Study to Identify Potential Long-Term Threats and Financial Assurance Mechanisms for Long-Term Postclosure Maintenance and Corrective Action at Solid Waste Landfills

DRAFT REPORT
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California Integrated Waste Management Board
Contract IWM06051

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TABLE OF CONTENTS

Page

ACKNOWLEDGMENTS ..... **ix**
EXECUTIVE SUMMARY **ES-1**
1. INTRODUCTION **1-1**
1.1 HISTORY OF STUDY 1-1
1.2 PURPOSE OF STUDY 1-2
1.3 STUDY REQUIREMENTS 1-2
1.4 CONTRACTOR/CONSULTANTS 1-3
1.5 UNDERSTANDING OF PROJECT 1-4
2. EVALUATION OF EXISTING FINANCIAL ASSURANCE MECHANISMS FOR SOLID WASTE LANDFILLS **2-1**
2.1 CRITERIA AND MECHANISMS FOR EVALUATION 2-1
2.2 EVALUATIONS 2-2
2.2.1 Trust Fund (27 CCR §22240 and Form 100) 2-3
2.2.1.1 What Is A Trust Fund? 2-3
2.2.1.2 How Does A Trust Fund Work? 2-4
2.2.1.3 Evaluation of Trust Fund 2-4
Certainty That Assured Funds Will Be Available 2-4
Adequacy of Amount of Funds Assured 2-5
Liquidity of Funds 2-5
Administrative Burden and Costs 2-5
Long-Term Extension of Assurance 2-5
2.2.2 Enterprise Fund (27 CCR §22241) 2-6
2.2.2.1 Evaluation of Enterprise Fund 2-9
Certainty That Assured Funds Will Be Available 2-9
Adequacy of Amount of Funds Assured 2-9
Liquidity of Funds 2-10
Administrative Burden and Costs 2-10
Long-Term Extension of Assurance 2-10
2.2.3 Proceeds from the Sale of Government Securities (27 CCR §22242) 2-10
2.2.3.1 How Does the Mechanism Work? 2-11
2.2.3.2 Who Can Use It? 2-13
2.2.3.3 Evaluation of Proceeds from Sale of Government Securities 2-13
Certainty That Assured Funds Will Be Available 2-13
Adequacy of Amount of Funds Assured 2-13
Liquidity of Funds 2-14
Administrative Burden and Costs 2-14
Long-Term Extension of Assurance 2-14

TABLE OF CONTENTS
(continued)

Page

2.2.4 Letter of Credit (27 CFR §22243 and Form 101) 2-15
2.2.4.1 What Is An Irrevocable Standby Letter of Credit? 2-15
2.2.4.2 How Does A Letter of Credit Work? 2-15
2.2.4.3 Who Can Use A Letter of Credit? 2-16
2.2.4.4 Evaluation of Letter of Credit 2-16
Certainty That Assured Funds Will Be Available 2-16
Adequacy of Amount of Funds Assured 2-17
Liquidity of Funds 2-17
Administrative Burden and Costs 2-17
Long-Term Extension of Assurance 2-17
2.2.5 Surety Bond (27 CCR §22244 and Forms 102 and 103) 2-17
2.2.5.1 What Is A Surety Bond? 2-17
2.2.5.2 How Does the Surety Bond Work? 2-18
2.2.5.3 Who Can Use A Surety Bond? 2-18
2.2.5.4 How Does A Surety Bond Compare to Insurance? 2-19
2.2.5.5 Evaluation of Surety Bonds 2-19
Certainty That Assured Funds Will Be Available 2-19
Adequacy of Amount of Funds Assured 2-19
Liquidity of Funds 2-20
Administrative Burden and Costs 2-20
Long-Term Extension of Assurance 2-20
2.2.6 Pledge of Revenue (27 CCR §22245) 2-20
2.2.6.1 What Is the Pledge of Revenue? 2-20
2.2.6.2 Who Can Use the Pledge of Revenue? 2-22
2.2.6.3 How Does the Pledge Work? 2-22
2.2.6.4 Evaluation of Pledge of Revenue 2-22
Certainty That Assured Funds Will Be Available 2-22
Adequacy of Amount of Funds Assured 2-23
Liquidity of Funds 2-23
Administrative Burden and Costs 2-23
Long-Term Extension of Assurance 2-23
2.2.7 Financial Means Test (27 CCR §22246 and Form 104)) 2-23
2.2.7.1 What Is the Financial Means Test? 2-23
2.2.7.2 How Does the Financial Means Test Work? 2-24
2.2.7.3 Who Can Use the Financial Test of Self-Insurance? 2-25
2.2.7.4 Evaluation of Financial Means Test 2-25
Certainty That Assured Funds Will Be Available 2-25
Adequacy of Amount of Funds Assured 2-28

TABLE OF CONTENTS
(continued)

Page

Liquidity of Funds 2-28
Administrative Burden and Costs 2-28
Long-Term Extension of Assurance 2-28
2.2.8 Corporate Guarantee (27 CCR §22247 and Form 105) 2-29
2.2.8.1 What Is A Corporate Guarantee? 2-29
2.2.8.2 How Does The Corporate Guarantee Work? 2-29
2.2.8.3 Who Can Provide A Guarantee? 2-29
2.2.8.4 Evaluation of Corporate Guarantee 2-31
Certainty That Assured Funds Will Be Available 2-31
Adequacy of Amount of Funds Assured 2-31
Liquidity of Funds 2-31
Administrative Burden and Costs 2-31
Long-Term Extension of Assurance 2-32
2.2.9 Insurance (27 CCR §22248 and Form 106) 2-32
2.2.9.1 What Is Insurance? 2-32
2.2.9.2 How Does Insurance Work? 2-32
2.2.9.3 Who Can Provide Insurance 2-33
2.2.9.4 Evaluation of Insurance 2-34
Certainty That Assured Funds Will Be Available 2-34
Adequacy of Amount of Funds Assured 2-35
Liquidity of Funds 2-35
Administrative Burden and Costs 2-35
Long-Term Extension of Assurance 2-36
2.2.10 Local Government Financial Test (27 CCR §22249 and Form 112) 2-36
2.2.10.1 What Is the Local Government Financial Test? 2-36
2.2.10.2 How Does the Local Government Financial Test of Self-Insurance Work? 2-36
2.2.10.3 Who Is Eligible to Use the Test? 2-36
2.2.10.4 Who Is Qualified to Use the Test? 2-37
2.2.10.5 Evaluation of Local Government Financial Test 2-39
Certainty That Assured Funds Will Be Available 2-39
Adequacy of Amount of Funds Assured 2-39
Liquidity of Funds 2-39
Administrative Burden and Costs 2-39
Long-Term Extension of Assurance 2-40
2.2.11 Local Government Guarantee (27 CCR §22249.5 and Form 113) 2-40
2.2.11.1 What Is the Local Government Guarantee? 2-40
2.2.11.2 Who Can Provide A Guarantee? 2-40

TABLE OF CONTENTS
(continued)

Page

2.2.11.3 Evaluation of Local Government Guarantee 2-41
Certainty That Assured Funds Will Be Available 2-41
Adequacy of Amount of Funds Assured 2-41
Liquidity of Funds 2-42
Administrative Burden and Costs 2-42
Long-Term Extension of Assurance 2-42
2.2.12 Federal Certification (27 CCR §22250) 2-42
2.2.12.1 What Is A Federal Certification? 2-42
2.2.12.2 How Does the Federal Certification Work? 2-43
2.2.12.3 Who Can Provide A Federal Certification? 2-43
2.2.12.4 Evaluation of Federal Certification 2-43
Certainty That Assured Funds Will Be Available 2-43
Adequacy of Amount of Funds Assured 2-43
Liquidity of Funds 2-43
Administrative Burden and Costs 2-44
Long-Term Extension of Assurance 2-44
2.3 MECHANISMS NOT RECOMMENDED 2-44
2.4 ANNUITIES 2-47
2.4.1 What are Annuities? 2-48
2.4.2 How Does An Annuity Work? 2-49
2.4.3 Annuities as FA Mechanisms for PCM and/or Reasonably Anticipated CA 2-51
2.4.4 California Example 2-52
2.4.5 Annuities in Financial Assurance: Pennsylvania 2-53
2.4.6 Annuities in Financial Assurance: Tennessee 2-54
2.4.7 Evaluation of Annuities 2-57
2.4.7.1 Certainty that Assured Funds will be Available 2-57
2.4.7.2 Adequacy of Amount of Funds Assured 2-57
2.4.7.3 Liquidity of Funds 2-58
2.4.7.4 Administrative Burden and Costs 2-58
2.5 GUARANTEED INVESTMENT CONTRACTS (GICs) 2-58
2.5.1 What are GICs? 2-58
2.5.2 GICs as FA Mechanisms for PCM and/or Reasonably Anticipated CA 2-61
2.5.3 Evaluation of GICs 2-62
2.5.3.1 Certainty that Assured Funds will be Available 2-62
2.5.3.2 Adequacy of Amount of Funds Assured 2-63
2.5.3.3 Liquidity of Funds 2-63
2.5.3.4 Administrative Burden and Costs 2-63

TABLE OF CONTENTS
(continued)

Page

3. ANALYSIS OF STATE FUND 3-1

3.1 FUND DESIGN FEATURES AND OPTIONS 3-1

3.1.1 Which Types of Costs Are Covered? 3-2

3.1.1.1 Default-Only Funds vs. Pay-All-Costs Funds 3-2

3.1.1.2 Closure, Postclosure Maintenance, Corrective Action, and Liability Compensation: What Does the Fund Cover? 3-2

3.1.2 Which Entities Are Covered? 3-7

3.1.2.1 Landfill Operating Status 3-7

3.1.2.2 Responsible Parties 3-8

3.1.3 Mandatory or Voluntary Participation 3-9

3.1.4 Sources of Money for the Fund 3-10

3.1.5 Analysis of Alternative Fund Designs 3-13

3.2 REVIEW OF EXPERIENCE WITH POOLED FUNDS 3-17

3.2.1 Definition of Pooled Funds 3-17

3.2.2 Solid and Hazardous Waste Pooled Funds 3-19

3.2.2.1 California Solid Waste Disposal Site Cleanup Trust Fund 3-19

3.2.2.2 Postclosure Liability Trust Fund (PCLTF) 3-22

3.2.2.3 Minnesota Closed Landfill Program 3-23

3.2.2.4 Mississippi Nonhazardous Solid Waste Corrective Action Trust Fund 3-25

3.2.2.5 Metropolitan Landfill Contingency Action Trust Account 3-28

3.2.3 Product Funds 3-29

3.2.3.1 California Underground Storage Tank Cleanup Trust Fund 3-30

3.2.3.2 Heating Oil and Used Oil Funds 3-32

3.2.3.3 Waste Tire Funds 3-32

3.2.3.4 Minnesota Drycleaner Environmental Response and Reimbursement Account 3-32

3.2.3.5 Wisconsin Drycleaner Environmental Response Fund (DERF) Program 3-35

3.3 WORKING MODEL OF STATEWIDE DEFAULT FUND FOR ASSURANCE OF PCM AND CA 3-37

3.3.1 Purpose and Design of the Working Model 3-37

3.3.2 Data Used in the Working Model 3-46

3.3.3 Key Modules 3-48

3.3.3.1 How ICF Simulated Postclosure Maintenance 3-48

3.3.3.2 How ICF Simulated Corrective Actions 3-49

3.3.3.3 How ICF Simulated Performance Defaults in Fund Working Model 3-68

3.3.3.4 Modeling How Landfills will Provide Funds in Fund Working Model 3-79

3.3.4 Results of the Model 3-83

TABLE OF CONTENTS
(continued)

Page

4. UMBRELLA POLICIES OF INSURANCE FOR FINANCIAL ASSURANCE OF POSTCLOSURE MAINTENANCE AND/OR CORRECTIVE ACTION 4-1
4.1 DESIRED COVERAGE 4-1
4.1.1 Reasons for Funding Shortfalls 4-2
4.1.2 Cancellation, Termination, Non-renewal, and Voiding/Rescission 4-3
4.1.3 Timely Payout to CIWMB 4-4
4.1.4 Draft Endorsement 4-4
4.2 OTHER ISSUES TO BE RESOLVED 4-5
4.2.1 Due Diligence 4-6
4.2.2 Type of Coverage 4-8
4.2.3 Defaults and Moral Hazard 4-9
4.2.4 Potential Limits of Liability 4-9
4.2.5 Potential Exclusions for Certain Perils and Causes of Default 4-10
4.3 FEEDBACK FROM THE INSURANCE MARKET 4-10
4.3.1 Background 4-10
4.3.2 Umbrella Insurance as Outlined in the ICF Document 4-12
4.3.3 Alternative Concepts 4-15
4.3.4 Conclusions 4-17
5. RISK SCREENING METHODOLOGY 5-1
5.1 INTRODUCTION AND PURPOSE 5-1
5.2 EVALUATIVE METHODOLOGY 5-1
5.3 SELECTION OF FACTORS 5-1
5.3.1 Temporal Issues 5-8
5.4 TESTING OF FACTORS 5-11
5.5 METHOD/MODEL FOR APPLYING FACTORS TO A LANDFILL 5-14

ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

Chapter 1 presents background information and introduces the study. The history of the study recaps several years of research, analysis, and outreach by the CIWMB and summarizes AB2296 provisions related to postclosure maintenance (PCM), corrective action (CA), financial assurance (FA), and identifying potential threats to public health and safety and the environment. Chapter 1 identifies the contractor team and the external consulting group reviewers. Finally, Chapter 1 provides context for the study by explaining the importance of PCM, CA, and providing FA.

Chapter 2 presents ICF's evaluation of currently allowed mechanisms in terms of the criteria certainty of assurance, amount assured, liquidity, and administrative burden and cost. ICF's ratings of the mechanisms are shown in Exhibit ES-1. In general, ICF rates the mechanisms good or better with the exception of the pledge of revenues and the federal certification.

EXHIBIT ES-1
Overview of Evaluation of Mechanisms

	Certainty	**Amount**	**Liquidity**	**Burden/Cost**
Trust Fund	High	Medium	High	High
Enterprise Fund	Medium	Medium	High	High
Sale of Securities	Medium	High	High	High
Letter of Credit	High	High	High	Low
Surety Bond	High	High	Medium	Low
Pledge of Revenue	Low	Low	Medium	Low
Financial Means Test	Medium	High	Medium	Medium
Corporate Guarantee	High	High	Medium	Medium
Insurance	Medium	Medium	Medium	High
Government Fin. Test	Medium	High	Medium	Medium
Government Guarantee	High	High	Medium	Medium
Federal Certification	Low	Low	Low	Low

ICF also reviewed the ability of the currently allowed mechanisms to provide a greater amount of assurance for a longer time period. For most of the mechanisms themselves, little to no change in the required forms would be necessary. For some mechanisms, providers may be dissuaded by the potentially lengthy time frames involved. The CIWMB might want to review -- across the relevant mechanisms – provisions for transfer or replacement of providers and rationales for any inconsistencies. If a larger dollar amount will be required to be assured (e.g., due to a greater number of years required for FA of PCM), then the CIWMB may want to assess

implications for the types of mechanisms with criteria that limit the dollar amount of coverage they can provide for any particular LF and mechanisms for which build-up periods are allowed.[1]

Chapter 3 presents ICF's work on a state fund alternative for FA. The chapter identifies the key features and options for designing state funds and considers the advantages and disadvantages of designing funds with different scopes of coverage. Specifically, Section 3.1 discusses whether a fund should cover all costs, or only costs where the responsible party has defaulted; whether to cover PCM, CA, or both, including only Post-30 PCM[2] or only postclosure CA; whether the fund should cover only closed, operating, or all landfills; whether the fund should cover landfills that have public sector responsibility parties, private sector responsible parties, or both; and whether the fund should be voluntary or mandatory. Options for revenue sources include tip fee surcharges, other landfill payments, product fees, cost recovery, government payments, and earnings on unexpended fund balances. The section concludes with a conceptual evaluation of a specific fund design and several variations. The evaluation demonstrates that a qualitative evaluation can go only so far, and that data are required for even a first-order screening assessment of a fund design.

Section 3.2 assesses experience with similar types of funds, primarily at the state level. ICF researched state environmental funds using criteria developed with the CIWMB staff and discovered very few true precedents of a state fund for only PCM and/or CA, funded primarily by assessments on potential fund claimants. ICF also summarized related state funds, such as those for underground storage tanks of petroleum, that draw revenues from assessments on products.

Section 3.3 presents the state fund working model developed by ICF as a tool for assessing state fund designs for PCM and/or CA for solid waste landfills. The model was designed to simulate a mandatory state fund for defaulted costs of PCM and/or CA at both operating and closed LFs, regardless of whether the LF is the responsibility of the private sector or the public sector. The contract specifies that fund contributions must be made only by operating LFs, not closed LFs. Otherwise, the model was designed so that its elements could be changed easily by the user. The model was designed to facilitate "what if" simulations. This section explains the design decisions made and their rationales, key assumptions, and data used in the model. Outputs from the model describe total PCM and CA costs over time, simulated defaults, simulated payments into the fund and earnings on unexpected balances, and resulting fund balances over time.

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[1] Operators that use mechanisms other than a trust fund or an enterprise fund are not allowed to use a buildup period. They must immediately demonstrate the full amount of coverage. A buildup period is not applicable to these mechanisms because the operator does not set aside funds to pay for postclosure maintenance. Rather, the operator either (1) contracts with a third party, who promises to satisfy the operator's obligations if the operator fails to do so; or (2) demonstrates the ability to pay for the assured costs by passing the financial test or pledges future revenues to cover the costs. These mechanisms are generally substantially less expensive than a trust fund or enterprise fund.

[2] Post-30 PCM refers to the costs of PCM from the end of the first thirty years until the end of the PCM period.

Exhibit ES-2 shows that a defined Base Case scenario with a 7.8 cents/ton surcharge on waste disposed has a 91% probability of always having sufficient funds to covered defaulted PCM and CA in all modeled years. Exhibit ES-3 plots the fund balance over time.

The parameters used to project future CA costs – which are very uncertain and controversial – indicate that PCM costs dominate CA costs, as shown in Exhibit ES-4. On the other hand, because the model treats private and public sector landfills virtually the same, and because about 75% of the landfills are public sector responsibilities, the bulk of defaulted costs are simulated to arise from public sector landfills, as shown in Exhibit ES-5.

Exhibit ES-6 indicates that the majority of cumulative total defaulted costs arise from urban LFs. Because over 90% of LFs are projected to be closed by 2050, most of the defaulted CA costs occur at closed LFs, not active LFs, as illustrated by Exhibit ES-7. Finally, Exhibit ES-8 presents a calculation that distinguishes between defaulted PCM costs in the first 30 years and in the following period. Given no assumed end of PCM in the model, post-30 PCM dominates the first 30 years of PCM.

Chapter 4 describes the development of a mandatory "umbrella" insurance concept that would fill any gaps in coverage or requirements for additional funding beyond that assured by FA mechanisms for PCM and/or CA. ICF prepared an endorsement that incorporates the desired coverage. Notably, the CIWMB seeks insurance that would cover all funding shortfalls with no exception, exclusions, conditions, or limitations based on the cause of the default. No deductibles, copayments, or self-insured retentions would reduce payments under the policy.

Chapter 4 describes a number of issues about the insurance concept. For example, the potential length of the program (e.g., over two hundred years) suggests that it should be implemented in 5- to 10-year phases, put out for bid. Given the many uncertainties, insurers should not be expected to sign up for a long-term program. Chapter 4 also discusses different perspectives on insurer claims management and ways of setting and raising premiums, which will require active oversight and supervision.

Chapter 4 also presents issues that can be expected to concern insurers such as due diligence, liability limits, and moral hazard. Feedback from the insurance marketplace reveals that major environmental insurers have some serious reservations about the umbrella concept.

Chapter 5 presents the work performed to assess potential proxy indicators of PCM and/or CA risk at LFs. The goal was to identify (and weigh, as needed) a small number of factors that can be applied to simply and easily screen LFs into high, medium, and low potential risk. Factors related to LF setting (e.g., seismic, rainfall); LF design, construction, and maintenance (e.g., capacity/size, engineering controls); operational practices; distance to sensitive receptors; and compliance status were evaluated, including scoring criteria and data sources. The study also analyzes those factors that typically vary over long periods of time. After testing the factors and their weighing for various scenarios, a method was developed that can be applied to any permitted LF. See Exhibit ES-9.

EXHIBIT ES-2
Probability that Annual Fund Balance is Adequate in all Model Years

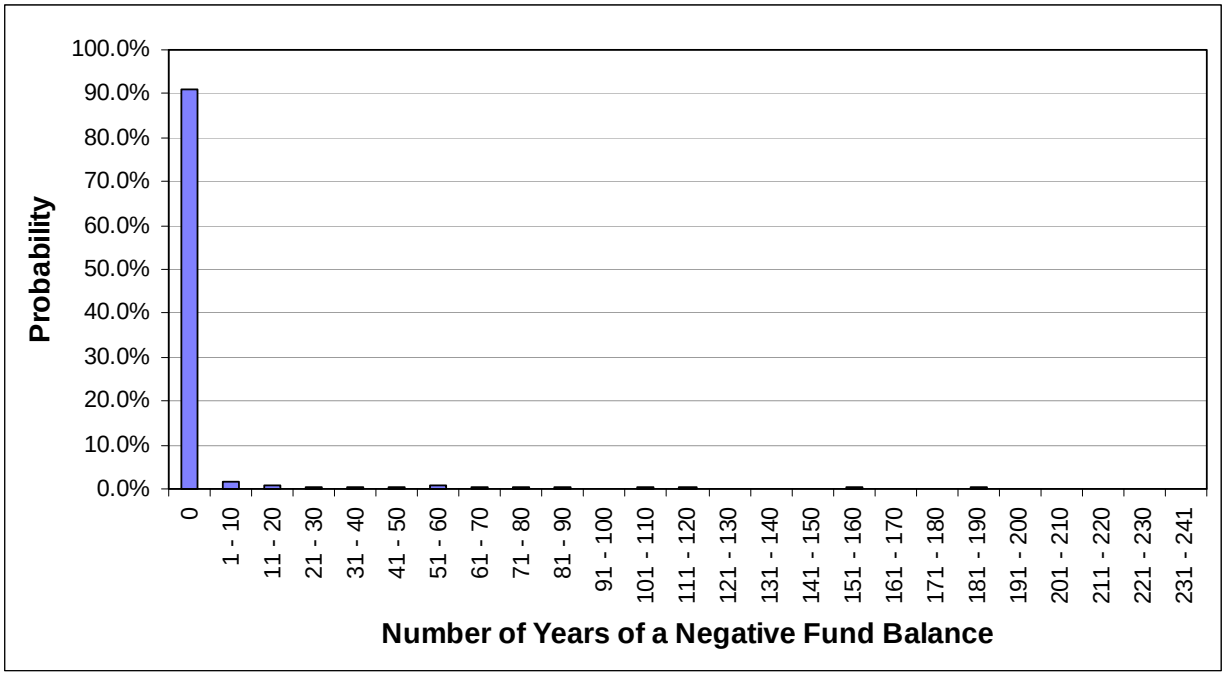

EXHIBIT ES-3
Fund Balance in Each Year of the Modeling Period for the Median Cost Scenario

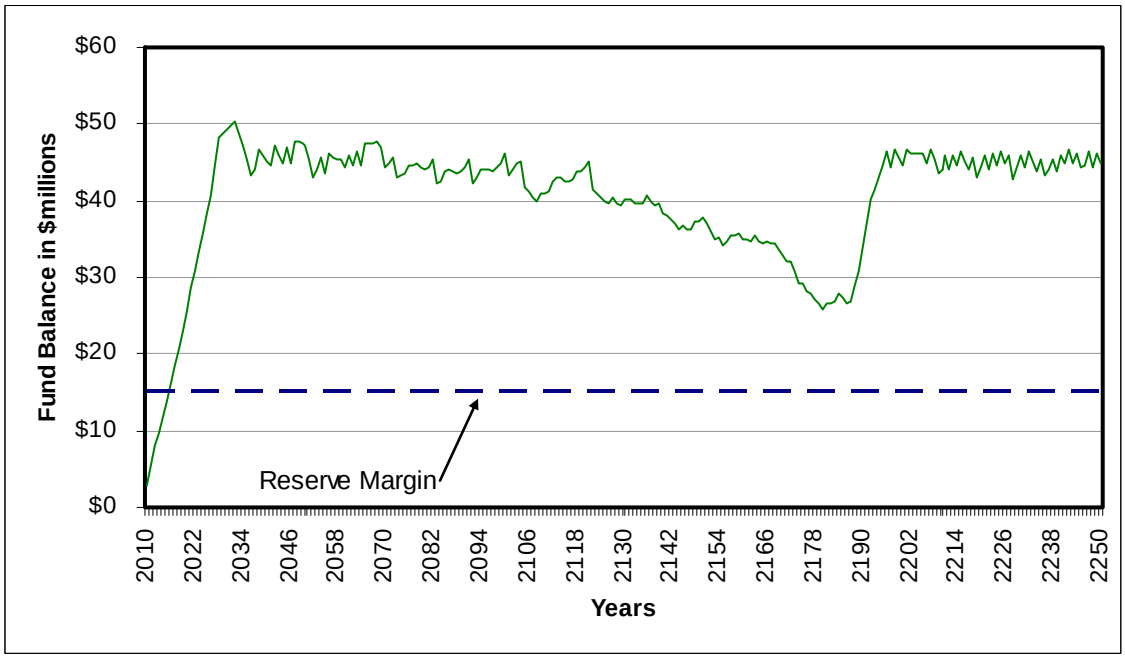

EXHIBIT ES-4
Cumulative Total Corrective Action and Postclosure Maintenance Costs for the Median Cost Scenario

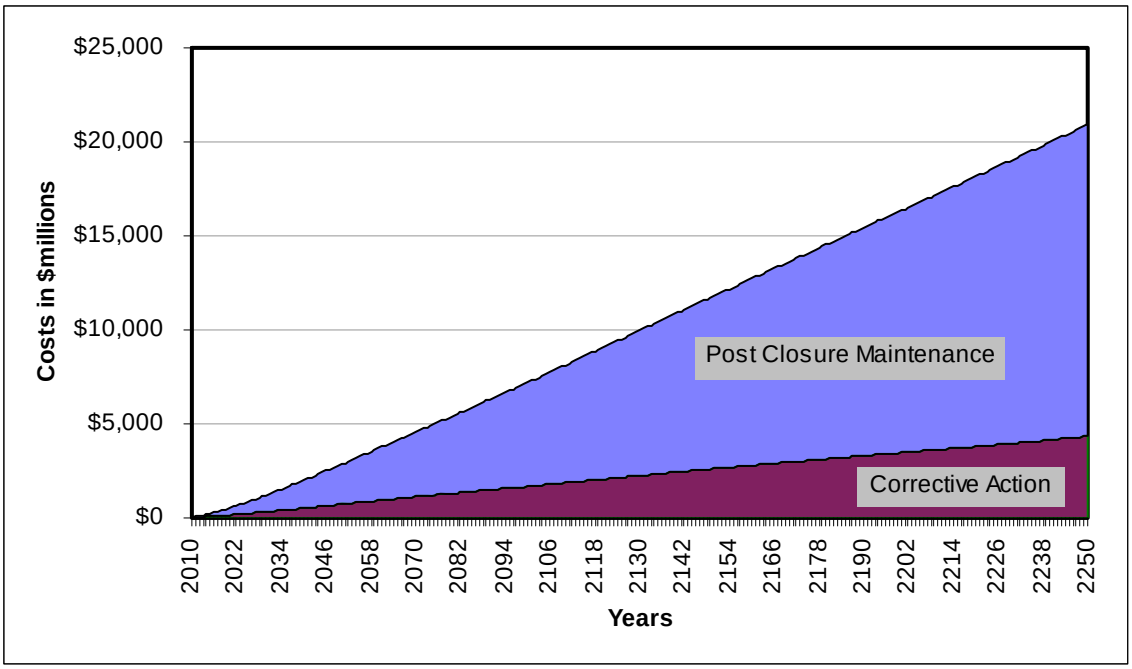

EXHIBIT ES-5
Annual Total Default Costs by Owner Type for the Median Cost Scenario

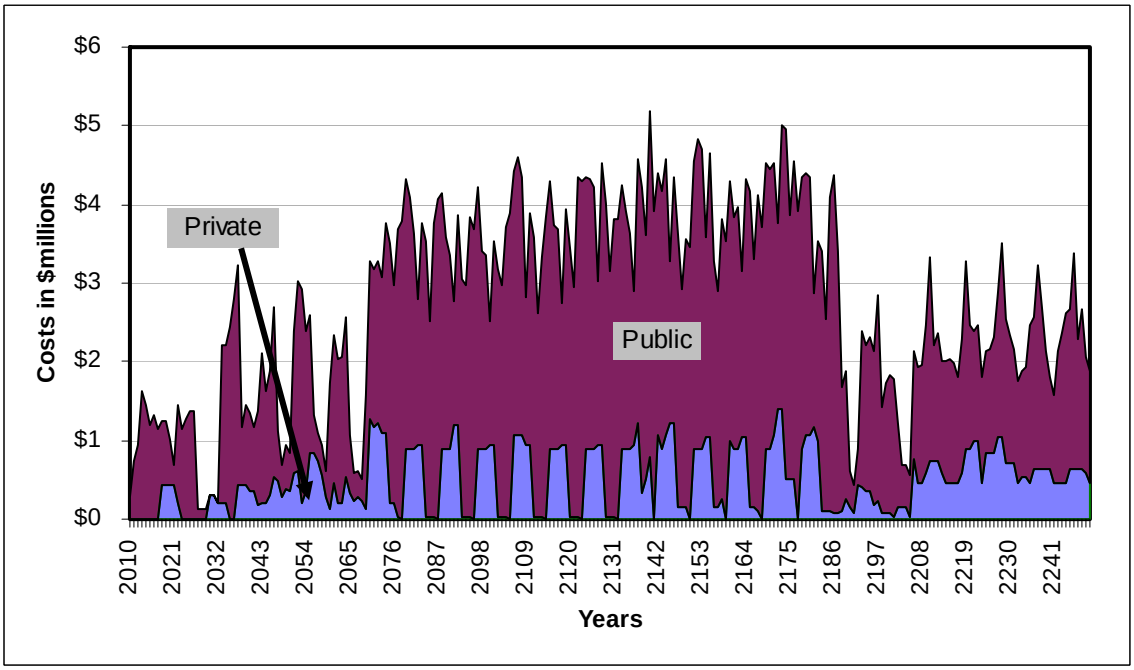

EXHIBIT ES-6
Cumulative Total Defaulted Costs by Proximity to Urban Areas

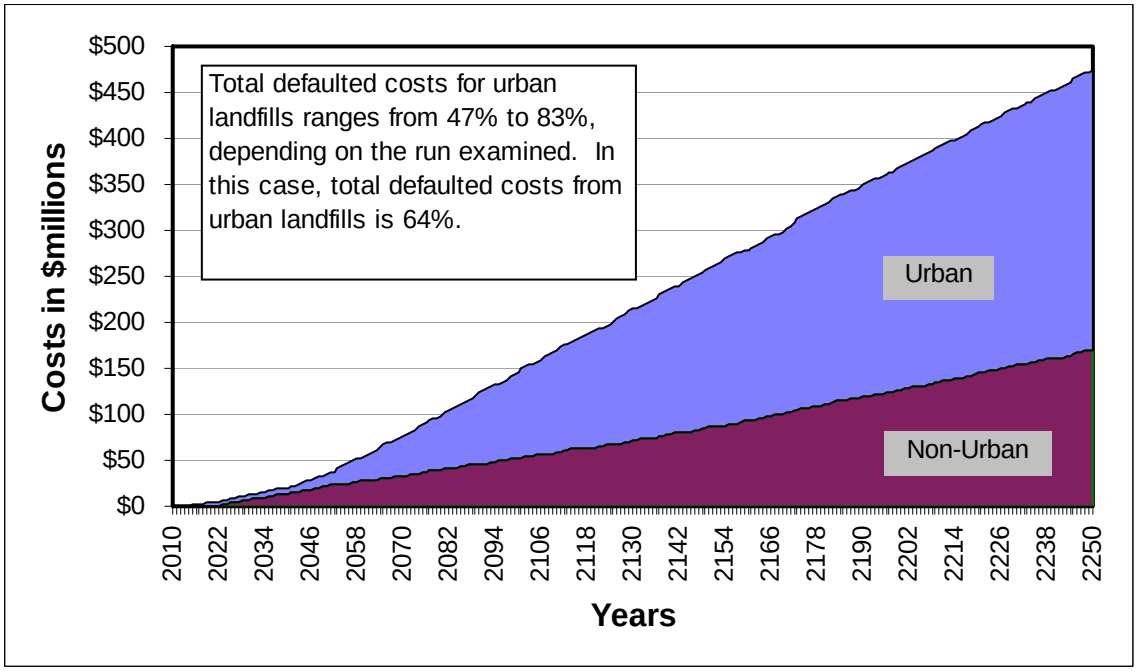

EXHIBIT ES-7
Cumulative Total Defaulted Corrective Action Costs by Operational Status

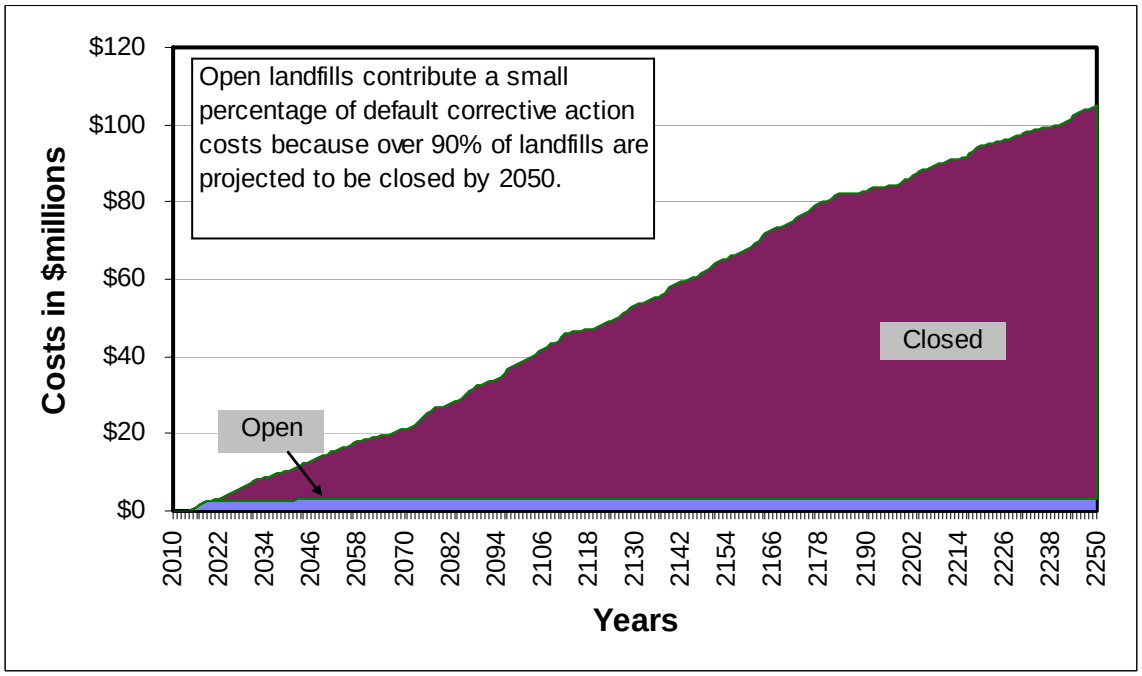

EXHIBIT ES-8
Cumulative Total Defaulted PCM Costs by 30 Year Period and Post 30 Year Period

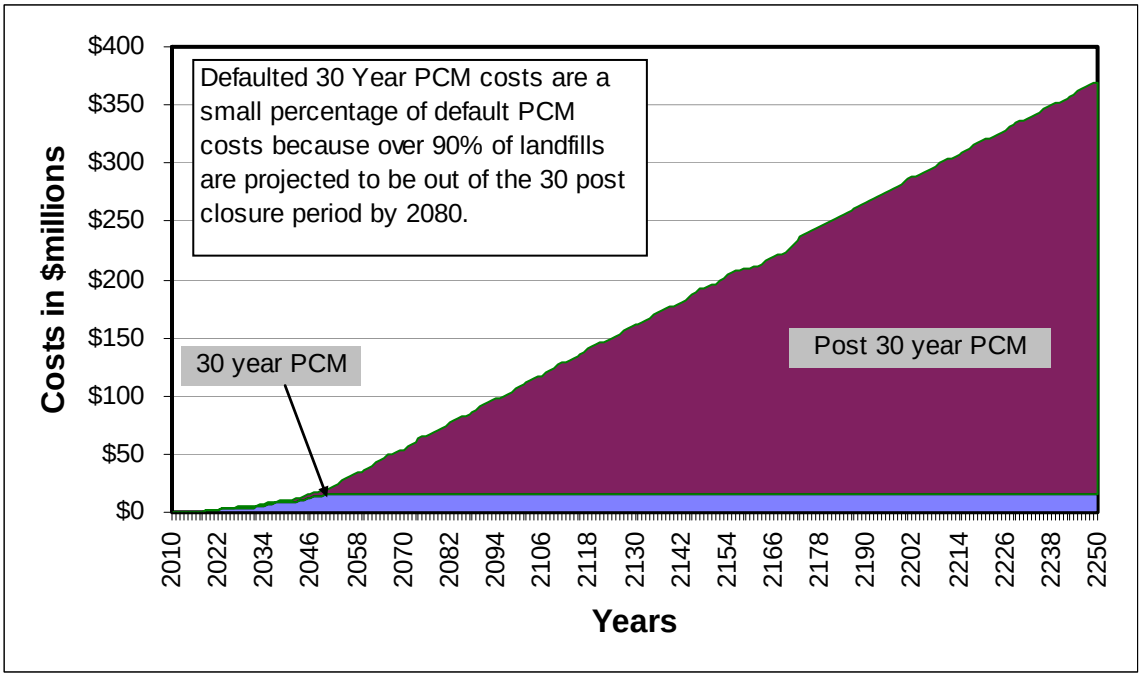

EXHIBIT ES-9
Risk Proxy Factors and Scoring Criteria

Factor	Scoring Criteria	Resource for Quantitative Data/Information
Seismic Characteristics	Designed for: • Max Credible Earthquake; 1.5 or above factor of safety (low impact (low)) • Most Probable Earthquake; below 1.5 factor of safety, but at least 1.3 (medium impact (medium)) • No design (high impact (high))	• US Geological Survey, Custom Mapping and Analysis Tools • California Geological Survey • California Waste Management Board, Solid Waste Facility Permits • Regional Water Quality Control Boards, Reports of Waste Discharge
Rainfall Intensity	Designed for: • 1000 year/24 hour storm (low) • 100 year/24 hours storm (medium) • Not designed for 100 year/24 hour storm (high)	• Reports of Waste Discharge • Local Electric Utilities • State Meteorological Stations
Floodplain (from base of landfill)	• Location within 100 year floodplain (high) • Location within 500 feet of 100 year floodplain (medium) • Location not Within 500 feet of 100 year floodplain (low)	• Federal Emergency Management Administration, Map Service Center

EXHIBIT ES-9
Risk Proxy Factors and Scoring Criteria

Factor	Scoring Criteria	Resource for Quantitative Data/Information
Fire (intrusion from off site)	• Adjacent land area with high fire hazard potential (high) • Adjacent land area with moderate fire hazard potential (medium) • Adjacent Land Area with low fire hazard (low)	• Department of Forestry and Fire Protection, Fire Hazard Severity Zones
Engineering Controls	• Combination of Subtitle D equivalent and non-Subtitle D equivalent design, or no Subtitle D design (high) • Subtitle D or equivalent design (medium) • Above Subtitle D design (low)	• California Waste Management Board, Solid Waste Facility Permits • Regional Water Quality Control Boards, Reports of Waste Discharge
Permitted Capacity[a]	• Greater than 30,000,000 cubic yards (high) • Less than 500,000 cubic yards (low) • 500,000 and 30,000,000 cubic yard (medium)	• California Waste Management Board, Solid Waste Facility Permits
Type of Waste in Place	• Pre-Subtitle D, co-disposal waste (high) • MSW (medium) • Monofill, C&D (low)	• California Waste Management Board, Solid Waste Facility Permits, Solid Waste Information System • Regional Water Quality Control Boards, Reports of Waste Discharge
Slope Stability	• Side slopes 2:1 or steeper, or history of slope failure (high) • Side slopes between 2:1 and 4:1 (medium) • Side slope less steep than 4:1 (low)	• California Waste Management Board, Solid Waste Facility Permits • Regional Water Quality Control Boards, Reports of Waste Discharge
Liquids Management/ Landfill Bioreactor Technology	• Permitted leachate recirculation(medium) • Bioreactor permitted (low) • Neither of the above (high)	• California Waste Management Board, Solid Waste Facility Permits • Regional Water Quality Control Boards, Reports of Waste Discharge
Hydrogeology	• Depth to groundwater (measured from base of landfill) • Less than 50 feet (high) • 50 to 100 feet (medium) • Greater than 100 feet (low)	• California Waste Management Board, Solid Waste Facility Permits • Regional Water Quality Control Boards, Reports of Waste Discharge
Proximity to Urban Areas	• In urban (high) • Not in urban (low)	• California Waste Management Board

[a] Permitted capacity intervals used for scoring criteria are preliminary and may be modified after further analysis.

