calendar year.

2019 Economic Conditions

In addition to accounting for new disposal projections, cost projections have been adjusted to reflect inflation for the year 2019 using the Consumer Price Index (CPI). Additionally, new economic data regarding the value of paper commodities is considered in a sensitivity analysis that is applied to each scenario.

The previous analysis was conducted before the impacts of new environmental standards adopted in China and other nations receiving export materials from California were fully realized. China and other nations that previously accepted large amounts of recyclables from California began adopting contamination limits on recyclable material imported from the US and other countries in 2017 and 2018. The phasing in of these new policies has coincided with a significant drop in the economic value of recovered commodities such as paper and cardboard.

Additional Factors Considered in Revised Projections

Cost Methodology Adjusted in Response to Comments

In the first 45-day comment period on the regulations (January 18–March 4), in addition to comments on substantive policy requirements in the regulations, CalRecycle received comments on cost methodology employed in various sections of the SRIA. In response to these comments, CalRecycle revised several provisions in the regulatory text. In response to stakeholder comments, CalRecycle has also revised the methodology used to estimate the costs of certain regulatory provisions.

Edible Food Recovery Costs

The department revised the requirements and the methodology for calculating costs associated with the edible food recovery requirements.

The SRIA relied upon studies cited in the Short-lived Climate Pollutant (SCLP) Strategy to determine the potential costs and benefits of achieving the edible food recovery targets. In response to stakeholder issues with this approach, and their concerns with the findings in the studies cited in the SLCP, CalRecycle revised the methodology for analyzing the potential economic impacts of food recovery in several ways. The revised edible food recovery costs and the revised methodology for calculating those costs are discussed in *Costs Associated with Infrastructure Collection and Processing: Edible Food Recovery.*

Transportation Cost Assumptions

The SRIA notes that an increase or decrease in Vehicle Miles Traveled (VMT) could not be projected at the time the SRIA was produced. This assessment remains true today, as noted in the *Draft Program Environmental Impact Report for SB 1383 Regulations—Short-Lived Climate Pollutants: Organic Waste Methane Emission Reduction:*

> *"Decisions by project proponents regarding the choice of compliance options and the precise location of new or modified facilities related to implementation of the proposed regulation cannot be known at this time. Furthermore, due to local planning, political (i.e., the willingness of jurisdictions to address local opposition to the siting of new or expanded facilities), and economic influences, attempting to predict project approvals*

about the specific location and design of facilities and operations undertaken in response to the proposed regulation would be speculative and infeasible at this stage. As a result, there is some inherent uncertainty in the degree of mitigation that would ultimately need to be implemented to reduce any potentially significant impacts identified…

While several stakeholders raised concerns with the assessment in the SRIA and the Draft EIR, CalRecycle did not receive conclusive data tangibly demonstrating a quantifiable increase in VMT that could be calculated as a result of the regulation. For a further discussion on the potential greenhouse gas emissions associated with potential increases in VMT, stakeholders should consult the Draft EIR.

Local governments that prioritize reductions in VMT in their planning process may employ mitigation measures designed to reduce VMT. As the regulations are implemented, these jurisdictions may realize localized reductions in VMT and in fuel costs. Local governments that do not prioritize VMT reductions are more likely to experience increased transportation costs and an increase in VMT. Despite the uncertainty associated with increased VMT, this analysis includes an estimate of potential costs that could occur as the regulation is implemented. See *Cost Sensitivity Analyses: Transportation Cost Sensitivity* for a sensitivity analysis demonstrating a potential range of transportation costs that could be incurred as a result of the regulation.

Changes to the Regulation

Costs Associated with Direct Regulatory Requirements

This section discusses the projected changes to direct regulatory costs resulting from changes in the final draft of the regulations.

The Administrative Procedures Act necessitates that a rulemaking agency produces economic estimates for public consideration prior to submitting the initial draft of regulatory text. CalRecycle has made several significant changes to the regulations in response to stakeholder feedback. These changes reduced or eliminated certain requirements of the regulations. The changes cumulatively reduce the total cost of direct compliance obligations. This could not be analyzed when the SRIA was prepared, as the number of comments warranting changes to the regulatory text could not be known at the time. In order to disclose potential changes in costs borne by regulated entities, the department has calculated the cost of the revised regulatory requirements. Ultimately, the regulatory changes reduce the total cost of compliance compared to the compliance costs analyzed in the SRIA.

Table 1: Direct Regulatory Costs (in millions)

Direct Cost Category	SRIA Estimates	Final Regulation Text[1]	Difference

MWELO/CalGreen	$0	$65	**$65**
Capacity Planning	$18.8	$6.2	**($12.6)**
Procurement	$391	$288	**($103)**
Hauler Contamination Monitoring & Reporting	$771	$60.7	**($710)**
Waste Sampling	$468	$156	**($312)**
Load-checking	$486	$0	**($486)**
Edible Food Recovery Reporting	$36	$23	**($13)**
Education and Outreach*	$500	$462	**($38)**
Coordination of Edible Food Recovery Programs*	$14.2	$13.2	**($1)**
Collection & LEA Enforcement Costs	$399	$530	**$131**
Application of Long-Term Cover	$270	$0	**($270)**
Adjustment of Franchise Agreements	$20	$20	**$0**
Solid Waste Facility Reporting	$6.3	$6.3	**$0**

Preparation of Status Impact Reports	$1	$1	**$0**
Reporting by Local Governments	$29	$29	**$0**
Total	$3,410	$1,660	($1,750)

Note: sums are rounded

The regulations waive or phase-in aspects of many of these requirements for rural jurisdictions. While this will reduce the cost of implementation statewide, the reduced costs realized from waiving requirements for rural jurisdictions was not factored into the cost categories in Table 1. For a discussion on cost savings realized by rural jurisdictions as a result of waivers and regulatory changes see *Regional Variation: Rural Cost Estimates.*

New Cost Categories

Model Water Landscape Efficiency Ordinance (MWELO) & CalGreen

The initial draft of the regulations did not include requirements for CalRecycle or jurisdictions to ensure compliance with MWELO. Jurisdictions are already under a legal obligation to comply with MWELO and CalGreen therefore costs associated with implementing those programs should already be incurred by jurisdictions. However, failure to comply with these programs is not currently subject to penalties administered by CalRecycle. This cost assumption conservatively assumes jurisdictions do not currently bear these costs and will only incur the cost of compliance with these programs in response to these regulations. This cost assumption likely overestimates the cost of compliance.

To estimate costs, CalRecycle surveyed several jurisdictions that provided an estimate of the costs they incur for implementation of MWELO as well as CalGreen as a whole. CalRecycle extrapolated the reported costs from those surveys and applied them statewide on a per capita basis. This new cost category likely overestimates the cost of compliance with this provision of the regulation as it includes the entire estimated cost of MWELO and CalGreen compliance, where as the regulations only require compliance with specific relevant provisions. However, to disclose any potential costs associated with the regulation, this document discloses the cost of compliance with this provision as though it were an entirely new requirement.

Modified Cost Categories

Organic Waste Capacity Planning Costs

The department revised the estimates of organic waste capacity planning costs to reflect the reduced frequency of this requirement. Previously, the regulations required planning documents to be updated annually, while the final draft of the regulations (October 2, 2019) only requires planning documents to be submitted periodically (a total of three times during the analysis period), start-up costs remain essentially identical but ongoing costs are reduced.

Procurement

The procurement requirements in the final draft of the regulations were expanded to include a wider array of product categories that a jurisdiction could procure to comply with the regulation. The cost projections for procurement in the SRIA assumed local governments would be required to procure minimum amounts of compost or renewable natural gas (RNG) for use as a transportation fuel. The final regulation allows a jurisdiction to comply through the procurement of the following products that are demonstrably sourced from recovering organic waste: compost, mulch, electricity derived from biomass conversion, and RNG used for transportation fuel, electricity, and various heating applications.

As the amount of each product category that will be procured by each jurisdiction can't be projected with certainty, CalRecycle assumed each category would account for an equal portion of procurement with the exception of biomass conversion, which is assumed to process less material as the number of facilities is not anticipated to expand and the facilities face more feedstock limitations then solid waste facilities. This methodology may overstate costs as jurisdictions would presumably procure the most affordable product available to them that is readily usable. For example, assuming each jurisdiction were to procure renewable natural gas derived from recovered organic waste for use in heating applications, which is the cheapest recovered organic product, the total statewide procurement cost over the 12-year analysis period would total roughly $30 Million.

Table 2: Estimated Cost of Each Product Per Ton of Organic Waste Recovered

Compost/ Mulch Cost	Renewable Fuel Cost	Electricity Cost	Heat Cost	Generic Pipeline Cost	Biomass Electricity Cost
$ 17.40	$ 10.08	$ 9.68	$3.96	$ 5.14	$26.00

Note: Costs represents estimated statewide average and may vary by region

The cost for electricity generated from biomass conversion and renewable natural gas (RNG) was derived assuming a price premium of $0.04/kwh over the average retail electricity rate in California. CalRecycle used data from the U.S. Energy Information Administration, Southern California Edison, and PG&E to derive this estimated cost premium. The price premiums that jurisdictions would have to pay to procure electricity from these sources were then converted to a price per ton of feedstock of $26 per ton for biomass conversion and $9.68 per ton for electricity generated from RNG.

The cost for the use of RNG in heating applications was based on an average of PG&E and Southern California Gas commercial gas rates of $0.90/therm. A 20 percent rate premium was applied to that value, to get an $0.18 price premium for heat from RNG. This price premium was then converted to a price premium per ton of feedstock of $3.96 per ton.

The cost for the use of RNG as fuel was estimated by applying a 20 percent premium to the price of $2.40 per gallon of fossil CNG in California, which was obtained from the CNG Now website. The price premium of $0.48 per gallon of RNG was converted to a price premium per ton of feedstock of $10.08 per ton.

The cost for procuring renewable gas injected into the common carrier pipeline was estimated by applying a 20 percent premium to the average California commercial price of $9.88 per thousand cubic feet, per the U.S. Energy Information Administration. This price premium was converted to a price premium per ton of feedstock of $5.14 per ton. Although the final draft of the regulations do not include pipeline injection of renewable gas as an end-use of renewable gas, jurisdictions may still procure renewable gas from the pipeline for an eligible end use. Therefore, the costs associated with procuring pipeline injected gas are included here.