EXHIBIT ES-9
Risk Proxy Factors and Scoring Criteria

Factor	Scoring Criteria	Resource for Quantitative Data/Information
Proximity to Sensitive Habitat	• Sensitive species at location (high) • No sensitive species at location (low)	• Department of Fish and Game, Biogeographic Information and Observation System, Internet Mapping Application Products and Solutions
Compliance Status	• Current CA, cleanup or abatement orders (high) • Past history of CA or ongoing/repeat violations (medium) • Compliant (low)	• California Integrated Waste Management Board • Regional Water Quality Control Boards

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1. INTRODUCTION

1.1 HISTORY OF STUDY

Current statutes and regulations require owners/operators to be responsible for postclosure maintenance (PCM) activities at solid waste landfills for a minimum of 30 years after closure and until it can be demonstrated by the owner/operator that the waste no longer poses a threat. However, financial assurance (FA) demonstrations for these activities currently are required only for the first 30 years of PCM. For several years, the Board has been exploring the issue and considering whether and how FA demonstrations should be required for more than 30 years.

In November 2003, December 2004, August 2005, October 2005, and January 2006, Board staff held workshops and work group meetings to discuss the various issues of PCM as it is currently implemented, including, but not limited to, the ongoing necessity to maintain closed landfills beyond 30 years, the costs of potential CA necessary at landfills, the current FA demonstrations provided to the State, and, the potential for new FA demonstrations and financing mechanisms.

As a result of these public workshops and public working group meetings, Assembly Member Cindy Montanez authored Assembly Bill 2296 (Chapter 504, Statute of 2006), enacted on September 27, 2006. This bill requires the Board on or before January 1, 2008 to:

- Conduct a study to define the conditions that potentially affect solid waste landfills, including technologies and engineering controls designed to mitigate potential risks, to identify potential long-term threats to public health and safety and the environment.

- Conduct a study on various financial assurance mechanisms that would protect the State from long-term postclosure maintenance and corrective action costs in the event that a landfill owner or operator fails to meet its legal obligations to fund postclosure maintenance or corrective action during the postclosure period.

- Conduct a study of the risks of landfills throughout the state and promulgate regulations and develop recommendations for needed legislation to implement the findings of the study.

- Adopt regulations that provide for an increase in the initial closure and postclosure maintenance cost estimates to account for cost overruns due to unforeseeable circumstances, and to provide a reasonable contingency comparable to that which is built into cost estimates for other, similar public works projects.

- On or before January 1, 2008, adopt regulations that require closure and postclosure maintenance cost estimates to be based on reasonably foreseeable costs the State may incur if the State would have to assume responsibility for the closure and postclosure maintenance due to the failure of the owner or operator.

The bill also requires the Board, when conducting the study, to consult with representatives of the League of California Cities, the County Supervisors Association of California, private and public waste management service providers, and environmental organizations.

At its meeting on September 12, 2006, the Board approved allocation proposal 2006-D-8, during its consideration of agenda item 22, for $300,000 from the Integrated Waste Management Account (IWMA) to conduct a study of the availability and applicability of FA mechanisms that could be used to cover long-term PCM and known or reasonably foreseeable CA at solid waste landfills.

1.2 PURPOSE OF STUDY

The study will identify potential long-term threats and FA mechanisms for long-term PCM and CA at solid waste landfills. It will assess the pros and cons of various options such as a statewide requirement in which all operators contribute to a pooled fund to provide for the PCM and/or CAs faced at facilities, or a statewide requirement that operators purchase insurance coverage for any costs faced at the facility that are not already identified and otherwise assured to the State. The study will also define potential threats to public health and safety or the environment posed by the location and conditions of different landfills, as well as possible positive aspects of landfills' construction and containment techniques and materials, which could impact long-term threats to public health and safety or the environment. Specific contract requirements are identified in the Scope of Work, which the Board approved at its November 15, 2006 Meeting. Based upon the results of the study, staff will provide the Board with recommendations regarding long-term PCM and CA financial assurance requirements.

1.3 STUDY REQUIREMENTS

The study consists of two components:

- **Component I**: Requires ICF to evaluate applicable FA demonstrations for long-term PCM and CA financial exposures for both active and closed landfills, and develop a working model for a statewide pooled fund and criteria for insurance coverage for all exposures not already identified and assured.

- **Component II**: Requires ICF to identify potential risks posed by the location and condition of solid waste landfills, evaluate how construction techniques and materials and environmental control systems may exacerbate or mitigate potential risks to public health and safety or the environment, and evaluate how these risks are likely to change over time.

The components are divided into six separate tasks:

Component I

- **Task 1**: Finalize a detailed work plan for Tasks 2 through 4 indicating the steps that will be taken in completing each task.

- **Task 2**: Review existing financial demonstrations and provide a detailed report of appropriate applicable alternative financial mechanisms.

- **Task 3**: Develop a detailed report and working model of a statewide pooled fund to receive equitable contributions from all operating solid waste landfills within California to cover all long-term PCM and CA at active and closed solid waste landfills.

- **Task 4**: Develop a model product that could be purchased by all landfill operators to provide an umbrella insurance policy capable of assuring all long-term PCM and CA costs at active and closed landfills not already identified and assured to the CIWMB.

Component II

- **Task 5**: Finalize a detailed work plan for Task 6 indicating the steps that will be taken in completing the task.

- **Task 6**: Develop a detailed report showing factor analysis, assumptions, and recommendations along with automated methodology for determining overall financial assurances coverage levels for any active or closed landfill in California.

1.4 CONTRACTOR/CONSULTANTS

At its meeting on May 15, 2007, the Board approved ICF Consulting Services of Fairfax, Virginia as the contractor during its consideration of agenda item 10. ICF included as subcontractors CalRecovery, Inc., American Risk Management Resources, and SDV/ACCI (disabled veteran small business). The original term of the contract was June 14, 2007 to December 1, 2007.

In response to the requirements of AB 2296 that the Board consult with specified representatives in conducting the study, Board staff worked with representatives of the following stakeholders during the contract period:

- League of California Cities

- California State Association of Counties (CSAC)

- Private and Public Waste Services
  - Solid Waste Association of North America (SWANA)
  - Regional Council of Rural Counties (RCRC)
  - Solid Waste Industry Group (SWIG)

- Los Angeles (LA) County Integrated Waste Management Task Force
- LA County Department of Public Works, Environmental Programs Division
- LA County Sanitation District

- Environmental Organizations

- Californians Against Waste (CAW)

- Sierra Club

The consulting group served throughout the contract process by reviewing and commenting on each draft deliverable developed by ICF. Because the time allowed for completing the contract was less than 5 months, the consulting group had approximately one week to review and comment on each draft deliverable. Board staff reviewed all of the comments received from the consulting group before submitting staff's recommendations to ICF. In addition, all comments received from the consulting group were forwarded to ICF as information. All comments submitted by the consulting group are available for public review.

1.5 UNDERSTANDING OF PROJECT

CIWMB has aggressively tackled one of the thorniest issues of environmental management – when wastes or hazardous materials are left in the ground for disposal, how do society's stewards (e.g., owners/operators, LEAs, CIWMB) ensure proper care for as long as the land disposal may pose a threat to public health, safety, and the environment? In particular, how can society ensure that responsible parties have arranged for sufficient funding of necessary care so as to equitably allocate the cost burden? These questions affect not only CIWMB's program for solid waste landfills but other state and federal programs for hazardous wastes, brownfields, Superfund, and radioactive wastes (high level and low level), among others.

Among the factors that make this a difficult issue are the time periods under consideration. The original, federal RCRA model was based on a somewhat arbitrary 30-year postclosure care period, but it has become clear with experience that a large number of sites may require longer periods of care and more expensive repairs/replacement and/or corrective actions. While the need for longer-term PCM and CA at solid waste -disposal sites has become recognized, increasingly globalized financial markets are emphasizing shorter time frames for financial instruments. The U.S. abandonment of 30-year bonds symptomatic of the new perspective. In addition, securing a policy period of even 20 years from environmental insurers has become difficult, if not impossible, and even 10-year policies have become quite expensive. Although capital is abundant, it is seeking its highest returns, and this trend works against effective private financing of long-term PCM and CA for solid waste landfills.

If financial assurance instruments cannot cost-effectively serve to assure long-term obligations, the alternative is to use or create government funds, as California and other states have done for a variety of environmental risks. Designing and managing such funds also pose challenges, as such funds have been known to become insolvent, be insufficient in amount, or be raided by state legislatures if they seemingly accumulate too much money.

Owners and operators of solid waste landfills have long been sensitive to financial assurance requirements and issues. Extensive consolidation by commercial waste management firms means that their aggregate future obligations have swelled and the consequences of any default have grown. In general, industry (both public and private sectors) has not embraced financial responsibility as a tenet of sustainable development and use of land, but instead often negotiates over every aspect of financial assurance.

This study was ordered by the California Legislature to provide a technical basis for the CIWMB to make important policy decisions in 2008. Originally focused solely on the issue of ensuring financial assurance for corrective action (CA) at closed solid waste landfills, which generate little to no revenues, the scope of the study was expanded to include CA at active solid waste landfills as well as postclosure maintenance (PCM) needs at both types of facilities. For purposes of the study, PCM and CA are defined as follows:

- Postclosure Maintenance (PCM) means all activities undertaken at a closed solid waste management unit to maintain the integrity of containment features and to monitor compliance with applicable performance standards. PCM is performed regularly or periodically to deal with routine wear and tear of containment features. It does not include repairs of containment features damaged as a result of major events, such as floods, stormwater runoff, earthquakes, or fires; nor does it include repairs of containment features damaged due to poor design, improper installation, or inadequate maintenance.

- Corrective Action (CA) means activities undertaken at an active or closed solid waste management unit needed to remediate a known release that has occurred to the environment, or activities that would need to be undertaken at an active or closed unit to restore the integrity of damaged containment, gas extraction, and drainage features. CA can include non-routine repairs, such as repairing covers and drainage systems damaged as a result of major events, such as floods, stormwater runoff, earthquakes, or fires; as well as repairs of containment features damaged due to poor design, improper installation, or inadequate maintenance.

Note that some PCM activities may be indistinguishable from similar CA activities because both PCM and CA can involve maintaining the integrity of containment features and monitoring compliance. However, a broader range of activities can occur under CA because PCM does not include groundwater remediation. A final distinction relates to the reasons for required maintenance and repairs: PCM is performed to deal with routine wear and tear (and to identify any non-routine wear and tear) whereas CA includes non-routine repairs resulting from "major" external events or from poor design, improper installation, or inadequate maintenance.

PCM and CA are important because a solid waste landfill presents a potential risk to public health, safety, and the environment from the migration of leachate, gas, and other public health and safety hazards:

- Properly maintaining a landfill after closure is completed is essential for minimizing risks. PCM may be costly. If adequate funds are not readily available to pay for these costs, the risks presented by the landfill will increase while proper waste management practices are delayed or evaded. If the parties responsible for the landfill go bankrupt or otherwise fail to pay for the costs, the burden of protecting public health, safety, and the environment may be shifted inequitably to other parties.

- Properly remediating releases from a disposal facility is essential for minimizing risks. CA may be costly. If adequate funds are not readily available to pay for these costs, the risks presented by the disposal facility will increase while proper waste management practices and corrective action activities are delayed or evaded. If the parties responsible for the disposal facility go bankrupt or otherwise fail to pay for the costs, the burden of protecting public health, safety, and the environment may be shifted inequitably to other parties.

As required by Public Resources Code, Section 43600, financial responsibility regulations apply to all operators of all solid waste landfills, as defined under Public Resources Code Section 40195.1, that were operating on or after January 1, 1988 and that are required to be permitted.

California's FA requirements for CA are more extensive than federal requirements. California requires FA not only for completing known CAs (a federal requirement) but also for all reasonably foreseeable releases (§22221). California's FA requirements for reasonably foreseeable releases/CA have not yet been fully elaborated, including such questions as how likely such CAs must be (probable, possible but not probable, remote), how many CAs are reasonably foreseeable, over what time frame, and cost estimating protocols.

Although California's FA requirement for PCM follows the federal model, California's PCM requirement differs from the federal model by putting the burden on the LF operator to demonstrate when the waste no longer poses a threat and the PCM period should end. Extending the current FA requirement for 30 years of PCM to cover post-30 PCM also raises a number of unresolved issues including such questions as how many years of FA coverage should be required for PCM.

The following chapters present the research and analysis performed by the ICF team in close collaboration with the CIWMB staff. The contractors appreciate the review and comments received to date from the external consultants and look forward to their comments on this draft report.

2. EVALUATION OF EXISTING FINANCIAL ASSURANCE MECHANISMS FOR SOLID WASTE LANDFILLS

For Task 2, ICF understands that the CIWMB is looking for a succinct evaluation of existing financial assurance (FA) mechanisms for postclosure maintenance (PCM) and corrective action (CA), ways that the current mechanisms can be modified to make the assurance cover more and last longer, and a discussion of potential new or alternative FA mechanisms, such as annuities and guaranteed investment contracts (GICs). This chapter starts by describing the criteria ICF used to evaluate the mechanisms. In Section 2.2, each mechanism is summarized and then evaluated in terms of the criteria. ICF describes why other mechanisms are inferior in Section 2.3. Finally, ICF assesses the potential for annuities and GICs as FA mechanisms in Sections 2.4 and 2.5, respectively. Chapter 2 is organized as follows:

2.1 Criteria and Mechanisms for Evaluation
2.2 Evaluations
2.3 Mechanisms Not Recommended
2.4 Annuities
2.5 Guaranteed Investment Contracts (GICs)

NOTE: ICF is conducting in Task 2 a review and analysis of the mechanisms only. A comprehensive review of CIWMB's FA program would entail other elements beyond the scope of the contract. ICF's comprehensive evaluation would address dollar amounts of coverage and/or the details of cost estimating rules; the applicability of the program (who is or is not covered); the scope of the program (what the demonstrations can be used for); program rules (triggers to start/end coverage, rules for maintaining coverage, required notices and recordkeeping); and eligibility criteria for issuers (e.g., captive insurers). These items are outside the scope of the contract.

2.1 CRITERIA AND MECHANISMS FOR EVALUATION

The effectiveness of financial assurance (FA) demonstrations depends in part on the effectiveness of their terms and conditions. This report applies to each mechanism the following set of effectiveness criteria:

- Certainty that assured funds will be available --certainty of assurance requires that FA demonstrations contain no provisions that would impair the availability of required funds, such as unacceptable cancellation, termination, or other conditions, and overly broad exclusions. Certainty also is affected by the criteria used to determine who is eligible to offer FA mechanisms.

- Adequacy of value (i.e., amount) of funds assured -- adequacy of value refers to potential limits to the full amount of coverage provided by a demonstration, which could result from exclusions, sublimits, and other conditions.

- Liquidity of funds -- liquidity refers to the degree to which the FA demonstration can be readily converted to cash (e.g., during the termination or cancellation notice period, if there is no acceptable replacement financial instrument to substitute within the period of the notice) or otherwise made to fulfill obligations on a timely basis.

- Administrative burden and cost on regulated parties, issuers, and administering agencies -- these burdens and costs may be inherent to a demonstration (e.g., annual submission of financial statement data) or may be influenced by how the financial assurance program is designed (e.g., required use of standardized wording for a mechanism reduces burdens).

In addition, ICF addresses the issue of using each mechanism to demonstrate FA for long-term PCM and/or long-term CA. CIWMB staff have been exploring the possible extension of FA for PCM beyond the 30 years currently required, in order to prevent the state's taxpayers from potential financial responsibility in the event of default, among other reasons. At a minimum, such an extension would affect the total amount of PCM assured, as the cost estimate would cover more than 30 years of PCM. A longer time period might make more CAs appear reasonably foreseeable, thus also possibly adding to the dollar amounts the mechanisms must be capable of assuring. Therefore, we comment on the implications of seeking more assurance for a longer time period from each mechanism.

ICF's analysis includes only the acceptable options for FA demonstrations for PCM and/or CA found in Title 27, California Code of Regulations, Division 2, Subdivision 1, Chapter 6, Subchapter 3:

Trust Fund (§§ 22240 and 22225-6)
Enterprise Fund (§§ 22241 and 22225-6)
Proceeds from Sale of Government Securities (§22242)
Letter of Credit (§22243)
Surety Bond (§22244)
Pledge of Revenue (§22245)
Financial Means Test (Not available for Corrective Action) (§22246)
Corporate Guarantee (Not available for Corrective Action) (§22247)
Insurance (§22248)
Local Government Financial Means Test (§22249)
Local Government Guarantee (§22249.5)
Federal Certification (§22250)

2.2 EVALUATIONS

For each mechanism listed in Section 2.1 above, ICF summarizes its key features and rates it for each of the evaluation criteria defined in Section 2.1 above. (Mechanisms allowable solely for liability coverage are not included in the scope of work.) Exhibit 2-1 displays the summary ratings assigned by ICF to each mechanism for the four criteria.

EXHIBIT 2-1
Overview of Evaluation

	Certainty	Amount	Liquidity	Burden/Cost
Trust Fund	High	Medium	High	High
Enterprise Fund	Medium	Medium	High	High
Sale of Securities	Medium	High	High	High
Letter of Credit	High	High	High	Low
Surety Bond	High	High	Medium	Low
Pledge of Revenue	Low	Low	Medium	Low
Financial Means Test	Medium	High	Medium	Medium
Corporate Guarantee	High	High	Medium	Medium
Insurance	Medium	Medium	Medium	High
Government Fin. Test	Medium	High	Medium	Medium
Government Guarantee	High	High	Medium	Medium
Federal Certification	Low	Low	Low	Low

Based on the regulations ICF reviewed, either the pledge of revenues has some significant deficiencies or the regulations should be amended to clearly describe that option in detail. The federal certification is a not-unprecedented option for compromising state-federal jurisdictional problematics.

2.2.1 Trust Fund (27 CCR §22240 and Form 100)

2.2.1.1 <u>What Is A Trust Fund?</u>

An operator may satisfy the CIWMB FA requirements for PCM and/or CA by establishing a **trust fund**. A trust fund is an option in many government-mandated financial responsibility programs, both environmental and non-environmental.

A **trust** is a three-party agreement whereby one party, called the **grantor** (sometimes also called the **trustor**), transfers some assets (often money) to a second party, called the trustee, to hold on behalf of a third party, called the **beneficiary**. The trust agreement sets out the responsibilities and rights of each party. The trustee has a fiduciary responsibility to keep or use the property in the trust fund for the benefit of the beneficiary. The property in the trust fund no longer is legally owned by the grantor. In a CIWMB trust fund, the operator is the grantor, a bank or other eligible entity is the trustee, and the implementing agency is the beneficiary.

The CIWMB trust agreement must be irrevocable, which means that it need not be renewed and can be terminated only at the written agreement of the grantor, the trustee, and CIWMB, or, if the grantor ceases to exist, the written agreement of the trustee and the CIWMB.

The trustee is empowered to invest the trust funds during the existence of the trust. The trust agreement states that the trustee is to make investments according to general investment

policies and guidelines communicated in writing by the grantor, subject to explicit restrictions and a general over-riding standard in the CIWMB trust agreement. The trustee must follow the "prudent investor" standard in managing the fund. The "prudent investor" standard allows any investment to be made that is prudent when analyzed as part of the total investment portfolio, rather than requiring each individual investment to pass a prudence test. California enacted a portfolio approach in 1984 and subsequently adopted the Uniform Prudent Investor Act in 1995 (see Probate Code §§ 16045-16054), which codified the duty to diversify, allowed the trustee to delegate investment management decisions, and recognized the importance of analyzing both risk and return, consistent with modern investment theory.[3] Of course, the return on the trustee's assets may vary depending on the risk level of the investments made. Any investment income accrues to the trust which is responsible for paying income taxes. All fees, commissions, and taxes must be paid from the trust fund rather than by the grantor.

2.2.1.2 How Does A Trust Fund Work?

An operator, as grantor, pays into the trust fund in cash or securities, which is held in trust and invested by the trustee. Based on written instructions from CIWMB, money in the fund is used for disbursements (including advance reimbursements) for PCM and/or CA.

The CIWMB trust fund allows gradual funding over a period of years until the value of the trust fund equals the required amount of coverage for PCM and/or CA. Unfortunately, until the trust is fully funded, it does not assure the appropriate amount of funds. For PCM and reasonably foreseeable CA, the trust must be fully-funded by the time the last shipment of waste has been received at the disposal facility. [ICF doesn't understand how this provision was applied to LFs that were closed when the FA regulations became effective.]

CIWMB regulations require that the trust fund has its trustee be an entity that is authorized to act as a trustee and whose trust operations are regulated and examined by a federal agency or state agency. The trustee typically is either a bank that is authorized to administer trusts or a trust company, which specializes in trust administration services. If a bank or trust company encounters financial difficulties, the receiver or liquidating agent will transfer the trust account to a substitute trustee. Similarly if a bank's fiduciary powers are revoked or surrendered, the trust account will be transferred. A trust never fails for lack of a trustee.

This option differs from **self-insurance** because it involves a source of FA other than the operator.

2.2.1.3 Evaluation of Trust Fund

Certainty That Assured Funds Will Be Available

[3] State of California, California Law Revision Commission, Staff Report *California Uniform Prudent Investor Act* (March 1998).

The trust fund is the gold standard for certainty of assurance. Consequently, ICF rates the trust fund as High for certainty. Notably, property in the trust fund ceases to be the legal property of the operator and thus is insulated from the operator's control and creditors. The trust is irrevocable and does not need renewal. The trust cannot be involuntarily cancelled or terminated, but new trustees can be appointed to succeed retiring trustees. Banking and legal system procedures ensure that a trust never fails due to lack of a trustee.

Trust funds are as secure as the ability of the depository institution to manage and honor them. Banking has traditionally been viewed as being unacceptably unstable if left unregulated. As a result, it has long been subject to official oversight in order to ensure that banks and their fiduciary activities are "safe and sound." The financial strength and liquidity of banks and trust companies are reasonably assured through federal and state regulation and supervision/examination.

Adequacy of Amount of Funds Assured

ICF rates the CIWMB trust fund as Medium for amount of funds assured because the regulations allow pay-in schedules whereby the balance in the trust fund reaches the required amount over a period of time. Fully-funded trust funds would receive a High rating. Moreover, although a CA could be required at any time, including prior to final closure of the LF, the trust used for FA of reasonably foreseeable CAs does not need to be fully-funded until receipt of the last shipment of waste at the disposal facility; as a result, coverage may not be fully available when needed for CA.

Liquidity of Funds

ICF rates the liquidity of funds in the trust fund as High. In following the prudent investor standard, a trustee considers the investment portfolio as a whole when selecting individual investments. This allows the trustee to make some investments (e.g., illiquid investments) that might not be prudent if the entire portfolio were invested that way; however, a prudent trustee may make nonconservative investments as long as they constitute a small portion of the entire portfolio.

Administrative Burden and Costs

ICF rates the CIWMB trust fund as High for administrative burden and cost. Use of a standard trust form reduces the burden. And there is no need for annual or periodic renewals. Involuntary termination or cancellation is not an issue. Fees and expenses tend to be low. However, money paid into the trust fund represents an opportunity cost and outflow of cash.

Long-Term Extension of Assurance

The trust fund is well-suited to provide more assurance over long time-periods, as it is irrevocable and does not require periodic renewal. There are no limits to how much money may be contributed to a trust; in fact, trustees typically seek to increase the assets under their management. However, CIWMB may want to revisit the trust fund pay-in schedule in light of increased amounts of required assurances for PCM and/or reasonably foreseeable CA.

Another option for extending the assurance provided by trust funds for a longer time frame would be to change the current policy for disbursements (including advance reimbursements) for conducting PCM. Instead, retaining money in the trust fund (unless there is a default) extends the assurance it provides.

A final option would require that the trust fund contain sufficient funding to allow for "perpetual" PCM. No further payments into the trust for PCM would be required when the balance is determined to be ample to support "perpetual" PCM, as needed. However, this concept does not work as well for assuring reasonably foreseeable CA for long time periods.

2.2.2 Enterprise Fund (27 CCR §22241)

An enterprise fund may be established by a local government as an accounting (and management) tool for government activities that are intended to be self-supporting or that are provided on a user-fee basis.[4] Revenues from an enterprise fund may be put into a "mechanism" that can be used for FA.

This option may be used only for disposal facilities operated by government agencies.

CIWMB regulations require that the enterprise fund

- dedicate its revenue exclusively or with exclusive first priority to financing PCM and/or CA and/or closure (if applicable) as documented by official resolutions, forms, letters, or other documents generated to establish the fund[5]

- deposit revenue into a mechanism that provides equivalent protection to a trust fund and assures that the funds in the mechanism will be used exclusively to finance PCM and/or CA and/or closure (if applicable)

- protects the money against all other claims, including claims by the operator, the operator's governing body, and the creditors of the operator and its governing body

[4] An enterprise fund must be used when the government activity is financed with debt that is secured solely by a pledge of the net revenues from fees and charges for the activity; when laws or regulations require that the activity's costs of providing services, including capital costs (such as depreciation or debt service), be recovered with fees and charges, rather than with taxes or similar revenues; and when the pricing policies of the activity establish fees and charges designed to recover its costs, including capital costs (such as depreciation or debt service). State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

[5] This requirement seems somewhat inconsistent with the concept that enterprise fund revenues are intended to cover costs incurred to provide the services covered by the enterprise fund, not just PCM and/or CA. In addition, an enterprise fund may have been initially capitalized with debt that is secured by a pledge of the net revenues from fees and charges; debt service likely will receive a high priority in terms of using net revenues from the enterprise fund.

Although titled "Enterprise Fund," Section 22241 refers to a FA "mechanism" that is equivalent or similar to a trust fund, without necessarily having to be a trust fund. The mechanism must authorize the CIWMB to direct payment for PCM and/or CA if the CIWMB determines that the operator has failed or is failing to perform PCM and/or CA.

Some other aspects of the regulation seem open-ended.

- The mechanism must meet "other requirements that the CIWMB determines are needed to ensure that the assured amount of funds shall be available in a timely manner."

ICF found no information on what "other requirements" might be imposed. Similarly, §22233 requires that an operator using an enterprise fund shall maintain "evidence documenting that the mechanism meets the requirements of Section 22241," without specifying what that evidence might be.

The financial operations of the provider of the mechanism must be "regulated by a federal or state agency, or the provider is otherwise certain to maintain and disburse the assured funds properly." These eligibility regulations appear vague to ICF.

CIWMB may require the operator using the mechanism or the provider of the mechanism to establish and use a depository trust fund (§22237). This suggests to ICF that the CIWMB did not expect that a trust fund necessarily would be used as the mechanism for receiving proceeds from an enterprise fund; it would be redundant and unnecessary to require a depository trust fund for a trust fund mechanism.

ICF identified a number of options a local government might use to implement this regulation:

(1) Establish a reserve in the General Fund for legally segregating PCM and/or CA funding[6]

(2) Designate funding for PCM and/or CA within the unreserved General Fund[7]

(3) Create a Special Revenue Fund for PCM and/or CA that is reserved, legally restricted, or limited for specified purposes.[8]

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[6] The reserve can be for legal obligations or self-insurance, among other purposes. A reserve limitation ordinarily cannot be changed unless the government takes the same action it employed to impose the limitation initially or through a higher authority action. State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

[7] Designation of unreserved fund balances indicates management's intent to use resources for a particular purpose, including equipment replacement and general contingencies; however, the designation is not irrevocable but tentative. State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

(4) Identify funds for PCM and/or CA as "restricted assets" [9]

(5) Establish a Fiduciary Fund[10] for PCM and/or CA

(6) Establish an escrow

(7) Establish a trust fund[11]

It seems to ICF that only a trust fund offers the protections from creditors and the assurance that funds will not be reprogrammed. Although not explicitly stated in the regulations, local governments are allowed to maintain the funds. Local governments generally are free to move money into and out of their various funds, other than trust or fiduciary accounts, which is why ICF is concerned if the mechanism holding the proceeds is not designated as a trust or fiduciary fund. The U.S. Congress apparently felt the same way when it changed federal law in 1996 to require that deferred compensation funds held by local governments be thereafter held in trust in order to prevent losses due to financial mismanagement by local governments and to protect the funds from claims of the local government's creditors.[12] The California legislature made conforming amendments, and the California Attorney General has stated that the California "held in trust" requirement was "added to prevent the funds from being diverted for other purposes."[13]

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[8] A Special Revenue Fund is used to account for proceeds of specific revenue sources (except pension trusts and major capital projects) that are legally restricted to expenditures for specific purposes. State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

[9] Restricted assets differ from reserves and designations in that there is an actual segregation of the asset (the cash is set aside). Reserves and designations are not backed by a specific asset. State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003). GASB Statement No. 34 first required the reporting of asset restrictions resulting from enabling legislation, constitutional provisions, or external parties (e.g., federal grants, government ordinances, resolutions, or administrative actions).

[10] A Fiduciary Fund accounts for assets held by a local government in trustee or agency capacity for the benefit of parties outside the government, including other governments; not used to report assets held for the government's own use. State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

[11] Counties that demonstrate FA for closure and PCM by placing assets in a trust, should report the amount on the county's balance sheet identified as "amounts held by trustee." State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

[12] *1996 U.S. Code, Congressional, & Administrative News* 1559. The U.S. General Accounting Office had expressed concern about the Orange County situation and reported about a plan by Los Angeles County to borrow money set aside for its compensation obligations to cover payroll expenses instead. U.S. GAO, *Section 457 Plans Pose Greater Risk than Other Supplemental Plans* (1996).

[13] Opinion No. 00-204 (Aug. 2, 2000).

In researching how this regulation has been implemented, ICF has found evidence on-line that other options besides trust funds have been used. For example:

- the City of Paso Robles reports using an enterprise fund and established a Landfill Closure/Post-Closure Fund as a Special Revenue Fund, although the City does not seem to have established an enterprise fund at all.

- the County of Santa Barbara uses the enterprise fund for one-third of PCM costs and restricts certain assets (cash and investments) in the enterprise fund for closure and PCM.

- Santa Cruz uses an enterprise fund and makes annual contributions to a fund for closure and PCM, which is reported as restricted assets;

- the County of Glenn transfers funds from its Waste Disposal Enterprise Fund into a "reserve," the Solid Waste Closure Fund (also termed the Landfill Closure/Postclosure Liability Fund).

2.2.2.1 Evaluation of Enterprise Fund

Certainty That Assured Funds Will Be Available

ICF rates this option Medium for certainty of assurance. The regulations neither require the FA mechanism to be a trust fund, nor indicate whether the mechanism can be an escrow or some other specified arrangement. Although the regulations include performance and specification standards for the FA mechanism, ICF believes that how those requirements are implemented has a major impact on certainty of assurance. Money retained by local governments may be legally applied to other purposes or for other creditors, thus reducing certainty of assurance.

Similarly, there appears to ICF some vagueness regarding the eligibility qualifications of the mechanism's provider. Regulations require that if the financial operations of the provider are not regulated, the provider must otherwise be "certain to maintain and disburse the assured funds properly." No criteria or benchmarks appear in the regulations for making that finding.

Adequacy of Amount of Funds Assured

ICF rates the CIWMB enterprise fund as Medium for amount of funds assured because the regulations allow pay-in schedules whereby the balance in the mechanism reaches the required amount over a period of time. Fully-funded mechanisms would receive a High rating. Moreover, although a CA could be required at any time, including prior to final closure of the LF, the mechanism used for reasonably foreseeable CAs does not need to be fully-funded until receipt of the last shipment of waste at the disposal facility (see 27 CCR §22225); as a result, coverage may not be fully available when needed for CA.

Liquidity of Funds

ICF rates the mechanism as High for liquidity. Contributions to the mechanism must be made in cash, which is the most liquid form of assurance. If the provider of the mechanism does not have authority to invest the cash, the result would be a mechanism with the highest level of liquidity. On the other hand, if the provider of the mechanism has investment authority, the regulations require that the provider exercise its investment discretion similar to a trustee; that should ensure that illiquid investments are minimized.

Administrative Burden and Costs

ICF rates this option as High for its burden and costs. Open-ended features of the regulation and the lack of a required form both indicate a higher administrative burden than for other FA options. This option requires that the institution maintaining the mechanism provide an annual letter documenting the amount of coverage provided. This option entails minor transaction costs, but money paid into the mechanism represents an opportunity cost and outflow of cash.

Long-Term Extension of Assurance

An enterprise fund is well-suited to provide more assurance over long time-periods, as it does not require periodic renewal, and there is no limit on the magnitude of funds that this option can assure. However, CIWMB may want to revisit the pay-in schedule in light of increased amounts of required assurances for PCM and/or reasonably foreseeable CAs. The actual mechanism that receives money from the enterprise fund may vary in its suitability for extending assurance.

One option for extending the assurance provided by mechanisms financed by enterprise funds would be to change the current policy for disbursements (including advance reimbursements) for conducting PCM. Instead, retaining money in the mechanism (unless there is a default) extends the assurance it provides.

Another option would require that the mechanism contain sufficient funding to allow for "perpetual" PCM. No further payments from the enterprise fund into the mechanism for PCM would be required when the balance is determined to be ample to support "perpetual" PCM, as needed. However, this concept may not work as well for assuring reasonably foreseeable CA for long time periods.

2.2.3 Proceeds from the Sale of Government Securities (27 CCR §22242)

A local government operator may satisfy the FA requirements by establishing or using a mechanism to receive the proceeds from the sale of government securities. Deposit of government securities is an option in some older government-mandated financial responsibility programs, both environmental and non-environmental (e.g., FR for workers compensation); however, this option requires the sale of those securities and funding a "mechanism" with the proceeds.

2.2.3.1 How Does the Mechanism Work?

Under this option, a local government must sell government securities (e.g., bonds) that had been issued with the intent of depositing sales proceeds into a FA mechanism for solid waste landfill PCM and/or CA. The proceeds must already have been deposited into the mechanism.

The mechanism must provide "equivalent protection to a trust fund" by

- ensuring that the proceeds are used exclusively and only as applicable for PCM and/or CA
- rendering all funds inviolate against all other claims, including any claims by the operator, the operator's governing body, and their creditors
- authorizing the investment of revenue through the exercise of investment discretion similar to a trustee
- meeting other reasonable requirements that the CIWMB determines are necessary to ensure that the assured funds shall be available in a timely manner

ICF found no information on what "other requirements" might be imposed. Similarly, §22233 requires that an operator using the proceeds-from-sale-of-government-securities mechanism must maintain "evidence documenting that the mechanism meets the requirements of Section 22241," without specifying what that evidence might be.

CIWMB may require the operator using the mechanism or the provider of the mechanism to establish and use a depository trust fund (§22237). This suggests to ICF that the CIWMB did not expect that a trust fund necessarily would be used as the mechanism for receiving proceeds from the sale of government securities; it would be redundant and unnecessary to require a depository trust fund for a trust fund mechanism.

ICF identified a number of options a local government might use to implement this regulation:

(1) Establish a reserve in the General Fund for legally segregating PCM and/or CA funding[14]

(2) Designate funding for PCM and/or CA within the unreserved General Fund[15]

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[14] The reserve can be for legal obligations or self-insurance, among other purposes. A reserve limitation ordinarily cannot be changed unless the government takes the same action it employed to impose the limitation initially or through a higher authority action. State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

[15] Designation of unreserved fund balances indicates management's intent to use resources for a particular purpose, including equipment replacement and general contingencies; however, the designation
(continued on bottom of next page)

(3) Create a Special Revenue Fund for PCM and/or CA that is reserved, legally restricted, or limited for specified purposes.[16]

(4) Identify funds for PCM and/or CA as "restricted assets" [17]

(5) Establish a Fiduciary Fund[18] for PCM and/or CA

(6) Establish an escrow

(7) Establish a trust fund[19]

It seems to ICF that only a trust fund offers the protections from creditors and the assurance that funds will not be reprogrammed. Local governments are generally free to move money into and out of their various funds, other than trust or fiduciary accounts, which is why ICF is concerned if the mechanism holding the proceeds is not designated as a trust or fiduciary fund. The U.S. Congress apparently felt the same way when it changed federal law in 1996 to require that deferred compensation funds held by local governments be thereafter held in trust in order to prevent losses due to financial mismanagement by local governments and to protect the funds from claims of the local government's creditors.[20] The California legislature made conforming amendments, and the California Attorney General has stated that the California

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is not irrevocable but tentative. State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

[16] A Special Revenue Fund is used to account for proceeds of specific revenue sources (except pension trusts and major capital projects) that are legally restricted to expenditures for specific purposes. State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

[17] Restricted assets differ from reserves and designations in that there is an actual segregation of the asset (the cash is set aside). Reserves and designations are not backed by a specific asset. State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003). GASB Statement No. 34 first required the reporting of asset restrictions resulting from enabling legislation, constitutional provisions, or external parties (e.g., federal grants, government ordinances, resolutions, or administrative actions).

[18] A Fiduciary Fund accounts for assets held by a local government in trustee or agency capacity for the benefit of parties outside the government; not used to report assets held for government's own use. State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

[19] Counties that demonstrate FA for closure and PCM by placing assets in a trust, should report the amount on the county's balance sheet identified as "amounts held by trustee." State of California, State Controller's Office, *Accounting Standards & Procedures for Counties* (May 2003).

[20] *1996 U.S. Code, Congressional, & Administrative News* 1559. The U.S. General Accounting Office had expressed concern about the Orange County situation and reported about a plan by Los Angeles County to borrow money set aside for its compensation obligations to cover payroll expenses instead. U.S. GAO, *Section 457 Plans Pose Greater Risk than Other Supplemental Plans* (1996).

"held in trust" requirement was "added to prevent the funds from being diverted for other purposes."[21]

2.2.3.2 Who Can Use It?

Any local government can use this option for solid waste disposal facilities operated by government agencies. Under this alternative, a local government establishes a fully-funded mechanism dedicated to payment of PCM and/or CA, in the amount of its total FA requirement.[22]

The provider of the FA mechanism must be (1) "regulated" by a state or federal agency or (2) "otherwise certain to maintain and disburse the assured funds properly." The first eligibility criterion appears to ICF to mean that the *financial operations* of the provider of the mechanism must be regulated by a state or federal agency. (See §22233(b)(3)(C), §22233(b)(2)(C)(3), and §22241(b)(4).) However, the second eligibility criterion appears subjective to ICF absent further guidance on how such a finding can be made.

2.2.3.3 Evaluation of Proceeds from Sale of Government Securities

Certainty That Assured Funds Will Be Available

ICF rates this option Medium for certainty of assurance. The regulations neither require the FA mechanism to be a trust fund, nor indicate whether the mechanism can be an escrow or some other specified arrangement. Although the regulations include performance and specification standards for the FA mechanism, ICF believes that how those requirements are implemented has a major impact on certainty of assurance. Money retained by local governments may be legally applied to other purposes or for other creditors, thus reducing certainty of assurance.

Similarly, there appears to ICF some uncertainty regarding the qualifications of the mechanism's provider. Regulations require that if the financial operations of the provider are not regulated, the provider must otherwise be "certain to maintain and disburse the assured funds properly." No criteria or benchmarks appear in the regulations for making that finding.

Adequacy of Amount of Funds Assured

ICF rates this option High in terms of amount of coverage. Although Section 22242 does not require explicitly that the proceeds from the sale of government securities deposited into the FA mechanism equal the amounts in the most recent cost estimates for PCM and/or CA, the regulations for pay-in formulae and schedules (§§ 22225 and 22226) allow build-ups only for

[21] Opinion No. 00-204 (Aug. 2, 2000).

[22] If the local government chooses an enterprise fund or trust fund as the mechanism to receive the proceeds, would a build-up period be allowed?

trust funds and enterprise funds. Therefore, it seems to ICF that the mechanism must be fully-funded, unless the proceeds are put into a trust fund or enterprise fund.

Liquidity of Funds

ICF rates this option as High for liquidity. Contributions to the mechanism must be made in cash (i.e., the sales proceeds), which is the most liquid form of assurance. If the provider of the mechanism does not have authority to invest the cash, the result would be a mechanism with the highest level of liquidity. On the other hand, if the provider of the mechanism has investment authority, the regulations require that the provider exercise its investment discretion similar to a trustee; that should ensure that illiquid investments are minimized.

Administrative Burden and Costs

ICF rates the administrative burden and cost of this option High. The regulations lack an approved form and other specific terms and conditions that reduce administrative burdens on all parties. This option puts the burden on the operator to demonstrate that the mechanism meets the performance criteria laid out in the regulations. This option requires an annual letter from an authorized officer of the institution maintaining the mechanism, although the mechanism may not require annual renewal. In addition, this option requires putting aside dollars, which has an opportunity cost.

Long-Term Extension of Assurance

This FA option is not easily retrofitted to provide greater amounts of assurance because the entire proceeds of the sale of government securities will already have been contributed to the mechanism. Depending on how much more assurance is required for post-30 PCM, a local government may find it more costly to arrange for another round of securities sales than to cover the additional amount using another FA mechanism.

Options for extending the assurance provided by this option also depend on the type of mechanism chosen to receive the proceeds from sale of government securities. If the mechanism is a trust fund, the trust fund is well-suited to provide assurance over long time-periods, as it is irrevocable and does not require periodic renewal. There are no limits to how much money may be contributed to a trust; in fact, trustees typically seek to increase the assets under their management.

An option for extending the assurance provided by mechanisms that receive proceeds from sale of government securities would be to change the current policy for disbursements (including advance reimbursements) for conducting PCM and/or CA. Instead, retaining money in the mechanism (unless there is a default) extends the assurance it provides.

A final option would require that the mechanism contain sufficient funding to allow for "perpetual" PCM. No further payments into the mechanism for PCM would be required when the balance is determined to be ample to support "perpetual" PCM, as needed. However, this concept does not work as well for assuring reasonably foreseeable CA for long time periods.

2.2.4 Letter of Credit (27 CFR §22243 and Form 101)

2.2.4.1 What Is An Irrevocable Standby Letter of Credit?

A letter of credit is a common option in many government-mandated financial responsibility programs, both environmental and non-environmental.

A **letter of credit** is a mechanism by which the credit of one party, a bank or other financial institution, is extended on behalf of a second party, called the **account party**, to a third party, the **beneficiary**. The first party, the **issuer**, allows the beneficiary to draw funds upon the presentation of documents in accordance with the terms of the letter of credit. While commercial letters of credit are used as payment instruments, the **standby letter of credit** typically is used as a **guarantee** of payment if the account party fails to fulfill its obligations. The parties do not expect that the standby letter of credit will ever be drawn upon because the account party is expected to perform its obligations.

Thus, there are three parties to the standby letter of credit.

(1) The account party is responsible for the obligation.
(2) The issuer guarantees payment of the obligation.
(3) The beneficiary is the party who receives the benefit of the letter of credit.

In a CIWMB standby letter of credit, the operator is the account party, the financial institution is the issuer, and the CIWMB is the beneficiary.

A letter of credit may be revocable or **irrevocable**, but standby letters of credit used for FA must be irrevocable because they would not serve their purpose if the issuer could revoke or modify the letter of credit at any time without notice to or consent of the account party and beneficiary.

2.2.4.2 How Does A Letter of Credit Work?

The standby letter of credit specifies the documents necessary to establish the fact of the account party's default. The issuer must pay the beneficiary upon presentation of two documents:

(1) a **sight draft** and

(2) a **signed statement certifying** that the letter is payable pursuant to government regulations.

A **draft** is a written demand for payment, prepared to conform to legal requirements for commercial paper such as checks, certificates of deposit, and promissory notes. The draft facilitates the unconditional transfer of a definite sum of money on a definite date to a named party. A **sight draft** must be paid when presented, in contrast to a **time draft**, which need not be paid until a future date. The draft must be in precise accordance with the terms of the letter (i.e.,

substantial compliance is not good enough).[23] In most jurisdictions, banks have virtually no discretion but to match the terms and conditions of the letter of credit to the documents presented. Apparently trivial variations can cause documents to be rejected. The **certified statement** accompanying the sight draft is a common requirement in standby letters of credit used for financial assurance.

The letter of credit does not require the issuer to determine whether the operator has failed to perform PCM and/or CA or failed to obtain alternate assurance when required. And the issuer typically does not intend to make any such inquiry. The issuer also is not required to determine how the funds are to be spent. The issuer's duty is simply to pay into the depository trust fund when presented with the proper documents.

This mechanism can apply both to PCM and/or CA.

This option differs from **self-insurance** because it involves a source of financial assurance other than the LF operator.

2.2.4.3 Who Can Use A Letter of Credit?

Any operator – private or public -- can apply for a letter of credit from a qualified financial institution which offers this assurance in exchange for a fee. Standby letter of credit fees are negotiated and can range from 1 to 3% per annum. For large amounts of coverage, the fee may be 1.5% or less. The LF operator also agrees to repay, with interest, any funds drawn through the letter of credit. The terms of the credit arrangement (e.g., rate of interest, payment terms, collateral) between the operator and the issuer depend on individual circumstances and negotiations and do not affect the letter of credit itself.

2.2.4.4 Evaluation of Letter of Credit

Certainty That Assured Funds Will Be Available

ICF rates the letter of credit High in terms of certainty of assurance. This mechanism is irrevocable in addition to being long-established and well understood; as long as the proper documents are presented to the bank, the necessary funds will be forthcoming. Certainty is also enhanced by automatic renewal and by restrictions on the ability of the issuer to cancel or terminate the letter.

Letters of credit are as strong as the ability of the issuing bank to honor them. Banking has traditionally been viewed as being unacceptably unstable if left unregulated. As a result, banks have long been subject to oversight in order to ensure that banks are "safe and sound." The financial strength and liquidity of banks is reasonably assured through federal and state regulation and supervision/examination. The CIWMB letter of credit is acceptable only when

[23] ICF notes a potentially significant typo in Form 105 (the closing parenthesis for (2) is missing, which makes the contents of the signed statement ambiguous).

issued by an institution with the authority to issue letters of credit and whose letter-of-credit operations is regulated and examined by a federal or state agency. These eligibility criteria are appropriate and help ensure certainty that the issuing institution will be able to provide the needed funds.

Adequacy of Amount of Funds Assured

ICF rates the letter of credit High in terms of the amount of assurance provided. The letter of credit must be issued for the full amount of the applicable cost estimate(s); the regulations specify that the letter of credit must contain appropriate sublimits when it is used for more than one coverage requirement and/or more than one LF, which provides additional protection.

Liquidity of Funds

ICF rates the letter of credit High in terms of liquidity of funds. Funds drawn from the letter of credit are available immediately and are paid in cash or cash equivalents into the depository trust fund.

Administrative Burden and Costs

ICF rates the letter of credit Low in terms of administrative burden and costs. Use of a standard form and automatic renewal reduce the administrative burden. Although this mechanism requires money drawn from the letter to be paid into a depository trust fund, the issuer of the letter of credit agrees to establish the needed depository trust fund if the operator fails to do so, which reduces burden and cost because it does not require the depository fund to be established prospectively. Transaction costs and fees for letters of credit tend to be low, although the issuer may require the posting of collateral based on its perception of the operator's creditworthiness. Because the letter of credit is a default mechanism, it does not require the operator to pre-fund it, which reduces its cost.

Long-Term Extension of Assurance

The letter of credit is well-suited to provide more assurance over long time-periods, as it is irrevocable, automatically renewed, and easily adjusted in amount. For most banks, there are few limits to the amount of funds the letter can guarantee. Because the financial institution issuing the letter does so based on assessments of the operator's creditworthiness, the institution can be expected to periodically review its outstanding letters of credit; this is not a mechanism issue.

2.2.5 Surety Bond (27 CCR §22244 and Forms 102 and 103)

2.2.5.1 What Is A Surety Bond?

A surety bond is a common option in many government-mandated financial responsibility programs, both environmental and non-environmental.

Surety bonds are used in business when one party, in order to protect itself in a transaction, insists that another party obtain such a bond. A surety bond is a contract which an organization (sometimes called the **principal**) can enter into with a qualified **surety company** (called the surety). Under the surety contract, the surety guarantees to the **beneficiary** (sometimes called the **obligee**) that the obligations of the principal (e.g., LF operator) will be fulfilled. Thus, there are three parties to the surety agreement.

(1) The principal is the party responsible for the obligation.
(2) The surety guarantees that the obligation will be performed.
(3) The obligee is the party who receives the benefit of the bond.

In a CIWMB surety bond, the LF operator typically is the principal, a surety or insurance company is the surety, and the CIWMB is the obligee.

There are many different types of surety bonds, but two general categories recognized in CIWMB regulations are (1) payment (or financial guarantee) bonds and (2) performance bonds. **Payment bonds**, as the name implies, assure that, if the principal fails to make obligated payments (such as to subcontractors and suppliers), the surety will make those payments. **Performance bonds**, on the other hand, may be carried out by the surety either by paying for or actually performing the obligation. Both types of bonds limit the liability of the surety to the face amount of the bond, called the **penal sum**. Either type of bond is acceptable to demonstrate compliance.

This mechanism can apply both to PCM and CA.

This option differs from **self-insurance** because it involves a source of financial responsibility other than the operator.

2.2.5.2 How Does the Surety Bond Work?

In issuing a surety bond, the surety company becomes **jointly and severally** liable for the guaranteed payment, meaning that the surety assumes the FA obligation of the operator as its own and can be sued together with the operator for the obligation. Consequently, most sureties require an indemnification from the principal to reimburse the surety for any costs incurred in satisfaction of the principal's obligations.

The surety becomes liable on the bond if the CIWMB determines that the operator has failed or is failing to perform PCM and/or CA. Under a performance bond, the surety **can either** perform PCM and/or CA obligations **or** fund a depository trust fund from which the CIWMB can direct payments. Under a payment bond, the surety must pay into a depository trust fund and does not have the option to perform.

2.2.5.3 Who Can Use A Surety Bond?

Any operator can apply for a surety bond from a qualified financial institution. To applicants who meet the surety's creditworthiness requirements, the surety offers the bond in

exchange for a fee. Fees can range from one to five percent of the penal sum: for large amounts of coverage, the fee can be less than 1% and as low as one-half percent, depending on market conditions. The operator also agrees to repay any funds drawn through the bond. The surety may also require the operator to post collateral.

2.2.5.4 How Does A Surety Bond Compare to Insurance?

Suretyship is a very specialized line of insurance that is created whenever one party guarantees performance of an obligation by another party. A surety relationship differs from more common lines of insurance in three ways:

(1) In traditional insurance, the insured's risk is transferred to the insurance company, which can then spread that risk across all of its insureds. In suretyship, the principal does not transfer its risk of having to pay legitimate claims. The protection of the bond is for the obligee (i.e., the CIWMB) in case the operator is unable to pay for PCM and/or CA.

(2) In traditional insurance, the insurance company expects that a certain portion of the premium for the policy will be paid out in losses. In true suretyship, the premiums paid are "service fees" charged for the use of the surety company's financial backing and guarantee. The surety expects no losses.

(3) In underwriting traditional insurance, the goal is to screen and spread risk. In suretyship, underwriting is a form of credit evaluation and the goal is to avoid risk.

2.2.5.5 Evaluation of Surety Bonds

Certainty That Assured Funds Will Be Available

ICF rates the surety bond High in terms of certainty of assurance. This mechanism is long-established and well understood; as long as the proper notifications are made to the surety, the necessary funds will be forthcoming. Certainty is also enhanced because the bond forms lack a termination date and by restrictions on the ability of the surety to cancel or terminate the bond.

Surety bonds are as strong as the ability of the issuer to honor them. Issuers are supervised and regulated by state and federal agencies. In addition, the U.S. Department of the Treasury regularly reviews and monitors the financial status of sureties approved to write federal bonds. The CIWMB surety bond is acceptable only when issued by a surety listed as acceptable in Circular 570 of the U.S. Department of Treasury. These eligibility criteria are appropriate and help ensure reasonable assurance that the surety will be able to provide the needed funds.

Adequacy of Amount of Funds Assured

ICF rates the surety bond High in terms of the amount of assurance provided. The bond must be issued for the full amount of the applicable cost estimate(s). There is no deductible or co-payment; coverage applies from the first dollar. The surety bond forms allow a yearly adjustment (up to 20%) of the penal sum (e.g., to keep up with inflation). Rather than specify

that the bond must contain appropriate sublimits when it is used for more than one coverage requirement, CIWMB provides separate bond forms for PCM and CA, which should accomplish the same goal.

Liquidity of Funds

ICF rates the surety bond Medium in terms of liquidity of funds. ICF rates the Payment Bond High for liquidity and the Performance Bond as Low. Funds drawn from a bond are not necessarily available immediately, although payments from the surety into the depository trust fund would be made in cash or cash equivalents.[24]

Administrative Burden and Costs

ICF rates the surety bond Low in terms of administrative burden and costs. The mechanism requires no annual or regular renewal. Use of standard forms also reduces administrative burden. The bond provides an optional rider for annual adjustments in its penal sum, which is another feature that reduces administrative burden. Although money drawn from the surety bond must be made to a depository trust fund, the issuer of the surety bond agrees to establish the needed depository trust fund if the operator fails to do so; this approach reduces burden and cost because it does not require the depository fund to be established prospectively. Transaction costs and fees for bonds tend to be low, although the surety may require the posting of collateral based on its perception of the operator's creditworthiness. Because the bond is a default mechanism, it does not require the operator to pre-fund it, which reduces its cost.

Long-Term Extension of Assurance

The surety bond mechanism is well-suited to provide more assurance over long time-periods, as it has no termination date and is easily adjusted in amount. Circular 570 does specify limits to the magnitude of bonds that sureties may issue. However, either through reinsurance or joining forces with other sureties, a larger amount of FA can be provided. Sureties have expressed reservations about issuing bonds for long timeframes.[25]

2.2.6 Pledge of Revenue (27 CCR §22245)

2.2.6.1 What Is the Pledge of Revenue?

A pledge of revenue consists of a **resolution** by the governing body of the operator or FA provider authorizing an **agreement** between the operator or FA provider and the CIWMB to establish the pledge. The resolution and the agreement must remain effective continuously

[24] The regulations specify no deadlines for the surety to make payments.

[25] See discussion in Section 2.5 of surety reservations about bonding long-term water treatment at surface mining sites. Also see the Surety Association of America's position statement concerning bonding long-term warranties: "If sureties raise their underwriting thresholds high enough to address the risks and uncertainty of an obligation lasting ten, fifteen, or twenty years, very few [highway] contractors, if any, would qualify for the required bond."

throughout the period in which the pledge of revenue is used to satisfy FA requirements for PCM and/or CA.

The pledge of revenue has been an acceptable FA mechanism under California's Surface Mining & Reclamation Act of 1975 (SMRA). The CIWMB regulations appear to ICF to be modeled after the SMRA regulations.

Although no required form has been promulgated by the CIWMB, the regulations require that the agreement establishing the pledge of revenue contain the following items:

(1) The types and sources of pledged revenue;

(2) The amount of revenue pledged from each source;

(3) The period of time that each source of revenue is pledged to be available;

(4) The solid waste landfill(s) and the current PCM and/or CA cost estimate(s) that are covered by the pledge; and

(5) The authorization for the CIWMB to direct payment for PCM and/or CA if the CIWMB determines that the operator has failed or is failing to perform activities covered by the mechanism.

An operator or FA provider is required to pledge the following types of revenue that the operator or FA provider "controls" and that will be available in a timely manner to pay for PCM and CA:

(1) User fees, rents, or other guaranteed revenue from existing or planned solid waste facilities;

(2) Tax increases within statutory limitations; and/or

(3) Other guaranteed revenues that are acceptable to the CIWMB.[26]

If an operator or FA provider ceases at any time to retain control of its ability to allocate any pledged revenue to pay PCM or CA costs, the operator or provider must notify the CIWMB and obtain alternate coverage after control lapses. The regulations do not define "control."

[26] The County of San Bernardino reports using a pledge of a portion of its future tipping fees and investment earnings from its Waste Systems Division enterprise funds to assure PCM. The County of San Diego reports using a pledge of an existing fund, not future revenue, to assure PCM; the County has designated over $72 million for LF postclosure and inactive landfill maintenance as a Special Revenue Fund. San Diego also used a pledge of revenue for a Class I (hazardous waste) landfill.

2.2.6.2 Who Can Use the Pledge of Revenue?

Only a local government can issue a pledge of revenue either on its own behalf as LF operator or for another operator that is a government agency. A government agency also may provide FA for PCM on behalf of private entities operating solid waste landfills, if either:

(1) The agency owns the solid waste landfills; or

(2) The agency is the rate-setting authority and has control of the waste stream in the jurisdiction where the disposal facilities are located.

Unlike the local government financial test or the local government guarantee, there are no eligibility requirements nor apparent limits on how much the pledge can cover.

2.2.6.3 How Does the Pledge Work?

A local government pledges future revenue for PCM and/or CA. When the PCM period starts, the covered operator will be expected to fund PCM costs, but the CIWMB can turn to the local government's pledge in the event of default. Similarly, when CA is required, the operator will be expected to fund CA, but the CIWMB can turn to the local government's pledge in the event of default. The mechanism authorizes the CIWMB to direct payment for PCM and/or CA if the CIWMB determines that the operator has failed or is failing to perform PCM and/or CA.

Unlike some other mechanisms, the regulations do not include procedures for drawing on the pledge and placing proceeds in a depository trust fund.

The pledge of revenue may be used for PCM and/or CA. The pledge of revenue seems to ICF better suited for PCM than for CA. The cash flow needs for PCM tend to be better defined than the cash flow needs for CAs, particularly for future CAs.

2.2.6.4 Evaluation of Pledge of Revenue

Certainty That Assured Funds Will Be Available

ICF rates the pledge of revenue Low for certainty of coverage. The pledge does not require money to be set aside, nor is there necessarily a third-party guarantor if the government is using the pledge for itself (i.e., self-insurance). Future revenue may be more or less than the funding needed, particularly if future revenue depends on LFs remaining open or new LFs being permitted. Of greatest concern to ICF is that the regulations contain no specific eligibility criteria for the local government making the pledge nor qualifications that must be satisfied. There are no provisions for termination or failure to renew that would allow the CIWMB to have funds placed in a depository trust fund; if the pledge is not renewed or is cancelled, the operator must find another mechanism.

Adequacy of Amount of Funds Assured

ICF rates the pledge of revenue Low for amount of coverage. Although §22245 does not appear to explicitly require the amount of revenue pledged to equal the PCM and/or CA cost estimates, it seems to ICF that is the intent. Future revenue may be more or less than required funding. The regulations require no demonstration that the types and sources of pledged revenues are not otherwise pledged, legally restricted, or limited for other uses. ICF also is concerned whether what is pledged are "revenues" or "net revenues," with the latter being less than the former depending on what is "netted" out.[27] The pledge provides assurance in terms of dollars per time period rather than making the full amount of coverage immediately available.

Liquidity of Funds

ICF rates the pledge of revenue Medium for liquidity. No funds must be set aside, legally limited, or restricted. However, revenue streams are liquid by their nature. The pledge provides assurance in terms of dollars per time period rather than making the full amount of coverage immediately available.

Administrative Burden and Costs

ICF rates the pledge of revenue as Low for administrative burden and costs. The regulations require that an operator using a pledge of revenue submit to the CIWMB at least annually a demonstration that the pledge is still in effect (§22223(b)(4)(B)), although the pledge does not appear to require formal renewal. Lack of a standard form for the agreement increases administrative burden. As no money must be put aside, there is no opportunity cost.

Long-Term Extension of Assurance

The pledge of revenue is well-suited to provide more assurance over long time periods, as it does not appear to require periodic renewal and the regulations specify no limits to the amount of FA that can be provided by this mechanism.

2.2.7 Financial Means Test (27 CCR §22246 and Form 104))

2.2.7.1 What Is the Financial Means Test?

A financial means test of self-insurance is a common option in many government-mandated financial responsibility programs, both environmental and non-environmental (e.g., FA for workers compensation). ICF terms this option **self-insurance** because it involves no source of funding other than the operator itself.

Self-insurance often will be the least expensive method of demonstrating FA. The financial means test of self-insurance allows large, financially viable or creditworthy private entities to demonstrate FA without having to pay the costs of procuring financial mechanisms

[27] For example, the County of Santa Cruz pledged "net revenues" to assure CA.

from other parties. Although large organizations may find passing a financial test easier than smaller organizations do, some large organizations may not be able to pass the test because it measures more than just size alone. To pass a financial test, an operator must meet specified criteria.

The CIWMB financial means test is available only for PCM, not for CA.

2.2.7.2 How Does the Financial Means Test Work?

Those who pass the test are expected to be able to pay for their PCM obligations. How these organizations arrange to pay their obligations is solely their decision. The test is designed so that those who pass are unlikely to experience financial distress that prevents their performance of their obligations, including arranging alternate assurance if necessary.

The CIWMB financial means test for PCM incorporates the U.S. EPA's financial test criteria for closure/postclosure of hazardous waste (i.e., RCRA Subtitle C) treatment, storage, and disposal facilities, promulgated in 1982. In 1998, U.S. EPA promulgated a corporate financial test as a mechanism to demonstrate FA for closure/postclosure of municipal solid waste LFs. CIWMB has not adopted the 1998 EPA financial means test.[28]

The CIWMB financial means test specifies that operators can satisfy FA requirements for PCM by demonstrating that, based on independently audited financial statements, they meet either of the following sets of criteria in Alternative I or Alternative II:

Alternative I

(A) Two of the following three ratios:

  (1) Total liabilities to net worth less than 2.0;

  (2) The sum of net income plus depreciation, depletion, and amortization to total liabilities greater than 0.1; and

  (3) Current assets to current liabilities greater than 1.5; and

(B) Net working capital and tangible net worth each at least six times the sum of current PCM cost estimates being covered by the test; and

(C) Tangible net worth of at least $10 million;[29] and

(D) Assets in the U.S. of at least 90 percent of total assets or at least six times the sum of the current PCM cost estimates covered by the test.

[28] The 1998 test has substantially lower private costs than the 1982 test because the 1998 test performs better in predicting bankruptcy than the 1982 test.

[29] The CIWMB is considering raising the requirement from $10 million to $15 million.

Alternative II

(A) A current rating for the most recent bond issuance of AAA, AA, A, or BBB as issued by Standard and Poor's or Aaa, A, or Baa as issued by Moody's; and

(B) Tangible net worth of at least six times the sum of current PCM cost estimates being covered by the test; and

(C) Tangible net worth of at least $10 million;[23] and

(D) Assets in the U.S. of at least 90 percent of total assets or at least six times the sum of the current PCM cost estimates covered by the test.

Because the annual financial statements form a basis of the assurance provided, the test must be passed anew with each year's independently audited financial statements. An operator that no longer passes the financial test must obtain an alternate mechanism. The CIWMB may disqualify use of the financial test upon a finding, based on reports of financial condition, that the operator no longer meets financial test requirements.

Section 22246 does not specify that the independently audited financial statements can not carry a qualified opinion, an adverse opinion, or a disclaimer of opinion by an independent certified public accountant. These types of auditor's opinions should generally disqualify a company from using the financial test.

2.2.7.3 Who Can Use the Financial Test of Self-Insurance?

Only private sector entities can use the financial means test. Due to differences in accounting practices and financial characteristics, government entities may not be able to use tests designed for privately-owned corporations. Private entities may not be able to satisfy the test if they lack necessary financial characteristics.

2.2.7.4 Evaluation of Financial Means Test

Certainty That Assured Funds Will Be Available

ICF rates the financial means test as Medium in terms of the certainty that assured funds will be available. Extensive data collection and analysis supported the development of the 1982 EPA financial test found in California's regulations. In assessing potential factors and benchmark values for literally hundreds of test options, EPA picked a financial test that minimized the sum of private and public costs. "Private costs" were the outlays required for an alternate FA mechanism if the financial test were not available, while "public costs" were the costs that the public (e.g., taxpayers) would incur if an operator went bankrupt that used the financial test for FA. In other words, EPA did not select the test that most protected against shifting costs to the public, such as a test that few, if any, companies could pass. Instead, in developing the 1982 test, EPA also took into account the costs that would be incurred by companies that could not use a financial means test and had to obtain a guarantee from a third party; those extra FA costs ultimately get passed on to the public through prices, which is why EPA chose to not ignore them. Nevertheless, the EPA test has a number of features intended to provide assurance that use of the financial means test would not allow companies to evade

financial responsibility for their environmental obligations. For example: firms passing the ratio requirements of the test must have net worth and net working capital equal to at least *six times* the amount of FA obligations covered by the test. As another example, the test was designed to fail companies well before their financial strength deteriorated to a position where other FA options were no longer available.

The public cost associated with any financial test reflects the risk of firms using the test and later failing to honor FA obligations, and this "assurance risk" is calculated by multiplying the firm failure rate times the firm-based misprediction rate. Exhibit 2-2 shows failure rates, misprediction rates, and assurance risk rates associated with the 1998 financial test, by net worth category. Exhibit 2-2 shows that firms in higher net worth categories are much less likely to fail than smaller firms and the 1998 financial test also had lower misprediction rates for firms with over $10 million of net worth, and especially for firms with more than $20 million of net worth. This difference suggests smaller firms are more vulnerable to failure due to economic conditions beyond their control, whereas larger firms with a stronger balance sheet (lower debt to equity) and cash flow (relative to total liabilities) are better able to survive even adverse economic

EXHIBIT 2-2
Firm Failure Rates and Financial Test Ratio Assurance Risks (%)

Net Worth ($ million)	**A: Overall Firm Failure Rate (%)**	**B: Bankrupt Firm Misprediction Rate**	**A X B: 1998 Financial Test Assurance Risk (%)**
1 – 10	1.6%	0.667	1.067%
10 – 20	1.5	0.429	0.644
20 – 100	1.1	0.300	0.330
100 +	0.7	0.333	0.233

conditions. The lower failure and misprediction rates for larger firms result in a much lower assurance risk for firms with more than $10 million of net worth, and especially for those with net worth over $20 million.

Although there is some assurance risk associated with the EPA financial test, there also is some assurance risk associated with other FA mechanisms. The 1996 EPA analysis found that a trust fund that is fully funded in advance, and invested in very low risk (and low return) investments (e.g., Treasury bills) is the one type of FA mechanism that entails virtually no assurance risk.[30] A trust fund with higher risk (and higher return) investments (e.g., diversified stocks) entails some risk that the market value of the trust fund could decline just when the funds

[30] The findings reported in Exhibits 2-2 and 2-3 reflect analyses presented in two Subtitle C and D Corporate Financial Test Analysis Issue Papers: "Assessment of Financial Assurance Risk of Subtitles C and D Corporate Financial Test and Third-Party Financial Assurance Mechanisms" and "Performance of the Financial Test as a Predictor of Bankruptcy," available at: http://www.epa.gov/garbage/finance/famc/.

are needed to pay for public obligations. Third-party mechanisms (e.g., standby letters of credit, surety bonds, and insurance) also entail some risk that the third-party guarantor and the insured firm could both fail at the same time. By combining firm failure rates with data on the failure rates for third-party guarantors, the EPA analysis also estimated the assurance risk associated with standby letters of credit, surety bonds, and insurance, shown in Exhibit 2-3.

EXHIBIT 2-3
Trust Fund and Third-Party Assurance Risks (%) by Net Worth Categories

Net Worth ($ million)	Trust Fund Low Risk Investments	Surety Bonds	Bank[a] Standby Letter of Credit	Thrift[b] Standby Letter of Credit	Insurance
1 – 10	0.0%	0.015%	0.018%	0.055%	0.014%
10 – 20	0.0	0.014	0.017	0.051	0.013
20 – 100	0.0	0.010	0.013	0.038	0.009
100 +	0.0	0.007	0.008	0.024	0.006

[a] FDIC Insured Banks
[b] SAIF/FSLIC Insured Thrifts

In relative terms, the assurance risk for third-party mechanisms is well below the assurance risk of the EPA financial test. In absolute terms, however, the assurance risk is very low for both third-party mechanisms and the financial test.

ICF recognizes that, for the past 25 years, the financial test has been somewhat controversial. There always has been a group of states that disallowed or restricted use of the financial test for one or another FA requirement; the identity of those states has changed over time. In 1991, EPA proposed revisions to the financial test, but did not proceed to a final rule. However, virtually no evidence has been found that indicates poor performance of the test, despite research by the EPA Inspector General[31] and the U.S. General Accountability Office,[32] among others.[33]

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[31] EPA OIG, *RCRA Financial Assurance for Closure and Post-Closure* (March 30, 2001).

EPA OIG, *Continued EPA Leadership Will Support State Needs for Information and Guidance on RCRA Financial Assurance* (Report No. 2005-P-00026, Sept. 26, 2005).

[32] GAO, *Environmental Liabilities: EPA Should Do More to Ensure that Liable Parties Meet Their Cleanup Obligations* (GAO-05-658, August 2005).

[33] In light of questions raised about the financial test, EPA engaged the assistance of the Environmental Financial Advisory Board (EFAB). In January 2006, EFAB recommended adding a bond rating requirement to Alternative I of the 1982 test, and recommended that the bond rating requirement be based on a firm's senior unsecured debt rating as opposed to its most recent bond rating, as in current Alternative II.

The second EFAB recommendation had already been implemented by EPA in the 1998 financial test, which specified that the bond rating alternative of the test must be based on a firm's senior unsecured debt rating. The first EFAB recommendation, to add an investment grade bond rating to Alternative I of
(continued on bottom of next page)

Finally, ICF notes that the U.S. EPA's 1998 corporate financial test for Subtitle D municipal landfills differs from the 1982 test found in CIWMB's regulations; the 1998 test includes new financial ratio tests and a change to the bond rating test. In developing the 1998 test, EPA expressed a preference for a test that limited public costs, in addition to reducing combined public and private costs. EPA subsequently adopted the 1998 Subtitle D financial means test as a basis for a new 2005 Subtitle C financial test for facilities using a RCRA standardized permit. EPA considered the newer 1998 test for Subtitle D to be superior to the prior 1982 Subtitle C test.

Adequacy of Amount of Funds Assured

ICF rates the financial means test as High in terms of the amount of coverage provided, which is a factor in both test alternatives. This mechanism must demonstrate the full amount of coverage.[34] However, the operator need put no actual money aside.

Liquidity of Funds

ICF rates the financial means test as Medium for liquidity. Two of the ratios in Alternative I measure liquidity. Bond ratings also include assessments of liquidity. On the other hand, the tangible net worth and assets criteria do not directly assure liquidity. The test was designed to fail companies sufficiently in advance of serious financial distress that they would have the liquidity to arrange alternate FA.

Administrative Burden and Costs

ICF rates the financial means test as Medium for administrative burden and costs. The administrative burden includes annual submittals, although costs to the operator typically are low, involving fees only for an independent CPA's special letter report. Use of a standard form reduces administrative burden. Because no funds need to be set aside, there are no corresponding opportunity costs.

Long-Term Extension of Assurance

The financial test is well-suited to provide more assurance over long time-periods, as it is updated annually and easily adjusted in amount. On the other hand, by its nature, there are limits to how much FA can be demonstrated by this mechanism.

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the 1982 test, would effectively make this Alternative moot, because any firm that could pass the financial test under this revised Alternative I would also be able to pass under Alternative II of the 1998 test.

[34] ICF notes what it considers to be deficiencies in Form 104's CFO letter paragraphs 1 and 2, which do not appear to require a complete accounting for other uses of the financial means test for environmental FA; as a result, companies will be able to assure somewhat more FA using this test in California than would be allowed in other states.

2.2.8 Corporate Guarantee (27 CCR §22247 and Form 105)

2.2.8.1 What Is A Corporate Guarantee?

A corporate guarantee is a common option in many government-mandated financial responsibility programs, both environmental and non-environmental (e.g., FR for workers compensation).

A guarantee is a promise by one party (the "**guarantor**") to pay specified debts or satisfy the specified obligations of another party (the "**principal**") in the event the principal fails to satisfy its debts or obligations. A CIWMB guarantee is an agreement in which a guarantor firm promises to pay up to the current cost estimate for PCM on behalf of the LF operator.

This mechanism can apply only to PCM and not CA in California.

A corporate guarantee often will be an inexpensive method of demonstrating FA. Firms that provide a corporate guarantee must both execute a **written guarantee** and also demonstrate financial strength by passing the §22246 **financial means test**, based on year-end independently audited financial statements or bond ratings.

2.2.8.2 How Does The Corporate Guarantee Work?

If the operator fails or is failing to satisfy its obligations, the guarantor must either perform (or pay third-parties for) PCM until the amount of guaranteed coverage is exhausted or fully fund a §22240 trust fund established to allow CIWMB to authorize disbursements upon the presentation of appropriate documentation.

This option differs from **self-insurance** because it involves a source of financial responsibility other than the operator.

2.2.8.3 Who Can Provide A Guarantee?

The guarantee is acceptable only for private firms. A CIWMB guarantee may be provided by certain related firms or by firms that have a "substantial business relationship" with the LF operator. Eligibility options include one or more of the following:

- **Parent firms** that own a controlling interest[35] in the operator,
- **Grandparent firms** that own a controlling interest in the parent firm of the operator
- A firm engaged in a **substantial business relationship** with the operator also may provide a guarantee as an act incidental to that business relationship.

[35] Controlling interest means direct ownership of at least 50 percent of voting stock.