The price of compost was obtained by conducting a survey of several facilities in California, which found that the overall cost to purchase compost at a bulk rate, transport it, and apply the compost to land was $30 per ton of compost, which was converted to a price of $17.40 per ton of feedstock. The cost of mulch can range substantially, but for the purpose of this analysis the cost of mulch was considered comparable to the cost of procuring compost and included in the same cost category. This may overestimate the cost of mulch in some regions and underestimate the cost in others but is used here to represent an estimated statewide average.

Hauler Contamination Monitoring and Reporting Requirements

The department revised the cost estimates of the contamination monitoring requirements to reflect the reduced frequency of the regulatory requirements. The same per capita cost estimates employed in the SRIA were updated with the latest population estimates and applied statewide. The frequency projected in the SRIA reflected the cost of compliance where a minimum of monthly contamination monitoring would be necessary to comply, the revised projections reflect the final draft regulations where the frequency of contamination monitoring was reduced to annual. The final draft regulations also allow for a facility-based monitoring approach. The cost of samples conducted for facility-based monitoring is assumed to be comparable to the cost of waste sampling requirements, as the nature and frequency of the sampling is similar. CalRecycle did not attempt to project which compliance option jurisdictions would select, as it is assumed jurisdictions would select whichever compliance option is more cost effective for their situation. The cost shown for this category in the table represent the projected statewide cost of annual container-based monitoring.

Waste Sampling

The waste sampling costs represent the revised processing costs for solid waste facilities to measure for recovery efficiency, incompatible materials, and the presence of organic waste in material sent to disposal (organic waste residual levels). The waste sampling cost also includes the estimated cost for transfer stations to conduct gray container waste evaluations.

The sampling frequency for all processing measurements was reduced in the final draft of the regulations compared to the initial draft. The initial cost estimates projected the sampling costs associated with daily sampling requirements for recovery efficiency, incompatible material levels, and organic waste residual levels. In the final draft, the frequency was reduced to a minimum sampling frequency of 40 days per year rather than each operating day. Sampling is estimated to cost $4,560 per facility per year. This is based on an estimate of each sampling event requiring 2 hours of employee time for a total of 80 hours per facility. This cost was applied to the projected number of facilities required to comply with the statutory reduction targets and calculated for each individual year. This results in a projected annual cost of $15.9 Million.

Each transfer and processing facility receiving more than 500 tons per year from a single jurisdiction is additionally required to perform a gray container waste evaluation once per quarter. Conservatively estimating that every transfer and processing facility in California meets the threshold would result in roughly 3,000 required samples per year. CalRecycle estimates that each sample would require an additional four hours of staff time for each sample. This produces an annual statewide cost estimate of $1.4 Million.

Load Checking

The originally proposed daily load checking requirements were removed from the final draft of the regulation. The anticipated benefits of this requirement were replaced with the more cost-effective gray container waste sampling requirements operating in conjunction with the revised contamination monitoring requirements (which are described in the two sections immediately preceding this one).

Edible Food Recovery Reporting

The food recovery reporting requirements were amended to only apply to food recovery organizations and food recovery services that have a contract or written agreement with commercial edible food generators. Data from CalRecycle's Food Waste Prevention and Rescue Grant Program (FRP) was used to estimate the number of food recovery organizations. CalRecycle used the annual tonnage that each Food Waste Prevention and Rescue grantee is expected to recover to determine a weighted average capacity. This capacity was applied to the tons that CalRecycle projects must be recovered for human consumption in order to achieve the edible food recovery targets of the statute. This results in an estimated equivalent of 3,000 food recovery organizations and services operating by 2030 (these could be expansions of existing facilities, not necessarily new facilities) that would be required to report each year. As many of the costs associated with reporting are considered in the following operating and management (O&M) calculations, CalRecycle surveyed existing food recovery organizations to reassess the total cost of only reporting on the pounds recovered annually. This estimate of approximately $1,050 per year was applied to the estimated number of food recovery organizations and services that will be necessary each year. To ensure that reporting costs were not underestimated, CalRecycle assumed that the calculated equivalent of 3,000 food recovery organizations and services would each constitute an individual reporting entity.

*Education and Outreach Costs***

The education and outreach requirements were amended in the final version of the regulation. The final version of the regulation aligns the requirements to translate educational materials with existing government code requirements, providing jurisdictions more discretion to align translation of educational materials with their current level of translative services rather than the minimum levels proposed in the initial draft of the regulations, and potentially lowering costs. Additionally, requirements to target and identify individual self-haulers for education regarding self-haul requirements were streamlined to clarify that jurisdictions are not required to seek out individual self-haulers for targeted education.

CalRecycle employed the same methodology used in the SRIA to calculate costs associated with education and outreach on a per capita basis based on surveys of jurisdictions. The per capita costs were updated to reflect the current population projections which had a slight moderating effect on the total projected cost.

*Coordination of Edible Food Recovery Programs***

The substantive requirements regarding jurisdiction's obligation to implement and coordinate edible food recovery program did not change significantly from the requirements analyzed in the SRIA.

CalRecycle employed the same methodology used in the SRIA to calculate costs associated with coordinating edible food recovery programs on a per capita basis based on surveys of jurisdictions. The per capita costs were updated to reflect the current population projections which had a slight moderating effect on the total projected cost.

Collection & LEA Enforcement Costs

The LEA enforcement costs and local jurisdiction collection enforcement were revised to reflect several changes to the draft regulations. LEA enforcement costs increase as the projected number of facilities required to achieve the organic waste disposal targets increase. LEA enforcement costs were also expanded to include costs associated with inspecting land application sites. While land application site inspections are not an explicit requirement of the regulation, the final draft of the regulation requires LEAs to inspect material destined for land application, which is expected to trigger independent land application site inspections. The total projected LEA inspection costs resulting from the requirements of this regulation are estimated at $12.1 Million.

Enforcement costs estimated for collection of solid waste use a similar methodology to the estimates employed in the SRIA. The primary impact on the projected costs is the increased number of businesses that exist statewide, due in part to new estimates of businesses based on 2019 data and new estimates the number of multi-family housing units that would constitute commercial businesses subject to inspection, see *Net Impacts to Businesses and Individuals*. Initial costs are estimated to be lower in 2022 and 2023 ($66 million compared to the previous estimate of $91 million), but they remain higher in the years 2024-2030 then previously projected ($51-$61 million compared to the previous estimate of $31 million). The higher sustained costs are similarly associated with the revised projections of the number of businesses that would be subject to jurisdiction monitoring.

Application of Long-Term Cover

The requirement to apply long-term cover was previously projected to cost $30 million per year. This requirement and the associated costs were removed from the final draft of the regulation.

Unchanged Cost Categories

Adjustment of Franchise Agreements

Costs associated with local governments adjusting local franchise agreements or contracts with haulers has not changed from the original estimate.

Solid Waste Facility Reporting

The data that must be reported did not change substantively from the previous version of the regulations. The cost of reporting through RDRS each quarter is not expected to change from previous estimates. The estimated cost of reporting for SB 1383 is approximately 10 percent of the estimated cost of reporting projected in the AB 901 rulemaking. This cost category represents the functional cost of reporting information to CalRecycle. The financial impact of any regulatory changes that altered the type of data that must be collected are represented in those categories.

Reporting by Local Governments

The data that must be reported did not change substantively from the previous version of the regulations. The cost of reporting to CalRecycle annually is not expected to change substantially from previous estimates. Please note that this cost category only represents the functional cost of reporting information to CalRecycle. The financial impact of any regulatory changes that altered the type of data that must be collected are represented in those categories.

Status Impact Report Costs (SIR)

The methodology for estimating the projected cost of the SIR was revised to reflect changes to the regulations. The projected cost of the revised requirement is comparable to the cost of the initial SIR requirements. For the revised SIR requirements, CalRecycle estimates that the cost of producing the primary aspects of the SIR will be $3,000 per landfill for a total cost of $372,000. CalRecycle revised the projected cost of the SIR to include the cost for landfill operators to identify areas where intermediate cover is being used for extended periods of time and to provide the results of surface testing performed over areas where intermediate cover is in place for more than 12 months.

CalRecycle also revised the projected cost to include the cost of evaluating the effectiveness of intermediate cover and comparing the performance of final cover. CalRecycle also estimated the costs associated with landfill operators taking actions to improve the effectiveness of intermediate cover and reevaluating its effectiveness. The original requirements to identify areas that will use intermediate cover and report the results of the surface testing were maintained. The requirement to compare the effectiveness of intermediate cover to final cover were ultimately removed from the final version of the regulation. However, CalRecycle conservatively estimates that if the SIR reveals that it is necessary to improve the intermediate cover, landfill operators would take actions to improve it. As a result, CalRecycle incorporated the projected costs of testing and investing in actions to improve the performance of intermediate cover (anticipated $600,000 statewide).

Statewide Cost Scenarios

Scenario One: AB 939 Disposal Trend (1989–2000)
This scenario projects a linear model of PPD reductions experienced in the 12 years following the enactment of AB 939. In 1989, CalRecycle estimates California had a disposal rate of 8.4 PPD which ultimately decreased to 6.3 PPD in the year 2000. This model projects a linear decrease that achieves an equivalent PPD reduction from 2019 to 2030.

Scenario Two: AB 341 and AB 1826 Compliance by 2022
This scenario assumes local government and commercial business efforts to implement Mandatory Commercial Recycling and Mandatory Organic Waste Recycling laws will reduce disposal to the AB 341 goal of 2.7 PPD by the year 2022 and that disposal will remain at 2.7 PPD through 2030 (reductions from 2019-2022 are a linear reduction from 5.3 PPD to 2.7 PPD). This scenario demonstrates that, if local government efforts that began in 2012 under AB 341 and expanded in 2014 under AB 1826 were sufficient to successfully achieve the statutory targets set out in that legislation, costs associated with SB 1383 implementation would be substantially reduced.

Scenario Three: Environmental Impact Report (EIR) Projections Averaged PPD
This scenario assumes that per capita disposal from 2019-2030 will reflect the average PPD experienced from 2000 to 2017 (5.3 PPD). The 2000-2017 average includes periods of economic growth and economic recession. While several intervening years may have PPD that is substantially higher or lower, 5.3 PPD represents a reasonable average of BAU disposal without SB 1383 implementation. The PPD and total disposal projections employed in this scenario are in alignment with the projections presented in the Environmental Impact Report for SB 1383.