These eligibility options[36] originally were developed for U.S. EPA FA programs to: (1) broaden the pool of potential guarantors beyond corporate parents, (2) ensure that guarantees are legally valid; (3) avoid running afoul of laws relating to the business of insurance, and (4) ensure that sufficient unity of interest exists between the guarantor and the facility operator to provide adequate FA. The CIWMB eligibility requirements mirror those that the U.S. EPA determined would most likely result in adequate and effective assurance coverage related to solid waste landfills (40 CFR 258), underground storage tanks of petroleum (40 CFR 280), and hazardous waste disposal facilities (40 CFR 264/265 Subparts G&H). The U.S. NRC, on the other hand, for its decommissioning FA program, has restricted the use of corporate guarantees solely to parent corporations.

A legal term of art, "substantial business relationship" has the circular-appearing meaning of the business relationship necessary under applicable law to make a guarantee issued incident to the relationship valid and enforceable, rather than an unlicensed entry into the business of insurance. A guarantee typically is considered incident to such a relationship if it arises from and depends either on an ongoing set of economic transactions between the guarantor and the operator, or on a single transaction of substantial importance to the operator (e.g., sale of capital equipment or land).

Guarantors must demonstrate that they are qualified to provide FA by satisfying the §22246 financial means test for the required amount of coverage. As stated above, the test is designed so that those who pass are unlikely to experience financial distress that prevents their funding their obligations. Because those obligations include demonstrating FA, the test has been consciously designed to ensure advance notice of the need to arrange alternate FA.

Because the guarantor's financial statements (and bond ratings) form the basis of the assurance provided, the test must be passed anew with each year's financial statements. After the close of each fiscal year, the chief financial officer (CFO) of the guarantor must sign a letter reporting the year-end financial information supporting the guarantor's use of the financial test. If a guarantor finds that it is no longer eligible or qualified to use a financial test, the operator should obtain an alternate mechanism but the guarantor must do so if the operator does not.

The CIWMB does not need to rely solely on the guarantor's self-evaluation of its qualifications to issue guarantees. The CIWMB itself may disqualify use of the corporate guarantee upon a finding, based on reports of financial condition, that the guarantor no longer meets §22246 financial test requirements.

[36] CIWMB regulations do not permit **sister companies** (also termed "affiliates") that are controlled by a common parent (i.e., that also owns a controlling interest in the operator) or subsidiaries to act as a guarantor, unless the affiliate or subsidiary is engaged in a substantial business relationship with the operator.

2.2.8.4 Evaluation of Corporate Guarantee

Certainty That Assured Funds Will Be Available

ICF rates the corporate guarantee as High in terms of certainty of coverage. The corporate guarantee provides a more or less independent source of funds to backstop the operator. ICF uses the phrase "more or less" because eligible guarantors are not fully independent of the operator. However, eligible guarantors are far from "alter egos" of the operator either. In addition, although guarantors may be spun out of the corporate family, reorganized, or otherwise rendered ineligible or may experience deterioration in their financial strength so that they cannot pass the financial test, the guarantee itself is a legally binding document that remains effective until it is cancelled or terminated. The corporate guarantee is effectively irrevocable (because unless the operator provides alternate FA, the guarantor cannot escape its obligation), and restrictions on termination/cancellation contribute to certainty of assurance.

Adequacy of Amount of Funds Assured

ICF rates the corporate guarantee as High in terms of the amount of coverage provided, which is a factor in both financial test alternatives. This mechanism must demonstrate the full amount of coverage.[37] However, the guarantor need put no actual money aside.

Liquidity of Funds

ICF rates the corporate guarantee as Medium for liquidity. Two of the ratios in Alternative I measure the guarantor's liquidity. Bond ratings also include assessments of the guarantor's liquidity. On the other hand, the tangible net worth and assets criteria do not directly assure liquidity. The test was designed to fail companies sufficiently in advance of serious financial distress that they would have the liquidity to arrange alternate FA.

Administrative Burden and Costs

ICF rates the corporate guarantee as Medium for administrative burden and costs. The administrative burden includes annual submittals, although expenses for the guarantor typically are low, involving fees only for an independent CPA's special letter report. Because no funds need to be set aside before the guarantee is called upon, there are no corresponding opportunity costs.

[37] ICF notes what it considers to be deficiencies in Form 104's CFO letter paragraphs 1 and 2, which do not appear to require a complete accounting for other uses of the financial means test for environmental FA; as a result, companies will be able to assure somewhat more FA using this test in California than would be allowed in other states.

Long-Term Extension of Assurance

The corporate guarantee is well-suited to provide more assurance over long time-periods, as it is effectively irrevocable, updated annually, and easily adjusted in amount. On the other hand, by its nature, there are limits to how much FA can be demonstrated by this mechanism.

2.2.9 Insurance (27 CCR §22248 and Form 106)

2.2.9.1 What Is Insurance?

An owner or operator may satisfy FA requirements for PCM and/or reasonably foreseeable CA by obtaining appropriate **insurance** from a qualified insurer. Insurance is a common option in many government mandated financial responsibility programs, both environmental and non-environmental (e.g., for workers compensation and automobile liability). Insurance may be in the form of a separate insurance policy or an endorsement to an existing insurance policy.

An **insurance policy** is a **contract** by an insurance company to pay for certain damages, injuries, or losses, under certain contractually-specified terms and conditions, definitions, and exclusions and limits. A **certificate of insurance**, not part of the insurance policy, can serve as proof that an insurance contract has been arranged. Form 106 specifies the wording required for the certificate of insurance.

Insurance may be used to demonstrate FA for PCM and/or reasonably foreseeable CA.

2.2.9.2 How Does Insurance Work?

The policy must guarantee that funds will be available when the PCM period begins or when CA is deemed necessary. The insurer is responsible for paying for PCM and/or CA up to the face amount of the policy.

The first step in using insurance to pay for PCM and/or CA is to notify the insurer about the onset of the PCM period or about releases that may require CA. Unlike most other FA providers, insurers expect to be notified about potential claims on a timely basis. Because they share the risk, insurers want to be informed about and may choose to play a more or less active role in resolving any claims. The insurer may reimburse the owner or operator for PCM and/or CA spending, although the more typical pattern is for the insurer to hire, oversee, and pay contractors.[38] Insurers may make reimbursement payments only if the expenditures have been reviewed and approved in writing by the CIWMB or its designee.

To obtain and maintain coverage, the insured must pay **premiums**, typically assessed on an annual basis. This type of insurance may or may not be available on a single-premium paid

[38] In some cases of CA, an implementing agency may undertake response activities to clean up a release in a timely manner. In such cases the implementing agency would receive reimbursement by the insurer.

basis; a single premium is preferable for FA certainty. Insurance policies frequently have high **deductibles** in order to keep premium costs down and reduce moral hazard. The regulations and Form 106 make no mention of deductibles. ICF recommends adding a **first dollar coverage** requirement to help prevent delay of PCM and/or CA by requiring the insurer to make payments included within any deductible amounts. The insurer is entitled to recover from the policyholder payments made within deductible limits. In other words, any deductible amounts must be reimbursed by the insured. (Form 108 Liability Insurance Endorsement has such a provision at clause 4(b).)

If PCM or CA activities are *ordered* by the CIWMB as a result of failure by the operator to perform, the policy must guarantee that the insurer shall pay "without delay" up to the face amount into a special depository account established by the CIWMB. ICF understands that the CIWMB prefers not to negotiate about payment of funds.

This option differs from **self-insurance** because it involves a source of financial responsibility other than the owner or operator.

2.2.9.3 Who Can Provide Insurance

The FA regulations require the insurer to be licensed by the California Department of Insurance as an admitted carrier. Under California law, a **licensed insurer** is subject to rate filing and approval requirements, reserving requirements, and investment restrictions. These requirements are intended to protect insurance buyers from unsound or unscrupulous insurers. That is why a key goal of insurance regulation is maintaining the solvency of insurers.[39]

If the insurance is not available from a licensed, admitted insurer, the coverage may be obtained from an insurer that is eligible as an excess or surplus lines insurer in California. **Excess or surplus (E&S) lines** of insurance are not subject to rate and form review and are, by definition, sold by non-admitted insurers. Non-admitted insurers typically are not allowed to transact the business of insurance in California except through specially-licensed brokers or agents. Three admitted carriers must decline coverage before a customer can purchase coverage from a non-admitted insurer. In California, excess or surplus lines insurance can be placed only with non-admitted insurers who are approved and appear on the List of Eligible Surplus Line Insurers ("LESLI list").

Although surplus lines companies may not be regulated as closely as traditional carriers, that does not mean they are not regulated. Each company must be licensed (admitted) in the state that serves as its domicile and must meet the solvency requirements of that state. As a result, the state of domicile becomes the regulator over that insurer. In addition, California reviews evidence of operating record, financial condition, and surplus as part of the approval process; compliance with the statutory minimum capital requirements alone does not guarantee admission (10 CCR §2275). Because the risks they underwrite have more opportunities for

[39] Solvency is measured in two ways: (1) assets equal to or greater than liabilities, and (2) sufficient "liquid" assets readily available to pay obligations as they are due.

things to go wrong, minimum capital requirements for surplus lines companies may be higher than for admitted companies.

One important disadvantage of excess or surplus lines is that non-admitted insurance is not covered by California insurance guaranty funds. These funds (sometimes called "security" funds) provide for limited payments to policyholders of insolvent insurance companies after the companies' assets have been exhausted.

Captive Insurers. California regulations allow conforming insurance to be obtained from captive insurers. Captives are insurance companies that provide insurance primarily to their owners. More than 75 percent of captive insurers are owned by a single parent. The others are group or association captives, which are owned by firms that primarily are not engaged in the business of insurance. Captive insurers tend to be domiciled in states (e.g., Vermont) and countries (e.g., Bermuda) that have the least restrictive regulations and low taxes. Because a single-parent captive is not selling insurance to others, it may not need to be licensed or admitted in any state to conduct the business of insurance. As long as a captive satisfies CIWMB requirements, it can provide insurance for FA.

Many parties have raised excellent questions about the appropriateness of accepting FA from a pure captive, and California has had extended proceedings over the issue. There are good reasons for concerns. Captive insurers (1) are less strictly regulated than commercial insurers, (2) may not be monitored closely once their operations have been approved, and (3) usually do not have access to guarantee funds that pay claims in the event the insurer is not able to do so. Due to factors including narrow spread of risk, lack of business diversification, and potential financial instability of the parent, it may be more difficult for single-parent captives to be rated comparably to other insurers. Some state regulators seek formal parental commitments from single-parent captives due to similar concerns.

Some state environmental agencies and EPA Regions are not comfortable with use of insurance written by a single-parent captive to demonstrate FA. Since a single-parent captive is, basically, a sophisticated self-insurance fund, there is no risk transfer or risk sharing, which is one of the goals of FA mechanisms other than self-insurance. Although captives have capital and loss reserve requirements, a single-parent captive may be able to loan a majority of those funds back to its parent for use in operations.

2.2.9.4 Evaluation of Insurance

Certainty That Assured Funds Will Be Available

ICF rates the insurance mechanisms as Medium for certainty of assurance. Termination, cancellation, and nonrenewal is allowed only for failure to pay premiums;[40] however, limits,

[40] ICF urges CIWMB to modify its regulations governing cancellation or nonrenewal by insurers to track 40 CFR 280.109(a)(2), which allows termination only for failure to pay premiums or for misrepresentation. In that way, California may benefit from the ruling in *Zurich American Insurance Co. v. Whittier Properties, Inc.*, 356 F.3d 1132 (9th Cir. 2004).

terms and conditions, exclusions, and definitions may reduce the certainty provided by insurance. Insurers may allege misrepresentation/fraud as a basis for voiding coverage or may find other breaches of the insurance contract.

Insurance policies are as strong as the ability of the issuing insurer to honor them. The financial strength and liquidity of insurers is assured through state regulation and oversight. In addition to being reviewed by state agencies, insurers also submit copies of their annual financial statements to the National Association of Insurance Commissioners (NAIC) for analysis of actual or potential insolvency. Due to the requirement of assignability, pure captives have not been able to offer insurance as a FA mechanism.

Adequacy of Amount of Funds Assured

ICF rates the insurance mechanism as Medium for amount of coverage assured. An insurance policy must be in an amount that is at least equal to the required level of coverage. The regulations also require that the face amount of insurance covering PCM must be annually increased to reflect inflation (such increases are not required of policies covering reasonably foreseeable CA). However, limits, terms and conditions, exclusions, and definitions may reduce the amount of coverage provided by insurance. "First dollar coverage" should be provided; first dollar coverage ensures that disputes between the insurer and the insured over who is responsible for paying amounts within deductible limits will not interfere with prompt performance of PCM and/or CA.[41]

Liquidity of Funds

ICF rates the insurance mechanism as Medium for liquidity. The insurer must be prepared to make PCM or CA payments or reimbursements whenever the PCM period or CA commences. However, §22248(g) authorizes the insurer to make reimbursements only if the remaining value of the policy (i.e., the face amount minus any payments made) is sufficient to cover the remaining costs of PCM and/or CA. ICF is concerned that an insurer might use this provision to justify issuing only partial reimbursements. Insurers, moreover, make their money in part by holding onto and investing premiums while delaying or negotiating payments of claims.

Administrative Burden and Costs

ICF rates the insurance mechanism as High for administrative burden and cost. Automatic renewal reduces administrative burden, although the lack of a standard form endorsement contributes to administrative burden. Because insurance is a funding mechanism, premium expenses will be relatively high, with consequent opportunity costs.

[41] If an owner or operator is in bankruptcy and therefore cannot reimburse the insurer for the deductible, the insurer, as a creditor, can pursue its claim through the bankruptcy proceeding, just as any other creditor can.

Long-Term Extension of Assurance

The insurance mechanism is well-suited to provide more assurance over long time periods, as is it has no termination date and can potentially assure large dollar amounts. However, insurers vary over time in their willingness to issue policies with long durations. Available policy limits also vary with market conditions. Insurance has been marketed as a long-term tool for FA, noting a maximum term of 30 years; however, currently, a maximum term of ten years is reported as typical.

2.2.10 Local Government Financial Test (27 CCR §22249 and Form 112)

2.2.10.1 What Is the Local Government Financial Test?

A local government operator may satisfy the FA requirements for PCM and/or CA by passing the **local government financial test**. A financial test of self-insurance is an option in many government-mandated financial responsibility programs, both environmental and non-environmental (e.g., FA for workers compensation). ICF terms this option **self-insurance** because it involves no source of funding other than the operator itself. A financial test can be an inexpensive method of demonstrating FA. Large, creditworthy local governments can demonstrate FA without having to pay the costs of procuring financial mechanisms from other parties. To use the financial test option, local governments must demonstrate financial strength by passing a set of criteria, termed a financial test.

2.2.10.2 How Does the Local Government Financial Test of Self-Insurance Work?

Local governments that pass the test are expected to be able to pay for their PCM and/or CA obligations. How these local governments arrange to pay their obligations is solely their decision. Passing the test does not limit the operator's liability for PCM and/or CA. The test is designed so that those who pass are very unlikely to experience financial distress that prevents their performance of PCM and/or CA obligations, including for FA.

The local government must be both **eligible** and **qualified** to use the financial test.

2.2.10.3 Who Is Eligible to Use the Test?

Local governments[42] can use the test only for disposal facilities operated by government agencies (§22228(e)). A private sector operator may not use this mechanism.

[42] Local government entities include both general purpose local governments (e.g., counties and cities) and special purpose local governments (e.g., regional bodies or special districts). Regional bodies with landfill responsibilities include Del Norte Solid Waste Management Authority, Lassen Regional Solid Waste Management Authority, Merced County Solid Waste Regional Authority, Napa-Valley Waste Management Authority, Salinas Valley Solid Waste Authority, Humboldt Waste Management Authority, Kings Waste and Recycling Authority, and Tehama County SLA/RBLMA.

A local government is not eligible to assure its obligations under Section 22249 if it:

(1) Is currently in default on any outstanding general obligation bonds, or

(2) Has any outstanding general obligation bonds rated lower than Baa as issued by Moody's or BBB as issued by Standard and Poor's, or

(3) Has operated at a deficit equal to five percent or more of total annual revenue in each of the past two fiscal years, or

(4) Receives an adverse opinion, disclaimer of opinion, or other qualified opinion from the independent certified public accountant auditing its financial statements.

The total amount of PCM and/or CA costs which can be assured under the local government financial test is determined as follows:

(1) If the local government operator does not assure other environmental obligations through a financial test, it may assure PCM and/or CA costs that equal up to 43 percent or the local government's total annual revenue.

(2) If the local government operator assures other environmental obligations through a financial test, including but not limited to those associated with underground injection control wells, petroleum underground storage tank facilities, PCB storage facilities, and hazardous waste treatment, storage, and disposal facilities, it must add those costs to the PCM and/or CA costs it seeks to assure. The total that may be assured must not exceed 43 percent of the local government's total annual revenue.

2.2.10.4 Who Is Qualified to Use the Test?

Exhibit 2-4 displays the elements of the test, which require the operator to either satisfy a bond rating test or pass two financial ratios.

EXHIBIT 2-4
Local Government Financial Test

Bond Rating	Financial Ratios
Investment grade rating for all outstanding, rated general obligation bonds ~ excluding bonds backed by credit enhancement ~ excluding revenue bonds	~ Liquidity ratio $\geq$ 0.05 ~ Debt service ratio $\leq$ 0.20
Financial statements prepared in conformity with Generally Accepted Accounting Principles (GAAP) for governments and audited by independent certified public accountant (or appropriate state agency).	

To satisfy the bond rating test, all outstanding issues of rated general obligation bonds must be rated at least "investment grade" by Moody's or Standard & Poor's. **Investment grade bonds** are bonds rated Aaa, Aa, A, and Baa by Moody's Investors Service (Moody's) or AAA, AA, A, and BBB by Standard & Poor's Corporation (Standard & Poor's).[43] The FA rule appropriately distinguishes between general obligation bonds that have "credit enhancement" and those that do not in determining whether a local government is qualified to use the test.[44] The ratings assigned to municipal bonds issued with credit enhancement are driven primarily by the creditworthiness of the insurer, not the issuing local government.[45] Because the ratings for revenue bonds issued by general purpose governments do not measure the financial health and fiscal management practices of that type of government as a whole, local governments may not use revenue bonds to pass the test.

To demonstrate satisfaction of the local government financial test, the chief financial officer (CFO) of the local government operator must sign a letter worded exactly as specified in Form 112. Because the operator's most recent audited financial statements form a basis of the assurance provided, the financial test must be passed anew with each year's financial statements. If an operator finds that it is no longer eligible to use the financial test, the operator must obtain an alternate mechanism.

The CIWMB may disqualify use of the local government financial test upon a finding, based on reports of financial condition, that the operator no longer meets the local government financial test requirements. A local government operator must obtain alternate assurance after a change in status, including downgrading of a bond below investment grade.

For an operator to qualify for self-insurance, the independently audited financial statements can not carry a qualified opinion, an adverse opinion, or a disclaimer of opinion by an independent certified public accountant. These types of auditor's opinions disqualify a local government from using the financial test. An independent auditor's report on examination addresses whether a set of financial statements conforms with **generally accepted accounting principles (GAAP)** and **government auditing standards** issued by the Comptroller General of the United States. Most financial statements receive an **unqualified** (or "clean") **opinion**,

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[43] Both Standard & Poor's and Moody's recognize groupings within the major bond rating classes. Moody's signifies higher ranking bonds within a class with a "1" (e.g., Baa1), whereas Standard and Poor's uses a +/- system to designate higher and lower ranking bonds.

[44] Local governments often prefer to offer their bonds with credit enhancement such as insurance in order to lower borrowing costs. This means that scheduled interest and principal payments are fully guaranteed by municipal bond insurers. Bond insurance enables the issuer to save on interest costs, since bonds with the highest rating - and thus with the greatest security - pay the least interest. Bond insurance is cost effective for an issuer as long as the interest cost savings exceed the premiums paid to the insurer. There are other means of enhancing the rating of a municipal bond besides insurance. The most common alternative is to use a standby letter of credit.

[45] Although the rating of insured bonds does not directly indicate a local government's financial condition, it does demonstrate both that the government has assured the insurance company of its ability to meet debts, and that the insurer has strong confidence in the financial health of the local government.

expressing no doubts about the financial statements. By stating that the financial statements conform to GAAP, the auditor indicates satisfaction with the accounting principles that local government management has chosen and the estimates employed. Qualified opinions express some reservations by the accountant that the financial statements do not fairly or completely represent the financial condition and operating results of the local governmental entity.

2.2.10.5 Evaluation of Local Government Financial Test

Certainty That Assured Funds Will Be Available

ICF rates the local government financial test as Medium for certainty of assurance. Extensive data collection and analysis supported the development of the test by the U.S. EPA. As EPA stated upon promulgation of the final federal rule on which §22249 is based: "The purpose of the test is not to predict whether a local government will go bankrupt but rather to indicate whether it will have adequate funds to establish a trust fund or other allowable instruments to provide financial assurance … if its financial position deteriorates beyond acceptable levels."[46] In addition, the eligibility requirements for local government add to certainty of assurance. Although the amount of coverage is not a factor in either of the test alternatives, the amount of coverage affects eligibility and must not exceed 43% of annual local government revenues.

Adequacy of Amount of Funds Assured

ICF rates the local government financial test as High in terms of the amount of coverage provided. This mechanism must demonstrate the full amount of coverage.[47]

Liquidity of Funds

ICF rates the local government financial test as Medium for liquidity. One of the two ratios is a standard measure of liquidity employed in financial analyses of municipal governments. Bond ratings also include assessments of liquidity. The revenue limitation also helps ensure liquidity. The test was designed to fail local governments sufficiently in advance of serious financial distress that they would have the liquidity to arrange alternate FA.

Administrative Burden and Costs

ICF rates the local government financial test as Medium for administrative burden and costs. Use of a standard form reduces administrative burden. The administrative burden includes annual submittals, although costs to the operator typically are low, involving fees only

[46] 61 *Federal Register* 60328 (Nov. 27, 1996).

[47] ICF notes what it considers to be deficiencies in Form 112's CFO letter paragraphs 1 and 2, which do not appear to require a complete accounting for other uses of the financial means test for environmental FA; as a result, companies will be able to assure somewhat more FA using this test in California than would be allowed in other states.

for an independent CPA's special letter report. Because no funds need to be set aside, there are no corresponding opportunity costs.

Long-Term Extension of Assurance

The local government financial test is well-suited to provide more assurance over long time-periods, as it is updated annually and easily adjusted in amount. On the other hand, by its nature, there are limits to how much FA can be demonstrated by this mechanism.

2.2.11 Local Government Guarantee (27 CCR §22249.5 and Form 113)

2.2.11.1 What Is the Local Government Guarantee?

A local government operator may satisfy the FA requirements by obtaining a **local government guarantee**. A **guarantee** is a promise by one party (the **guarantor**) to pay specified debts or satisfy the specified obligations of another party (the **principal**) in the event that the principal fails to satisfy its debts or obligations. In the CIWMB local government guarantee, if the local government operator fails to perform PCM and/or CA or fails to provide alternate FA when required, the local government guarantor agrees either to perform (or pay the costs for) PCM and/or CA or fund a §22240 trust from which the CIWMB can direct the payment of PCM and/or CA costs.

This mechanism provides local government operators with a financial assurance mechanism comparable to the corporate guarantee allowed for private operators. The mechanism can be used by an operator that is a private entity or a government agency (§22228(k)). The provider of the mechanism must be a different government agency.

To provide a guarantee, a local government both must execute a **written guarantee** using Form 113 and also must demonstrate financial strength by passing the §22249 **financial test**, based on the guarantor's audited year-end financial statements for the latest completed fiscal year or on the guarantor's bond ratings.

No government is required to act as a guarantor.

This option differs from self-insurance because it involves a source of financial responsibility other than the local government operator.

Because the guarantor's financial qualifications form the basis of the assurance provided, the guarantor must renew its qualifications every year. After the close of each financial reporting year, if the guarantor finds that it is no longer eligible or qualified to provide a guarantee, the guarantor must notify the operator who is required to obtain another FA mechanism. If the operator fails to do so, the guarantor must provide the alternate assurance.

2.2.11.2 Who Can Provide A Guarantee?

Guarantors must demonstrate that they are **qualified** to provide financial assurance by satisfying the §22249 financial test. Guarantors who qualify are expected to be able to pay for

PCM and/or CA if the operator does not. Guarantors who meet those requirements are very unlikely to experience financial distress that prevents their funding PCM and/or CA. To be **eligible** to provide a guarantee, a local government need not have a "**substantial governmental relationship**" with the local government operator.

Most guarantees likely will be based on significant governmental relationships such as overlapping geographical boundaries, common taxing or service constituencies, or shared impact from an LF release. Examples include: (1) a guarantee offered by a county to an incorporated city located partially or entirely within the limits of the county; (2) a guarantee offered by one county to another if both counties cover a common aquifer subject to contamination by LF releases; or (3) a guarantee offered by a general purpose local government to special district serving the guarantor in whole or in part.

> **NOTE**: Although guarantors may cease to be eligible or qualified, the guarantee itself remains effective until it is cancelled or terminated.
>
> **NOTE**: The government guarantee may be combined with a local government financial test of self-insurance only if the financial statements of the local government operator are not consolidated (i.e., combined) with the financial statements of the local government guarantor.

2.2.11.3 Evaluation of Local Government Guarantee

Certainty That Assured Funds Will Be Available

ICF rates the local government guarantee as High in terms of certainty of coverage. The guarantee provides a more or less independent source of funds to backstop the operator. The guarantee has no termination date and requires no renewal. The corporate guarantee is effectively irrevocable (because unless the operator provides alternate FA, the guarantor cannot escape its obligation), and restrictions on termination/cancellation contribute to certainty of assurance. By passing the financial test, the local government guarantor demonstrates its financial strength, which supports certainty of assurance.

Adequacy of Amount of Funds Assured

ICF rates the local government guarantee as High in terms of the amount of coverage provided. This mechanism must demonstrate the full amount of coverage.[48] Although the amount of coverage is not a factor in either of the financial test alternatives, the amount of coverage affects eligibility and must not exceed 43% of annual local government revenues.

[48] ICF notes what it considers to be deficiencies in Form 112's CFO letter paragraphs 1 and 2, which do not appear to require a complete accounting for other uses of the financial means test for environmental FA; as a result, companies will be able to assure somewhat more FA using this test in California than would be allowed in other states.

Liquidity of Funds

ICF rates the local government guarantee as Medium for liquidity. One of the two ratios is a standard measure of municipal liquidity employed in financial analyses of municipal governments. Bond ratings also include assessments of liquidity. The revenue limitation also helps ensure liquidity. The test was designed to fail local governments sufficiently in advance of serious financial distress that they would have the liquidity to arrange alternate FA.

Administrative Burden and Costs

ICF rates the local government guarantee as Medium for administrative burden and costs. The administrative burden includes annual submittals, although costs to the guarantor typically are low, involving fees only for an independent CPA's special letter report. Because no funds need to be set aside before the guarantee is called upon, there are no corresponding opportunity costs.

Long-Term Extension of Assurance

The local government guarantee is well-suited to provide more assurance over long time-periods, as it is irrevocable, updated annually, and easily adjusted in amount. On the other hand, there are limits to how much FA can be demonstrated by this option.

2.2.12 Federal Certification (27 CCR §22250)

2.2.12.1 What Is A Federal Certification?

A **federal certification** is a commitment by the Federal government to make a timely request and obtain funds for completing PCM from its funding body when necessary. A federal certification must also include a commitment not to restructure the PCM funding in a manner that would interfere with timely completion of PCM.

A federal certification is an option in government-mandated financial responsibility programs.[49]

This mechanism can apply only to PCM and not to CA.

ICF notes that some states have required the federal government to establish a trust fund for PCM. For example, the State of Tennessee has required the Department of Energy to pay into a trust fund for long-term monitoring and grounds maintenance for the Oak Ridge Environmental Management Waste Management Facility (EMWMF) for lower activity mixed waste. In general, see W. Paul Robinson, Southwest Research and Information Center, *Is "Trust Us, We're the Government" Really a Guarantee? A Review of Financial Assurance Options for Long-Term Stewardship at the Mixed Waste Landfill, Sandia National laboratories*, prepared for Citizen Action (June 18, 2002).

[49] The NRC allows materials licensees to use this option for decommissioning FA.

2.2.12.2 How Does the Federal Certification Work?

Should Congress fail to appropriate the necessary funding for PCM, the federal entity must notify the CIWMB and document all measures it will undertake to ensure PCM activities are completed in accordance with the most recently approved PCM plan.

2.2.12.3 Who Can Provide A Federal Certification?

Only a federal entity may provide a federal certification of FA, although the certification may be issued on behalf of other operators.[50] A federal entity may provide FA for PCM on behalf of private or other entities operating solid waste landfills, if either:

(1) The solid waste landfill is located on federal land; or

(2) The operator operates or manages the solid waste landfill pursuant to a contract with the federal entity or an applicable subcontract.

This option differs from **self-insurance** when it involves a source of financial responsibility other than the operator.

2.2.12.4 Evaluation of Federal Certification

Certainty That Assured Funds Will Be Available

ICF rates the federal certification Low in terms of certainty of assurance. Problems with federal funding result not only from delays by Congress in enacting spending bills but also from issues within federal agencies. The certification does not guarantee that the federal government will be successful in seeking needed funds. No money is set-aside.

Adequacy of Amount of Funds Assured

ICF rates the federal certification Low in terms of the amount of funds assured. The federal budget process does not allow for requests for long-term funding. Thus, the funding "assured" will be less than the amount needed for PCM and long-term CA.

Liquidity of Funds

ICF rates the federal certification as Low for liquidity. Although no money is set aside, federal appropriations – when made – are liquid.

[50] ICF notes a possible inconsistency between §22250(f) and §22228(i) regarding use of the federal certification.

Administrative Burden and Costs

ICF rates the federal certification as Low in terms of administrative burden and costs. Although a required form might reduce transaction costs, the certification need only be filed one time. As no money is set aside, opportunity costs are virtually nil.

Long-Term Extension of Assurance

The federal certification is well suited to provide more assurance over long time-periods as it requires no renewal, has no termination date, and is easily adjusted in amount. There are no inherent limits to how much FA can be demonstrated by this mechanism. This mechanism can be made applicable to long-term obligations with no changes.

2.3 MECHANISMS NOT RECOMMENDED

ICF is not aware of any additional form of financial demonstration (e.g., catastrophe bonds) we would recommend as appropriate for PCM and/or CA at solid waste landfills. Limitations of previously rejected mechanisms (e.g., security interests, escrows) have not changed; they continue to lack important security/certainty/ liquidity protections. This section describes the strengths and weaknesses of several specific mechanisms that ICF does not recommend.

Security Agreements. ICF does not recommend security agreements because of three concerns about the adequacy of the assurance such agreements provide: (1) limited liquidity and uncertain value of the collateral subject to the agreement; (2) complex and demanding procedural requirements to establish, maintain and oversee a security agreement; and (3) ability of an environmental agency to seize and sell the collateral. These three concerns raise questions about the certainty, amount, and liquidity of coverage as well as high administrative costs both to the operator and to the implementing public agency.

Lines of Credit. ICF does not recommend lines of credit because they are conditional on the current financial standing of the borrower and therefore do not represent a substitution of the issuer's credit for the borrower's. Moreover, because lines of credit can be used for other business purposes as well as FA, the amount of available credit may not be adequate when needed for PCM and/or CA. This mechanism raises concerns about both the certainty and amount of coverage; liquidity, on the other hand, is excellent.

"**Cleanup Cost Cap**" or "**Stop Loss**" or "**Cost Containment**" coverage is a special type of **insurance** that provides cost overrun coverage and is designed to cover an unanticipated increase (e.g., over 20-30%) in the costs of a known cleanup that has a detailed cost estimate from a reputable environmental cleanup contractor. This insurance does not provide FA for the estimated amount of the CA itself. Coverage arises when the cost to perform the approved cleanup plan ultimately exceeds the contractor's estimate, plus a buffer. The buffer is a self-insured retention (SIR) or deductible layer of 10%-30% of the total cost and there also may be a copayment required above the SIR. Policies effectively limit the coverage to cost overruns caused by three identified triggers only: discovery of unidentified pollution during the implementation of the insured cleanup, additional amounts of pollution, or a change in regulatory

requirements. In addition, this type of insurance *does not cover* the cost to cleanup any contamination discovered after the completion of the cleanup, nor government oversight costs. Typically, these policies exclude professional negligence, faulty workmanship, breach of warranty, unreasonable contractor delays, bankruptcy, strikes, acts of God, war, and terrorism. Coverage under this type of policy ends when the project is complete and the insured received a No Further Action letter or similar documentation from the government authority having jurisdiction over the cleanup. Cleanup cost cap coverage is not right for every cleanup, and insurers generally are not interested in insuring a cleanup of less than $1,000,000 and prefer cleanups in excess of $3,000,000. The market for this type of coverage has restricted due to recent negative claims history.[51]

Finite Risk also is not traditional insurance coverage. Rather, it combines a funded self-insurance program with administrative and investment services provided by an insurer. Finite risk sometimes is recommended by insurance companies for a long-term costly cleanup. Generally, the insurance company requires the insured to pay a premium equal to a discounted value of the cleanup, based on a formula that takes into account the expected length of the cleanup and when the insured expects to expend funds. This type of policy must be carefully created by the insured, with input from both its tax advisor [52]and the insurance company, and it must contain an established claims procedure. An insured, paying a substantial up front sum of money to the insurance company, will want to ensure that the claims trigger and payment mechanism are precisely as intended, to avoid disputes with the insurance company over payments. The following disclosure by Marsh, a leading insurance broker, sums up the status of finite risk coverage:

> Clients should be aware that "finite risk" solutions consist of a combination or blend of risk transfer and other risk financing strategies. Under certain circumstances auditors and regulators such as the SEC, IRS, and various insurance departments have challenged transactions accounted for as a "finite risk" solution, questioning, for example, whether among other things, there is sufficient risk transfer to support the accounting and/or tax position taken by the client. Marsh believes that the finite risk can be a valuable risk management tool. However, Marsh makes no representations concerning the proper accounting, legal, or tax treatment for any transaction.

Finite risk coverage may also include cleanup cost cap coverage and pollution legal liability coverage as components, which is commonly known as "blended finite" coverage. ICF recommends caution, given that blended finite risk insurance has been described in the following way: "Yes, it is insurance and it is legal."

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[51] Ann M. Waeger, *Current Insurance Policies for Insuring Against Environmental Risks* (2006).

[52] A case in point: the City of San Bernardino purchased a finite risk policy in order to stretch a settlement received from the U.S. Army for a Superfund site with contaminated groundwater. The City subsequently was surprised when it received a bill for premium tax on the contract.

Institutional Controls and Post Remediation Care Insurance. This niche policy, created and marked by **Zurich**, was designed to cover risks associated with "institutional controls" (but which includes engineering controls) used when contamination remains in place at a site after remediation. This insurance does not assure the costs of PCM but rather covers other PCM exposures. This insurance offered four types of coverage: (i) cost overruns related to the design and initial implementation of the institutional control; (ii) third-party bodily injury and property damage and cleanup coverage due to errors in the design or establishment of an institutional control by a professional; (iii) failure of a properly designed and established institutional control, including coverage for both third-party bodily injury and property damage and cleanup costs associated with such a failure; and (iv) third-party bodily injury and property damage and cleanup costs associated with an error or omission by a party responsible for maintaining or enforcing an engineering or institutional control.[53] Zurich North America has no information about this product on its websites.

Escrow Accounts. An **escrow** (or **escrow account**) is a written agreement whereby the operator transfers assets to an **escrow agent**, such as a bank. The escrow agent manages the account according to the terms of the written **escrow agreement** for the benefit of the **beneficiary**. An escrow account functions much like a savings account except that (1) monies are legally segregated for a specific purpose, and (2) the account is administered by someone with a **fiduciary responsibility** to keep or use the property in the account. The escrow itself is a written instrument that creates the fiduciary obligation and gives instructions to the escrow agent concerning the deposit. Money deposited to be held until the performance of a condition is treated as "deposited in escrow." An escrow is an infrequent option in government-mandated financial responsibility programs, both environmental and non-environmental. The main reason is because it offers less security than other mechanisms. The strengths and weaknesses of the mechanism are as follows:

Strengths	Weaknesses
• Easier and cheaper for operator than trusts	• Funds remain legal property of the operator and are vulnerable to the bankruptcy of the operator • Escrow agent must look out for the interests of the operator and thus is not as independent as the trustee

NOTE: A trust differs from an escrow account in that although a bank can take possession of property in an escrow account, it does not hold legal ownership of escrow property.

Certificates of Deposit. The **certificate of deposit** (CD) is a written acknowledgment of the receipt of a sum of money on deposit for a pre-specified period of time, which the depositary institution promises to pay to the depositor, to the order of the depositor, or to some other person or to his order. An **order** is a designation of the person to whom the money is to be paid. A CD is in effect a loan to a bank by the depositor for period of time at a stated rate of interest, and

[53] Ann M. Waeger, *Current Insurance Policies for Insuring Against Environmental Risks* (2006).

creates the relationship of **debtor** and **creditor** between the bank and the depositor. The CD should acknowledge the receipt of a deposit and contain a promise of repayment. The promise of repayment is essential to distinguish a CD from a mere deposit slip. The strengths and weaknesses of this mechanism are as follows:

Strengths	Weaknesses
• Because there is typically no transaction fee, may be cheaper than other mechanisms for operator • May provide a higher rate of return than trust fund	• Less liquid; usually there is a penalty for early withdrawal • Funds remain legal property of the operator (unless deposited in trust fund) and are part of the debtor's estate in bankruptcy • Funds vulnerable to bank's set-off rights[a] • If negotiable, requires special custodial care

[a] A "set-off right" refers to the ability of the bank to look to deposits it holds for the repayment of any indebtedness to the bank on the part of the depositor and to apply the debtor's deposit to these debts as they become due.

Deposits of Government Securities. A **deposit of government securities** is the deposit by an operator into either a trust fund, an escrow account, or a government fund of securities backed by the federal government or a state or local government. The strengths and weaknesses of this mechanism are as follows:

Strengths	Weaknesses
• Government securities have low risk of default	• Market risk can impair current value of securities • Negotiable instruments require special safekeeping • If not placed in a trust, funds remain legal property of the operator and vulnerable to the bankruptcy of the operator • Administrative burden and costs

2.4 ANNUITIES

"Annuities" have been marketed by insurance underwriters, agents, and brokers as components of financial assurance and/or insurance programs for site-specific environmental liabilities. Yet, financial assurance regulations for environmental obligations, such as those in California and Texas, do not list or mention annuities. This section of Chapter 2 tackles the question of whether CIWMB should consider adding annuities to its list of acceptable forms of demonstrating financial assurance for PCM and/or CA, and evaluates how ICF believes such a mechanism would perform using the criteria defined earlier. In addition, this section describes types of annuities and their typical terms and conditions, how annuities could be used as financial assurance for PCM and/or CA, a California example found by ICF, and the story behind the addition of annuities to lists of acceptable FA mechanisms for reclamation related to surface mining of coal in Pennsylvania and Tennessee.

2.4.1 What are Annuities?

In reading about annuities, ICF cautions the reader to bear in mind that every investment is relatively strong in one or two of the following criteria at the expense of the other(s):

(1) Safety (and volatility) of principal
(2) Liquidity
(3) Return on Investment

Thus, the guarantees in annuities come at the price of reduced liquidity and return. Compared to a basket of common stocks, annuities will have much lower but much more certain rates of return.

The three basic types[54] of annuities include:

(1) commercial annuities issued by insurance companies
(2) charitable annuities issued by qualified charitable organizations
(3) private annuities involving transfers of appreciated property

This discussion addresses only commercial annuities issued by insurance companies because the other types are not directly relevant to FA. Annuities are popularly known due to their connection with retirement savings and benefits payments. In that context, an annuity functions as the converse of a life insurance policy: an annuity makes payments until the payee dies; a life insurance policy typically makes no payments until the insured dies. An annuity may be the most complex financial instrument marketed to general consumers, albeit upper income consumers. The complexity is, in part, inherent to a long-term instrument that may have tax, investment, insurance, retirement, long-term care, and/or estate planning features. In addition, the complexity arises from the many contingencies that are built into annuities to protect the interests of the issuer and the other parties.

In light of reports about the inappropriate marketing of annuities, particularly to seniors, California's Department of Insurance has established regulations governing the marketing of annuities, replacement of existing annuities, and calculation of any paid-up annuity, cash surrender, or death benefits, and offers training programs and materials (e.g., to insurance agents and brokers). It is beyond the scope of this section to determine and explain the applicability of Title 10 of the California Administrative Code to the annuities discussed here.

The California Insurance Guarantee Association, which provides a maximum of $500,000 per policy if a California-licensed insurance company is declared insolvent, is not authorized by law to cover annuity policies. The California Life & Health Insurance Guarantee Association may cover annuities up to a limit of $100,000.

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[54] Phillip E. Allen, Esq., "Annuities: What They Are and How They Are Used," *Federation of Regulatory Counsel Journal* (Spring 2007).

2.4.2 How Does An Annuity Work?

Buyers of annuities have their money invested by a bank or insurance company, which agrees to pay the money back according to the annuity contract's terms. A specified payment schedule and early withdrawal penalties enable annuities to offer more attractive terms than more flexible arrangements. The annuity contract may have the following characteristics:

- provides payouts starting within 12 months ("immediate annuities") or at some future date ("deferred annuities"). Immediate annuities typically are purchased with a single premium payment.

- (a) multiple investment choices and the right to switch among the choices ("variable annuities") or (b) specific investments that cannot be changed ("fixed annuities"). Only the latter option typically offers certain guarantees, such as a specific rate of return for some period, guarantee of principal, and so on. Fixed annuities typically are purchased with a single premium but some accept additions after being opened.

- avoids charges for early withdrawals within certain time periods (e.g., the first 7 years) or accepts such charges in exchange for a "bonus" sweetener.

Among the key advantages of retirement-related annuities is tax deferral on investment earnings and favorable tax treatment of contributions and payouts (with specified limits, exceptions, and penalties). It is not clear to ICF that annuities <u>not</u> related to retirement offer such tax advantages. Annuities not purchased or provided in connection with an employer's retirement plan or an individual retirement arrangement (such as an IRA) are termed "nonqualified" under federal tax law. Contributions to nonqualified annuities are not deductible from gross income for income tax purposes. (This is similar to tax treatment of most payments into trust funds used for financial assurance.) In addition, annuities owned by non-natural persons (such as corporations) are subject to annual taxes on investment earnings. (Note: Immediate annuities are excepted from that tax rule.)

Variable annuities are much like mutual funds wrapped in an annuity contract. Unlike mutual funds, variable annuities do not pay out earnings or distribute capital gains. The issuing insurer does not assume the investment risk. As a result, by law, variable annuities are considered securities; therefore, the contracts must be registered with the SEC. (ICF reviewed a couple of annuity contract forms registered with the SEC.) Sellers of variable annuities must be registered representatives with the National Association of Securities Dealers (NASD) as well as licensed insurance agents.

Non-retirement annuities include both "structured settlement" products that are mostly used in settling legal cases and, most relevant for this discussion, "period certain" annuities which do not incorporate a mortality contingency. Period certain policies have been described as effectively bonds issued by an insurance company. Annuities without life contingencies are regulated as insurance policies although they might not technically meet the definition of insurance.

Annuities sold by or through depository institutions (e.g., banks) must be accompanied by disclosures prescribed under the federal Gramm-Leach-Bliley Act). The key disclosures are that

- annuities are not insured by the Federal Deposit Insurance Company (FDIC)
- annuities are not guaranteed by the bank or credit union that sells them, and
- annuities involve an investment risk, including the possibility of lost principal[55]

Selecting an annuity provider is not straightforward. In the employee benefits arena, the Department of Labor (DOL) reported that plan sponsors had not been adding annuity options to their plans because of the requirement to select the "safest available" annuity. In 2006, Congress directed DOL to issue regulations clarifying that the "safest available" standard was not applicable. Therefore, DOL developed a revised standard for selecting annuity providers that also required plan fiduciaries to determine whether they have the expertise to meaningfully evaluate annuity providers. If the expertise was present, then the fiduciary was not required to engage an independent expert to evaluate annuity providers. The fiduciary is required to assess the ability of the annuity provider to make all future payments under the contract. DOL's guidance indicates that the fiduciary should consider the following factors:

- the annuity provider's experience and financial expertise

- the annuity provider's level of capital, surplus, and reserves available to make payments

- the annuity provider's use of separate accounts to underwrite benefit obligations

- the annuity provider's rating by insurer rating services

- additional protections through state guarantee associations, the extent of their guarantees, and any readily available information calling into question the ability of a state association to meet its obligations

Notably DOL's guidance does not provide benchmarks to determine whether an annuity provider should be considered acceptable or not.[56]

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[55] See *Bank Products: What's Insured and What's Not*. The Federal Reserve System of San Francisco.

[56] See Proposed Regulation, "Selection of Annuity Providers for Individual Account Plans," 72 *Federal Register* 52021 (Sept. 12, 2007).

2.4.3 Annuities as FA Mechanisms for PCM and/or Reasonably Anticipated CA

Annuities appear better-suited as a potential FA mechanism for PCM than for CA. PCM expenditures will occur continuously following closure until landfilled waste no longer poses a threat. Although some years of PCM will require more money than others (e.g., to cover replacement of capital goods), most years of PCM will require generally similar amounts of expenditures (in current dollars).[57] This pattern of funding needs better matches the annuity model than anticipated funding requirements for reasonably foreseeable CA. Unlike PCM obligations which automatically begin after closure, the need for funding reasonably foreseeable CA cannot usually be scheduled in advance. Once the need for CA is determined, spending on CA may occur over a relatively short time-period or over a relatively long period of decades. CA costs likely will have greater annual variability, in many cases, than PCM costs.

An annuity could be used either as a "pay on behalf of" FA mechanism or a "pay only for defaults" FA mechanism. The first instance better follows the annuity paradigm; an annuity for PCM can be structured to provide funding immediately following closure, which the responsible party can use to pay PCM costs. Alternatively, the annuity could be structured to provide PCM funding only in the event of failure to perform PCM (termed a "default" in this study), similar to a surety bond or letter of credit. Likewise, it may be feasible to structure an annuity for reasonably foreseeable CA as a pay on behalf of mechanism for the costs of CA whenever they are required. Or the annuity could be structured to begin CA payouts only in the event of default. Both ways of assuring CA through an annuity face the problem of scheduling payments.

Similar to a trust fund, an annuity contract represents a store of value. As a "store of value," an annuity may be better suited as a payment vehicle than a pay-on-default vehicle. The store of value represents the money put into the annuity and its net earnings. When the annuity is intended to cover only defaults and there is no default, a permittee would lose the value of the annuity unless it was structured to disburse the unused funds back to the permittee. (The same reasoning applies to trust funds.)

Another issue is that annuities do not specify a face amount as do other insurance products. Annuities, for example, specify minimum or maximum benefit payments per year and/or may specify guaranteed minimum interest rates when issued; however, such amounts as account value, cash value, or surrender value change over time. This feature of annuities does not comport with certain FA requirements. For example, the regulations describe a situation when the insurer is required to pay funds, without delay, to the CIWMB as requested up to the "face amount" of the policy.[58] Whether this approach can work with annuity contracts is unclear to ICF and may require formal legal analysis.

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[57] Annuities may not provide payments that reflect the impact of inflation over time.

[58] Current regulations using insurance to demonstrate FA for PCM and/or reasonably foreseeable CA specify certain actions in the event that the CIWMB or its designee order PCM or CA activities as a result of failure by the operator or authorized person to conduct such activities.

An annuity appears to be an attractive mechanism for FA by promising to generate a constant stream of payments from low-risk investments. A sufficiently large annuity may be able to generate enough after-tax earnings to cover PCM (and reasonably foreseeable CAs) until the landfilled waste no longer poses a threat. Whether that outcome is feasible depends on such factors as the following:

- amount of pay-in (premiums)
- rates of after-tax earnings
- time period between premium payment(s) and distribution of funds
- amount of needed PCM
- amounts and timing of needed CA
- accuracy of cost estimates for PCM and CA

Once the waste no longer poses a threat, then the corpus of the annuity may pass to designated beneficiaries (a common feature of annuities) or may revert to the issuer of the annuity.

2.4.4 California Example

ICF found only one documented example of the use of an "annuity" for financial assurance of environmental obligations in California. The City of Newport Beach reportedly established an "annuity account" for maintenance dredging and water quality compliance. As part of a watershed sediment control plan, the U.S. Corps of Engineers (Corps) would restore and expand two sediment control basins in Upper Newport Bay; the Corps required that local agency participants in the project provide assurances that they will provide for the long-term maintenance of the restored area. The City of Newport Beach and the California Regional Water Quality Control Board (Santa Ana Region) applied for and received a grant of $3.8 million to be put "in an annuity account by the City and invested in low-risk annuities to generate funding for maintenance dredging in Newport Bay, in perpetuity."[59] Described both as an annuity fund and an annuity account, the concept articulated for Newport Beach was not to spend the principal in the account, but only the earnings.

Subsequently, the fund ceased to be described as an "annuity" but as a segregated interest-bearing account.[60] Consistent with the intent that the grant money be invested conservatively, the City of Newport Beach agreed to invest the principal in accordance with its conservative investment principles.

The City of Newport Beach's financial statements do not separately list the "Newport Bay Dredging Fund" (probably because it is too small), but the Budget Detail for FY2007-2008

[59] See Item 11 Staff Report on Resolution No. R8-2002-0047 (April 26, 2002). This plan was described as having been modeled on an agreement between the Coastal Conservancy and the San Elijo Lagoon Conservancy, which was established for similar maintenance dredging, in perpetuity, in San Elijo Lagoon in San Diego County.

[60] See proposed Resolution No. R8-2002-0054 (December 3, 2002).

lists it as a distinct fund with a 2005-6 balance consisting of a $3,857,000 "permanent endorsement" and an "appropriation reserve" of $168,602. ICF interprets the latter number as representing annual earnings on the fund, given that the City's budget also estimates 2006-2007 revenue for the fund at $160,000 (about 4.4%).

Ultimately, it is not clear to ICF whether the fund should be described as an annuity. On the one hand, the intent is to pay for regular maintenance dredging, which may be needed until sediment transport reaches equilibrium, estimated to take 50 to 200 years. Thus, a key feature of annuities – a schedule of regular payments – appears present. The relatively long time-frame also is a core feature of annuities. On the other hand, the parties recognized that more dredging may be required after unpredictable events such as major storms and El Nino years. Therefore, the City expected to manage the fund "on an as-needed basis," which is not typical of annuities. The City also expected that additional funds would be used to generate the necessary income; subsequent additions to the fund from other parties do not fit the "single-payment premium annuity" model. Finally, ICF notes some uncertainty regarding how often regular maintenance dredging will be needed and when regular maintenance dredging will begin – due to uncertainty about when the Corps project will be completed. Such uncertainties are not typical of annuities.

2.4.5 Annuities in Financial Assurance: Pennsylvania

Annuities are considered to be acceptable forms of financial assurance for certain aspects of state surface mining programs for coal (see 25 Pa. Code §86.158). In 1992, the Pennsylvania legislature amended the Pennsylvania Surface Mining Control and Reclamation Act to expand the list of acceptable forms of financial assurance for coal mining and reclamation operations to include life insurance policies, annuities, and trust funds. Regulations proposed in 1995 were largely finalized in 1997, including revising the proposed definition of "annuity" to reflect its "more common definition:" "A financial instrument which provides a sum payable periodically over a length of time." (See 25 Pa. Code §86.142) The 1997 final regulations also added a provision intended to address "potential concern over the taxability [sic] of investment proceeds of trust funds and annuities." Neither of these changes were made in response to written comments received on the proposed regulations; commenters raised no issues at all regarding life insurance, annuities, or trust funds.[61]

Pennsylvania's regulations address both trust funds and annuities as forms of "collateral bonds"[62] in the same subsection 86.158(f). With one exception, all of the provisions apply equally to trust funds and annuities. The regulations are not extensive nor detailed. They state the following:

- the amount of the trust fund or annuity shall be determined and set by the DEP

[61] See 27 *Pa. Bulletin* 6041 (November 14, 1997) and EQB Docket No. 7-285 "Summary of Comments" (July 14, 1997).

[62] Pennsylvania defines a "collateral bond" as an indemnity agreement in a "sum certain." (§86.142) As discussed above, annuities are not typically issued for a total "sum certain."

- the form and terms and conditions shall be as required by the DEP. At a minimum:

  - the DEP shall be irrevocably established as the beneficiary
  - investment objectives shall be established by the DEP
  - termination shall occur only as specified by the DEP
  - release of monies may be made only with written authorization of the DEP

With respect to the criteria for qualifying issuers of trust funds and annuities, the regulations address financial institutions issuing a trust or annuity, and, separately, insurance companies issuing annuities (25 Pa. Code §86.158(f)(3)). ICF found no forms or guidance for annuities on the DEP's website. As of August 2007, the DEP's website lists 25 trust agreements in place, none of which are described as annuities.

Because Pennsylvania has a federally authorized state program for surface mining of coal, as its laws and regulations change, they are submitted to the federal government for review and determination regarding their effectiveness by the U.S. Department of the Interior's Office of Surface Mining (OSM). OSM reviewed Pennsylvania's additional financial assurance provisions against the benchmarks contained in the federal financial assurance regulations at 30 CFR 800.21. The federal regulations do not specifically list annuities (or life insurance policies) as acceptable financial assurance demonstrations. In its final rule of 2005, the OSM determined that Pennsylvania's laws and regulations for trust funds and annuities "present no greater risks, and are, therefore, no less effective" than the forms of financial assurance expressly contained in 30 CFR 800.21. OSM provided no technical analysis supporting this finding.[63] ICF notes that in the same 2005 proceeding, OSM made the same determination regarding the use of a life insurance policy as an acceptable form of reclamation financial assurance. ICF would not endorse such use of life insurance policies due to issues concerning the poor liquidity and uncertainty of availability of funds of such instruments, at a minimum. In addition, the 30 CFR 800.21 benchmark used by OSM may not represent best FA practices, in ICF's opinion.

2.4.6 Annuities in Financial Assurance: Tennessee

Annuities are included as an option for financial assurance in the federal regulations for surface mining of coal in Tennessee (30 CFR 942). Back in 1984 the federal government ended up with most of the regulatory responsibility for surface coal mining and reclamation in Tennessee. In issuing regulations for the State, the OSM had applied the federal benchmark regulations for financial assurance (30 CFR 800) with specific modifications appropriate to Tennessee. In 2006, OSM proposed, seemingly on its own initiative, three changes to its regulations for Tennessee, one of which was to allow the use of trust funds or annuities to demonstrate financial assurance for treatment of known "long-term postmining pollutional discharges." The OSM used Pennsylvania's surface mining financial assurance regulations as a basis for the proposed regulations it developed for Tennessee.[64]

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[63] See 70 *Federal Register* 25472 (May 13, 2005).

[64] See 71 *Federal Register* 17681 (April 6, 2006).

Postmining pollutional discharges are unanticipated events identified prior to termination of the permit that can increase the cost of reclamation activities because treatment of discharges (e.g., acid mine drainage) may be needed during and after land reclamation. How to require financial assurance for such treatment costs – including operating and maintenance costs as well as capital costs for replacement of the system during the 75-year treatment period – had become a problem and a source of litigation.[65]

This rulemaking affected only the regulations for Tennessee (30 CFR 942.800). No conforming changes were made to the federal regulations at 30 CFR 800. However, the preamble to the 2007 final rule stated OSM's position and interpretation that adequate authority for the use of annuities already was available under the federal Surface Mining Control and Reclamation Act (SMCRA) and its implementing regulations. In addition, the rulemaking approved annuities and trust funds as financial assurance mechanisms only for long-term treatment of postmining pollutional discharges. Annuities and trust funds were not added as financial assurance mechanisms for other aspects of reclamation. As its rationale, OSM noted that surety companies had no interest in bonding long-term water treatment, whereas sureties were comfortable bonding other reclamation activities. In response to an earlier 2002 national-level rulemaking, the Surety Association of America commented that surface coal mining operations "would not be prudently bondable if the scope of the obligation included perpetual treatment of discharges." OSM took the position that, as dedicated income-producing accounts, trust funds and annuities were the best approach to financial assurance of long-term treatment of pollutional discharges. OSM came to that conclusion "based on Pennsylvania's experience," not on input from banking, trust, or insurance associations concerning industry's willingness to provide appropriate instruments. OSM did not conclude that trust funds and annuities were not appropriate for financial assurance of reclamation; rather, OSM's action seemed to reflect the view that trust funds and annuities were not needed as additional financial assurance options for reclamation.[66] ICF must point out that Pennsylvania's experience with financial assurances for postmining discharges has been exclusively with trust funds.[67]

For the 2006 Tennessee proposal, OSM virtually cut and pasted the Pennsylvania regulations described above for trust funds and annuities, substituting itself for the DEP. OSM did not elaborate on the minimal provisions found in the Pennsylvania Code. Not surprisingly to ICF, commenters complained that the proposed provisions lacked sufficient content to allow for meaningful comments. They asked OSM to put in the rule more details about the creation and administration of the mechanisms, their termination, and so on. OSM declined, in almost all instances. ICF agrees that the federal "framework" promulgated by OSM leaves out too many details to characterize and evaluate annuities.

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[65] See ANPR, "Bonding and Other Financial Assurance Mechanisms for Treatment of Long-Term Pollutional Discharges and Acid/Toxic Mine Drainage (AMD) Related Issues," 67 *Federal Register* 35070 (May 17, 2002).

[66] See 72 *Federal Register* 9615 (March 2, 2007).

[67] As of early 2006, eight trust fund agreements covering 35 treatment facilities had been executed, with 45 other trust fund agreements in various stages of processing.

Some specific issues raised by this rulemaking include the following:

- Is the Annuity an Investment or a Mechanism? The preamble to the Tennessee regulations includes a statement suggesting that OSM may have viewed an annuity as an investment made by a trustee. OSM describes the "best approach" to financial assurance for long-term treatment of polluting discharges as allowing the permittee to establish a "dedicated, income-producing account, such as a trust fund or annuity or both, that is held by a third-party as trustee for the regulatory authority." Does this mean that OSM would require an insurance company acting as the custodian of the annuity to take on a fiduciary responsibility as trustee to the government agency? The fiduciary's legal duty of loyalty to the beneficiary may conflict with the insurer's commercial responsibilities. Insurers have contended in various situations that they are not and cannot be fiduciaries to their customers and beneficiaries. If the issuing insurer is not an appropriate party to serve as a fiduciary, does the use of an annuity also require the establishment of a trust agreement and appointment of a qualified trustee?

- When and How Should Payments from Annuities Be Made? Annuities are characterized by their making regular, periodic payments to their annuitants. The term "annuity" itself denotes such periodic payments. As originally proposed by OSM, the release of funds from an annuity could be made only upon OSM's written authorization. This approach, while laudable for various reasons, appears inconsistent with the basic concept of an annuity. In finalizing the rule, OSM changed the provisions for release of money to be either upon OSM's written authorization or according to a schedule included in the agreement. Although this change better comports to the concept of an annuity, it reduces the certainty the funds will be used only for their intended purpose, in ICF's opinion.

- How Can Coverage Amounts Be Adjusted Over Time? Annuities often are fixed, meaning that their provisions, requirements, and promises are based on an initial one-time premium. That paradigm does not mesh well with a common provision of financial assurance programs where coverage amounts are based on site-specific cost estimates. Such programs typically require that amounts of assurance be increased to reflect new estimates of remaining costs that are greater than the amount currently being assured. In addition to unanticipated significant increases in cost estimates, a requirement for making additional contributions to and/or supplementing financial assurance can arise from a quite different scenario. As recognized by OSM, investment performance may adversely impact the value of trust funds and annuities. Where the value is less than the target amount, OSM would require the permittee to make additional contributions. Those who use fixed annuities would need to provide either a second instrument to cover the needed increase or replace the first instrument entirely; both of these options have significant transaction costs and possible early surrender charges.

2.4.7 Evaluation of Annuities

The following evaluation assumes that eligibility requirements for issuers will be equivalent to those for banks issuing letters of credit and insurers issuing insurance policies in the CIWMB FA regulations. Regulations also must limit unacceptable cancellation, termination, or other terms and conditions that could reduce the certainty that funds will be made available.

2.4.7.1 Certainty that Assured Funds will be Available

ICF believes that annuities can provide a High degree of certainty if subject to terms and provider eligibility requirements similar to current FA regulations. For example, annuities should be subject to cancellation/termination provisions similar to other FA mechanisms. Lack of established forms and lack of a lengthy track record in commercial practices militate against certainty of coverage. Annuities purchased with a single premium payment offer greater certainty because they can avoid the risk that the insurance company will cancel later due to failure to make appropriate premium payments.[68]

In part, certainty of assurance depends on the financial strength of the issuer of the annuity. Determining a sound provider of an annuity is not a simple task. The Department of Labor (DOL) has identified factors that should be considered by fiduciaries in evaluating an annuity provider's claims-paying ability and creditworthiness. Moreover, DOL recognized that a fiduciary may not have the expertise or knowledge to evaluate annuity providers and therefore may need to engage an independent expert. CIWMB regulations on insurance policies as FA mechanisms do not require insurers to meet any specific level of financial strength – such as a minimum rating from a nationally recognized rating agency – and that approach may or may not be adequate for issuers of annuities as FA mechanisms.

2.4.7.2 Adequacy of Amount of Funds Assured

ICF rates annuities as Medium to Low in terms of amount of coverage. Fixed annuities deserve a higher rating on this criterion than variable annuities. Fixed annuities entail less investment risk than variable annuities and may include some guarantees for principal and rates of return. On the other hand, variable annuities allow for multiple investment choices and switching among them; switching can reduce returns on investment even when not taxable events. Also, variable annuities do not offer guarantees comparable to fixed annuities. The interrelated contingencies within typical annuities also raise concerns about the amount of assurance provided. Annuities lack the face amount or penal sum specifications found in other forms of insurance or guarantees. If the required amount of assurance increases for any reason, annuities may lack the flexibility to accept new contributions to generate higher levels of distributions. Annuities do not, in general, provide protection against inflation, which can result in substantial shortfalls over long time periods.

[68] CIWMB FA regulations for insurance allow cancellation only for failure to pay required premiums; a lengthy schedule of required premium payments for annuities increases the potential risk of cancellation due to failure to pay premiums.

2.4.7.3 Liquidity of Funds

ICF rates annuities Low to Moderate in terms of liquidity. The fixed annuity scores Low on this criterion because its guarantees usually limit early access to funds or specify early withdrawal penalties. A variable annuity also typically disallows or penalizes early withdrawal, but should have better liquidity because it allows changes in investments.

2.4.7.4 Administrative Burden and Costs

ICF rates annuities High for their administrative burden and cost. Because variable annuities are considered to be securities, their terms and conditions are specified in master documents filed with the SEC. Making changes to those terms and conditions may be burdensome or impossible. Fixed annuities may allow more flexibility to add to or modify key terms and conditions for FA than variable annuities. Nevertheless, ICF expects that considerable effort will be needed to render an annuity into an acceptable FA mechanism, in part because existing laws and regulations focus on annuities related to post-employment benefits, not period certain annuities. Administrative burdens also are expected to be high due to the complexity of annuities. Annuities incorporate many types and amounts of charges and fees, including loads, contract fees, transaction fees, withdrawal fees, and surrender charges. Similar to other store of value mechanisms such as trust funds, an annuity entails more expenses than transaction costs and fees; money must be paid into the annuity, and those payments have opportunity costs and are not likely to be tax deductible. Thus, ICF believes that annuities will entail high administrative burdens and costs.

2.5 GUARANTEED INVESTMENT CONTRACTS (GICs)

"GICs" have been marketed by insurance underwriters, agents, and brokers as potential components of financial assurance and/or insurance programs for site-specific environmental liabilities. Yet, financial assurance regulations for environmental obligations, such as those in California and Texas, do not list or mention GICs. This section of Chapter 2 tackles the question of whether CIWMB should consider adding GICs to its list of acceptable forms of demonstrating financial assurance for PCM and/or CA, and evaluates how ICF believes such a mechanism would perform using the criteria defined earlier. In addition, this section describes types of GICs and their typical terms and conditions, and how GICs could be used as financial assurance for PCM and/or CA,

2.5.1 What are GICs?

In reading about annuities, ICF cautions the reader to bear in mind that every investment is relatively strong in one or two of the following criteria at the expense of the other(s):

(1) Safety (and volatility) of principal
(2) Liquidity
(3) Return on Investment

Thus, the guarantees in GICs come at the price of reduced liquidity and return. Compared to a basket of common stocks, GICs will have much lower but much more certain rates of return.

A guaranteed investment contract or "GIC" is an investment device. As described by the California Court of Appeals (First District), pursuant to the terms of the investment contract, the purchaser deposits a premium with the issuer and, in return, is paid a guaranteed rate of interest for the specified period. At the end of the contract period, the issuer repays the purchaser's premium.[69] The key terms and conditions in GICs address the following:

- investments
- rates of interest credited
- withdrawals, and
- termination provisions

GICs and other types of funding agreements are generally sold to sophisticated buyers, including local government officials responsible for investing note and bond proceeds. Issuers of GICs are major financial institutions.

There are 3 different types of GICs:

(1) traditional GICs (general account)
(2) separate account GICs
(3) synthetic GICs

The traditional GIC credits interest at a rate guaranteed for a defined period. The contract holder usually does not participate in the investment experience of the underlying assets. The traditional GIC is based in the insurance company's general account, making the insurer the legal owner of the assets. In general, ICF prefers FA mechanisms where the assets are legally owned by a party other than the operator, all other things being equal. Contracts based in an insurance company's general account have no claim against specific assets of the company. All general account assets are available to support all potential claims against an insurance company. If the insurer experiences financial distress, the policy holder will be in the third tier of general asset creditors (after administrative expenses and employee compensation), well above general creditors and stockholders.[70]

Separate account (or "Alternative") GICs allow the insurer to transfer all or most of the investment risk to the purchaser while remaining the legal owner of the assets. In general, ICF prefers FA mechanisms where the assets are legally owned by a party other than the operator, all other things being equal. These GICs typically are offered as open-ended ("evergreen") or with

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[69] *Unisys Corporation v. California Life & Health Guarantee Association* (filed 4/28/98).

[70] The Executive Life litigation in California affirmed the status of GICs as policy claims. See *Unisys Corporation v. California Life & Health Insurance Guarantee Association* (Ct.App. CA 1998).

a fixed maturity. Separate account statutes in California[71] and other states allow insurers to protect separate account assets from liabilities arising out of any other business the insurer conducts (e.g., general creditors). The principal is protected and the guaranteed interest rate is reset periodically.[72] The California Insurance Code also specifies that the separate accounts "shall have sufficient net investment income and readily marketable assets to meet anticipated obligations" (§10506(a)). The Code adds that the insurer shall not hold itself out to be a trustee in respect of amounts in separate accounts. The Insurance Code provisions require the insurer to meet minimum qualifications and to have its policy forms approved by the Insurance Commissioner.[73]

Synthetic GICs have been written only since 1990 and generally are divided into two categories: maturing synthetic GICs and evergreen structures. Maturing synthetic GICs resemble traditional GICs, whereas evergreen synthetic GICs do not have a set maturity. Synthetic GICs combine a customer-owned pool of assets with a "wrap contract" written by a bank or other financial institution. In general, ICF prefers FA mechanisms where the assets are legally owned by a party other than the operator, all other things being equal. Some investors prefer the synthetic GIC because it is based on a segregated portfolio of assets that is not owned by the insurer, although the insurer wraps certain guarantees around the portfolio (e.g., guarantee to pay book value regardless of the actual market value of the portfolio upon the occurrence of specified circumstances). Synthetic GICs allow customers to diversify away from insurance company credit risk which is inherent in traditional and separate account GICs. A synthetic GIC contract can be highly complex and lengthy. Experts recommend having the product documents reviewed by counsel.[74] Accounting expertise also may be needed when using GICs. GASB recently issued an exposure draft addressing accounting for derivatives; synthetic GICs are considered to be derivatives.[75] California has specific requirements for "investment return assurance" at CCR §§ 10507 and 10507.5, including minimum capital and surplus (net worth) and a special contingency reserve fund.

The California Insurance Guarantee Association, which provides a maximum of $500,000 per policy if a California-licensed insurance company is declared insolvent, is not authorized by law to cover annuity policies. The California Life & Health Insurance Guarantee Association may cover annuities up to a limit of $100,000.

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[71] See Insurance Code §10506.

[72] Guarantees of interest that extent beyond 14 months can be no greater than 3 percent per year (§10506.4(b)).

[73] The authorizing statute may limit the policies or contracts to "those issued in connection with a pension, retirement, retirement medical benefits, profit-sharing plan, or life insurance. See §10506(h).

[74] Alfred A. Turco, *Á "Common Sense" Guide to Alternatives and Synthetics: An Outline of Legal Issues*, Stable Value Investment Association (Monograph No. 13).

[75] Governmental Accounting Standards Board, *Exposure Draft: Accounting & Financial Reporting for Derivative Instruments* (No. 26-4, June 29, 2007).

GICs require payment of significant fees, commissions, or penalties for unexpected withdrawals. Surrender or early termination provisions vary by the type of contract. As the American Academy of Actuaries put it, a GIC "is typically not a liquid asset" and has restrictions on transfers or early settlement.[76]

The proper accounting, valuation, and calculation of reserves for GICs have been challenges for regulators and actuaries for many years. For example, purchasers of GICs have sought provisions that allow contract holders to get their money back at full book value if certain events occur, such as a drop in the issuer's credit ratings below a certain level. Some regulators became concerned that these provisions could result in a major liquidity and possibly a solvency problem for insurance companies. The Life & Health Actuarial (Technical) Task Force (LHATF) of the Natural Association of Insurance Commissioners (NAIC) requested the American Academy of Actuaries to assist in developing reserving standards for such GICs. The Academy's report discusses the types of products and provisions that may result in unanticipated liquidity demands and also discusses various reserving issues.[77] Proper reserving, valuation, and accounting have continued to receive attention from regulators, due to many complex issues.

2.5.2 GICs as FA Mechanisms for PCM and/or Reasonably Anticipated CA

GICs appear better-suited as a potential FA mechanism for PCM than for CA. PCM expenditures will occur continuously following closure until landfilled waste no longer poses a threat. Although some years of PCM will require more money than others (e.g., to cover replacement of capital goods), most years of PCM will require generally similar amounts of expenditures (in current dollars).[78] This pattern of funding needs better matches the GIC model than anticipated funding requirements for reasonably foreseeable CA. Unlike PCM obligations which automatically begin after closure, the need for funding reasonably foreseeable CA cannot usually be scheduled in advance. Once the need for CA is determined, spending on CA may occur over a relatively short time-period or over a relatively long period of decades. CA costs likely will have greater annual variability, in many cases, than PCM costs. Thus, although GICs can be customized to meet an investor's cash draw-down schedule, the GIC lacks flexibility to respond to unanticipated cash needs.

A GIC could be used either as a "pay on behalf of" FA mechanism or a "pay only for defaults" FA mechanism. The first instance better follows the GIC paradigm; a GIC for PCM can be structured to provide funding immediately following closure, which the responsible party can use to pay PCM costs. Alternatively, the GIC could be structured to provide PCM funding

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[76] American Academy of Actuaries, Public Policy Monograph, *Fair Valuation of Insurance Liabilities: Principles and Methods* (Sept. 2002).

[77] See American Academy of Actuaries, *Preliminary Report of the GIC with Credit Rating Downgrade Provisions Working Group of the American Academy of Actuaries to the Innovative Products Working Group of the Life and Health Actuarial Task Force of the NAIC* (October, 1999). No subsequent report by the Academy has appeared.

[78] GICs may not provide payments that reflect the impact of inflation over time.

only in the event of failure to perform PCM (termed a "default" in this study), similar to a surety bond or letter of credit. Likewise, it may be feasible to structure a GIC for reasonably foreseeable CA as a pay on behalf of mechanism for the costs of CA whenever they are required. Or the GIC could be structured to begin CA payouts only in the event of default. Both ways of assuring CA through a GIC face the problem of scheduling payments.

Similar to a trust fund, a GIC contract represents a store of value. As a "store of value," a GIC may be better suited as a payment vehicle than a pay-on-default vehicle. The store of value represents the money put into the GIC and its net earnings. When the GIC is intended to cover only defaults and there is no default, a permittee would lose the value of the GIC unless it was structured to disburse the unused funds back to the permittee. (The same reasoning applies to trust funds.)

ICF researched how California laws treat GICs as acceptable public investments for insights into the potential risks/benefits of GICs as FA instruments. Following the 1994 Orange County investment pool bankruptcy, the California Legislature enacted numerous changes to the Government Code that restricted permissible investments by local governments and promoted oversight of public funds management. The Government Code's lists of permissible and prohibited investments do not include GICs among the permissible investments for all local agencies; however, counties (or a city and county) may invest in short-term contracts (including GICs) issued by insurance companies that have a maximum maturity of 397 days.[79] The Government Code does not specify any quality requirements (e.g., minimum rating levels) for issuing insurers. The California Government Code §53601(1) allows bond proceeds held in trust for the bondholders (to secure repayment) to be invested in a wider class of investments than other local agency funds. One example of this wider class is the GIC, which frequently is used for investing bond proceeds.[80]

2.5.3 Evaluation of GICs

The following evaluation assumes that eligibility requirements for GIC issuers will be equivalent to those for banks issuing letters of credit and insurers issuing insurance policies in the California FA regulations. Regulations must limit unacceptable cancellation, termination, or other terms and conditions that could reduce the certainty that funds will be made available.

2.5.3.1 Certainty that Assured Funds will be Available

ICF believes that GICs can provide a Moderate degree of certainty when subject to terms and eligibility requirements similar to current FA regulations. Lack of established forms – virtually each GIC contract is different – and lack of a lengthy track record in commercial practices militate against certainty of coverage. GICs purchased with a single premium payment

[79] 397 days is set at the maximum maturity for most of the types of allowable short-term investments.

[80] California Debt & Investment Advisory Commission, *California Public Fund Investment Primer* (Dec. 31, 2004).

offer greater certainty because they can avoid the risk that the insurance company will cancel later due to failure to make appropriate premium payments.[81]

The separate account basis of the Alternative GIC indicates that it would be better protected from the insurer's creditors than the traditional GIC in the event the insurer encountered serious financial difficulties. The synthetic GIC rates lower for certainty than the traditional or alternative GIC because the assets would be held by the operator not the insurer, an arrangement which provides less insulation from the operator's creditors.

Certainty of assurance also is a function of the characteristics of the issuing entity. The guarantee in a GIC is only as strong as the ability of the issuer to support it. If the issuer defaults, the contract guarantee may be worthless. ICF does not believe that the CIWMB's insurer eligibility requirements (see §22248) are sufficiently stringent for this class of insurance products.

2.5.3.2 Adequacy of Amount of Funds Assured

ICF rates GICs as Medium to Low in terms of amount of coverage. The interrelated contingencies within typical GICs raise concerns about the amount of assurance provided. GICs lack the face amount or penal sum specifications found in other forms of insurance or guarantees. If the required amount of assurance increases for any reason, GICs may lack the flexibility to accept new contributions. GICs do not, in general, provide protection against inflation, which can result in substantial shortfalls over long time periods. Traditional GICs deserve a higher rating on this criterion than other GICs because the policyholder does not usually participate in the investment risk of the underlying assets.

2.5.3.3 Liquidity of Funds

ICF rates GICs Low to Moderate in terms of liquidity because GICs usually limit early access to funds or specify early withdrawal penalties. Traditional GICs may be backed by relatively illiquid investments such as private placements and commercial mortgages. Alternative and synthetic GICs usually are backed by actively managed, publicly-traded securities with a high degree of liquidity. Because the contract holder also owns the underlying assets, the synthetic GIC should have the best liquidity of the 3 types of GICs; however, ICF prefers FA mechanisms where parties other than the operator hold/own funds for FA.

2.5.3.4 Administrative Burden and Costs

ICF rates GICs High for their administrative burden and cost. GICs frequently are tendered in response to RFPs, making it cumbersome to evaluate different offers and pick a GIC

[81] California FA regulations for insurance allow cancellation only for failure to pay required premiums; a lengthy schedule of required premium payments increases the potential risk of cancellation due to failure to pay premiums.

supplier. GICs require prior approval of each type of contract and other information submitted to the California Department of Insurance. Making changes to GIC terms and conditions may be difficult or impossible. ICF expects that considerable effort will be needed to render a GIC into an acceptable FA mechanism. Administrative burdens also are expected to be high due to the complexity of GICs. GICs incorporate many types and amounts of charges and fees, including loads, contract fees, transaction fees, withdrawal fees, and surrender charges. Similar to other store of value mechanisms such as trust funds, a GIC entails more expenses than transaction costs and fees; money must be paid into the GIC, and those payments have opportunity costs and may not be tax deductible. Thus, ICF believes that GICs will entail high administrative burdens and costs.