Table 14: Projected Economic Scenarios

Projection	Total Amount of Recovery Required	Gross Cost[1]	Gross Benefit[2]	Net Cost	Rural Waivers Discount[3]
SRIA	194 Million Tons	$20.9 Billion	$17 Billion	$3.9 Billion	$424 Million
Scenario One	212 Million Tons	$ 28.7–29.9 Billion	$ 21.9–20.2 Billion	$ 6.8–9.7 Billion	$463 Million
Scenario Two	140 Million Tons	$ 19.2–20.0 Billion	$ 14.4–13.3 Billion	$ 4.9–6.8 Billion	$306 Million
Scenario Three	289 Million Tons	$ 39.2–40.9 Billion	$ 30.4–28.1 Billion	$8.8–12.8 Billion	$632 Million

1. *Gross Costs* range depending on estimates of transportation costs.
2. *Gross Benefit* estimates range depending on the projected commodity values for fiber. Gross benefits does not include the value of avoided health and social costs.
3. *Rural Waivers Discount* provides an estimate of the net costs that are waived for rural areas of the state under Scenario Three. The value of the waiver is proportionally reduced based on the tons that must be recovered in all other scenarios. See *Rural Cost Estimates*.

Scenarios one and two represent modifications of the disposal tonnage projected in the Draft Environmental Impact Report (EIR). The EIR employed the projections used in scenario three, where PPD is averaged over the last 17 years. This figure was selected as the most reasonable projection of BAU disposal and was used for the purposes of CEQA compliance to disclose any potentially significant environmental impacts associated with the regulations. To ensure that the projection of net costs and benefits for SB 1383 regulations are in alignment with the assumptions in the Environmental Impact Report, this scenario is considered the primary scenario and is used for economic modeling, and estimates of impacts to businesses and individuals.

Future waste generation and disposal levels, which are the primary factor impacting costs, cannot be predicted with certainty. An economic recession could substantially decrease the amount of material generated for disposal, resulting in a substantial decrease in the tons that must be collected, processed, transported, and recovered, and ultimately the capital expenditures necessary to finance and construct organic waste recovery infrastructure necessary to manage the material. Likewise, sustained or increased economic growth will result in a substantial increase in the tons that must be collected, processed, transported, and recovered in order to achieve the organic waste reduction targets.

Costs Sensitivity Analyses: Commodity Values and Transportation Costs

Fiber Values Sensitivity

As noted above, the previous analysis was conducted before the impacts of new environmental standards adopted in China and other nations receiving export materials from California were fully realized. The phasing in of these new policies has coincided with a significant drop in the economic value of recovered fibers, such as paper and cardboard. The future values of these commodities is uncertain, but they will have a substantial impact on the cost of implementation. To reflect this uncertainty, CalRecycle is providing a range of costs that reflect a range of fiber values and applies those values to the tons of fiber material projected to be recovered to meet the statutory recovery levels.

To develop these ranges CalRecycle reviewed data on the market value for paper grades in May and June 2019. CalRecycle used a weighted average using projections of recovered material to estimate an average commodity price of $14.07 per ton for newspaper, white ledger, and other paper. For cardboard, CalRecycle used the reported average value of $7.50 per ton. This represents a substantial decrease in the commodity value of these materials. To develop the high end of the range, CalRecycle relied on fiber values for November 2017. Employing the same methodology results in a weighted average commodity price of $53.03 per ton for newspaper, white ledger, and other paper. For cardboard, CalRecycle used the reported average value of $115 per ton.

It is reasonable to assume that fiber values will recover as jurisdictions, the waste industry, and the state invest in education to reduce container contamination. Similarly, investments in technology designed to remove contaminants and improve the quality of recovered material, as well as efforts to secure new local and foreign markets for this material, could improve prices for this material during the period of the analysis. Quantifying the impact these efforts will have on fiber values would be speculative, particularly as markets are global and not only impacted by actions taken in California. The ranges presented below are intended to disclose best- and worst-case scenarios for the value of recycled fiber.

Low Fiber Values

This analysis assumes that fiber values will remain at current levels indefinitely. This scenario applies fiber values reported in May and June 2019 and holds that value constant for all years in the analysis.

Medium Fiber Values

This analysis assumes that by 2025 fiber values will rebound to their reported values in November 2017 (May and June 2019 fiber values are used for 2019-2024). Fiber values are then assumed to remain constant at the 2017 values from 2025-2030.

High Fiber Values

This analysis applies the November 2017 fiber values to the entire analysis period of 2019-2030.

Table 3: Fiber Values Sensitivity (in millions)

Scenario	Low Fiber Values	Medium Fiber Values	High Fiber Values
Scenario 1	$338	$1,550	$1,991
Scenario 2	$219	$1,001	$1,291
Scenario 3	$467	$2,241	$2,750

Transportation Costs Sensitivity

The collection costs calculated in the original SRIA, and shown in the following *Collection and Processing of Organic Waste* section, relied upon values derived from *Cost Study on Commercial Recycling* prepared by HF&H Consulting and Cascadia Consulting Group for CalRecycle. The values in the cost study included fuel costs associated with collecting organic waste as a part of the total cost of collection. In this analysis, the department has additionally included data available from the cost study to project a range of potential costs associated with transporting finished products (e.g. compost, recycled paper, etc.) to market. While fuel costs were included in the original SRIA, this analysis shows a range of additional potential cost scenarios.

The *Cost Study on Commercial Recycling* provides a statewide weighted average cost per ton for transporting a range of recovered commodities to market. The transportation costs represent the cost of delivering finished product to market. (As noted above, the fuel and transportation costs associated with collection are a part of the collection line-item shown in *Collection and Processing of Organic Waste*). For each material category, the per ton transportation costs include 1) base costs, 2) fuel costs, and 3) hauling costs. Base costs are defined as the minimum charge for picking up the materials from the processing facility. This represents the cost of loading, unloading, queuing, and a minimum travel distance of 10 miles. The fuel and hauling cost components represent the additional cost per ton per mile beyond the minimum charge. The calculator includes per ton costs for various material categories (e.g. compostables, glass, wood waste, etc.). The transportation costs were applied to the projected tons that would be recovered in each category. The *Cost Study on Commercial Recycling*, and the O&M costs for compost and AD derived from the SLCP economic assessment, include several similar or duplicative costs associated with collecting material from a facility. This was controlled for in the following low and medium transportation costs summaries. For each sensitivity analysis for transportation costs, slight variations were made to the calculator.

Low Transportation

In this scenario, green waste and compostables, which are assumed to be transported to compost or anaerobic digestion facilities, only incur the fuel and hauling costs identified in the *Cost Study on Commercial Recycling* analysis, as the base cost from that analysis includes cost factors that are already included in the infrastructure O&M costs that CalRecycle derived from the SLCP analysis and applied to those materials. In this scenario, the per ton transportation cost for bringing compostables and green waste to market is $2.77 per ton (the combined fuel and hauling costs).

This scenario also only applies the base cost of $8.30 per ton to paper, cardboard, and wood waste. The base cost represents the cost of collecting the material from a processing facility and transporting it a modest distance to market.

Medium Transportation

This analysis employs the same assumption for transportation costs for compostable and green waste as the low transportation analysis. However, the cost for paper, cardboard and wood waste is increased to include fuel and haul costs categories. This increases the projected cost of transporting these materials to $17.48–$20.63 per ton.

High Transportation

This analysis applies the base cost, fuel, and hauling costs to all material categories. As noted above, this scenario likely overstates the transportation costs for compostable and green waste, as the base cost factor includes costs that are already included in the infrastructure O&M costs for compost and AD facilities (see *Organic Waste Recycling Infrastructure Costs*). In this scenario, the per ton cost for transporting paper, cardboard, and wood waste are the same as the medium transportation analysis. The per ton transportation costs for green waste and compostables increases to $11.05 and $11.02, respectively.

Table 4: Transportation Costs Sensitivity (in millions)

Scenarios	Low Transportation	Medium Transportation	High Transportation
Scenario 1	$698	1,389	$1,910
Scenario 2	$455	$904	$1,246
Scenario 3	$965	$1,919	$2,639

Costs Associated with Infrastructure Collection and Processing

The costs associated with the infrastructure, collection, and processing capacity necessary to recover the minimum amounts of organic waste required by statute are presented in this section. These categories represent the cost associated with recovering anywhere from 140 million tons of organic waste(Scenario 2) to 289 million tons of organic waste (scenario 3). The costs presented here constitute the majority of the costs calculated in this analysis for all scenarios; these costs represent the investments required by the statute regardless of the regulatory structure.

Organic Waste Recycling Infrastructure Costs

In the SRIA, CalRecycle estimated the number of new or expanded facilities that would be constructed based on the projected BAU disposal numbers and the resulting amount of material that would be required to be recovered from 2019-2030 (194 million tons). CalRecycle updated the facility projections for the Draft EIR to reflect the revised projection that SB 1383 will require a minimum recovery of 289 million tons of organic waste from 2019-2030. This increases the total number of new or expanded compost and anaerobic digestion facilities projected as necessary to comply with the statutory reduction targets (see Table: 2-18 in *Draft Program Environmental Impact Report*). CalRecycle used the revised facility numbers projected in the *Draft Program Environmental Impact Report* to revise the estimates of the total costs associated with the construction and management of new facilities in this analysis.

To estimate the cost associated with the construction of anaerobic digestion and compost facilities, CalRecycle updated the estimates used in the SRIA. CalRecycle recognizes that there is uncertainty regarding the costs, savings, and potential revenue streams associated with organic waste reduction and recovery. Additional uncertainty related to existing infrastructure and technology development may also create economic impacts that are not evaluated in this analysis.

The figures displayed in Table 5 below demonstrate conservative estimates of capital expenditures. For example, while many stakeholders have indicated that substantial existing anaerobic digestion infrastructure at waste water treatment plants can be accessed, potentially significantly reducing the capital expenditures necessary to construct AD infrastructure, CalRecycle's cost projections assume a more conservative scenario where all AD facilities are entirely new, resulting in substantially higher capital expenditures. Additionally, consistent with the SLCP analysis, all new compost infrastructure is assumed to employ a covered aerated static pile system, which is typically more capital intensive than traditional composting systems and would substantially increase the cost of capital infrastructure. The O&M costs represent the cost of processing organic waste at compost and anaerobic digestion facilities and bringing the final product to market. To estimate the cost of infrastructure and O&M for the scenarios where less waste must be recovered, CalRecycle proportionally reduced the costs to a level commensurate with the reduced tonnage.