3. ANALYSIS OF STATE FUND

Chapter 3 presents ICF's analysis of using a statewide pooled fund as a financial assurance (FA) mechanism for PCM and/or CA. A state fund can serve as a supplement to or replacement for other FA mechanisms. To the extent that substantial funds will not be needed until many years in the future, a pooled fund raises the prospect of using the power of compounding fund earnings to meet funding targets. That is the most painless way of accumulating needed resources. However, many fund design features and options need to be considered in designing a state fund, as well as lessons from states that have implemented similar funds. Finally, designing a working model that uses representative data and evaluating its results is a necessary further step in evaluating the usefulness of this option for FA.

This chapter is organized as follows: Section 3.1 provides context and background relating to fund design features and options, criteria for evaluating conceptual fund designs, and applying the criteria to selected conceptual fund designs. Section 3.2 summarizes ICF's research into experiences with relevant pooled funds. Section 3.3 presents a working model of a selected fund design and some results of "what if" simulations.

3.1 FUND DESIGN FEATURES AND OPTIONS

ICF's report analyzes the fund design features and options shown on Exhibit 3-1, which represent a minimum set of fund design criteria for the landfills in the study. Too many features and options would increase the number of potential fund designs almost geometrically.

EXHIBIT 3-1
Key Fund Design Features and Options

Feature	Major Options
Covered Costs	- All or Only Defaults
	- PCM, CA, or Both
Covered Landfills	- Active, Closed, or Both
	- Private, Public, or Both
Participation	- Mandatory or Voluntary
Revenue Sources	- Tip Fee Surcharges, Cost Recovery, Product Fees, Other Owner/Operator Payments, Fund Earnings, and/or Government Revenues

Features and options relevant to the design of government FA funds include but are not limited to, the following:

- Which types of costs are covered?
- Which types of entities are covered?
- Is participation mandatory or voluntary?
- What are the sources of money to pay for covered costs of covered entities?

This section explores the advantages and disadvantages of a variety of potential fund design features and options relevant to solid waste landfills subject to FA requirements in California.

3.1.1 Which Types of Costs Are Covered?

3.1.1.1 Default-Only Funds vs. Pay-All-Costs Funds

A key initial fund design decision is whether the fund will pay for all covered environmental activities ("Pay-All-Costs Funds") or only for activities at landfills where the operators are unavailable, unable, or unwilling to pay ("Default-Only Funds"). Many environmental funds address orphaned sites only,[1] making them Default-Only Funds. However, most UST state funds are Pay-All-Costs Funds (with deductibles, in some states).

Although virtually all orphaned sites by definition lack available, willing, and able funding sources, the landfills that are the subject of this study all have responsible operators.[2] For this cohort, as in much of the U.S. economy, defaults are relatively rare. The rarity of defaults means that the funding needs of Default-Only Funds will be much less than the funding needs of Pay-All-Costs Funds. This has important implications for how funds are financed, with the government often being willing to provide the needed money for Default-Only Funds.

Pay-All-Costs Funds have much greater financing needs than Default-Only Funds because payout amounts are much greater in the aggregate. Government agencies typically provide only a small amount of money, if any, to Pay-All-Costs Funds. Full government financing of Pay-All-Costs Funds is much less common.

3.1.1.2 Closure, Postclosure Maintenance, Corrective Action, and Liability Compensation: What Does the Fund Cover?

A state fund for solid waste landfills could cover one or more of the following types of costs:

Closure	Landfills that are not promptly and properly closed after operations have substantially ceased, pose greater risks than those which have been properly closed in a timely manner. The primary reason is that installation of a final cover on the landfill greater reduces and may eliminate the entrance of water into the landfill. Water stimulates the decomposition of organic matter in solid waste leading to generation of potentially dangerous gas and leachate.

[1] California has established some funds to address various types of orphaned sites, such as the Solid Waste Cleanup Program (CCR §§ 18900 through 18932.

[2] Some small operators in the cohort may lack the needed financial reserves to successfully address environmental obligations.

Postclosure maintenance (PCM)	PCM is critical for managing the potential risks of solid waste landfills because PCM activities ensure that the systems (e.g., the final cover, vegetation, gas control and removal system, leachate control and removal systems) for controlling risks are monitored, maintained, repaired, and replaced as necessary.
Corrective action (CA)	Activities required to control potential risks that are not covered by either closure or PCM. The most important example of corrective action is the suite of activities involved in responding to releases of leachate and/or gas in the subsurface that could contaminate water resources, such as groundwater.
Liability compensation	Satisfaction of legally recognized claims for compensation of harm to the property, persons, and other rights of those in the vicinity of solid waste landfills.

In recognition of the importance of each of these types of costs, California requires operators of permitted solid waste landfills to demonstrate financial assurance (FA) of each type of cost. However, for those landfills required to provide FA demonstrations, the current regulations include certain gaps, notably:

- FA for PCM is required only for thirty years although the requirement to conduct PCM continues for as long as the landfill poses a threat

- FA for liability compensation is required only during the active life of a landfill. Liability compensation is not required to be assured after the landfill is closed

Because PCM and CA are the focus of this study, further discussion of fund design will not address closure and liability coverage, for the most part.

Fund for Postclosure Maintenance Only. A fund for PCM could address two major concerns. First, postclosure obligations arise at the time when a landfill is not generating significant revenues. One fear is that when a landfill becomes more of a liability than an asset, some operators may be tempted to abandon their LFs or may be limited in how much PCM they can afford. Second, the PCM obligation may last a very long time. Society has little useful experience with long-term stewardship, which appears to require special institutional and financial arrangements. A state fund could address both of these concerns as long as sufficient contributions are made soon enough in the lifecycle of the LF cohort.

Rather than having every LF contribute the same amount to such a fund, contributions might reflect the probabilities of a LF needing PCM of different durations. A tool such as that discussed in Chapter 5 could be used with the goal of making contributions to a state fund for PCM more equitable.

Fund for Corrective Action Only. A fund for CA could address three major concerns. First, postclosure CA arises at the time when a landfill is not generating significant revenues. One fear is that when a landfill becomes more of a liability than an asset, some operators may be tempted to abandon their LFs or may be limited in how much CA they can afford. Second, the

CA obligation may last a very long time. Society has little useful experience with long-term stewardship, which appears to require special institutional and financial arrangements. Third, a CA that arises before a LF closes could require more unanticipated resources than the responsible party(ies) can generate. A state fund could address all of these concerns as long as sufficient contributions are made soon enough in the lifecycle of the LF cohort.

A fund for covering CAs also may provide some risk sharing if we view CAs as similar to accidents that are not certain to occur. In other words, if the probability of a $2 million CA at each of the 282 LFs was 50%, for example, a state fund would require only half the money (i.e., $1 million each) needed for FA than an alternate system that required each LF to be able to cover $2 million. This simple hypothetical illustrates the importance of the uncertain likelihood of CAs to the ability of a fund to accomplish risk sharing.[3] If the probability of a reasonably foreseeable CA was 10%, then fund contributions would need to be about one-tenth the amount required than if FA were demonstrated individually for the full $2 million for each LF. However, if the probability of a reasonably foreseeable CA occurring is 90%, then the fund will require contributions very close to the amounts that would be required if there was no pooling of risk.

Rather than having every LF contribute the same amount to a CA fund, contributions might reflect the probabilities of a LF needing CAs of different magnitudes. A tool such as that discussed in Chapter 5 could be used with the goal of making contributions to the fund more risk-informed and, hence, equitable.

Fund for Postclosure Corrective Action Only. An important subset of costs to consider as an option in fund design is whether to cover CA costs after landfill closure, before closure, or at any time. The legislative history of AB2296 can be read as indicating a concern about FA for CA costs during the postclosure period. Although not spelled out in the legislative history, ICF infers that lawmakers had concerns about how a landfill would finance CA requirements once it closes, because its primary source of revenue, tip fees, will have ceased.

Advantages of reducing the scope of a state fund from all CA to only postclosure CA include the following:

- potentially satisfying the greatest need for a fund because closed LFs may be operated by those with fewer available financial resources

- having only closed LFs in the fund will simplify and reduce administrative costs

Disadvantages of limiting fund coverage to postclosure CA only as opposed to all CA include the following:

- funding needed for CA at active landfills also may not be readily available

[3] The above simplified example focused only on the *probability* of a reasonably foreseeable CA of a given size (e.g., $2 million). The dollar magnitudes (e.g., $5 million, $2 million, $500,000 per CA) also are relevant.

- possible incentive to delay discovery of need for CA until after closure occurs

- possible incentive to accelerate landfill closure in order to qualify for fund coverage of CA

ICF's working model of a fund provides estimates of funding requirements for CAs that occur before closure and those that arise after closure. See Section 3.3.4.2.

Funds That Cover Multiple Categories of Obligations. As stated above, a fund may be designed to cover different combinations of closure, PCM, CA, and liability compensation costs. One approach to environmental fund design is based on whether the costs are considered certain to occur (referred to in this study as "noncontingent" costs) or, instead, may or may not occur (referred to as "contingent" costs). Although noncontingent costs are certain to occur sometime, there is uncertainty about exactly when they will be incurred (and for how long, in the case of PCM).

Combination Fund for Closure and Postclosure Maintenance. Because every landfill will undergo closure and PCM at some point in its lifecycle, these noncontingent costs may be grouped together in a fund design.[4] Grouping noncontingent costs together in a fund recognizes that closure and PCM are intimately connected. PCM follows closure immediately in time, with little or no gap. Also, better design, materials, and performance of site closure may reduce the costs of PCM; poor design, materials, and performance of closure may lead to more expensive PCM. Planning and managing a fund for closure and PCM should be more straightforward than planning and managing a fund for contingent costs, because of fewer uncertainties.

Combination Fund for Corrective Action and Liability Compensation. Alternatively, a fund may be designed to cover the contingent costs together. For example, many states including California have established state funds to address both CA and liability compensation associated with underground storage tanks of petroleum. Although both CA and liability compensation costs are contingent, they both usually depend on a release of contaminants from containment. We expect claims for compensation to be more likely to occur after a release requiring CA than before such a release occurs. However, claims for compensation (e.g., due to contamination of water wells) may occur before CA is required, due to releases that have not yet been identified as requiring CA. Thus CA and compensation costs are not as directly linked sequentially in time as are closure and PCM costs. Although the magnitude, frequency, and timing of CA costs are uncertain, ICF believes that CA is more likely to arise than are legally valid claims for compensation. A major reason for this is that a timely and successful CA may prevent the escape of dangerous gases and liquids onto neighboring properties, which should prevent most compensation claims. Thus, there is a causal connection between the costs of CA and liability compensation analogous to the connection between the costs of closure and PCM.

[4] For example, many years ago CIWMB investigated a closure/postclosure maintenance fund for solid waste landfills. See ICF Consulting Associates, *Closure and Post-Closure Fund for Solid Waste Landfills: Initial Assessment* (February 1986).

A fund design that includes both CA and liability compensation will be less lumpy (i.e., have less volatile cash flows from year to year) than a fund design that includes only CA or only liability compensation. When the contingent costs are combined into a single fund, the CA costs act to reduce the lumpiness of liability compensation because CAs are expected to occur more frequently, to cost more, and to extend over longer periods.

Combination Fund for Postclosure Maintenance and Corrective Action. Funds may be designed to cover other combinations of costs. Most relevant for this study is the combination of PCM and CA costs within a single fund. One rationale for this combination reflects the belief that proper and timely PCM may reduce both the likelihood and magnitude of needing CA at a landfill. For example, by ensuring the continuing integrity of the final cover, PCM reduces potential infiltration of water into the landfill and resultant generation of gases or leachate, which can lead to the need for CA. If a fund is designed to cover both active and closed landfills, however, a need for CA may arise during the active life of the facility, before any PCM activities are performed.

Another reason for combining PCM and CA in a single fund relates to the financial profiles of each type of activity. In general, PCM involves a relatively small to moderate unit cost annually over an extended time period for every landfill, until the landfill no longer poses a threat. Although there is uncertainty about when PCM will commence and end at active landfills, the *estimated annual costs* for PCM should be *relatively* steady, in real terms. Corrective actions, on the other hand, tend to entail larger cash outlays, often over a period of only a few years, although some CAs also will require spending over a long period (e.g., extraction and treatment of contaminated groundwater). In other words, CA expenditures are more "lumpy" than outlays for PCM. Combining CA with PCM in a single fund will reduce the "lumpiness" of the combined cash flows. Less lumpiness makes it easier to estimate and provide for funding.

For a fund design that includes active as well as closed landfills, on the other hand, the degree to which the lumpiness of CA costs is dampened by the need to fund PCM will be affected by the relative proportion of active and closed landfills, all other factors being equal.

Combination Fund for Postclosure Maintenance, Corrective Action, and Liability Compensation. Finally, a fund can be designed to include PCM, CA, and liability compensation costs. For example, that was the design for the federal Post-Closure Liability Trust Fund (PCLTF) for properly closed hazardous waste disposal facilities. This fund design recognizes that there is some degree of interdependence among these cash flow needs:

- proper and timely PCM can reduce the likelihood and expense of CA and liability compensation.

- proper and timely CA can reduce the likelihood and expense of liability compensation

- claims for liability compensation may signal a need for CA and/or better PCM.

Because all other fund design parameters will not be equal, ICF cannot say that one particular conceptual fund design is better than another by looking only at which types of costs are covered. Therefore, the next section analyzes another major aspect of fund design: Which types of entities are covered?

3.1.2 Which Entities Are Covered?

Two major fund design issues dominate the question of which types of solid waste LF entities a state fund should cover:

(1) landfill operating status – open vs. closed LFs
(2) responsible parties – public vs. private sector

This section addresses each of these issues next.

3.1.2.1 Landfill Operating Status

An environmental fund for permitted solid waste landfills subject to FA could cover the following types of LFs:

- closed landfills only
- active landfills only
- active and closed landfills
- subsets of the above

Fund for Closed Landfills Only. Landfills that are closed often are viewed as lacking the ability to generate funds, particularly for unexpected costs. This "tip fee paradigm" makes them appear to be good candidates for a state fund, depending on how the state fund acquires its money. This "tip fee paradigm" treats tipping fees as the sole source of revenues available to landfill operators. ICF believes it is important to recognize that behind most landfills stands an owner or operator that has access to money from other, typically affiliated, sources. A private landfill operator usually has a corporate entity that is a division or affiliate of a larger corporate group. For those companies, there often will be sources of revenue other than tip fees that can be used to meet environmental needs even at closed landfills, such as using the location for a transfer station. The reasoning is similar for publicly owned or operated landfills: even if operated under a distinct enterprise fund, the public entity usually has the ability to raise necessary funds for closed LFs from other sources besides tipping fees. However, because raising money for closed landfills may be more uncertain, difficult, and/or time-consuming for public and private entities (compared to raising money for active landfills), that provides a rationale for designing a state solid waste landfill fund to address the environmental needs of closed facilities only.

Fund for Active Landfills Only. What then is the rationale for designing a fund that covers active landfills only? There are at least two components. First, the lumpiness and uncertainty of contingent CA costs may pose a cash flow challenge even to landfills that have a stream of revenue from tipping fees. Second, raising needed funds for CA may be just as

difficult for active landfills as it is for closed landfills, whether they are privately or publicly owned/operated. Public and private entities alike are subject to market/economic constraints on raising revenues as well as incentives not to carry large balances of cash that are not being put to work.

Fund for Both Active and Closed Landfills. A fund design may include both active and closed landfills. In addition to the rationales described above, there may be reasons of equity and incentives to include both active and inactive landfills in a state fund. From the point of view of equity, it may be appropriate to treat active and closed landfills similarly. Where any given landfill is on its lifecycle when a fund is being created may be viewed as just an arbitrary matter of timing and not an equitable basis for fund eligibility. In addition, a fund that includes both active and inactive landfills may avoid potentially perverse incentives. For example, if a fund is available only for closed landfills and is perceived as "generous" (taking into account pay-ins and payouts), it might create an incentive for some landfills to close early; a material, unexpected reduction in landfill capacity in California can lead to higher tipping charges at open landfills due to the reduced competition. Conversely, if a fund is available only for active landfills and is perceived as "generous," landfill operators might feel an incentive to delay closure, which is undesirable because installation of the final cover is an important step in protecting against LF risks.[5]

Fund for Subset(s) of Active and Closed Landfills. As noted at the start, a fund may be designed to cover subsets of active and/or closed landfills. For example, the federal PCLTF would have been available only to disposal facilities 5 years following closure. Congress included that waiting period so that facilities that did a poor job of closure, for example, could be screened out. A common feature of state UST funds is to limit coverage only to owners/operators that are in compliance with all UST regulatory requirements. A fund's goal to create additional incentives for compliance, however, can conflict with the intent of providing needed funding for environmental remediation activities. Typically, the latter takes precedence over the former. Another option is to design the fund to address small LFs and operators, because they may have the least resources and need the most risk sharing or transfer. For example, the CIWMB gave priority to small, publicly-operated facilities that primarily service rural areas in awarding interest-free loans under the Facility Compliance Loan Program.[6]

3.1.2.2 Responsible Parties

Another fund design option relates to whether the parties responsible for solid waste LFs are public sector or private sector entities. A fund design could cover the following:

- public entities only
- private entities only

[5] ICF recognizes that CIWMB has been addressing the issue of delayed closure due to lack of funding through the Landfill Closure Loan Program (LCLP). See CCR §§ 23001 through 23014.

[6] *CIWMB Facility Compliance Loan Program: Fiscal Years 1999/2000–2000/2001, Final Report to the Legislature* (June 2002).

- public and private entities
- subsets of the above

Fund for Public Entities Only. California has a distinguished history of fostering pooled financial approaches for public sector entities. For example, many counties participate in an excess coverage program provided by the California State Association of Counties (CSAC) Excess Insurance Authority. By helping local governments reduce their risk management costs, the state helps local governments avoid unnecessary tax or borrowing increases (or cuts in services), all of which ultimately accrues to the benefit of taxpayers. In addition to this public interest rationale, a case can be made that there is greater need for a state fund for public LF entities, because, for the convenience of citizens, there are more smaller LFs that are not very economical to run and generate limited revenue flows compared to private sector facilities. Of the 128 LFs in the study population that are currently closed, a majority fall in the public sector.

Fund for Private Entities Only. Some view private entities as posing a greater risk of failing to satisfy their LF environmental obligations than public sector entities.[7] It is feared that the profit motive will encourage abandonment or neglect of closed LFs because they become cost centers rather than profit centers. Thus, a state fund can be designed for private sector responsible parties only. One issue with such a fund design is the potential incentive it might create for privatization of public LFs.[8]

Fund for Both Private and Public Entities. This fund design option includes both private and public entities within the same fund, thus eliminating incentives for changing the type of party responsible for a LF in order to qualify for the fund. This fund design also appears on its face more equitable than a fund available only for private or only for public entities.

Fund for Subsets for Public and/or Private Entities. One subset of particular relevance for this study constitutes private or public entities that could be considered "small" in terms of financial parameters. Small entities tend to have fewer resources to call upon than large entities. Thus, the need for a backstop to protect the taxpayers may be greater for small entities than for large entities. Some may worry that a generous fund available only to small entities could create incentives for LF "sales" or spin-offs from larger to smaller parties. ICF believes that such incentives will have limited effects, if any. Although reported literature is sparse, the few reported studies have not found larger entities reorganizing in that fashion for financial reasons.

3.1.3 Mandatory or Voluntary Participation

A fund can be designed that is mandatory for all covered entities or, instead, is a financial assurance option that can be chosen or declined by eligible entities. Both conceptual models are in use.

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[7] Center for a Competitive Waste Industry, *Day of Reckoning: Protecting California Taxpayers from the Looming Landfill Crisis* (Draft No. 19, October 2004) provided to ICF by CIWMB.

[8] See, for example, Geoffrey F. Segal and Adrian T. Moore, *Privatizing Landfills: Market Solutions for Solid Waste Disposal* (Reason Public Policy Institute, Policy Study No. 267, May 2000).

Mandatory Fund. A mandatory fund would include all solid waste disposal facilities required to demonstrate FA. A key advantage of a mandatory fund is that it avoids what insurers term "adverse selection." That term describes the tendency for the worst risks to seek coverage while the best risks (from the insurer's point of view) do not. To the extent that the fund provides some degree of risk sharing, the fund will perform better if it includes the full gamut of risks. In addition, a mandatory fund may be easier to manage than a fund where landfills can join or leave at their pleasure. Movement into and out of the fund can potentially impact funding needs and, therefore, financing strategies, which ideally are carefully balanced with a finite "cushion" and/or other mechanisms to deal with expected contingencies. For a fund with many participants (e.g., many state UST funds), a few entries and departures may not have a significant impact. For a fund with fewer participants and more heterogeneous costs (e.g., there is much less difference between large and small UST facilities than there is between large and small solid waste landfills), entries and exits may cause greater financial havoc. One option for damping the increased risk of a voluntary fund compared to a mandatory fund is to have "one-way turnstiles," meaning that a landfill could not exit the fund once it chooses to participate (or must stay in the fund for a certain minimum length of time). A concern with mandatory funds is that, in the absence of competition with other options for financial assurance, costs could swell. Although there are mechanisms to address this risk, such as legislated caps on overhead/administrative costs, it is a concern with mandatory funds. Finally, a mandatory fund may be viewed as more equitable than a voluntary fund because it applies to all covered landfills.

Voluntary Fund. A voluntary fund for landfill PCM and/or CA would be one of several potential FA compliance options. Each landfill would be able to assess the net costs of the available compliance options and choose the option that best met its needs. Depending on the perceived "generosity" of the fund compared with other available options (e.g., low cost self-insurance or guarantees using financial tests), landfills might be more or less likely to select the fund. That uncertainty makes a voluntary fund more difficult to plan and administer than a mandatory fund. How money is provided to the fund also can influence selection where a fund is voluntary. For example, many states add a small, uniform surcharge to the unit cost of gasoline for all service stations to finance state UST funds, whether the stations join the state fund or not. In a sense, fund participation in those states may be seen as "free," and therefore, although the fund is voluntary, most UST owners/operators choose to participate. A voluntary fund could well be considered as equitable as a mandatory fund, although on different grounds; some will equate having a choice about joining the fund as more equitable than not having a choice.

3.1.4 Sources of Money for the Fund

An environmental fund for solid waste disposal facilities could be designed with one or more of the following sources of revenues:

- surcharge on tipping fees
- cost recovery from participants
- other payments from owners/operators
- product fees/surcharges

- government revenues
- earnings on fund balances

Surcharges on Tipping Fees. Surcharges of $X dollars or Y% per unit of waste landfilled typically are among the first sources of revenues considered in discussions of landfill fund design. This type of assessment appears equitable because it applies equally to all waste disposed. Tipping fees have certain advantages as a funding source. In particular, tipping fees send economic signals to waste generators which can encourage source reduction and recycling of solid wastes rather than their disposal. If the market allows, tipping fees can be set at levels which can generate cash to pay for the costs of running solid waste recycling and household hazardous waste programs. On the other hand, market forces and imperfections may lead to tipping fees that are insufficient to cover the full lifecycle costs of solid waste disposal. In this situation, necessary funds must come from other sources of revenue. Tipping fees foster economic incentives for source reduction and recycling more efficiently than "advance disposal fees" on products purchased by consumers.[9] However, by their nature, tipping fees are generated only by active landfills, not by closed ones. If a state fund covers both active and closed landfills, but receives revenues only from active landfills, the equity of the fund may be called into question. Finally, if the surcharge is large, it may foster "sticker shock" and associated political opposition.

Cost Recovery. All or part of the money entering a fund may derive from some form of cost recovery from those under its jurisdiction. This can take a couple of forms, depending on fund design. One form would be cost recovery from an individual fund "beneficiary." Under this option, fund payments for defaults are seen formally or informally as an advance that lets an operator manage the unexpected lumpiness of covered costs with the expectation of repayment to the fund over a period of time that would be more affordable for the operator. The fund has some risk that the operator will be neither willing nor able to repay the "advance" provided by the fund. The legislation establishing the fund could provide the full panoply of cost recovery mechanisms (e.g., liens) typically found in analogous situations. Cost recovery is a common design feature of default funds.

A second type of cost recovery looks not to an individual "beneficiary" for repayment but to all participants in the fund. This type of arrangement often is termed a "retrospective assessment" in insurance schemes. By spreading the funding call over all participants, each landfill has a smaller payment than when cost recovery comes only from the beneficiary, and there should be less reluctance for all participants to make these payments to the fund because they should be more affordable. The fund may be designed to require some form of assurance that the retrospective assessments will be paid.[10]

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[9] The efficiency is due to several factors: First, the tip fee applies to all solid waste disposed in the aggregate, rather than individual types of products and packaging. Second, the tip fee applies close in time to the decision to discard solid waste. Third, there is an established system in place for assessing, collecting, and using tip fees.

[10] The NRC's Price-Anderson system for assuring liabilities of nuclear power plants has such a requirement. See 10 CFR 140.

Product Fees. Some environmental funds receive revenues raised from taxes, fees, or surcharges on raw materials or products that are related to environmental contamination. Funds for remediation of spills/releases of petroleum products often receive revenues from fees on gasoline, diesel fuel, heating oil, and motor oil. As illustrated in Section 3.2, this model has been extended to dry cleaner funds. Although these liquids have been addressed in this way, ICF found little evidence of remediation or long-term care of solid products (e.g., tires, electronic equipment) being handled in this way.

Other Payments from Owners/Operators. Drawing an analogy with insurance, operators of landfills could make payments into a fund that are analogous to premium payments. These payments could be uniform so that every landfill pays the same, or the payments could be risk-informed, meaning that payments may differ based on such landfill characteristics as size and presence of liners.[11] If a fund provides sufficient risk sharing (i.e., transfer and distribution) among fund participants, then the payments to the fund made by operators may well be tax deductible, which would be appreciated by private operators.

Government Revenues. A variety of environmental funds for PCM or CA receive money from federal or state governments. This is particularly true for default or orphan site funds, which cannot rely solely on cost recovery from defaulting owners/operators or orphan site PRPs. In addition, government revenue is often used to capitalize environmental funds, particularly revolving loan funds.

Earnings on Fund Balances. Funds designed to address expenditures not expected in the near term may take advantage of the opportunity to invest and grow unexpended balances. Expected returns typically depend on how funds are invested, which may be constrained by state or local laws or policies.[12] This concept is similar to the modern approach to financing personal retirement through savings and investments. The analogy to retirement plans implies that this funding option is best suited to PCM financing rather than contingencies such as CA, which can arise during a LF's active life. Enabling legislation for a fund should clearly authorize the collection, investment, and use of monies for defined purposes. Often, such legislation limits the collection of new monies when a state fund hits a certain benchmark. If the benchmark for turning off new contributions is too low and the time period for growing the fund balance is too short, it may not be possible to grow earnings sufficiently to attain funding targets. Even more sobering is raiding of available balances in some state funds in order to make up for budgetary shortfalls affecting other programs.

The next section combines elements of the key fund design features and options discussed above.

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[11] Tip fee surcharges reflect risk as measured by waste throughput.

[12] See, for example, California Debt & Investment Advisory Commission, *Local Agency Investment Guidelines: Update of 2007 Statutory Changes and Consensus Recommendations* (May 2007).

3.1.5 Analysis of Alternative Fund Designs

In Section 3.1.5, ICF evaluates specific fund designs listed in Exhibit 3-2, which draw from the fund design features and options discussed in Section 3.1 and shown in Exhibit 3-1 above. Exhibit 3-2 includes a spectrum of variations on the fund design that is the focus of the Task 3 working model (Model No. 1 in Exhibit 3-2). The Exhibit 3-2 fund designs are based on the expected drivers of demand on the fund (e.g., types of costs and landfills to be covered). ICF determined that also considering the options for revenue sources affecting the supply of dollars in the funds would result in too many potential variations in fund designs for efficient comprehension and analysis.

Exhibit 3-2 below lists the selected fund design for the working model (i.e., Model No. 1 that covers only defaulted PCM, including Post30-PCM, and CA) and variations that focus on

EXHIBIT 3-2
Conceptual Fund Designs Selected for Evaluation

Model No.	Covered Costs	Covered Landfills	Public, Private, or Both	Mandatory or Voluntary?
1	Only Defaulted Costs of PCM and CA	Active and Closed	Both Public and Private	M
2	Only Defaulted Costs of PCM	Closed	Both Public and Private	M
3	Only Defaulted Costs of Post30-PCM	Closed	Both Public and Private	M
4	Only Defaulted Costs of CA	Active and Closed	Both Public and Private	M
5	Only Defaulted Costs of Post30-PCM and CA	Active and Closed	Both Public and Private	M
6	Only Defaulted Costs of PCM and CA	Active and Closed	Private Only	M
7	Only Defaulted Costs of PCM and CA	Active and Closed	Public Only	M

alternative fund designs that would cover PCM only or Post30-PCM only (Model Nos. 2-3), that would cover CA only (Model No. 4), that would cover Post30-PCM and CA (Model No. 5), and that would cover only privately-owned or publicly-owned LFs (Model Nos. 6-7). All fund designs provide CA and/or PCM coverage to closed landfills whenever closure occurs. All of the fund designs shown in Exhibit 3-2 are for defaults only and would require mandatory participation. The fund designs were selected for evaluation in consultation with CIWMB staff.

ICF evaluated the conceptual fund designs listed above using the criteria shown in Exhibit 3-3. These criteria include coverage and equity. Coverage is a key criterion because the need for coverage is a key rationale for creating a fund. Equity is another key criterion because a fund may not be politically acceptable if costs and benefits are not distributed fairly across

EXHIBIT 3-3
Criteria for Evaluating Conceptual Fund Design

Coverage of Potential Risks to the State
Equity
Efficiency/Administrative Burden
Incentives (e.g., for early closure, proper closure, proper and timely PCM)

different types of landfills and their responsible parties. In addition, ICF recommends the additional criterion of efficiency, which addresses the relative costs of running different types of funds, as well a criterion that considers the potential incentive effects of alternate fund designs. Costs and incentive effects are relevant criteria because they affect the cost-benefit and cost-effectiveness of alternative fund designs.

Coverage of Potential Financial Risk to the State

Ranking the funds in Exhibit 3-2 in order of the amount of coverage provided starts easily enough by recognizing that fund design #1 provides the most complete coverage. That fund covers PCM and/or CA defaults whenever they occur and all LFs are included, whether open or closed, whether public or private.

All the other fund designs in Exhibit 3-2 cover a subset of financial risks addressed by fund design #1. Without further data, it is difficult to determine how to rank the funds. For example, without knowing more about the landfills with public versus private sector responsible parties, we cannot say whether fund design #6 provides more coverage than fund design #7, even when all other factors (e.g., default rates) are kept the same.

We can say that fund design #5 provides more coverage than fund design #4 because the former would include all PCM while the latter includes only post-30 PCM; otherwise, both of these fund designs cover all types of eligible LFs, regardless of operational status or type of responsible party. Fund design #5 also provides more coverage than fund design #3, because the former covers CA at active and closed sites while the latter does not cover CA at all; both fund designs #3 and #5 cover post-30 PCM, but not all PCM.

Despite knowing that, by definition, fund designs #3 and #4 offer less coverage than fund design #5, we need data to determine whether fund #3 provides more coverage than fund #4, or vice versa. Needed data would include the magnitude and duration of post-30 PCM costs compared to the magnitude, duration, and frequency of CA costs.

Likewise, although we know that fund design #2 provides more coverage than fund design #3 by definition, we need more information to determine whether fund #2 provides more coverage than fund #5. Fund #2 covers more PCM than fund #5, but fund #2 does not cover any CA while fund #5 does cover CA. Which is more important to the state, covering only post-30 PCM or covering CA? That question is best answered based on data.

Equity in Fund Designs

If we define equity as treating all of the permitted LFs the same, regardless of operational status or type of responsible party, then we can rank fund designs #1, #4, and #5 as High on equity because those designs open the fund to all LFs. The remaining designs would open the fund only to a subset of the LFs: fund designs #2 and #3 exclude active landfills, while fund designs #6 and #7 exclude LFs with public and private responsible parties, respectively.

For this study, CIWMB required that fund contributions can be made only by active LFs, not closed LFs, which affects how we think of equity. One perspective is to rank fund designs #2 and #3 as Low in terms of equity because their benefits accrue only to closed LFs while their funding comes only from active LFs. (Note: none of the fund designs in Exhibit 3-2 cover only active landfills.) However, such a ranking may be incorrect because some portion of the closed LFs benefiting from fund designs #2 and #3 would have contributed to the fund before they closed; only LFs closed when a fund commences would receive benefits without having made contributions. Again, data would be required to determine how serious an equity issue those fund designs pose (e.g., are 10%, 50%, or 90% of the LFs expected to be closed when the fund begins?).

Another approach to equity is to consider the degree to which "high risk" LFs are paying in their fair share compared to "low risk" LFs. At the start, an acceptable method is needed to determine whether a LF is "high" or "low" risk, without having to conduct a lengthy, resource-intensive site-specific risk assessment. But the metric selected should be appropriate for the type of state fund. Specifically, "high risk" and "low risk" should be defined differently for a Pay-All-Costs fund than for a Defaults-Only Fund. For a Pay-All-Costs Fund, factors associated with LF siting/climate; design, construction, and maintenance; operational practice; potential for migration and proximity of sensitive receptors; and compliance record can be used. Why is a Defaults-Only Fund different? This fund design provides coverage only for the subset of PCM and CA costs that are defaulted. Therefore, indicators of the potential need for PCM and CA are not by themselves sufficient to determine "high" or "low" risk of demand on the fund, because they may not include indicators of default likelihood.

As this discussion illustrates, relative equity of the fund designs in Exhibit 3-2 is more difficult to assess conceptually than their relative coverage. Restricting contributions to be made only by active LFs while making benefits available to both active and closed LFs, further complicates equity assessments.

Efficiency/Administrative Burden

What makes a fund efficient? From one perspective, an efficient fund likely is one that handles a greater proportion of large claims than small claims, because fund administrative costs will have both fixed and variable components. The fixed costs of administering claims do not reflect the magnitude of the claims, but the variable costs do. None of the fund designs in Exhibit 3-2 have features that are explicitly based on claim size. Therefore, this definition of efficiency is not helpful for evaluating the fund designs in Exhibit 3-2.

Another approach to defining efficiency considers that the more transactions handled by a fund, the more efficient it will be, due to such factors as learning curves and economies of scale. That perspective would produce a ranking of fund designs similar to the ranking discussed for coverage, with the largest (i.e., most inclusive) funds being considered more efficient than the smallest funds.

Another indicator of efficiency might be the annual lumpiness of claims, with more efficient funds having less variation in annual payouts. As discussed earlier, ICF expects that coverage of PCM alone will be less volatile from year to year than coverage of CA alone, with a fund covering both PCM and CA having a level of yearly volatility in between. That suggests that fund designs No. 2 and No. 3 would have the least lumpiness and the greatest efficiency of the designs in Exhibit 3-2. Consequently, fund design No. 4 would have the greatest lumpiness of cash flows and the lowest efficiency because it covers only CAs, not PCM also. In between, ICF ranks fund design No. 1 above fund design No. 5 because the former covers all PCM which will have a greater smoothing effect when combined with coverage of CA than covering only post-30 PCM. Conceptually, using this approach, ICF expects that fund designs Nos. 6 and 7 would have more lumpiness – and less efficiency – than fund design No. 1 because they are smaller funds that cover only a part of the covered universe of LFs. The law of large numbers indicates that, all other things being equal, a larger fund will have less lumpiness in annual cash flows than a smaller fund.

Incentives

To the extent that economics drives behaviors, incentives will be affected by fund design. ICF expects that a Pay-All-Costs fund design would have much greater incentive effects than a Defaults-Only fund design because much more money would be disbursed by the Pay-All-Costs fund. Moreover, a Pay-All-Costs fund is a "no-fault" FA mechanism whereas a Defaults-Only fund has some element of culpability. Thus, by selecting a Defaults-Only approach to fund design for PCM and/or CA, the CIWMB has significantly reduced the potential for a fund to distort incentives.

In designing a fund for solid waste LFs, ICF recommends considering how a fund might affect the closing of current LFs and the opening of new ones. For example

- A fund that does not cover all CA but only CA at closed LFs might cause some LFs to close prematurely in order to benefit from the fund's coverage of CA. Such a fund design does not appear on Exhibit 3-2 for this reason.

A Pay-All-Costs of PCM fund design could create a similar "moral hazard" incentive for premature closure or for poor closure. An operator may not perform the best closure because any resulting savings in PCM expenses would accrue to the fund, not the operator. However, fund coverage of PCM defaults only, does not create such an incentive for early closure. It is not clear to ICF that a fund covering PCM defaults only would create a meaningful incentive to do a relatively poor job of closure, whereas a Pay-All-Costs of PCM fund design might create such incentives.

Given the relationship between PCM and postclosure CA discussed earlier, a Pay-All-Costs fund for CA (but not for PCM) might create an incentive for conducting a poor job of PCM because any resulting impacts of poor PCM on the magnitude and frequency of CA would be incurred by the fund not the LF.

A final point on incentives relates to fund designs Nos. 7 and 8, one of which applies only to responsible parties in the private sector while the other applies only to responsible parties in the public sector. Fund design No. 7 could provide an incentive for privatization of eligible LFs to qualify for fund coverage. Conversely, fund design No. 8 may create incentives for shifting LF responsibility to the public sector.

Exhibit 3-4 summarizes the results of this conceptual analysis of the Exhibit 3-2 fund designs in terms of the criteria shown in Exhibit 3-3. ICF believes that this exercise has value but much more can be learned by conducting a quantitative analysis of a preferred fund design, which ICF performed for Model No. 1. A conceptual fund evaluation has unavoidable limitations.

EXHIBIT 3-4
Conceptual Evaluation of Selected Fund Designs

Fund Model No.	Coverage	Equity	Efficiency	Incentives
1	Excellent	Excellent	Good	Good
2	Limited	Poor	Excellent	Good
3	Limited	Poor	Excellent	Good
4	Limited	Excellent	Poor	Good
5	Good	Excellent	Limited	Good
6	Limited	Limited	Limited	Poor
7	Limited	Limited	Limited	Poor

3.2 REVIEW OF EXPERIENCE WITH POOLED FUNDS

3.2.1 Definition of Pooled Funds

CIWMB asked for a review of existing California pooled funds and pooled funds in other states that could be applicable to long-term PCM and CA at active and closed solid waste landfills. For this study "pooled fund" means a fund that:

- is established by statute
- is used exclusively for CA and/or PCM, including Post 30-PCM

- is funded to a great degree[13] by assessments on an industry and/or fees on its products/services/feedstocks

- generally is available as a source of funds only to those (1) directly contributing to the fund or (2) whose need for CA and/or PCM is due to use of products on which taxes or fees are contributed to the fund.

A pooled fund for this study is not one that:

- is established voluntarily, such as a risk retention group, group captive insurance, or a mutual insurance entity

- addresses issues other than CA and/or PCM

- is funded primarily by general tax revenue, borrowings, and/or cost recovery

- is available as a source of funds to a wide variety of parties regardless of whether they have previously contributed to the fund directly or whether the need for CA and/or PCM is due to use of specific products.

The definition of pooled fund excludes most state environmental funds established to address orphan sites, spills needing cleanup, and/or PCM (as the state's responsibility following CERCLA actions). Other types of "pooled funds" in the state and elsewhere would include many state underground storage tank funds, as well as certain programs for heating oil tanks, used oil management, and waste tire management.

To focus the review on material most relevant for this study, ICF researched only those pooled funds that can be used exclusively for CA and/or PCM. Our research turned up very few pooled funds that meet the definition and even these do not satisfy all the criteria. The most relevant funds are the Mississippi Nonhazardous Solid Waste Corrective Action Trust Fund, the Minnesota Closed Landfill Program, and the Twin Cities (Minnesota) Metropolitan Landfill Contingency Action Trust. We started our research from a study ICF performed to identify FA requirements and government funds applicable to management of hazardous wastes[14] and recyclables and then expanded into on-line research. We collected available documentation and summarized experience with a cross-section of different types of pooled funds, including funds used in California (e.g., State Underground Storage Tank (UST) Fund), funds found in other states, and the repealed federal post-closure liability trust fund (PCLTF), which was supported by a waste-end tax.

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[13] Some funding can come from general tax revenues and/or borrowings, but such sources should be relatively small contributions to the fund.

[14] *A Fact-Finding Analysis of the Liability and Compensation Regimes for Hazardous Wastes and Hazardous Recyclables Management in Canada, the United States, and Mexico, Final Report*, prepared for Environment Canada by ICF Consulting, October 24, 2003.

Data collected includes such information as types of facilities and costs covered, source(s) of funds, conditions or limits on payments (e.g., compliance with financial assurance rules), and how funds are prioritized when needs are greater than current balances. ICF also included information on the type (e.g., mandatory or voluntary) of the fund because a mandatory participation feature is an uncommon feature of most state funds. The sizes of the fund also is important to describe because fewer than 300 landfills make up the universe of concern for this project, whereas many pooled funds for USTs cover thousands of locations.

The following pooled funds are reviewed:

- Solid and Hazardous Waste Pooled Funds
    - California Solid Waste Disposal Site Cleanup Trust Fund
    - Postclosure Liability Trust Fund
    - Minnesota Closed Landfill Program
    - Mississippi Nonhazardous Solid Waste Corrective Action Trust Fund
    - Metropolitan Landfill Contingency Action Trust Account
- Product Funds
    - California Underground Storage Tank Cleanup Trust Fund
    - Heating Oil and Used Oil Funds
    - Waste Tire Funds
    - Drycleaner Environmental Response and Reimbursement Account (Minnesota)
    - Drycleaner Environmental Response Fund Program (Wisconsin)

The sections below review the following characteristics of these funds:

- Scope and purpose
- Eligibility
- Types of costs covered
- Sources of funds
- Conditions or limits on payments
- Priorities
- Size of fund
- Administrative costs

3.2.2 Solid and Hazardous Waste Pooled Funds

3.2.2.1 California Solid Waste Disposal Site Cleanup Trust Fund

Scope and purpose. Assembly Bill 2136, enacted October 1993, required the CIWMB to initiate the Solid Waste Disposal and Codisposal Site Cleanup Program for cleanup of solid waste sites and solid waste at codisposal sites where the responsible party either cannot be identified or is unwilling or unable to pay for timely remediation and where cleanup is needed to protect public health and safety and/or the environment. Under the program, local governments can finance a wide range of remediation projects. Participation in fund activities is voluntary. Three funding mechanisms are available:

- Grants to Public Entities for Illegal Disposal Site Cleanups: Grants up to $500,000 are available to local governments to clean up illegal disposal sites.

- Local Government Matching Grants: Matching grants up to $750,000 are available to assist local governments to remediate environmental problems old dumps and landfills and other solid waste problems.

- Local Government Loans: Loans to local governments who can demonstrate need and the ability to repay state funds.

Eligibility. Candidate sites may be eligible for funding if:

- The site is a solid waste disposal site, codisposal site, or illegal disposal site;

- The responsible parties either cannot be identified, located, or are unable or unwilling to pay for timely and proper remediation; and

- Remedial action is required to protect public health and safety and/or the environment.

Types of costs covered. Remedial actions that are appropriate for the use of funds include, but are not limited to: waste removal and disposal; security measures such as fences and warning signs; drainage controls; slope and foundation stabilization; excavation, consolidation, and capping of waste areas; field and laboratory testing; and installation of landfill gas and leachate control systems.

Ineligible actions include, but are not limited to: closure as defined in the California Code of Regulations; ground water remediation; operation and maintenance of leachate, surface water, or vadose zone monitoring systems; closure and postclosure maintenance services; improvements to property for postclosure land uses; preparation of closure or postclosure maintenance plans; removal, abatement, and cleanup or otherwise handling only hazardous substances not codisposed with nonhazardous solid waste. The remediation of landfill or disposal site fires is eligible only in situations where the fire is remediated as one part of a project approved for remediation under this program.

Eligible emergency actions at disposal sites include technical assistance to local emergency response agencies. Funding of final site remediation may be approved after the emergency response if all other applicable criteria are met.

Sources of funds.

- Funds appropriated by the Legislature from the Integrated Waste Management Account to the board for solid waste disposal or codisposal site cleanup.

- Any interest earned on the money in the trust fund.

- Any cost recoveries from responsible parties for solid waste disposal or codisposal site cleanup and loan repayments.

The balance in the trust fund each July 1 must not exceed $30,000,000.

Conditions or limits on payments. Most applicants for fund grants are pre-regulation sites, so compliance with financial assurance rules does not apply.

Priorities. Sites are prioritized for eligibility based on the following factors:

- The actual or potential degree of risk to public health and safety and/or the environment posed by conditions at the site as determined by a comparison with state minimum standards.

- The ability of the site owner and or responsible parties to promptly and properly remediate the site without monetary assistance.

- The ability of the Board to adequately remediate the site with available funds;

- The amount of contributions of money and/or in-kind services from local governments and responsible parties.

- The availability of other appropriate federal or state enforcement and/or cleanup programs to remediate the site.

- The ability to obtain site access for the proposed remediation.

Size of fund. California has appropriated $5 million each year to implement this fund. The amount currently available in the Solid Waste Trust Fund for fiscal year 2007/08 for contracts, grants, and loans was approximately $2.8 million. It is anticipated that an additional $5 million will become available upon approval of the budget for fiscal year 2007/08, making a total of $7.8 million available for new contracts, grants, and loans.

Expenditures ($000)

2001-02	2002-03	2003-04	2004-05	2005-06
$6,527	$9,016	$7,271	$5,293	$5,321

Since Assembly Bill 2136 was enacted in 1993, approximately 200 site activities have been completed. There are now 10 new approved sites actively engaged in fund activities.

Administrative costs. Not more than 5 percent of the funds appropriated for the purpose of the program by a statute other than the Budget Act may be used to administer the program, unless a different amount is otherwise appropriated in the annual Budget Act. There are currently 3 positions associated with the operation and management of the fund.

3.2.2.2 Postclosure Liability Trust Fund (PCLTF)

Section 232 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) established the PCLTF to provide for future PCM, CA, and liability compensation for permitted and closed hazardous waste land disposal facilities. Because of many uncertainties about the provisions and implementation of the PCLTF, Congress mandated the performance of specific studies, such as an evaluation of the adequacy of the revenue to be raised for the PCLTF compared to estimated future requirements.[15]

Qualification for PCLTF Coverage. In order for a land disposal facility to qualify for Fund coverage (i.e., transfer its liabilities to the Fund as outlined in CERCLA Section 107(k)) it must meet certain conditions, including a final RCRA permit and a five-year period of monitoring. The demonstration of "no substantial likelihood" of migration off site, release, or risk to public health required by CERCLA was interpreted as requiring that no release be detected prior to the end of the five-year qualification monitoring period. This meant that any release detected prior to this time (including during operation) would disqualify a facility from PCLTF coverage. Finally, CERCLA required that the facility comply with all RCRA regulations which may affect the performance of the facility after closure (CERCLA Section 107(k)(1)(A)).

Fund Coverage at Qualified Facilities. The PCLTF was authorized to cover costs of monitoring, response, and compensation of claims established under CERCLA or any other state or federal law (CERCLA Section 111(j)). Consequently, PCLTF coverage includes all liability compensation claims, non-routine monitoring, and response actions immediately following the transfer of liability to the Fund. Routine monitoring and care (including detection monitoring, compliance monitoring, and postclosure care such as leachate collection and security) were to remain the responsibility of the owner/operator throughout the 30-year postclosure period. The PCLTF covered routine PCM costs only following the facility's postclosure period.

Fund Revenues. Fund revenues came from a tax of $2.13/dry-weight ton of disposed hazardous waste. This tax rate was fixed in nominal terms, as was the Fund ceiling of $200 million. The total amount of disposed waste was assumed to grow at the rate of growth of industrial output, approximately two percent per year. Therefore, the total potential annual tax revenue also would grow at this rate, which is less than the assumed annual rate of inflation of approximately four percent in the model. The Fund may also obtain revenue by investing any positive fund balance in federal securities. A nominal rate of return of 5.1 percent per year was assumed in the Fund model.

Fund Prognosis. Using a large, sophisticated simulation model, the Base Case showed a less than 50% probability that the PCLTF would run out of money in its first 44 years. The model median estimate was that the fund would have a positive balance by year 44. The median estimate, however, becomes negative by year 56.

[15] See *Post-Closure Liability Trust Fund Simulation Model* prepared by ICF for U.S. EPA, Office of Solid Waste (May 1985).

The model estimated that by year 50, 211 facilities would be covered by the PCLTF, with another 26 facilities having their qualification status pending.

There are at least three issues that affected the long-term performance of the fund:

- First, because Congress fixed the tax rate at $2.13 per dry weight ton, fund revenues would be hard pressed to keep up with inflation, which increases the nominal costs of PCM, CA, and liability compensation, but does not affect the tax rate. The PCLTF model confirmed that indexing both the tax rate and the fund ceiling (the point at which no further taxes are collected) improved the fund's stability.

- Second, as time passes, more disposal sites enter the fund, require CA, generate liability compensation claims, and eventually reach post-30 PCM. The funding needs are inescapably back-loaded

- Third, as time passes, hazardous waste disposal was projected to decrease, thus reducing the base on which the tax was assessed.

Eventually, the Congress decided to repeal the PCLTF, ending a key national initiative to address issues of long-term responsibility for wastes left in the land.

3.2.2.3 Minnesota Closed Landfill Program

Scope and purpose. As an alternative to the Superfund process, Minnesota's Closed Landfill Program was established in 1994 through the Minnesota Landfill Cleanup Act whereby the State of Minnesota would assume the environmental responsibilities of landfills that had operated prior to, and not in compliance with, RCRA Subtitle D Standards.

The Minnesota legislature enacted the Landfill Cleanup Act (LCA) in 1994. The purpose of the LCA is to ensure proper closure and postclosure care at up to 112 closed, permitted municipal sanitary landfills located throughout Minnesota. Based on this legislation, the Minnesota Pollution Control Agency (MPCA) created the Closed Landfill Program (CLP) to administer the LCA mandates. The legislature amended the LCA in 1999 and again in 2000, allowing additional sites to enter the CLP.

Because the CLP is a voluntary program, not all closed permitted landfills are in the CLP; however, most closed, permitted facilities in the state have opted to join the CLP.

Eligibility. Any MPCA-permitted mixed-municipal solid waste landfill that stopped accepting mixed municipal solid waste (MMSW) by April 9, 1994 and demolition debris before May 1, 1995, can qualify for this program. Based in part on the legislative changes in 1999 and 2000, two additional landfills entered the CLP in 2002 and 2003, with three more expected to enter the program in 2005. Some of the landfills in the CLP are owned by the State, while others remain in private or public ownership.

Types of costs covered. The MPCA has the authority to initiate cleanup actions, complete closures, and take over long-term operation and maintenance at qualified closed, state-permitted landfills. The LCA also authorizes the MPCA to reimburse eligible parties for past cleanup costs after actions have been completed. Response actions completed by the CLP include:

- Waste relocation (consolidation of waste and reduction in waste footprint);
- Construction of enhanced landfill covers to reduce infiltration (improved barrier layer design, drainage controls);
- Installation of enhanced passive landfill collection systems, including deep gas vents for source control within the waste;
- Active collection of landfill gas for destruction of methane and non-methane organic carbons via flares and in some instances operation of gas-to-energy plants;
- Gradient control systems to capture impacted groundwater;
- Groundwater remediation(carbon stripping, aeration, documentation of natural attenuation); and
- Leachate collection (toe drains).

Sources of funds. Funding for the CLP in FY 2006 came from five sources:

(1) New general obligation bonds authorized in May 2006 totaling $10.8 million;

(2) Remaining general obligation bonds from FY 02 and FY 05 appropriations;

(3) The balance of funds transferred from financial assurance accounts of closed landfills that previously entered the Program; (From inception of the CLP through FY 06, the state received a total of $15,406,837 in financial assurance payments from owners or operators of 26 closed landfills. No additional financial assurance was received in FY 06 as no new sites entered the Program.)

(4) Settlements from landfill-related insurance coverage; (The state, along with Special Attorneys representing the state, pursued financial settlements with insurance carriers that wrote policies for owners and operators of, as well as for generators of waste brought to, CLP landfills. In FY 06, the state received $5,354,838 in insurance settlement payments. These payments were divided and deposited equally in the Remediation and the Closed Landfill Investment Funds.) and

(5) Transfers from the Environmental Fund (Seventy percent of the revenues from the Solid Waste Management Tax (SWMT) are deposited into the Environmental Fund. The tax is composed of a 9.75 percent charge on residential waste collection bills; a

17 percent charge on commercial municipal waste collection bills; and 60 cents per cubic yard of container capacity on most industrial, demolition/construction, and medical waste. The SWMT collections deposited in the Environmental Fund in FY 06 totaled approximately $43.3 million. A portion of these funds is transferred into the Remediation Fund for use at CLP sites and for other remediation programs.).

Conditions or limits on payments. Minnesota requires owners of mixed municipal solid waste landfills remaining in operation after July 1, 1990 to set aside funds to pay for the cost of facility closure, postclosure care, and contingency action. Because several of the landfills that entered the CLP were still in operation as of July 1, 1990, their owners were required to meet these financial assurance rules. As part of the LCA, the owners of these landfills, upon entering the CLP, were required to transfer their financial assurance balances to the MPCA after having met closure requirements.

Priorities. The List is arranged by site classification and site score, from highest to lowest priority. Class A sites pose an imminent threat to human health, welfare or the environment. Class B sites require response actions to mitigate violations of environmental standards. Class C sites are those where the cover does not meet the requirements of the current Solid Waste Rules. Class D sites are those where the site is in compliance with current Solid Waste Rule cover requirements.

Size of fund. Program expenditures are primarily for investigation, design, construction, operation and maintenance, reimbursements, administration, and insurance recovery. Expenditures in FY 06 totaled $23,775,931. Total costs since the program began in 1994 are $246,629,811.

There are 112 landfill sites participating in the fund.

Administrative costs. Administrative costs in FY 06 were $2,650,682. Total administrative costs since program inception in 1994 are $25,617,075. Administrative costs are slightly more than ten percent of total costs, both for FY 06 and since program inception.

3.2.2.4 Mississippi Nonhazardous Solid Waste Corrective Action Trust Fund

Scope and purpose. The Mississippi Nonhazardous Solid Waste Corrective Action Trust Fund (CATF) Program is one of several funding assistance programs administered by the Mississippi Department of Environmental Quality (MDEQ) Solid Waste Policy, Planning, and Grants Branch. This program provides an opportunity for financial assistance to site owners to conduct corrective actions at closed or abandoned municipal solid waste (MSW) landfills that closed prior to the effective date of the Federal Subtitle D Regulations.

Eligibility. Only closed sanitary or municipal landfills that accepted household garbage during the life of the landfill are considered eligible for funding assistance from CATF. In addition, only those closed landfills that ceased receiving waste prior to the effective dates of

Federal Subtitle D Regulations: October 9, 1993 (>100 tons per day) or April 9, 1994 (<100 tons per day) are eligible for funding consideration through the CATF.

Types of costs covered. The assistance can be used for preventive or corrective actions due to a real or potential release of contaminants from the landfill or for monitoring or abating other problem conditions at an eligible closed landfill. This fund may be utilized to assess the impacts (onsite or offsite) from potential groundwater contamination and landfill gas migration and also to remediate contaminants at an old closed landfill.

The Mississippi Commission on Environmental Quality may utilize funds in the Trust Fund for the following purposes:

- To take whatever emergency action is necessary or appropriate to assure that the public health or safety is not threatened whenever there is a release or substantial threat of a release of contaminants from any source within the permitted area of an eligible facility;

- To take preventive or corrective actions where the release of contaminants from any source within the permitted area of an eligible facility presents an actual or potential threat to human health or the environment including, but not limited to, closure and postclosure care of an eligible facility; and

- To take such actions as may be necessary to monitor and provide postclosure care of any eligible facility, including preventive and corrective actions, without regard to identity or solvency of the owner.

The Trust Fund may not be used to pay for the normal costs of closure and postclosure care of an eligible facility or where no release or substantial threat of a release of contaminants has been found by the Commission.

While determination of eligible costs must be made on a case-by-case basis, the following activities are considered eligible when “performed in a diligent and fair manner” and when prior approval of the Department has been obtained:

- Development of remedial plans.

- Drilling of soil borings.

- Installation of groundwater monitoring wells.

- Sampling and analysis of soil and groundwater.

- Installation of groundwater recovery wells.

- Removal of contaminants by approved methods.

- Disposal or treatment of contaminated media.

- Replacement of contaminated water supply wells.

- Legal fees and costs, where necessary to ensure the proper conduct of any site assessment, preventive or corrective action, monitoring activity, or closure or postclosure activity. Legal costs associated with litigation regarding the site or facility are not eligible for reimbursement.

Sources of funds. Operators of commercial nonhazardous solid waste management facilities managing municipal solid waste pay to the State Tax Commission $1.00 per ton of municipal solid waste generated and managed in the state by landfilling or incineration, including waste-to-energy management. The fee is not levied upon rubbish which is collected and disposed separately from residential or household waste and which is not managed for compensation. Fifty percent (50%) of these monies (i.e., 50¢ per ton) are remitted to the Mississippi Nonhazardous Solid Waste Corrective Action Trust Fund. The fund is managed in conjunction with the Local Governments Solid Waste Assistance Fund so that the balance in the Nonhazardous Solid Waste Corrective Action Trust Fund remains between $1 million and $3.5 million.

Conditions or limits on payments. Most applicants for fund grants are pre-regulation sites, so compliance with financial assurance rules does not apply.

Priorities. Whenever there are insufficient unencumbered funds to pay for the costs of all activities or facilities which have been identified as needing corrective action, the following factors are used by the Department in establishing priorities:

- Sites where methane gas in explosive concentrations has migrated from the property boundary and is threatening an adjacent inhabited building receive the highest priority.

- Sites or facilities which present a threat or potential threat to contaminate a drinking water supply that is currently being used by the public have priority over sites which present a threat or potential threat only to potential drinking water supplies.

- Where a threatened or potentially threatened drinking water supply is actually being used by the public, the number of persons currently using the water supply is considered.

- Where a threatened or potentially threatened drinking water supply is not being used by the public, the number of persons residing within one mile of the site or facility is considered.

- The degree of contamination found, including the areal extent of contamination, the depth of contamination, the concentration of contaminants, and the toxicity level of the specific contaminants, also is considered.

Size of fund. In 2005 the fund had been depleted and stood at $1 million. There is now $2 million in the fund.

Since 1995, five projects (sites) have been funded. The fund is now reviewing three applications.

Administrative costs. [to be provided]

3.2.2.5 Metropolitan Landfill Contingency Action Trust Account

Scope and purpose. The Metropolitan Landfill Contingency Action Trust (MLCAT) Account is a fund dedicated for the care of certain closed disposal sites for mixed municipal solid waste in the seven-county Twin Cities metropolitan area.

Eligibility. To be eligible for MLCAT expenditures in FY 2006, a closed, state-permitted MMSW landfill must be located within the seven-county metropolitan area and have been maintained for at least 30 years; or, if closed for less time, must have an owner/operator who has not taken necessary response actions. A site can also be eligible for MLCAT spending if it was both a city dump for municipal waste and also a state-permitted landfill for disposal of wastewater treatment sludge ash.

Types of costs covered. The original purpose of MLCAT was to ensure that reasonable and necessary long-term care would be adequately funded at mixed municipal solid waste (MMSW) disposal facilities within the seven-county Twin Cities Metropolitan area (Anoka, Carver, Dakota, Hennepin, Ramsey, Scott and Washington Counties). Money would be available on an emergency basis to address immediate threats that older landfills might pose to the air, water, and land, where the owners or operators proved unable to meet their financial obligations. In addition, the fund would help pay the cost of long-term care at sites that had been closed properly for three decades.

With the passage of the Landfill Cleanup Act by the Minnesota Legislature in 1994, reliance on MLCAT for such actions at metro-area landfills was considerably reduced. The reduction was because the majority of closed metro-area landfills that had been eligible for spending under MLCAT became qualified for cleanup and long-term care under the state's new Closed Landfill Program, after owners earned a notice of compliance under the CLP statutes. Even so, the advent of the CLP left six landfill sites still reliant on the older MLCAT because they did not qualify for participation in the CLP.

Sources of funds. Money deposited in MLCAT has come from three sources:

- 25 percent of the $2.00/cubic yard Metropolitan Solid Waste Landfill fee on MMSW disposed in Twin Cities metro-area landfills, which amounts to $.50 per cubic yard (main source);

- Interest earned from investment of money in MLCAT; and

- Any money recovered by the MPCA for reimbursement of costs incurred, including any money paid under any agreement, stipulation, or settlement.

Conditions or limits on payments. Participants in Account activities are pre-regulation sites, so compliance with financial assurance rules does not apply.

Priorities. Only six landfill sites still rely on MLCAT because they did not quality for participation in the CLP. The first costs for long-term postclosure care at these landfills could occur in 2009. Current priorities are inspections at the four closed sites, and inspections, administrative, and technical tasks at the two remaining open landfills.

Size of fund. On June 30, 2004, $9,905,000 – essentially the entire available balance of MLCAT – was transferred out of the MLCAT program and into the state's General Fund as part of a budget-balancing initiative. As part of the transfer authorization, the Legislature expressed the intent to restore an equivalent amount to MLCAT at a later date, as revenue becomes available, so that the fund could meet the needs of long-term care at MLCAT-eligible landfills. During FY 2005, the Legislature authorized the transfer of an additional $4 million from the MLCAT Account balance. The transfer will occur in FY 2007. Revenue from the Metro Landfill Contingency Fee in FY 2006 was $716,000. With balances forward from previous years, resources available in FY 2006 were $4.5 million. Expenditures in FY 06 were $62,000.

Six state-permitted landfills were MLCAT-eligible in FY 2006, with one additional landfill benefiting from a one-time, state-funded construction project that is essentially complete.

Revenues and Expenditures ($000)

	FY 2006 (actual)	**FY 2007 (estimated)**
Balance Forward	3,537	4,460
Revenue	941	936
Total Resources Available	4,522	5,396
Expenditures	62	4,100
Balance Forward	4,460	1,296

Administrative costs. [to be provided]

3.2.3 Product Funds

Product funds are used to address cleanups (and liability compensation) from such liquids as petroleum and petroleum products (including heating oil), used oil, chemicals/hazardous materials in liquid form, and certain solvents. Some of the funds focus on releases to surface water while other funds primarily address releases onto or into land. This latter category includes a large group of state underground storage tank (UST) funds, which were established as FA mechanisms in many cases. State UST funds have had varied financial trajectories: several

have become insolvent, bankrupt, or severely constrained due to insufficient revenues or controls on expenditures; at the other extreme, well-funded state UST funds have had other programs added to their responsibilities or have had money deobligated and reprogrammed for other purposes. In addition, because state UST funds often were created in the late 1980s due to perceptions of the lack of other available FA mechanisms, particularly insurance, another theme has been a recurring interest in sunsetting these funds in favor of private FA mechanisms. Once put in place, however, the funds have attracted constituencies that have expressed serious reservations about switching to a FA system dependent on insurance. This section profiles the California UST fund as well as several other "product funds."

3.2.3.1 California Underground Storage Tank Cleanup Trust Fund

Scope and purpose. Federal Environmental Protection Agency (EPA) regulations and California laws require owners and operators of petroleum underground storage tanks (USTs) to demonstrate through insurance coverage or other acceptable mechanisms that they can pay for cleanup and third-party compensation resulting from leaks that may occur from their USTs.

The Barry Keene Underground Storage Tank Cleanup Fund Act of 1989 created the Underground Storage Tank Cleanup Fund, administered by the California State Water Resources Control Board, to help owners and operators of USTs satisfy federal and state financial responsibility requirements.

In addition, the Fund also provides money to the Regional Water Quality Control Boards and local regulatory agencies to abate emergency situations or to cleanup abandoned sites that pose a threat to human health, safety, and the environment, as a result of a petroleum release from a UST.

Eligibility. In order for the Fund to be used as a financial responsibility mechanism, the law requires that the claimant must (1) be the owner or operator of a petroleum UST, (2) be in compliance with applicable financial responsibility requirements, and (3) be in compliance with UST laws and regulations. The Fund works closely with regulatory agencies to determine whether a claimant has made a good faith effort to achieve compliance with the regulations and relies heavily on the recommendation of the regulatory agency when evaluating eligibility. Participation in Fund activities is voluntary.

Types of costs covered. To fulfill the federal financial responsibility requirements specified in 40 CFR Part 280 (Subpart H), the Fund is available to assist eligible UST owners and operators meet the costs to cleanup contaminated soil and groundwater caused by leaking petroleum USTs. The federal financial responsibility requirements also require the Fund to provide coverage for third-party liability compensation due to unauthorized releases of petroleum from USTs. On June 9, 1993, the United States EPA approved California's Fund as a mechanism for meeting the federal financial responsibility requirements for USTs containing petroleum.

Sources of funds. Fund statutes require every owner of a regulated petroleum UST to pay a per gallon storage fee into the Fund. This fee, which began to accrue on January 1, 1991, has

increased over time to $0.014 per gallon and currently generates in excess of $240 million annually.

Conditions or limits on payments. This fund was specifically established as an alternative mechanism to meet federal financial responsibility requirements.

Priorities. The claim priority system is based on characteristics relating to the claimant's ability to pay. The highest priority, designated as Class A, is reserved for residential tank owners; the second priority, Class B, is reserved for small California businesses, governmental agencies, and nonprofit organizations with gross receipts below a specified maximum; the third priority, Class C, is for certain California businesses, governmental agencies, and nonprofit organizations not meeting the criteria for Class B; and the fourth priority, Class D, is given to all other eligible claimants.

The State Water Board must update the priority list at least annually; however, in practice the priority list is updated monthly. Claims from previous updates retain their relative ranking within their priority class with new claims ranked in their appropriate class below those carried over from the previous list. New claims in a higher priority class must be processed before older claims in a lower priority class.

There are two exceptions to the priority system. One requires the Fund to award approximately 14-16 percent of annual appropriation to any lower priority classes that would not otherwise be funded (i.e., Class C and D claimants each receive at least 14-16 percent of the annual Funding). The other provided a one-time appropriation of $5 million to immediately fund Fire Safety Agencies that submitted applications to the Fund before January 1, 2000.

Size of fund. Following the approval of the regulations in 1991, claim applications were mailed to more than 10,000 potential claimants. By January 1992, over 6,200 claims had been received. Fund staff conducted a preliminary review of the initial claim applications and the State Water Board adopted the initial priority list containing 3,583 claims in July 1992. The first check was issued in September 1992.

During FY 2005-06, the Fund received 5,462 reimbursement requests and processed 4,795 payments for a total of $199,727,438. The average time for processing payments was 70 days. During FY 2006-07, the Fund expects to receive and process approximately 5,500 reimbursement requests.

Fund Activity

Activity	FY 2005-06	Life of Fund
Claims Received	285	18,627
Claims Approved for Priority List	246	14,928
Claims Reviewed for Letter of Commitment (Detailed Review)	184	11,942
New Letters of Commitment Issued	236	10,621
Value of Letters of Commitment	$220 Million	$2.055 Billion

Fund Activity

Activity	FY 2005-06	Life of Fund
Reimbursement Requests Processed	4,795	51,374
Value of Reimbursements	$199 Million	$1.970 Billion
Claims Closed	383	6,027

Administrative costs. In FY 2005-06, fund administration totaled $13,970,936 out of $250,344,211 total fund expenses. Since inception, fund administration has totaled $139,015,097 out of $2,567,987,645 total expenses. Administrative costs have thus been about 5 percent of total expenses, both for FY 2005-06 and since inception.

3.2.3.2 Heating Oil and Used Oil Funds

Given that some state funds are used for cleanup and compensation of leaks from underground storage tanks of petroleum products as well as for spills of petroleum products from vessels and aboveground facilities, ICF undertook research into whether heating oil and used oil funds followed those models. For example, Vermont amended its Petroleum Cleanup Fund in 2004 to include a 5 cent per gallon fee on heating fuels to help cover the costs of responding to heating oil releases. Commercial and residential storage and handling of heating oil generally has been exempted from many regulatory systems in the federal level and in many states. State fire codes that do address heating oil storage and handling typically do not cover corrective action for releases. However, most state UST funds include used oil and/or heating oil tanks and cleanup of heating oil and used oil releases within their jurisdictions.

3.2.3.3 Waste Tire Funds

In searching for examples of pooled funds used for solid waste land disposal PCM and/or CA, ICF looked into some distinct types of wastes, including scrap tires. Across the country, states have addressed how to finance cleanups of waste tire piles, including looking into what other states are doing, such as adding a fee to new sales of tires. ICF's research found that states were addressing abandoned and uncontrolled "legacy" sites as well as putting requirements (e.g., permits, licenses) in place for waste tire storage and processing. Most states use a fee or tax on the sale of tires and/or vehicles, and/or vehicle registrations at least in part (e.g., in combination with bonds) to address waste tire management. The funds are used not only for cleanup but for recycling, reuse, or reprocessing grants, and other purposes further afield (e.g., brownfields).[16]

3.2.3.4 Minnesota Drycleaner Environmental Response and Reimbursement Account

Scope and purpose. The Minnesota Legislature, working with the drycleaners' trade associations and the Minnesota Pollution Control Agency (MPCA), established the Drycleaner

[16] Maine Department of Environmental Protection and Maine Department of Economic & Community Development, Report to the Joint Standing Committee on Natural Resources, *Long-Term Funding Alternatives for the Scrap Tire Abatement Program* (January 2000).

Environmental Response and Reimbursement Account (Drycleaner Fund) in 1995 to help clean up contamination problems faced by members of the drycleaning industry. This fund provides a means to pay for the cleanup of soil, groundwater, or surface-water contamination at drycleaning facilities. Cleanup can be conducted either by the MPCA or by drycleaning facility owners or operators who volunteer to conduct response actions that have been approved by the MPCA.

Eligibility. With only a few exceptions, drycleaning facilities that provide or provided services to the general public may apply for reimbursement. The Drycleaner Fund is intended to benefit past or present members of the dry-cleaning industry. However, landowners who own the property occupied by a dry-cleaning business also are eligible for reimbursement. An owner or operator of a dry-cleaning facility or a property owner need not be a Minnesota business to use the fund, but the site must be located in the state. Participation in Fund activities is voluntary.

Types of costs covered. The MPCA can use the money in the Fund for two primary purposes:

- Emergency removals, environmental investigations, and cleanups at drycleaning facilities on the state Superfund list (the Permanent List of Priorities); or

- Reimbursement of current or former owners or operators of drycleaning facilities who have entered the MPCA's Voluntary Investigation and Cleanup (VIC) Program and whose sites require cleanup.

Under either approach, the drycleaning facility owner or operator is responsible for $10,000 of the environmental response costs.

The criteria include:

- The contamination at the property must have resulted from current or former drycleaning operations;

- If non-drycleaning operations are determined to be contributing sources to the contamination, then only the portion of costs allocated to the drycleaning contamination will be reimbursed;

- The cleanup activities must have begun on or after July 1, 1995;

- The cleanup must be conducted by the former or current owner or operator of the drycleaning facility or the owner of the property occupied by the drycleaning facility;

- The owner or operator had to have complied with all state or federal laws and regulations regarding management of drycleaning solvents in effect at the time of the release;

- The investigation and response actions, as well as the costs submitted for reimbursement, must be reviewed and approved by the MPCA;

- The response actions at the site must include cleanup activities. Sites where only investigation activities have been conducted are not eligible for reimbursement. If the site investigation confirms the need for cleanup, the investigation activities would then also be eligible for reimbursement. Sites where cleanup is not necessary, as determined by the MPCA, are not eligible for reimbursement. In assessing the need for a response action, the MPCA will evaluate:

    - the quality of the investigation, relevant VIC guidance documents, current professional practice, and reasonable exercise of professional judgment; and

    - the reimbursement application must document all expenditures (totaling at least $10,000) in reasonable investigation and clean-up costs, as well as any payments received or coverages for all applicable insurance associated with the investigation and cleanup of the site (or assign the MPCA those insurance rights).

The applicant is responsible for the first $10,000 in costs. In evaluating the reimbursement request, the MPCA will consider MPCA guidance, current professional practice, sound professional judgment, and the range of prices currently in effect for similar activities and services. Reimbursement applications may be submitted when the MPCA has determined that a response action is necessary and has approved a response-action plan.

If the owner or operator of the drycleaning facility or the property owner declines to conduct the investigation and cleanup of a release at a site, the MPCA will assess the site, prioritize the site, and conduct an investigation and any necessary cleanup. Once the MPCA has incurred costs with respect to the site that are final or exceed $10,000, the agency will request payment from the owner or operator for the actual amount or up to a maximum of $10,000. The drycleaning facility owner or operator or the property owner must also assign all applicable insurance coverages to the MPCA.

Sources of funds. Annual registration fees paid by drycleaning facilities, as well as solvent fees collected by retailers of particular drycleaning chemicals, are used to finance the Drycleaner Fund. The fees are submitted to the Minnesota Department of Revenue, which administers the fund. Registration fees are based on facility size (number of employees). Solvent fees are $11.70 per gallon on perchloroethylene, $6.70 per gallon on hydrocarbon-based solvents, and $2.70 per gallon on non-aqueous solutions. Registration fees and solvent fees contribute about equally to the Drycleaner Fund.

Conditions or limits on payments. Applicants are responsible for the first $10,000 in costs.

Priorities. There is no formal process for establishing priorities among applicants. An attempt is made to favor small operations that may not be financially able to wait for reimbursement, and those who have been waiting a long time for reimbursement. No single site may receive more than 20 percent of the Fund in a given year.

Size of fund. The balance in the Fund is now $600,000. Statute provides that fees be adjusted to maintain annual income to the Fund of $650,000. In FY 2007 (ended June 30, 2007), ten parties were reimbursed from the Fund.

Administrative costs. No separate account of administrative costs is maintained. There are two staff members working on the Fund, part-time. Other staff members are also involved in site investigations.

3.2.3.5 Wisconsin Drycleaner Environmental Response Fund (DERF) Program

Scope and purpose. The Dry Cleaner Environmental Response Program (DERP) is a reimbursement program for dry cleaners for the investigation and cleanup costs of dry cleaning facilities. This program was created in the 1997 - 1999 state budget, effective October 1997. This program was developed by the dry cleaning industry to cover eligible costs associated with responding to, investigating, and cleaning up contamination caused by releases of dry cleaning solvents.

Eligibility. An owner or operator of a dry cleaning facility is eligible for reimbursement if they comply with several provisions of the statute.

An owner is any one of the following:

- a person who owns, possesses, or controls any of the following:
  - a licensed dry cleaning facility;
  - a dry cleaning facility that stopped operating before October 14, 1997;
  - a dry cleaning facility that stopped operating on or after October 14, 1997, and was licensed before it stopped operating; and/or
  - receives or received money, or other direct or indirect consideration, from the operation of such facility;
- a subsidiary or parent corporation of the person specified above; and
- a person who owns property on which is located any of the following:
  - a licensed dry cleaning facility; and/or
  - a closed dry cleaning facility that was licensed and operating while the person owned the property.

A person who owns property on which a dry cleaning facility was located that closed before October 14, 1997 (the date licensing requirements began) is not eligible for the DERF

program. Likewise, those who purchase property on which a licensed dry cleaning facility was located, but purchased it after the facility ceased operation, are also not eligible for the program.

An eligible operator is defined as:

- A person who holds the license for a dry cleaning facility.
- A subsidiary or parent corporation of the person specified above.
- A person who operated a dry cleaning facility that closed prior to October 14, 1997.

Types of costs covered. Wisconsin allows reimbursement of costs for discovering, investigating, and remediating the discharge of dry cleaning solvents to the environment. The DNR Remediation and Redevelopment (RR) Program's project managers are the dry cleaner's first point of contact when seeking to participate in this program; the project managers also work with the dry cleaner throughout the cleanup process.

All discharges must be reported to the DNR as soon as they are discovered. The owner/operator or his/her agent or consultant must submit a Potential Claim Notification Form to the RR project manager prior to incurring any reimbursable costs. The Potential Claim Notification Form should provide the RR project manager with sufficient information to confirm that the DNR was notified that a release occurred at a particular facility. The eligibility of the applicant pursuing reimbursement is then assessed, and the applicant is sent an initial eligibility determination letter, based on the information provided on the Potential Claim Notification Form. The applicant is also informed of the status of the program's fund in the eligibility letter.