Table 5: Capital Expenditures and Operations and Management (in millions)

Scenario	Capital Expenditures	Operations and Management
Scenario 1	$2,628	$5,775
Scenario 2	$1,657	$3,801
Scenario 3	$3,739	$8,047

Revenues from Recycling Facilities

Markets for products from organic waste recycling rely on many variables. Potential revenues from sale of compost and biogas products depend on many factors that influence demand, including regional factors, prices for substitute products, and seasonal fluctuations. CalRecycle expects revenues to remain relatively stable and compost markets to remain localized, since transportation costs prohibit long-distance product distribution. Revenues for biogas are highly dependent on renewable markets and fluctuate with credits and market prices for low-carbon alternative fuel products. To estimate the value of revenue and avoided disposal for the scenarios where less waste must be recovered, CalRecycle proportionally reduced estimates to a level commensurate with the reduced tonnage.

Table 6 Revenues and Avoided Costs from Recycling (in millions)

Scenario	Recycling Facility Revenues	Avoided Disposal
Scenario 1	$12,386	$7,509
Scenario 2	$8,155	$4,906
Scenario 3	$17,258	$10,368

Collection and Processing of Organic Waste

As noted in the SRIA, CalRecycle used a modified version of the *Cost Study on Commercial Recycling* to estimate the cost of collection and processing of organic waste. CalRecycle adjusted the model to reflect updated projections of tonnage and material types used in the Draft EIR. As noted above, CalRecycle additionally adjusted costs to reflect inflation for the year 2019 using the Consumer Price Index. The inflation adjusted values are shown in Table 7.

Table 7: Cost Study on Commercial Recycling Per Ton Costs Updated using 2019 Consumer Price Index

Item	Solid Waste	Paper	Cardboard	Wood Waste	Green Waste	Compostables
Collection	$93.42	$197.04	$197.39	$37.21	$149.11	$159.83
Processing	$0.00	$94.90	$86.85	$29.92	$33.77	$31.47

Note: Values adjusted from Appendix E-8, *Cost Study on Commercial Recycling*

The 2019 cost per ton data in Table 7 was applied to updated projections of tonnage and material types used in the Draft EIR. To estimate the cost of collection and processing for the scenarios where less waste must be recovered, CalRecycle proportionally reduced the collection and processing costs to a level commensurate with the reduced tonnage. Table 8 below shows the estimated collection and processing costs for each Scenario.

Table 8: Collection and Processing Costs (in millions)

Scenario	Collection[1]	Processing[2]
Scenario 1	$12,747	$3,735

Scenario 2	$8,333	$2,427
Scenario 3	$17,624	$5,178

[1] The cost for collection and processing of the tons projected to go to edible food recovery organizations is calculated separately. Those costs are represented by the Capital expenditures and O&M for food recovery infrastructure noted in Table 9.
[2] The cost for processing the tons projected to be recovered through composting and anaerobic digestion is included in the O&M costs noted in Table 5.

Edible Food Recovery Infrastructure and Operations and Management

As noted above, CalRecycle revised the methodology used to calculate the costs associated with recovering edible food. To revise the methodology, CalRecycle reviewed primary data from grants awarded under FRP cycles and reviewed financial audits of several food banks. CalRecycle concluded that it is not appropriate to use the financial data provided in grant applications because the budgets submitted with the applications did not include all costs associated with food recovery; in other words, this source data could underestimate costs. Therefore, financial audits of food banks from various regions across the state were used to delineate costs for capital expenditures and costs for O&M related to recovering edible food at food banks. Capital expenditure estimates were based on the value of property and equipment, and O&M costs were estimated based on activities associated with operating the food banks. These values were used to determine a weighted per ton cost estimate for food recovery occurring at food banks.

The weighted cost per ton derived from these primary data sources was then applied to the amount of edible food the department projects will be recovered in each calendar year from 2019-2030. The new weighted cost per ton model is applied equally in each scenario to the projected tons of edible food that will be recovered.

Table 9: Food Recovery Costs (in millions)

Food Recovery Costs	Capital Expenditures	Operations and Management
Scenario 1	$77	$1,356
Scenario 2	$51	$867
Scenario 3	$105	$1,904

Economic Impacts

As noted above, CalRecycle revised estimates of direct cost impacts to reflect increases in disposal and changes in the value of recovered commodities. Similar to the approach taken with the SRIA, CalRecycle used REMI software to analyze the macroeconomic impacts of the revised SB 1383 figures. CalRecycle modified the original REMI analysis used in the SRIA to respond to stakeholder comments. The economic modeling calculated in this section is linked to the highest estimated costs projected under Scenario Three (lowest fiber value sensitivity and highest transportation cost sensitivity).

In the SRIA, the macroeconomic assumptions assumed that the costs would be completely passed through to consumers:

> *The increase in costs to private industry is assumed to pass through completely to consumers, so it is also entered into the model via an increase in Consumer Price. These increases in Consumer Price have several impacts, including decreases in real disposable income, migration, and consumption.*

Stakeholders raised concerns that this approach may understate the economic impacts of the regulations as many businesses would be required to absorb costs and could not pass costs through to consumers. To respond to stakeholder concerns, this analysis assumes that only 50 percent of costs are passed on to households through the consumer price policy variable and 50 percent of costs are absorbed by businesses through the production cost policy variable. The previous analysis modeled all program costs as consumer price increases. While it is speculative to assume the proportion of costs that will be absorbed as production costs, CalRecycle opted to revise the model to provide a mechanism for demonstrating potential impacts on the ability of California businesses to compete. The results of this analysis are below. See Addendum 1 for additional detail on the approach to economic modeling.

Impact on Employment

The model demonstrates that the regulation will result in a net increase in total employment in California, with employment peaking in 2025 as construction peaks. The total employment figures are higher than those projected in the SRIA, which aligns with the projected increase in the amount of tons that must be collected, processed, and recovered.

Table 10: Employment projections (in thousands)

Category	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total Employment	10.5	11.6	13.4	18.7	17.0	18.9	20.6	20.1	19.5	18.9	18.5	17.6
Private Non-Farm Employment	10.1	11.1	12.7	15.3	15.2	17.0	18.6	18.2	17.6	17.0	16.6	15.8
Residence Adjusted Employment	10.4	11.6	13.3	18.6	16.9	18.8	20.4	20.0	19.4	18.8	18.3	17.5

Other Economic Impacts

The SRIA included measurements of economic impact in addition to employment. Those measurements were recalculated using the new minimum recovery projections for scenario three. The results track the results of the original SRIA showing similar impact levels as those disclosed in the SRIA.

Impact on California Gross Domestic Product

Consistent with the SRIA, the state's gross domestic product (GDP) is projected to increase slightly, with the increase peaking in 2025 during the construction phase. This increase reflects the increased construction and related economic activity during each year.

Table 11: Gross Domestic Product (in billions)

Category	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Gross Domestic Product	1.0	1.2	1.4	1.9	1.8	2.0	2.2	2.1	2.1	2.0	2.0	1.9

Impact on California Businesses and Investment

Consistent with the SRIA, the net impacts of the proposed regulation on California Business Output (private non-farm) are both small and positive. The overall economic impact of the proposed regulations is minimal

Table 12: Business Output (in billions)

Category	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Output	1.8	2.1	2.5	3.4	3.2	3.5	3.8	3.8	3.7	3.6	3.5	3.3

Impact on Individuals

Consistent with the SRIA, new economic activity is created through regulations requiring improved organic waste disposal. The demand for new economic output in organic waste-related industries causes new hiring and higher wages. The total wages and salaries increase very modestly.

Table 13: Wages and Salary (in billions)

Category	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total Wages	0.623	0.811	0.986	1.452	1.419	1.620	1.821	1.861	1.884	1.902	1.920	1.895

and Salaries													

Net Impacts to Businesses and Individuals

The costs calculated in this category are linked to the highest estimated costs projected under scenario three (lowest fiber value sensitivity and highest transportation cost sensitivity).

Direct Costs to Individuals and Businesses

The department updated the estimated cost to reflect the increased tonnage and corresponding increase in costs. Consistent with the standardized regulatory impact assessment, the direct costs are distributed to households and businesses. In the SRIA CalRecycle disclosed a potential cost scenario that assumed half of the direct costs would be applied to commercial industry ($662 per year) and half of the direct costs would be applied to residential households ($17 per year).

To show an alternative cost breakdown, CalRecycle is also presenting a scenario that applies direct costs to each sector based on the tons of waste generated by that sector. The waste characterization shows that approximately 40 percent of solid waste is generated by single family homes, and 60 percent of solid waste is generated by the commercial sector (including multi-family housing units of 5 or more).

In each scenario, a modest growth factor based on historic growth is applied to the number of businesses and the number of households beginning in 2020. The costs shown here represent reasonable estimates of a statewide average cost increase that could be experienced by individuals and businesses. Circumstances will vary across the many jurisdictions in the state. A number of factors will impact how the costs of compliance are passed through to businesses and individuals, these factors include but are not limited to the local fee structure, the type of community (e.g. industrial or bedroom community), and the existing level of organic waste collection and recycling services provided.

Monthly Cost per Individual (Measured per Household): *$3-$5*

The cost per individual is shown in terms of the number of single-family households. Assuming half of the direct cost of the regulation will be passed through to households, the average monthly cost is estimated at **$4.59** per household.

Assuming that direct costs are distributed to each sector based on the tons generated by that sector (40 percent), the average monthly cost is estimated at **$3.65** per household.

Monthly Cost Per Business: $70-$90[1]

To determine the cost for individual businesses, the department used the most recent number of businesses reported by the California Employment Development Department (EDD). CalRecycle also revised the estimate of the number of California businesses to include commercial multi-family properties (multi-family properties with more than five units) in the overall number of businesses. CalRecycle used statistics from the US Census Bureau's American Community Survey to estimate the number of multi-family housing units that would constitute commercial businesses under the regulation.

Applying half of the cost of the regulations to the total number of businesses statewide produces an average monthly cost of **$73.19** per business.

Assuming that direct costs are distributed to each sector based on the tons generated by that sector (60 percent), the average monthly cost is estimated at **$87.82** per business.

Additional Business Cost Estimates

In updating the costs, the department has also estimated costs to business categories based on their size. As noted above, a myriad of factors will impact the costs applied to businesses. For example, under AB 1826 the majority of commercial businesses are already required to have organic waste collection services, and those services must be offered by jurisdictions. Implementation of SB 1383 was designed to follow the key implementation dates and graduated timelines for AB 1826, to allow infrastructure costs to be phased in. To the extent jurisdictions complied with the requirement to offer services, the cost of those collection services should already be encumbered and passed through to businesses subject to the law. As a result, businesses that are located in jurisdictions that already require AB 1826 compliance will likely experience more modest rate increases as the primary aspect of the SB 1383 requirements should already be met. The costs shown below do not attempt to estimate the proportion of the costs that are, or should already be, incurred as a result of compliance with AB 1826.

To differentiate business costs by business size, the department used EDD data that categorizes businesses by employee number. The department projected an average business size by dividing the total employee number from each category by the total number of businesses reported for that category. CalRecycle then applied the per employee disposal number from the 2014 Waste Characterization Study to estimate the tons of waste produced by each business category. The cost of recovering the tons associated with each category was then weighted by business category and applied to the number of businesses in that category.

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[1] The statewide average business cost includes businesses with 5 or more employees and the estimated number of multifamily households with more than five units. Estimates do not include the category of 0-4 employees which would lower the average business cost to less than $40 per month. See *Additional Business Cost Estimates.*

Table 15-A: Estimated Business Cost Breakdown by Business Size

Business Size	Number of Businesses	Average Employee Number	Cost/month (2022)
0 to 4	1,112,836	1	$3.78
5 to 9	172,689	7	$20.64
10 to 19	125,695	14	$41.29
20 to 49	94,916	30	$88.48
50 to 99	34,403	69	$203.50
100 to 249	17,923	149	$439.44
250 to 499	4,428	343	$1,011.59
500 to 999	1,667	683	$2,014.33
1000+	1,055	2,394	$7,060.47

Note: *Table 15-A Includes businesses with 0-4 employees as they are reported by EDD. The number of these businesses that subscribed to commercial solid waste services is unknown. As the average employee number for this category is 1.2, it is likely that many of these businesses do not have commercial accounts, although some of these businesses may be a part of a shared office space where a commercial account is used and the cost of garbage services is presumably included in office rental costs. Due to uncertainty regarding this category, CalRecycle prepared Table 15-B which only distributes costs to the 450,000 businesses with at least five employees.*

Table 15-B: Estimated Business Cost Breakdown by Business Size (excluding businesses with 0-4 Employees)

Business Size	Number of Businesses	Average Employee Number	Cost/month (2022)
5 to 9	172,689	7	$22.48
10 to 19	125,695	14	$44.96
20 to 49	94,916	30	$96.33
50 to 99	34,403	69	$221.56
100 to 249	17,923	149	$478.45
250 to 499	4,428	343	$1,101.40
500 to 999	1,667	683	$2,193.17
1000+	1,055	2,394	$7,687.34

Note*: The total employee number for each category as reported by EDD was divided by the number of businesses in each category to determine an average employee number. The average employee number was rounded to the nearest whole number.*

The department has also calculated a scenario that assumes the costs associated with food recovery will be born entirely by businesses. This scenario assumes that none of the food recovery costs are applied to single family or multi-family households. This scenario is presented to respond to stakeholder comments and to disclose an additional potential cost scenario.

This scenario builds off the weighted business and single-family household cost scenario and applies 60 percent of the non-food recovery costs to commercial businesses (including commercial multi-family properties) and 40 percent of the non-food recovery costs to single-family households. The food recovery costs (capital expenditures, O&M, and reporting) are then separately applied only to commercial businesses (excluding commercial multi-family properties). Under this scenario CalRecycle estimates that the costs would break down as follows:

Single Family Households: **$3.09 per month**
Commercial Businesses Organics (all commercial): **$74.40 per month**
Commercial Food Recovery (excluding multi-family): **$33.47 per month**

All commercial businesses would experience a monthly rate for organic waste services estimated at $74.40 per month. If the food recovery costs are only applied to businesses (excluding multi-family businesses), this could add an estimated $33.47 per month to the cost experienced by those businesses, it would also lower household costs as the residential households would not incur any of the costs associated with food recovery. It is speculative to project how jurisdictions will structure rates and distribute costs with any certainty, as such decisions are within the purview of local governments and will be subject to analysis by local decision makers and local counsel.

Competitive Advantages and Disadvantages for California Businesses

This analysis reveals that certain businesses in the state may enjoy a competitive advantage over other businesses, while others may face a competitive disadvantage, or have a previous advantage reduced. Any advantage or disadvantage will be an indirect result of the regulations and will be partially attributable to how local governments exercise their discretion in structuring mechanisms used to fund their compliance obligations. Business competitiveness could be impacted by a myriad of factors and decisions made in response to the regulations.

Jurisdictions that currently provide many of the services required by the regulation, may see their businesses become more competitive with other businesses in the state. A business that is located in a jurisdiction that already implements a majority of the requirements of the law likely already pays a higher rate for waste collection services then businesses located in jurisdictions that do not provide these services. These businesses may experience more modest rate increases compared to businesses located in jurisdictions that do not provide any, or only provide a minimal amount, of the additional services required by the regulation.

Businesses that are located in jurisdictions where the level of organic waste recycling services is substantially lower than what the regulations require, may see a potential competitive advantage reduced as their jurisdiction may need to increase collection service rates to a greater degree. Businesses that already incur the costs of higher organic waste collection services, either voluntarily or due to requirements already imposed by their local government will see a potential competitive disadvantage mitigated as businesses located in other jurisdictions will now be required acquire a similar level of service and will begin to share in the costs associated with this form of environmental protection.

Jurisdictions that elect to impose rates on a volumetric basis, or apportion certain costs to specific business types, may create a competitive advantage for certain businesses while others experience a competitive disadvantage. For example, if a jurisdiction charges for waste services on a volumetric basis, businesses that reduce their waste generation may qualify for a lower waste service rate than their competitors, affording them a distinct competitive advantage. Businesses that generate more material may face a competitive disadvantage if they do not take actions, or are unable, to reduce their own waste generation. Further, if a jurisdiction elects to apportion certain costs to certain businesses, competitive advantages and disadvantages could be created. For example, if a jurisdiction distributes the cost of coordinating its food recovery program exclusively to tier one commercial edible food generators (i.e. supermarkets, grocery stores with more than 10,000 square feet, food service providers and distributors and wholesale food vendors), those businesses may be at a competitive disadvantage to tier two commercial edible food generations (e.g. restaurants and hotels).

The size and location of a jurisdiction can impact rates and ultimately business competitiveness. larger jurisdictions with a broader base of residential and commercial generators may be able to negotiate more competitive contracts with waste haulers as the value of the contracts will be more lucrative, attracting more competition from the private sector. CalRecycle mitigate this impact through the inclusion of waivers for low population and rural areas See *Regional Variation.* Additionally, jurisdictions that have secured or are located close to existing, or expandable, organic waste recycling infrastructure may be able to negotiate more competitive rates as fuel costs could be reduced. Businesses located in these jurisdictions may experience a competitive advantage as rates could be lower.

Finally, as noted above CalRecycle revised economic modeling to assume that the costs associated with the regulation will partially absorbed by businesses (rather than all costs being passed through to consumers), which would result in higher operating costs. Higher operating costs serve to make these firms less competitive, driving down exports and overall sales, all else being held equal. This effect is modeled with the production cost policy variable in the REMI model, and 50 percent of all costs were modeled with the production cost policy variables. See *Economic Impacts, and Addendum 1 Economic Inputs.*

Regional Variation

Several stakeholders requested additional discussion of how the regulatory costs will vary across region. Specific regional costs will be highly dependent on local decision-making and will vary depending on the implementation pathway chosen by local governments (e.g. which type of container collection scheme they select, the type of facilities they already have access to or that local leaders elect to pursue). Providing a specific estimate of regional costs would be highly speculative; however, in an effort to respond to stakeholder comments and disclose how the regulatory requirements could vary by region, two examples of how the regulatory costs could vary by region are discussed below.

Southern California Cost Estimates

For this analysis, the Southern California region consists of the following counties: Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura. This represents a Southern California county breakdown used in the 2014 Waste Characterization Study.

These counties account for an estimated 61 percent of total disposal in the state and 56 percent of the state's total population. These are the primary cost factors driving the cost of the regulation. The total costs were estimated for these southern California counties and then distributed on a per capita, per business, and per household basis. The first column titled "statewide" shows the range in statewide costs depending on whether direct costs are distributed evenly between businesses and households (50/50) or if the costs are weighted by disposal (60/40). SoCal 1 shows costs when they are distributed evenly between businesses and households in the counties that are included in the scenario. SoCal 2 shows costs when they are distributed by weight between businesses and households (60/40) in the counties that are included in the scenario.

Table 16: Southern California Regional Variation

Categories	Statewide	SoCal 1	SoCal 2
Total Cost for 12 years *($ Billions)*	$12.8	$7.8	$7.8
Monthly Per Capita Cost (2022-2030 Average)	$2.47	$2.69	$2.69
Monthly Cost per Business (2022-2030 Average)	$72.98–87.58	$72.17	$86.63
Monthly Cost per Household (2022-2030 Average)	$3.65–$4.57	$5.69	$4.55

This analysis shows that these Southern California counties may incur a higher portion of the cost on a per capita basis. The potential for economic impacts to vary by region is in alignment with recent findings in rate surveys performed in 2018 as a part of a study under contract for CalRecycle. The surveys found that existing service rates in Southern California are notably lower than the statewide average:

1. The average rate for single-family bundled collection in Southern California is 25–42 percent below the statewide average (depending on container size).
2. Multi-family collection rates in Southern California are substantially lower than the statewide average:
    a. Garbage collection for 3 cubic yards, once per week: 45 percent below the statewide average.
    b. Mixed organics collection for 3 cubic yards, once per week: 34 percent below the statewide average.
3. Commercial collection rates in Southern California are substantially lower than the statewide average:
    a. Garbage collection for 3 cubic yards, once per week: 42 percent below the statewide average.
    b. Mixed organics collection for 3 cubic yards, once per week: 20 percent below the statewide average.

This analysis does not attempt to quantify the level of organic waste recycling services currently provided in Southern California, and whether that contributes to the existing lower rates the survey found in Southern California.

Rural Costs Estimates

The department is also providing an estimate of the costs that are projected to be incurred by rural jurisdictions in the state. Several stakeholders argued that rural areas of the state will incur higher compliance costs, potentially creating competitive disadvantages for these areas. The department made several changes to the regulation in response to this argument regarding potentially higher compliance costs in more rural areas of the state.

In order to disclose potential variations in regional costs incurred by the regulations, the department is providing an estimate of the direct costs that is projected to apply to rural jurisdictions, as well as an estimate of the costs that would apply to rural jurisdictions if regulatory changes to allow for waivers in rural areas were not included. To estimate the impact the regulations will have on rural jurisdictions, the department isolated the fraction of statewide disposal and the fraction of the state's population that are attributable to rural jurisdictions and areas of the state, and the department projected costs for those areas. The jurisdictions and areas of the state that are considered rural for this analysis are the rural counties eligible for an exemption from the collection and procurement aspects of the regulations until 2027 (Section 18984.12 (c)), and cities and census tracts that are permanently eligible for low-population waivers from the organic waste collection requirements Section 18984.12(a)), hereafter referred to as "rural areas."[2]

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[2] The department did not control for elevation waivers (Section 19894.12(d)), as there is substantial overlap between the populations eligible for low population waivers and the

The value of the exemption was calculated by controlling for the cost factors that are linked to the specific regulatory requirements that rural areas are exempt from until the year 2027. Beginning in 2027 the exemptions are narrowed to only include the cities with small populations and census tracts with low-population densities.Specifically, from 2022–2027 exemptions for rural areas will waive 3 percent of organic waste that is projected to be disposed and 4.7 percent of the state's population from the organic waste collection and procurement requirements. Beginning in 2027, the exemptions become more limited, and only exempt 2 percent of organic waste and slightly less than 1 percent of the state's population from the organic waste collection requirements.

The analysis demonstrates that absent any regulatory provisions for waivers and exemptions, these rural areas would incur approximately $729 million in direct costs from 2022–2030 in order to comply with and implement the provisions of the regulation. Once the waivers are accounted for, these areas are projected to incur a total cost of $100 million from 2022–2030.

A multitude of existing factors that are not related to the regulation and cannot be predicted may also impact regional costs across the state. However, in an effort to show the cost difference in rural areas compared to the rest of the state, CalRecycle calculated the per capita cost for rural areas compared to statewide per capita cost.

Table 17: Rural Area Costs Waived (in millions)

Cost Category	2022–2026	2027–2030	Total 2022–2030
Capital Expenditures and operations[1]	**$162**	**$103**	**$265**
Collection Processing and Transportation	**$194**	**$121**	**$315**
Oversight, Compliance and Enforcement	**$40**	**$11**	**$52**
Total	**$396**	**$236**	**$632**

Totals may not add up exactly due to rounding.

1. Capital expenditures and operations costs incurred from 2022–2026 only include costs incurred as a result of expanding edible food recovery activities.

Table 18: Total Rural Area Costs Waived and Incurred (In millions)

2022–2026	2027–2030	Total 2022–2030
$443	**$286**	**$729**

populations eligible for elevation waivers. Adding the population eligible for elevation waivers could introduce double-counting and overstate the financial impact of the waivers in rural areas.

Average monthly per capita costs 2022–2030:

Statewide: $2.47
Rural area with waivers: $0.57
Rural area without waivers: $5.83

Minus the inclusion of the rural waivers, rural areas would incur a disproportional level of costs. On a per capita basis, rural residents would incur $5.83 per month, more than double the estimated statewide average per capita rate. This does show a potential regional impact in rural areas that is greater than the impact that would be felt in the rest of the state. However, once the costs that are linked to the waived requirements are accounted for, the impact in rural areas is reduced to $0.57 per month. Once waiver provisions of the regulations are accounted for, the financial impact to rural areas, as defined here, is projected to be less on per capita basis than other areas of the state. It is important to emphasize that these numbers represent an estimated statewide average and costs experienced in individual jurisdictions may vary.

Health and Social Benefits

Social Cost of Methane

SLCPs, such as methane, are more potent greenhouse gases than carbon dioxide and have significant negative impacts on human health and the climate. Diverting organic waste from landfills to recovery activities, along with implementing food recovery programs, will significantly reduce methane emissions from landfills.

Reducing these emissions will have beneficial impacts on California's climate and public health and will result in avoided social costs. Social costs estimate the health and environmental damage that is prevented by reducing GHGs, as opposed to representing the cost of achieving the GHG reductions.

Since the mid–2000s, numerous federal agencies have estimated the social costs of greenhouse gases, including methane, as part of their regulatory actions. In 2009, the Council of Economic Advisors and the Office of Management and Budget convened the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG) to develop a methodology for estimating these social costs. The IWG recommended the use of values using discount rates to account for future values of 2.5, 3, or 5 percent. It then provided estimates of the social costs of methane for the years 2015-2030, using 2007 dollars. Table 1 below shows the IWG's estimates per metric ton of methane:

Table 19: Social Costs of Methane, 2015–2030 (in 2007 dollars per metric ton)

Year	5 Percent Discount Rate	3 Percent Discount Rate	2.5 Percent Discount Rate
2019	$520	**$1,200**	**$**1,500
2020	$540	**$1,200**	**$**1,600

2021	$560	**$1,200**	$1,600
2022	$590	**$1,300**	$1,700
2023	$610	**$1,300**	$1,700
2024	$630	**$1,400**	$1,800
2025	$650	**$1,400**	$1,800
2026	$670	**$1,400**	$1,900
2027	$700	**$1,500**	$1,900
2028	$720	**$1,500**	$2,000
2029	$740	**$1,600**	$2,000
2030	$760	**$1,600**	$2,000

CalRecycle used this approach to estimate the avoided social costs of reducing methane emissions pursuant to the proposed SB 1383 regulations. CalRecycle multiplied the metric tons of methane reductions with the corresponding year's social cost value~~s~~, adjusted to 2019 dollars, from the above IWG table. Note that this approach to the social cost of methane may overstate the avoided adverse impacts in California, because it uses worldwide or global climate damages rather than impacts specific to California.

Based on this, CalRecycle estimates the avoided social cost in 2019 dollars, using the three discount rates, to range from $865 million (5 percent discount rate) to $2.4 billion (2.5 percent discount rate) by 2030.

Monetized Health Benefits

CARB staff conducted a PM mortality and illness analysis based on the statewide emission reductions of $PM_{2.5}$ and NO_x that would be achieved by the regulation. The methods used to estimate the premature deaths and other health outcomes related to $PM_{2.5}$ exposure are based on a peer-reviewed methodology developed by U.S. EPA (US EPA, 2010) and CARB's incidence-per-ton (IPT) methodology (CARB 2010a, 2010b). For a detailed explanation of estimating health impacts, see the CARB document *Estimating Health Benefits Associated with Reductions in PM and NOx Emissions: Detailed Description* (CARB, 2019).

In accordance with U.S. EPA practice, health outcomes are monetized by multiplying each incident by a standard value derived from economic studies. The value for avoided premature mortality is based on the value of statistical life (VSL), which provides a dollar estimate of benefits for an avoided premature death. The VSL is a statistical construct based on the aggregated dollar amount that a large group of people would be willing to pay for a reduction in their individual risks, such that one death would be avoided in the year across the population. This estimate does not explicitly consider any specific costs associated with mortality such as hospital expenditures.

Unlike premature mortality valuation, the valuation for avoided hospitalizations and ER visits are based on a combination of typical costs associated with hospitalization and the willingness of surveyed individuals to pay to avoid adverse outcomes that occur when hospitalized. These include hospital charges, post-hospitalization medical care, out-of-pocket expenses, and lost earnings for both individuals and family members, lost recreation value, and lost household production (e.g., valuation of time-losses from inability to maintain the household or provide childcare). These costs are most closely associated with specific cost savings to individuals and costs to the healthcare system.

While the cost savings associated with premature mortality are important to account for in the analysis, the valuation of avoided premature mortality does not correspond to changes in expenditures, and is not included in the economic modeling nor are the monetized health benefits factored into the direct costs of the regulation. The valuation per avoided health incident that is used in the report is given in Table 20.

Table 20: Valuation per Incident for Avoided Health Outcomes

Outcome	**Value per incident (2019$)**
Avoided Premature Mortality	$9,744,432
Avoided Cardiovascular Hospitalizations	$58,541
Avoided Acute Respiratory Hospitalizations	$51,062
Avoided Emergency Room Visits	$838

Statewide valuation of health benefits were calculated by multiplying the value per incident by the statewide total number of incidents (Table 21). The estimated total statewide health benefits derived from criteria emission reductions is estimated to $10.48 billion, with $10.46 billion resulting from reduced premature mortality and $20.56 million resulting from reduced hospitalizations and emergency room visits. The spatial distribution of these benefits across the state follows the distribution of the health impacts by air basin as described in Table 25.

Table 21: Statewide Valuation from Avoided Health Outcomes (<1KM Distance)

Outcome	**Avoided Incidents**	**Valuation (Million 2019$)**
Avoided Premature Mortality	1074	$10,462.37
Avoided Cardiovascular Hospitalizations	168	$9.86
Avoided Acute Respiratory Hospitalizations	201	$10.27
Avoided Emergency Room Visits	530	$0.44
Total	**N/a**	**$10,482**

Addendum to the Appendix

Addendum 1 Economic Inputs

As the result of SB 1388, CalRecycle is tasked with adopting regulations designed to reduce organic waste disposal 50 percent from 2014 levels by 2020 and 75 percent by 2025. Furthermore, CalRecycle must include provisions in the regulations that are designed to recover 20 percent of edible food for human consumption by 2025.

As noted above, CalRecycle revised estimates of direct cost impacts to reflect increases in disposal and changes in the value of recovered commodities. Similar to the approach taken with the SRIA, CalRecycle used REMI software to analyze the macroeconomic impacts of the revised SB 1383 figures. CalRecycle modified the original REMI analysis used in the SRIA to respond to stakeholder comments.

Following an initial analysis and subsequent public comments, CalRecycle provided estimates for costs and revenue in five major categories, with each including several subcategories. The major categories include:

- Infrastructure Costs and Revenue
- Edible Food Recovery Costs
- Collection, Processing, and Transportation
- Local Government Costs
- Waste Industry Costs

In general, the program will result in economic costs and benefits. Costs will accrue in the industries that must comply with the increased requirements for organic waste disposal. Benefits will be realized in industries that experience an increase in demand for their services, such as waste management, as a result of the regulation.

Costs

Costs associated with the program are the result of a variety of activities, including operation and maintenance of facilities, collection, processing, and transportation. In addition to such costs, CalRecycle also provided estimates for prevented disposal costs and additional revenue for the waste management industry that would result from selling recycled materials. Prevented disposal and additional revenue from the sale of products made from the recovered material were assumed to decrease the total costs of the regulation, as waste management companies would have to pass on less costs to businesses and households. Line items for each of the individual cost categories were summed to derive the total cost.

This analysis assumes that all costs are eventually either passed on to businesses or households through higher waste management rates. For the economic modeling in this analysis, 50 percent of costs were passed on to households through the consumer price policy variable. The remaining 50 percent of costs were passed on to businesses through the production cost policy variable. The previous analysis assumed all program costs were modeled with consumer price increases. While it is speculative to assume how much of the costs of the program will be passed through to households and businesses versus the amount that will be incorporated into production costs, CalRecycle opted to revise the model to provide a mechanism for demonstrating potential impacts on the ability of California businesses to compete.

Increased costs to businesses are assumed to be passed on through higher rates for waste management services, which businesses then have to absorb. Higher operating costs serve to make these firms less competitive, driving down exports and overall sales, all else being held equal. This effect is modeled with the production cost policy variable in the REMI model, and 50 percent of all costs were modeled with the production cost policy variables

It is assumed that households will also be impacted by higher costs for waste management services. As the costs of the new regulations filter through the industry, households will be faced with higher prices on consumption goods. To model these impacts, the analysis uses the consumer price policy variable to raise the cost of goods in relation to their utilization of waste management services. In the REMI model, as consumer prices for certain goods increase, consumers will consume relatively less of those goods. This decrease in consumption will lead to a decrease in output and employment, ceteris paribus.

<u>Benefits</u>

For the benefit portion of the analysis, many of the line items included in the cost spreadsheet will drive some amount of economic activity as well. For example, additional waste collections activity will result in higher costs to consumers, but will also result in increased operations and revenue for the waste management industry. The sub-categories of each of these cost items were re-categorized into policy variables interpretable by REMI. A detailed crosswalk translating the costs and revenues into policy variables is provided at the end of this document. The final policy variables that benefits were incorporated into include:

- Exogenous Production
    - For Business Service Industries
    - For Energy Industries
    - For Waste Management Industries
- Local Government Spending

The Exogenous Production policy variable was used to capture several buckets of spending, the first being spending on new equipment. Capital investments include the new capital spending on anaerobic digestion composting and processing equipment as well as new equipment needed to accept and recover edible food.

Exogenous production also models the additional demand that will accrue in the private sector due to activities associated with organic waste capture. Exogenous Production of

Waste Management services is expected to increase due to increased operations and maintenance of compost and AD infrastructure, edible food recovery operations, collection costs, processing costs, transportation costs. Some negative revenue is generated as well through the avoided disposal of food waste, which is subtracted from other areas of revenue creation.

Business services are expected to see an increase in exogenous production from adjustment of franchise agreements and preparation of status impact reports. Finally, renewables are expected to see an increase in exogenous production through regulatory requirements that local governments procure recovered organic waste products including renewable gas derived from recovering organic waste.

Regulatory oversight operations for new food recovery and organics recycling programs is modeled by an increase in local government spending. This local government spending will create new local government employment and drive spending in downstream industries. Government spending comprises all sub-categories of the "Local Government Costs" line item, except adjustment of franchise agreements and procurement. These two subcategories were assumed to result in additional exogenous production in the private sector. The local government would only be responsible for the various reporting, planning, education, and enforcement roles associated with the program.

REMI Policy Variable Inputs (Benefits Only)

Compost and AD Infrastructure

CalRecycle: Cost/Benefits Category	REMI: Benefit Policy Variable
(a) Annual capital spend, not discounted	Exogenous Production (Investment)
(b) O&M, not discounted	Exogenous Production (Waste Management)
(c) Revenues, not discounted	Not Modeled (NM) – Revenue from AD.

Edible Food Recovery

CalRecycle: Cost/Benefits Category	REMI: Benefit Policy Variable
(a) Annual capital spend	Exogenous Production (Investment)
(b) Operations	Exogenous Production (Waste Management)
(c) Edible Food Recovery Organizations Reporting	NM – No associated output benefits
CalRecycle: Cost/Benefits Category	**REMI: Benefit Policy Variable**

Collection Processing and Transportation

CalRecycle: Cost/Benefits Category	REMI: Benefit Policy Variable
(a) Collection	Exogenous Production (Waste Management)
(b) Processing	Exogenous Production (Waste Management)
(c) Transportation	Exogenous Production (Waste Management)
(d) Disposal–Avoided	Exogenous Production (Waste Management)
(e) Commodities–Fiber	NM – Revenue for WM industry

Local Government

CalRecycle: Cost/Benefits Category	REMI: Benefit Policy Variable
(a) Collection Enforcement Costs	Government Spending

(b) LEA Enforcement Costs for Solid Waste Facilities	Government Spending
(c) Coordination of Edible Food Recovery Programs	Government Spending
(d) Reporting	Government Spending
(e) Capacity Planning	Government Spending
(f) Education and Outreach	Government Spending
(g) MWELO/CalGreen	Government Spending
(h) Adjustment of Franchise Agreements	Exogenous Production (Business Services)
(i) Procurement	Exogenous Production (Energy Production and Transmission)

Waste Industry

CalRecycle: Cost/Benefits Category	**REMI: Benefit Policy Variable**
(a) Hauler Contamination Monitoring and Reporting	NM–No associated output benefits
(b) Solid Waste Facility Reporting	NM–No associated output benefits
(c) Waste Sampling	NM–No associated output benefits
(d) Preparation of Status Impact Reports	Exogenous Production (Business Services)

REMI Policy Variable Inputs (Costs Only)

Compost and AD Infrastructure

CalRecycle: Cost/Benefits Category	**REMI: Cost Policy Variable**
(a) Annual capital spend, not discounted	Production Cost/Consumer Price Increase
(b) O&M, not discounted	Production Cost/Consumer Price Increase
(c) Revenues, not discounted	Production Cost/Consumer Price Increase

Edible Food Recovery

CalRecycle: Cost/Benefits Category	**REMI: Cost Policy Variable**
(a) Annual capital spend	Production Cost/Consumer Price Increase
(b) Operations	Production Cost/Consumer Price Increase
(c) Edible Food Recovery Organizations Reporting	Production Cost/Consumer Price Increase

Collection Processing and Transportation

CalRecycle: Cost/Benefits Category	**REMI: Cost Policy Variable**
(a) Collection	Production Cost/Consumer Price Increase
(b) Processing	Production Cost/Consumer Price Increase
(c) Transportation	Production Cost/Consumer Price Increase
(d) Disposal–Avoided	Production Cost/Consumer Price Increase
(e) Commodities–Fiber	Production Cost/Consumer Price Increase

Local Government

CalRecycle: Cost/Benefits Category	**REMI: Cost Policy Variable**
(a) Collection Enforcement Costs	Production Cost/Consumer Price Increase
(b) LEA Enforcement Costs for Solid Waste Facilities	Production Cost/Consumer Price Increase
(c) Coordination of Edible Food Recovery Programs	Production Cost/Consumer Price Increase
(d) Reporting	Production Cost/Consumer Price Increase
(e) Capacity Planning	Production Cost/Consumer Price Increase
(f) Education and Outreach	Production Cost/Consumer Price Increase
(g) MWELO/CalGreen	Production Cost/Consumer Price Increase
(h) Adjustment of Franchise Agreements	Production Cost/Consumer Price Increase

(i) Procurement	Production Cost/Consumer Price Increase

Waste Industry

CalRecycle: Cost/Benefits Category	**REMI: Cost Policy Variable**
(a) Hauler Contamination Monitoring and Reporting	Production Cost/Consumer Price Increase
(b) Solid Waste Facility Reporting	Production Cost/Consumer Price Increase
(c) Waste Sampling	Production Cost/Consumer Price Increase
(d) Preparation of Status Impact Reports	Production Cost/Consumer Price Increase

Addendum 2—$PM_{2.5}$ Mortality and Illness Analysis

PM Mortality and Illness Overview

$PM_{2.5}$ is associated with adverse health outcomes such as the risk of premature deaths, hospitalizations, and emergency room visits (U.S. EPA, 2010). As a result, reductions in $PM_{2.5}$ emissions are associated with reduction in these health outcomes. NO_x includes nitrogen dioxide, a potent lung irritant, but its most serious impact on human health comes about when atmospheric processes convert NO_x into fine particles of ammonium nitrate. $PM_{2.5}$ formed in this manner is termed secondary $PM_{2.5}$ to distinguish it from primary $PM_{2.5}$, which is emitted directly from a source, such as soot from engine exhaust.

CARB staff conducted a PM mortality and illness analysis based on the statewide emission reductions of $PM_{2.5}$ and NO_x that would be achieved by the regulation. The methods used to estimate the premature deaths and other health outcomes related to $PM_{2.5}$ exposure are based on a peer-reviewed methodology developed by U.S. EPA (US EPA, 2010) and CARB's incidence-per-ton (IPT) methodology (CARB 2010a, 2010b). For a detailed explanation of estimating health impacts, see the CARB document *Estimating Health Benefits Associated with Reductions in PM and NOx Emissions: Detailed Description* (CARB, 2019).

Incidents-Per-Ton Methodology

CARB uses the IPT methodology to quantify the health benefits of emission reductions in cases where dispersion modeling results are not available. CARB's IPT methodology is based on the methodology developed by U.S. EPA (Fann et. al., 2009, 2012, 2018). It is used to estimate the benefits of reductions in primary $PM_{2.5}$ emitted directly from sources and secondary $PM_{2.5}$ formed from precursors by chemical processes in the atmosphere.

Under the IPT methodology, changes in emissions are approximately proportional to changes in health outcomes. IPT factors are derived by calculating the number of health outcomes associated with exposure to $PM_{2.5}$ for a baseline scenario using measured ambient concentrations, and dividing by the emissions of $PM_{2.5}$ or a precursor. The calculation is performed separately for each air basin:

$$IPT = \frac{number\ of\ health\ outcomes\ in\ air\ basin}{annual\ emissions\ in\ air\ basin}$$

Multiplying the emission reductions in an air basin by the IPT factor then yields an estimate of the reduction in health outcomes from the regulation. For future years, the number of outcomes is adjusted to account for population growth. CARB's current IPT factors are based on a 2014-2016 baseline scenario, which represents the most recent data available at the time the current IPT factors were computed. IPT factors are computed for two types of $PM_{2.5}$: primary $PM_{2.5}$ and secondary ammonium nitrate $PM_{2.5}$ aerosol formed from precursors.

The 2014-2016 baseline scenario for primary $PM_{2.5}$ is based on estimated diesel particulate matter (DPM) concentrations. DPM sources are concentrated around freeways, transportation and freight hubs, and commercial and industrial facilities, which are predominantly located in densely populated urban areas. By contrast, landfills are mostly located just outside urban areas. Emissions from landfills distant from urban areas are dispersed before reaching residential neighborhoods, and the IPT methodology may overestimate their impacts. Health impacts from NO_x emissions are not affected this way because they arise primarily from secondary ammonium nitrate PM, which is formed by chemical processes at a distance downwind from emission sources.

To assess the effect of this uncertainty in the health benefit estimates, CARB staff performed a sensitivity analysis. Primary $PM_{2.5}$ emission reductions from facilities in each air basin were multiplied by the fraction of waste tonnage disposed in landfills within a 1, 2 and 5 km buffer of urban areas, and for all facilities. Changes in total health outcomes ($PM_{2.5}$ plus NO_x) were estimated for each of these subsets. The most conservative estimate, from all facilities, showed health benefits only 14 percent higher than the least conservative estimate, from facilities within 1 km of an urban area. For this analysis and to prevent overestimating the health benefits, CARB chose the 1 km buffer from urban areas as an estimate of health benefits of the regulation.

Reduction in Health Outcomes

Table 1 shows estimated reductions in health outcomes resulting from the regulation summed from 2019 to 2060, for landfills with 1 km of the nearest urban area. The values in parenthesis represent the 95th percentile confidence interval for each health outcome. All values are rounded to two significant digits.

Table 24: Reduction in Health Outcomes Resulting from the Regulation, 2019-2060

Air Basin	Cardiopulmonary Mortality	Hospitalizations for Cardiovascular Illness	Hospitalizations for Respiratory Illness	Emergency Room Visits
Great Basin Valleys	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Lake County	1 (1–1)	0 (0–0)	0 (0–0)	0 (0–0)
Lake Tahoe	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Mojave Desert	5 (4–6)	1 (0–1)	1 (0–1)	2 (1–2)
Mountain Counties	0 (0–1)	0 (0–0)	0 (0–0)	0 (0–0)
North Central Coast	5 (4–6)	1 (0–2)	1 (0–2)	3 (2–4)
North Coast	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Northeast Plateau	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Sacramento Valley	27 (21–33)	3 (0–6)	4 (1–7)	10 (7–14)
Salton Sea	1 (1–1)	0 (0–0)	0 (0–0)	1 (0–1)
San Diego County	83 (65–100)	12 (0–23)	14 (3–24)	34 (21–46)

San Francisco Bay	91 (71–110)	14 (0–28)	17 (4–30)	50 (31–70)
San Joaquin Valley	78 (61–96)	9 (0–18)	11 (3–20)	29 (18–40)
South Central Coast	32 (25–39)	5 (0–10)	6 (1–10)	14 (9–19)
South Coast	890 (690 – 1,100)	150 (0–290)	180 (41–310)	450 (290–620)
Statewide	1,200 (950 – 1,500)	190 (0–380)	230 (54–400)	590 (380–810)

Table 2 shows the results of the sensitivity analysis: estimated statewide reductions in health outcomes resulting from the regulation summed from 2019 to 2060, for landfills with selected distances of the nearest urban area. The values in parenthesis represent the 95th percentile confidence interval for each health outcome. All values are rounded to two significant digits.

Table 25: Sensitivity Analysis—Statewide Reduction in Health Outcomes Resulting from the Regulations, for Landfills within Selected Distances of Urban Areas, 2019-2060

Health Endpoint	<1 km	<2 km	<5 km	all
Cardiopulmonary Mortality	1,200 (950–1,500	1,280 (1,000–1,570)	1,370 (1,070–1,670)	1,380 (1,080–1,690)
Hospitalizations for Cardiovascular Illness	190 (0–380)	200 (0–400)	220 (0–420)	220 (0–430)
Hospitalizations for Respiratory Illness	230 (54–400)	240 (57–430)	260 (60–460)	260 (61–460)
Emergency Room Visits	590 (380–810)	630 (400–860)	670 (430–920)	680 (430–930)

Uncertainties Associated with the Mortality and Illness Analysis

Although the health outcome estimates presented in this report are based on the best methodologies currently available, they are subject to uncertainty. The uncertainty ranges on health estimates in this analysis only take into account the uncertainty of the relative risk, which is a parameter in the CRF that determines how changes in air quality translate into changes in health outcomes. Other sources of uncertainty include:

- Air quality data are subject to natural variability from meteorological conditions, local activity, etc.
- The assumption that changes in concentrations of pollutants are proportional to changes in emissions of those pollutants or their precursors is an approximation. There may be cases where actual changes in concentrations are higher or lower than predicted.
- The estimation of $PM_{2.5}$ concentrations and $PM_{2.5}$ /NO_x emission ratios are subject to uncertainty. Emissions are reported at an air basin resolution, and do not capture local variations.

- Inverse distance-squared weighting, a spatial interpolation method, is used to estimate concentrations for each census tract. Compared with other geospatial estimation methods (such as Kriging), inverse distance-squared interpolation has the virtue of simplicity, and does not require selection of parameters. When data are abundant, most simple interpolation techniques give similar results (Jarvis et al., 2001). All geospatial estimation techniques exhibit greater uncertainty when data points are sparser, and uncertainty increases with distance from the nearest data points.
- Future population estimates are subject to increasing uncertainty as they are projected further into the future. For reasons of computational efficiency, the spatial resolutions of population estimates are limited to census tract resolution.
- Observed baseline incidence rates change over time, and are subject to random year-to-year variation and systematic shifts as population characteristics and medical treatments evolve. Sample size requirements necessitate estimating baseline incidence rates at large geographic scales (such as state or county).
- Relative risks in the CRFs are estimated with uncertainty and reported as confidence ranges.
- IPT factors were developed for on-road diesel sources and NO_x sources. Application to other sources is subject to availability of relative potency factors.

Addendum 3 Scenario Detail

Several scenarios are presented in order to provide context of the potential costs that could be incurred or prevented depending on various factors.

SRIA Disposal Estimates

In the original estimates calculated for the SRIA, CalRecycle used Department of Finance population projections to estimate disposal through 2030 using pounds Per Person Disposal (PPD) figures from the 2014 base year. At the time the methodology was developed for the SRIA, linking to the 2014 base year was an appropriate methodology for several reasons. First, 2014 is the base year identified in SB 1383, and it is the year that waste characterization figures identifying the percent of organic waste are derived from. Second, local governments are under a statutory obligation to make a good faith effort to implement new commercial recycling programs under AB 341 (Mandatory Commercial Recycling) and AB 1826 (Mandatory Organic Waste Recycling). These laws were designed to decrease disposal through the phasing in of increasing recycling mandates through the year 2020. The disposal projection developed for the SRIA reasonably assumed that the phasing in of these new recycling programs would mitigate increases in per capita disposal. The most recent disposal data suggests that despite these laws and the good faith effort of local governments, disposal continues to increase.

The previous disposal projections linked to 2014 PPD resulted in a BAU disposal projection of 286 million tons of organic waste for the years 2019–2030. That is, the amount of organic waste that would be disposed when the 2014 PPD trend is applied to the 2019–2030 timeframe. Achieving the SB 1383 reductions targets under that scenario would have required the management and redirection of 194 million tons of organic waste from landfill disposal.

Scenario One Historic AB 939 Estimate

To provide an alternative scenario, CalRecycle reviewed the PPD reduction that occurred from 1989–2000.This time frame was selected as it represents the 12 years prior to the effective date of the AB 939 50 percent diversion target. AB 939 additionally included an interim reduction target of 25 percent diversion by 1995. The trigger dates and the overall timeframe are relatively analogous to the timeframe bounding the SB 1383 cost assumptions 2019–2030. The 2019–2030 timeframe represents the 12 years leading to the statutory greenhouse gas reduction target SB 1383 is designed to achieve by 2030, with the interim disposal reduction measure of 75 percent by 2025. While there is no perfect historic analogy, this scenario was designed to provide an analysis of a similar mandate over a comparable time frame.

A review of the years from 1989–2000 shows disposal decreasing from a peak of 8.4 PPD in 1989 to 6.3 PPD in 2000. This represents a reduction of roughly 2.1 pounds per person per day. While the PPD increases and decreases in the interim years of the period from 1989–2000, CalRecyle projected a linear reduction that replicates the difference between 1989–2000 PPD to replicate the PPD reduction for 2019-2030. In this scenario, the average 2000–2017 PPD is used to project 2019 PPD of 5.3 which is then reduced by 0.19 in each year, resulting in a PPD of 3.2 in the year 2030. (Note that although the values are impacted by rounding, the impact is insignificant).

Scenario Two: AB 341 & AB 1826 Goals Achieved Estimate

This analysis contemplates a scenario where local government efforts to implement Mandatory Commercial Recycling and Mandatory Organic Waste Recycling requirements are sufficient to achieve the existing targets included in those statutes by 2022. In effect, this scenario assumes that much of the disposal reductions that are necessary to achieve the SB 1383 targets will already be achieved through the full implementation of AB 341 and AB 1826 by industry and local governments. In other words, the costs attributable to SB 1383 would be reduced due to those costs being incurred as a result of implementation of local government, commercial business, and waste industry implementation of AB 341 and AB 1826.

Under this scenario, the implementation of AB 341 and AB 1826 would reduce disposal to 2.7 PPD by 2022, which is the target for recycling 75 percent of solid waste. It is then assumed that PPD will remain flat from 2022–2030.

Scenario Three: Environmental Impact Report Scenario Averaged PPD

For the scenario prepared for the Environmental Impact Report, CalRecycle considered disposal trends data that was available in May 2019. The department indexed disposal projections to 2017 disposal levels and incorporated the high disposal years of 2016–2017 into the PPD projection. To control for disposal trends demonstrated by the newly available data, the EIR used the average PPD from 2000–2017, which is 5.3 PPD. This figure is more in line with recent disposal trends, which demonstrates sustained year-over-year PPD growth. While the methodology for the SRIA was appropriately linked to the 2014 base year, as noted above recent disposal trends suggest that the implementation of existing recycling mandates (AB 341 and AB 1826) has not substantially mitigated disposal in the intervening years.

Disposal trends appear to be most closely linked to economic growth and economic contractions. Averaging PPD from 2000–2017 includes years of strong economic growth and years of economic downturn. This is appropriate for projections, as there are likely to be periods of economic growth and economic contraction in the years leading up to 2030.

The revised disposal projections linked to 2000–2017 PPD result in a BAU disposal projection of 384 Million tons of organic waste. Achieving the SB 1383 reductions targets under the revised projection will require the management and redirection of 289 million tons of organic waste from landfill disposal.

This scenario attempts to account for the increase in disposal demonstrated in previous years, which results in a roughly 50 percent increase (95 million tons) in the total amount of organic material that must be redirected from landfills from 2019–2030.

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