A Potential Claim Notification Form must be submitted no later than August 30, 2008, for investigation and cleanup costs to be eligible for reimbursement.

Cleanups conducted under this program must comply with the DNR's NR 700 cleanup rule series.

Because DERF is a voluntary reimbursement program, owners must make decisions on when they apply to the program and start the investigation and cleanup process. These decisions are largely controlled by property transactions and by the amount of money the owner can afford to spend on the cleanup at any given time.

Sources of funds. The program is funded by a license fee for dry cleaners and a solvent fee on the sale of dry cleaning solvents.

Conditions or limits on payments. The maximum reimbursement for any dry cleaner site is $500,000.

Priorities.

Size of fund. The DERF receives about $1 million dollars each fiscal year from fees on dry cleaning. License fees of 1.8% of gross dry cleaning revenues provide the bulk of the money in the Fund. The remaining money in the Fund comes from solvent fees ($5 per gallon on

perchloroethylene, and $.75 per gallon on other dry cleaning products) paid by chemical suppliers and from interest earnings.

The license fees generate the vast majority (almost 80%) of revenues. As of November 30, 2006, over $10 million has been generated to fund DERF.

As of November 2006, 138 properties have entered the Dry Cleaner Environmental Response Program. Of these, 57 sites (41%) have completed a site investigation and begun cleanup actions. A total of 22 (16%) of these sites have received final closure from the DNR.

Administrative costs. State employee positions represent 18.7% ($1,996,800) of the total fees ($10,660,500) expected to be paid between FY97 and the end of FY07.

3.3 WORKING MODEL OF STATEWIDE DEFAULT FUND FOR ASSURANCE OF PCM AND CA

Section 3.3 presents ICF's approach for developing a working model of the desired mandatory state fund design, which is a Defaults-Only fund that covers defaults of all PCM and CA for all 282 LFs permitted and operating after January 1, 1988. This section describes the model's purpose and design, use of data, key assumptions, and results.

3.3.1 Purpose and Design of the Working Model

Objective of the Model: To evaluate different fund constructs with respect to the probability that a given construct will provide sufficient funds to cover 100% of expected defaulted PCM and CA costs.

The model will:

- Estimate the expected annual PCM and CA costs for landfills that have defaulted.
- Use Monte Carlo simulation to generate a probability distribution of the number of years that the fund balance is below a pre-set reserve margin and below zero.
- Generate one simulation that uses the average or median input values so that CIWMB can review the numbers in detail for one "average" case.
- Display results on an annual basis.
- Allow CIWMB to adjust most model parameters easily.
- Calculate fund withdrawals in the form of payments to cover the costs of defaulted PCM, CAs, and fund operating expenses.
- Calculate fund income from contributions and interest earnings on the fund balance.

- Be able to summarize costs by PCM, CA, as well as landfill characteristics, such as size, ownership, or other characteristics identified under Task 6 prior to completion of model development.

- Present results in current dollars.

- Incorporate macro procedures to execute the Monte Carlo analysis, for a number of simulations selected by the user. Model results for the report will be generated using between 2,000 and 10,000 simulations.

The model will not include:

- Landfill-specific detailed cost estimates for PCM or CA.
- New landfills beyond the 282 modeled.

Simplifying Assumptions:

1. No new landfills will be modeled for the study period beyond the 282.

2. The study period will start with the year 2011 and extend through 2250. Two landfills are projected to close after 2250. However, to extend the modeled time period to include the closure dates for these two landfills would significantly complicate model development, without significant gains expected in model results.

3. Three types of CAs will be modeled, covering low-, medium- and high-cost corrective actions. For example, low-cost CAs would include installing additional groundwater monitoring and/or extraction wells. Medium-cost CAs would include installing an active gas collection system. High-cost CAs would include groundwater remediation.

4. There will be more shorter, less expensive CAs than longer, more expensive CAs.

5. Each CA type will have different probabilities of occurring in any one year.

6. The probability of incurring each CA type is independent of the other CA types.

7. In each year the model will determine whether a landfill must address each of the CA types based on their probabilities of occurring in that year.

8. A landfill may have to address more than one CA type in one year, but only one CA of each type in any one year.

9. The probability of each CA type occurring will vary by one or more of the following five landfill characteristics: the size of the landfill as measured by the permitted capacity in cubic yards, engineering controls, proximity to urban areas, hydrogeology, and annual rainfall.

a. The probability of low-cost corrective actions will vary by the size of the landfill, proximity to urban areas, and rainfall intensity. Exhibit 3-5 shows the assumed annual probabilities that a landfill will have a low-cost CA. the annual probabilities were developed using the following assumptions: (1) urban landfills are more likely to have low-cost corrective actions than non-urban landfills, (2) larger landfills are more likely to have low-cost corrective actions than smaller landfills, and (3) landfills receiving more rainfall are more likely to have low-cost corrective actions than landfills receiving less rainfall.

EXHIBIT 3-5
Annual Probability that a Landfill will have a Low-Cost Corrective Action

Proximity to Urban Areas and Rainfall	Permitted Capacity					
	< 0.5 M CY		0.5 M to 30 M CY		>30 M CY	
	Probability	Number	Probability	Number	Probability	Number
Urban (110 LFs)						
<=26 inches	1%	8	2%	62	3%	33
>26 <=48 inches	3%	2	4%	3	5%	1
>48 inches	5%	0	6.25%	1	6.5%	0
Not Urban (172 LFs)						
<=26 inches	0.5%	36	1%	101	1.5%	10
>26 <=48 inches	2%	7	2.5%	10	3%	0
>48 inches	3%	3	3.75%	5	4%	0

b. The probability of medium-cost corrective actions will vary by the permitted capacity, proximity to urban areas, and rainfall intensity. Exhibit 3-6 shows the assumed probabilities for the medium-cost corrective actions. The annual probabilities were developed using the following assumptions: (1) urban landfills are more likely to have medium-cost corrective actions than non-urban landfills, (2) larger landfills are more likely to have medium-cost corrective actions than smaller landfills, and (3) landfills receiving more rainfall are more likely to have medium-cost corrective actions than landfills receiving less rainfall.

c. The probability of high-cost corrective actions will vary by permitted capacity, engineering controls, and hydrogeology. Exhibits 3-7 and 3-8 show the assumed probabilities for the high-cost corrective actions for open and capped LFs, respectively. The annual probabilities were developed using the following assumptions: (1) landfills that are capped are less likely to have high-cost corrective actions than landfills without caps, (2) landfills with a greater percentage of lined areas have lower probabilities of having a high-cost corrective action than landfills with lower percentages of lined areas, (3) larger landfills are more likely to have high-cost corrective actions than smaller landfills, and (4) landfills that have groundwater at shallow depths beneath the landfill are more likely to have high-cost corrective actions than landfills with groundwater at greater depths.

EXHIBIT 3-6
Annual Probability that a Landfill will have a Medium-Cost Corrective Action

Proximity to Urban Areas and Rainfall	Permitted Capacity					
	< 0.5 M CY		0.5 M to 30 M CY		>30 M CY	
	Probability	Number	Probability	Number	Probability	Number
Urban (110 LFs)						
<=26 inches	1.5%	8	2%	62	3%	33
>26 <=48 inches	2%	2	3%	3	3.5%	1
>48 inches	4%	0	4.75%	1	5%	0
Not Urban (172 LFs)						
<=26 inches	0.5%	36	1%	101	1.25%	10
>26 <=48 inches	1%	7	1.5%	10	2%	0
>48 inches	2.5%	3	3%	5	3%	0

EXHIBIT 3-7
Annual Probability that a Landfill without a Cap will have a High-Cost Corrective Action

Engineering Controls and Hydrogeology (depth to groundwater)	Permitted Capacity					
	< 0.5 M CY		0.5 M to 30 M CY		>30 M CY	
	Probability	Number	Probability	Number	Probability	Number
0 – 50% Lined (98 LFs)						
< 50 ft	3.5%	3	4%	2	5%	0
50 – 100 ft	2%	6	3%	36	3.5%	8
> 100 ft	1.5%	11	2%	30	3%	2
50 – 99% Lined (35 LFs)						
< 50 ft	2.5%	0	3%	2	3%	1
50 – 100 ft	1%	1	1.5%	10	2%	11
> 100 ft	0.5%	1	1%	7	1.25%	2
100% Lined (17 LFs)						
< 50 ft	2%	0	2.5%	0	2.5%	0
50 – 100 ft	0.5%	0	1%	6	1.5%	7
> 100 ft	0.25%	0	0.5%	2	1%	2

EXHIBIT 3-8
Annual Probability that a Landfill with a Cap will have a High-Cost Corrective Action

Engineering Controls and Hydrogeology (depth to groundwater)	Permitted Capacity					
	< 0.5 M CY		0.5 M to 30 M CY		>30 M CY	
	Probability	Number	Probability	Number	Probability	Number
0 – 50% Lined (119 LFs)						
< 50 ft	3%	6	3.5%	8	4%	0
50 – 100 ft	1.5%	17	2.5%	46	3%	7
> 100 ft	1%	9	1.5%	26	2.5%	0
50 – 99% Lined (8 LFs)						
< 50 ft	2%	0	2.5%	3	2.75%	0
50 – 100 ft	0.5%	1	1%	2	1.5%	2
> 100 ft	0.25%	0	0.5%	0	1%	0
100% Lined (5 LFs)						
< 50 ft	0.75%	0	1%	0	1.25%	0
50 – 100 ft	0.25%	0	0.5%	2	0.75%	1
> 100 ft	0.1%	1	0.25%	0	0.5%	1

10. The corrective actions that are modeled are assumed to include corrective actions due to catastrophic events that affect a landfill. Catastrophic events include, but are not limited to, wild fires, earthquakes, tornadoes, and floods.

11. The duration of CAs is assumed to be randomly selected from the ranges provided in Exhibit 3-9. Exhibit 3-9 shows that a low-cost CA will be simulated to last from 1 to 3 years, a medium-cost CA will be simulated to last from 2 to 5 years, and a high-cost CA will be simulated to last between 20 and 35 years. A uniform distribution of durations within the ranges is assumed for low-, medium-, and high-cost CAs.

EXHIBIT 3-9
Minimum and Maximum Durations of Corrective Actions

Corrective Action Type	Minimum Duration (Years)	Maximum Duration (Years)
Low Cost	1	3
Medium Cost	2	5
High Cost	20	35

12. The costs of medium- and high-cost CAs will be simulated from statistical distributions that vary by LF size. All LFs will be treated the same for low-cost CAs. Exhibit 3-10 shows the distributions, means, and standard deviations of costs for each type of CA.

EXHIBIT 3-10
Statistical Distributions and Parameters for Estimating the Cost of Corrective Actions

Corrective Action Type	Landfill Size	Distribution	Mean Cost per Corrective Action	Standard Deviation
Low Cost	All	Normal	$200,000	$50,000
Medium Cost	Small Medium Large	Normal	$400,000 $500,000 $600,000	$40,000 $50,000 $60,000
High Cost	Small Medium Large	Normal	$2,500,000 $3,000,000 $4,000,000	$800,000 $1,000,000 $1,250,000

13. Costs of low- and medium-cost CAs will be evenly distributed throughout their durations. High-cost CAs will have their costs weighted to the first five years with the remaining years having the same annual cost; fifty percent of the total CA cost is assumed to be incurred in the first five years. Exhibit 3-7 shows the cost allocation weights for four different durations of high-cost CAs.

EXHIBIT 3-7
Cost Allocation Weights for Long Duration Corrective Actions

Duration of Corrective Action	Weight for 1st through 5th Years	Weight for Remaining Years
20	10.0%	2.8%
25	10.0%	2.2%
30	10.0%	1.8%
35	10.0%	1.5%

14. For the purposes of the fund model, 100% of estimated defaulted PCM and CA costs will be paid from the fund. The assumption that 100% of defaulted costs will be paid by the fund greatly simplifies the development of the model and eliminates many other assumptions that would have to be made about how much other funding (e.g., from financial assurance, FEMA) would be available. An unlikely but possible event such as a major waste mass slope failure could draw from the default fund even though it was not anticipated in the estimated CA costs.

The modeling period is limited to 240 years due to the constraints of the software used for the modeling, Microsoft Excel 2003. The number of years is limited by the number of columns on a single worksheet. Although more years could be modeled in Excel 2003; the complexity of the model increases significantly and its size would make the model unwieldy and hard to use. The size of the model with 240 years is expected to be around 25 MB. Modeling more years would at least double the current expected size.[17] However, modeling 240 years should be sufficient to determine the feasibility of a fund design.

Parameters that can be changed by the model user:

General Modeling and Monte Carlo Parameters

1. Start year of analysis. Default value is 2011.

2. Number of years to delay, after a landfill closes, the inclusion of PCM costs in total and defaulted costs. Default value is zero years.

3. The number of runs to use to generate the Monte Carlo results. The default value is 2000.

Landfill Characteristics

1. Year of landfill closure for each landfill. Default values are landfill specific.

2. Amount of PCM cost for each landfill. Default values are landfill specific.

3. PCM multiplier to adjust current estimates of PCM. Default value is 1.2.

4. Proximity to urban area determination for each landfill. Default values are landfill specific.

5. Annual rainfall amount for each landfill. Default values are landfill specific.

6. Operational status of each landfill. Default values are for operational status as of 2007.

7. Closure year of each landfill. Default values are landfill specific.

8. Owner type for each landfill. Default values are landfill specific.

9. Permitted capacity for each landfill. Default values are landfill specific.

[17] Postclosure maintenance could extend beyond 240 years if the waste in the landfill continues to pose a threat to human health and the environment.

10. Percent lined for each landfill. Default values are landfill specific.

11. Depth to groundwater for each landfill. Default values are landfill specific.

12. Permitted capacity size category definitions. The default values for this parameter are 0.5 million cubic yards for the division between small and medium-size landfills, and 30 million cubic yards for the division between medium and large-size landfills.

Waste Quantity Disposed Characteristics

1. Estimated tons of waste disposed in the first model year. The default value for this parameter is 42 million tons in the year 2011. The quantity of waste disposed in 2005 was approximately 42 million tons. Based on projections of the growth in waste generation and the growth in recycling and diversion, the quantity of waste disposed in 2011 is likely to be between 41 and 47 million tons. The model is somewhat sensitive to this parameter.

2. Growth rate of the amount of waste disposed in each year. The growth rate can be changed at four points in the modeled time period. For this parameter, the user enters a year that the growth rate changes and the percentage growth rate going forward starting from the year entered. Negative growth rates can be used. A limited number of additional opportunities to change the growth rate can be added to the model at the CIWMB's request. The model is moderately sensitive to this parameter.

Fund Characteristics

1. The dollars per ton of waste disposed contribution amount to the fund.

2. The fund balance reserve margin. The default value for this parameter is $15 million.

3. Fund expenses. The model provides for both a percent of fund value and a constant fund expense amount. These two can be used in combination to provide three fund expense options: (1) percent of fund value amount, (2) flat fund expense amount regardless of fund balance, and (3) a combination using a percent of fund value and a minimum expense amount that is triggered when the fund balance is low. The default values for these parameters are one percent and $50,000. The model is insensitive to these parameters.

4. Minimum and maximum fund investment interest rates. The model randomly selects a real interest rate in each year between the minimum and maximum values. To restrict the interest rate to a single value, make the minimum and maximum values equal. The default values for these parameters are 1.5% and 3.5%. The model is moderately sensitive to the fund interest rate parameter.

5. Fund balance at which contributions would be suspended. To include fund contributions in each year regardless of the fund balance, set this value very high, such as to $1,000,000,000. The default value for this parameter is $50 million. The model is moderately sensitive to this parameter.

6. Fund balance at which contributions would resume after being suspended. The default value for this parameter is $45 million.

Corrective Action Parameters

1. The annual probability of corrective actions each landfill will have during the study period. See Exhibits 3-5 through 3-8 above for the assumed default probabilities.

2. The minimum and maximum duration in years for each type of CA. See Exhibit 3-9 above for the assumed default values.

3. Distribution parameters, such as the mean and standard deviation, for the cost of each type of CA. See Exhibit 3-10 above for the assumed default values.

Parameters to Determine How Many Landfills Default on Their Corrective Action and PCM Obligations

1. Annual default probability for single landfill owners, private and public owners of multiple landfills, the catastrophic event probability, and a default probability multiplier for when a landfill has a high-cost corrective action. See Section 3.3.3.3 below for default values and rationales.

2. Duration of defaults. The default value for this parameter is five years.

3. Percent of defaults that are permanent. The default value for this parameter is one percent.

Additional Parameters that could be Included in the Fund Model, but are Not Currently Included

1. A lump sum contribution amount, where different amounts could be assigned to landfills with different characteristics, such as landfill size or operational status.

2. Allowing for different fund contribution amounts in different years. For example, a high initial fund contribution amount might be used to quickly get the fund to a desired balance, and then a lower contribution amount might be used after that or if the fund balance falls below a threshold and contributions had been suspended.

3.3.2 Data Used in the Working Model

This section provides details about data used in the model and how ICF resolved data gaps and data inconsistencies in the description of the universe of 282 landfills which are included in this analysis of the fund working model. The fund working model was designed to simulate PCM and CA occurrence, as well as associated costs and performance default rates, based on parameters that depend on landfill-specific characteristics, such as social setting (proximity to urban areas), permitted capacity, final cover status, annual rainfall, and liner status. This section lists instances where data on these landfall characteristics are either missing or of questionable quality for the landfills in the selected universe.

Data Sources. Data were used preferentially in the order of the sources presented below:

(i) The Solid Waste Information System (SWIS) database from the CIWMB website (http://www.ciwmb.ca.gov/swis/) provided data on disposal areas, disposal volumes, daily throughputs, remaining capacities, closure dates, and owner names. These data are referred to as the SWIS database in this report.

(ii) Data made available by CIWMB staff including estimates of PCM and CA costs for the entire universe of 282 landfills.

(iii) A Microsoft Access database derived from the Landfill Compliance Study (LCS)[18] provided data on landfill names, operational status, construction date, social setting, physical setting, geologic materials, depth to groundwater, annual rainfall, owner type, cover type, liner type, fill method, site monitoring status, and surrounding land use. This data will be referred to as the LCS database in this report.

Data Gaps. Of the universe of 282 landfills, 56 LFs were entirely or substantially missing data on the following characteristics:

(i) Social Setting
(ii) Owner Type
(iii) Annual Rainfall
(iv) Permitted capacity

Of the 225 LCS LFs, some LFs are missing data for certain fields:

(i) Capacity either missing or reported zero for 10
(ii) Annual Rainfall missing for 1
(iii) Closure Date missing for 3

[18] GeoSyntec Consultants, Inc., *Landfill Facility Compliance Study* (August 2004).

Potential Data Inconsistencies. Of the 225 LCS LFs, 3 report closure dates of the year 2150 or later.

Multiple Data Sources and Unit-Level Resolution. For some data fields, more than one data source was available. In such cases, ICF used the data source hierarchy as presented above. For instance, data related to landfill size -- such as landfill volume, area, throughput, and remaining capacity -- were available from both the LCS database and the SWIS database. ICF preferred the SWIS data where available because these data are more recently updated. If SWIS data on these parameters were not available, ICF used LCS data as a second preference. SWIS data on the operational status of landfills were also preferred over LCS data.

An additional issue is that some data fields in the source databases are described at the disposal unit level rather than at the landfill level. Certain landfills have more than one disposal unit, each of which receives different types of waste or has distinct acreages and volumes. For several data fields, ICF used already available aggregated data from the LCS database to represent the landfill as a whole. In these aggregated data, the total landfill volume, for instance, is presumably the sum of the volumes of the disposal units within the landfill. ICF did not recheck the aggregation method used in the LCS database. It is possible that some of the data inconsistencies and data gaps described above are the result of improper aggregation of data described at the disposal unit level.

The SWIS database also provided data at the disposal unit level but did not contain readily available aggregated data to represent landfills as a whole. For these data fields -- such as volume, area, throughput, and remaining capacity -- ICF aggregated the data by summing across disposal units. In the case of closure date, ICF applied an algorithm which reported the farthest closing date among the disposal units of a landfill. The operational status of a landfill was derived from the operational status of the disposal units constituting that landfill; if even a single disposal unit was active, the entire landfill was considered active. If no disposal units were active and none were planned, the entire landfill was considered closed.

Methods Adopted for Closing Data Gaps. The data gaps and inconsistencies described in above were addressed as follows:

- For the 56 landfills with substantial data gaps, a combination of statistical averaging and extrapolation based on random sampling was used to close data gaps. The extrapolation methods were based on observed statistical trends in the data.

  (i) Missing social setting data were randomly assigned, while ensuring that the same ratio of urban, rural, and suburban sites was maintained as in the LCS database.
  (ii) Missing owner type data were randomly assigned, while ensuring that the same ratio of private and publicly owned sites was maintained as in the LCS database for landfills located in the same social setting.
  (iii) Missing annual rainfall data were estimated as the average of the annual rainfall for landfills of the same social setting from the LCS database.

(iv) Missing landfill capacity data were estimated as the average of the landfill capacities for landfills of the same social setting and owner type from the LCS database.
(v) For three 3 LFs lacking closure year data, the average closure year of the LCS database was used.

- For the 225 LCS LFs, statistical averages from like groups were used to fill the limited data gaps.

  (i) The average capacity for landfills of the same social setting and owner type was used for the 10 landfills for which capacity was either missing or reported zero.
  (ii) The average annual rainfall for landfills of the same social setting was used for the 1 landfill missing annual rainfall data
  (iii) The average landfill lifetime for landfills of the same social setting and owner type was used to estimate closure dates from construction dates for the 3 landfills missing closure date data.

- For the limited data inconsistencies relating to closure dates, manual rechecking of the source data was undertaken to ensure that data had been appropriately aggregated across multiple units in the LCS database. For two cases where errors were detected, the appropriate dates were entered. In three other cases, potentially erroneous date fields were replaced by average values. No substitutions were effected for three LFs with extended (and potentially erroneous) closure dates. It is not expected that these data, even if erroneous, will substantially affect model results. Also, a few landfill capacity values are unusually low and are potentially erroneous. No action was taken in these cases for the same reason.

3.3.3 Key Modules

The key modules of the working model include the elements that simulate demands on the state fund. Because the fund is to cover defaults of PCM and/or CA, the key modules address how the model simulates defaults and how the model simulates the occurrence of PCM and/or CA and their costs. This section is organized as follows:

3.3.3.1 How ICF Simulated Postclosure Maintenance
3.3.3.2 How ICF Simulated Corrective Actions
3.3.3.3 How ICF Simulated Defaults

3.3.3.1 How ICF Simulated Postclosure Maintenance

In order to simulate PCM in the working model, ICF addressed two issues:

(1) estimating closure dates for operating LFs, and
(2) estimating annual costs of PCM

Estimating Closure Dates for Active Landfills. ICF primarily drew on SWIS data for this information. As discussed in Section 3.3.2, there were only a few gaps in the data sources.

Estimating Annual Costs of PCM. ICF started with the reported 30-year PCM cost estimates, and divided the PCM cost estimates by 30 to obtain annual PCM costs. Although this method will result in annual PCM costs that are equal in each year, ICF does not believe that this simplifying assumption will have a material impact on the results of the model. Note that the model does not define the end of the PCM period.

ICF understands that the regulations for developing PCM cost estimates are under review and are expected to change. ICF believes that those changes may cause current cost estimates to increase by 20% or more. Thus ICF proposes to multiply the existing PCM cost estimates by a factor of 1.2.

As the CIWMB has recognized, a preliminary PCM cost estimate often is calculated many years in advance of closure and often changes significantly prior to preparing the final PCM plan.[19] Moreover, the preliminary PCM plan must include only a lump sum estimate of PCM costs while the final PCM plan must include a detailed estimate of PCM costs, including costs of (1) site security, (2) cover maintenance and repair, (3) maintenance of vegetation and irrigation system, (4) landfill gas monitoring and control systems, and (5) drainage and erosion control systems. (§21840) In ICF's experience, both preparation and review of cost estimates is facilitated by having detailed estimates that break out costs by type of activity, by labor vs. parts/equipment, and so on. Thus, ICF anticipates that PCM cost estimates based on preliminary PCM plans will be subject to significant changes, including possibly substantial increases. The final PCM plan is submitted two years prior to the anticipated date of closure. The PCM cost estimate data provided by the CIWMB staff did not distinguish between costs based on a preliminary or a final PCM plan.

3.3.3.2 How ICF Simulated Corrective Actions

This section describes how the working model simulates CAs – their frequency, their timing and duration, and their costs. The model incorporates the primary proxy factors described in Chapter 5.

Modeling the Frequency of Corrective Actions in Fund Working Model. At any time a landfill may have to address one or more CAs under the jurisdiction of either the RWQCB or CIWMB. ICF designed the model to simulate the CAs a landfill will have to address during the modeling period. Key questions for modeling the frequency of CAs include the following:

(1) Should the number of CAs a landfill must address during the modeling period be based on landfill characteristics or should the same number be assigned to all landfills?

[19] See CIWMB, *Final Statement of Reasons* (April 9, 1997).

(2) Should the number of CAs a landfill must address during the modeling period be based on a statistical distribution or an average number assigned?

(3) Which landfill characteristics are most likely associated with the number of CAs a landfill may have to address?

(4) Are all CAs created equal, or are some types of CAs more likely than others?

(5) What is a reasonable range for the number of CAs a landfill may have to address during the modeling period?

(6) What annual probabilities of having a CA yield the average number of CAs in question 5?

1. Should the Model Use Landfill Characteristics or Assign a Uniform Number of Corrective Actions

ICF considered two ways that the number of CAs can be simulated for each landfill in the working model. The first is assigning a number of CAs to each landfill, and the second is using landfill characteristics to determine the number.

Advantages and disadvantages of assigning a number of CAs to each landfill:

+ This method is very easy to implement, verify, and change.

– This method is not very realistic as each landfill is unique, when major landfill characteristics are considered.[20]

Advantages and disadvantages of using landfill characteristics to simulate the number of CAs for each landfill:

+ This method is more realistic as each landfill is unique when major landfill characteristics are considered.

+ Certain landfill characteristics may indicate a higher likelihood of having CAs.

+ This method can better capture the variability inherent in the occurrence of CAs. All landfills are not designed, built, located, or operated in the same way. Thus there are inherent differences among landfills.

[20] Major characteristics include: Seismic Characteristics; Rainfall Intensity; Floodplain; Fire (intrusion from off site); Engineering Controls; Permitted Capacity; Type of Waste in Place; Slope Stability; Liquids management/ landfill bioreactor technology; Hydrogeology; Proximity to Urban Areas; Proximity to Sensitive Habitat; and, Compliance Status.

– The relationships between landfill characteristics and probability of a CA are not well documented and are likely to be controversial. At best, whether a characteristic is positively or negatively correlated to the occurrence of a CA, and the relative magnitude of the characteristic may be all that is known. For example, if size (permitted capacity) is determined to be a good indicator of potential for CAs, then we may know that large landfills likely have more CAs than small landfills, but we may not know whether a large landfill has two, three, or four times as many CAs as a small landfill.

– Professional judgment would be required to estimate the probabilities of CAs associated with landfill characteristics.

For purposes of the working fund model, ICF used landfill characteristics to simulate the number of CAs so that the model better reflects the variability of landfills and thus will provide a more robust evaluation of a given fund design.

2. Should the Number of Corrective Actions be Based on Statistical Distributions or be Assigned?

The number of CAs a landfill is likely to incur over the modeling period is highly uncertain. The model reflects this uncertainty by allowing the number of CAs to vary in some way. ICF considered two methods to model the uncertain nature of the occurrence of CAs. The first method uses a fixed number of CAs associated with different landfill characteristics; the model would employ lookup tables to determine the number of CAs for each individual landfill, depending on its characteristics. The second method simulates the number of CAs from a statistical distribution, which could use one of two alternatives. The first alternative would draw from a distribution to determine the total number of CAs a landfill would be simulated to address during the modeling period. The second alternative would determine, based on a probability of incurring a CA in each year, whether a landfill would have to address a CA in a specific year. The total number of CAs for a landfill would be the sum of the CAs incurred over the modeling time horizon.

Advantages and disadvantages for using deterministic tables of the number of CAs:

+ This method is easy to implement and to understand.

+ The numbers of CAs would be easy to change.

– How the number of CAs might be affected by different landfill characteristics is not well documented and is likely to be controversial.

– A deterministic approach using look-up tables may not fully capture the variability and uncertainty in the number of CAs a landfill might have to address. A large table of landfill characteristics and CAs would be required to capture most of the variability.

Advantages and disadvantages for using statistical distributions to determine the number of CAs:

+ This method is relatively easy to implement in the model.

+ The distribution parameters could be easily modified to adjust the number of CAs.

+ This method captures the inherent uncertainty in the number of CAs a landfill may have to address.

– The appropriate distribution and distribution parameters (such as mean and standard deviation) are not well documented and could be controversial.

– How the distribution might be affected by different landfill characteristics is not well documented and could be controversial.

– This method separates modeling the number of CAs from modeling when the CAs might occur.

Advantages and disadvantages for using annual probabilities to determine whether a CA occurs in any one year:

+ This method is relatively easy to implement in the model.

+ The probabilities could be easily modified.

+ This method captures the inherent uncertainty in the number of CAs a landfill may have to address.

+ This method combines the frequency of a CA with the timing, or start year, of a CA.

– The probability of a CA occurring in any one year is not well documented and could be controversial.

– How the probability of a CA might be affected by different landfill characteristics is not well documented and could be controversial.

– The percentages used would have to be calibrated with the assumed number of CAs over the modeling period to ensure the model generates the assumed number of CAs.

For purposes of the working fund model, ICF used the method of using probabilities to simulate whether a landfill incurs a CA in each year, and basing these probabilities on landfill characteristics. Using probabilities better reflects the uncertain and random nature of the occurrence of CAs and thus will provide greater variability of CA costs against which a modeled fund design can be tested, meaning a more robust evaluation. Linking the occurrence and timing

of CA also simplifies model development by using the same method to determine both the timing and occurrence of CAs, thus reducing the number of inputs and calculations.

3. Which Landfill Characteristics are Most Likely to be Associated with the Number of Corrective Actions?

Landfill characteristics that may be correlated with the number of CAs include: proximity to urban areas, permitted capacity (size), engineering controls, rainfall intensity, and hydrogeology:

- Proximity to Urban Areas: An urban landfill will have more people within a mile radius than a rural landfill. Proximity to more human receptors means a greater chance that people will be impacted or concerned. Proximity to human receptors might indicate greater scrutiny by regulators and thus higher likelihood that a CA will be identified.

- Permitted Capacity (Size): Larger landfills may be more complex, which means more can go wrong. Due to sheer size, larger landfills have more opportunities for breaches in liners or cover materials. Larger landfills may also be better run and more likely to be lined.

- Engineering Controls: Whether a landfill is lined or unlined and capped or not is expected to be correlated with the need for CAs to prevent or mitigate threats.

- Rainfall Intensity: More rainfall can create more leachate and gas generation, which are positively correlated with more CAs. In addition, high rainfall intensity is more likely to cause cover erosion and failure of drainage systems.

- Hydrogeology (Depth to Groundwater[21]): The closer groundwater is to the base of the landfill, the less distance leachate and landfill gas must travel to reach the water table. Therefore all other characteristics being equal, groundwater contamination is more likely to occur with a shallow water table. While a shallow groundwater table may indicate the number of groundwater CAs, shallow groundwater is more indicative of high-cost CAs due to the cost of groundwater cleanups compared to other CAs at landfills.

For purposes of the working model, ICF used these characteristics (proximity to urban areas, permitted capacity (size), engineering controls, rainfall intensity, and hydrogeology) to simulate the number of CAs. Specifically, low- and medium-cost CAs use proximity to urban areas, permitted capacity, and rainfall intensity; and high-cost CAs use permitted capacity, engineering controls, and hydrogeology. Due to limitations on available data, ICF used annual rainfall as a proxy for rainfall intensity, and, for engineering controls, ICF used percent lined and the presence of a final landfill cap.

[21] As presented in Chapter 5, depth to groundwater is used as the quantitative measure of hydrogeology.

4. Are All Corrective Actions Equally Likely?

Smaller, less costly, CAs are assumed to be more likely than larger, more costly CAs. Larger, more costly CAs include groundwater remediation or replacing large areas of cover. Although a large landfill may have more than one groundwater remediation project during its lifetime, it is likely to have fewer of these types of CAs than lower cost ones such as installing additional groundwater monitoring wells or repairing sections of cover vegetation. ICF modeled three types of CAs: low-cost, medium-cost, and high-cost: low-cost CAs include installing additional groundwater monitoring or extraction wells, medium-cost CAs include installing an active gas collection system, and high-cost CAs include groundwater remediation.

5. How Many Corrective Actions are Reasonable?

The minimum, maximum, and average number of CAs that a landfill might incur over the full 240-year modeling period is unknown and no documentation has been found that substantiates the probability of incurring a CA. Projections of the average number of CAs are based on ICF's and the CIWMB staff's best professional judgment at this time. Exhibit 3-12 shows the average number of CAs a single landfill is expected to incur over the modeling period. ICF calibrated the probabilities of the occurrence of a CA in any one year so that the average total number of CAs is equal to the values in Exhibit 3-12. Although one might expect small and large landfills to have approximately the same number of CAs, a disproportionately large number of small landfills is located in desert areas; these areas with low rainfall and deep groundwater tables are less likely to have CAs related to water quality, thereby decreasing the average number of this type of CA compared to larger size LFs.

EXHIBIT 3-12
Average Number of Corrective Actions by Type and Landfill Size
Over the Modeling Period for a Single Landfill

Corrective Action Type	Landfill Size		
	Small LF	Medium LF	Large LF
Low Cost	10	13	15
Medium Cost	5	8	10
High Cost	2	3	4
Total	17	24	29

6. What Annual Probabilities of Having a Corrective Action Yield the Average Number of Corrective Actions in Exhibit 3-12?

Exhibits 3-13, 3-14, 3-15, and 3-16 show the annual probabilities for incurring each type of CA for the chosen landfill characteristics. ICF used the five landfill characteristics identified under Task 6 as dominant.

EXHIBIT 3-13
Annual Probability that a Landfill will have a Low-Cost Corrective Action

Proximity to Urban Areas and Rainfall	Annual Probabilities of a Corrective Action by Permitted Capacity		
	< 0.5 M CY	0.5 M to 30 M CY	>30 M CY
Urban			
<=26 inches	5.5%	6.0%	6.5%
>26 <=48 inches	6.0%	7.0%	7.5%
>48 inches	7.0%	8.0%	8.5%
Not Urban			
<=26 inches	3.75%	4.75%	5.0%
>26 <=48 inches	4.5%	5.5%	6.0%
>48 inches	5.0%	6.0%	7.0%

EXHIBIT 3-14
Annual Probability that a Landfill will have a Medium-Cost Corrective Action

Proximity to Urban Areas and Rainfall	Annual Probabilities of a Corrective Action by Permitted Capacity		
	< 0.5 M CY	0.5 M to 30 M CY	>30 M CY
Urban			
<=26 inches	3.0%	4.0%	4.5%
>26 <=48 inches	4.0%	5.0%	5.5%
>48 inches	5.0%	6.0%	6.5%
Not Urban			
<=26 inches	1.5%	2.75%	3.0%
>26 <=48 inches	2.5%	3.5%	4.0%
>48 inches	3.0%	4.0%	5.0%

EXHIBIT 3-15
Annual Probability that a Landfill without a Cap will have a High-Cost Corrective Action

Engineering Controls and Hydrogeology (depth to groundwater)	Annual Probabilities of a Corrective Action by Permitted Capacity		
	< 0.5 M CY	0.5 M to 30 M CY	>30 M CY
0 – 50% Lined			
< 50 ft	2.5%	3.0%	4.0%
50 – 100 ft	2.0%	2.5%	3.25%
> 100 ft	1.0%	1.5%	3.0%
50 – 99% Lined			
< 50 ft	1.5%	2.5%	2.75%
50 – 100 ft	0.75%	1.25%	1.75%
> 100 ft	0.25%	1.0%	1.25%
100% Lined			
< 50 ft	1.0%	2.0%	2.5%
50 – 100 ft	0.5%	1.0%	1.5%
> 100 ft	0.1%	0.5%	1.0%

EXHIBIT 3-16
Annual Probability that a Landfill with a Cap will have a High-Cost Corrective Action

Engineering Controls and Hydrogeology (depth to groundwater)	Annual Probabilities of a Corrective Action by Permitted Capacity		
	< 0.5 M CY	**0.5 M to 30 M CY**	**>30 M CY**
0 – 50% Lined			
< 50 ft	1.5%	2.5%	3.0%
50 – 100 ft	0.75%	1.5%	2.5%
> 100 ft	0.25%	1.0%	2.0%
50 – 99% Lined			
< 50 ft	1.0%	2.0%	2.5%
50 – 100 ft	0.5%	1.0%	1.5%
> 100 ft	0.1%	0.5%	1.0%
100% Lined			
< 50 ft	0.75%	1.0%	1.25%
50 – 100 ft	0.25%	0.5%	0.75%
> 100 ft	0.05%	0.1%	0.5%

Modeling the Timing and Duration of Corrective Actions in Fund Working Model. ICF designed the model to simulate when a CA starts at a landfill and the duration of the CA. Key questions for modeling the timing of CAs include the following:

(1) Are there deterministic ways of modeling the year a CA may occur?

(2) Should the model treat CAs as random and unpredictable?

(3) If deterministic ways of modeling CA start years are available, should both deterministic and statistical methods be used?

Key questions for modeling the duration of CAs include the following:

(1) How should the model determine the duration of CAs? Deterministically or based on a statistical distribution?

(2) What are reasonable ranges for the duration of each type of CA?

1. Are There Deterministic Ways of Identifying the Corrective Action Start Years?

The heart of this question is whether there are certain activities, operational modes, or operating techniques for which a CA typically is required after a given time period. For example, after closing a landfill, are there CAs that typically occur after five or ten years? Do some CAs occur with some predictable regularity that should be modeled? As ICF found no empirical evidence to support deterministic approaches to timing of CAs, this approach was not used in the fund model.

2. Should the Model Treat Corrective Actions as Random and Unpredictable?

If CAs occur with little or no correlation with operational factors, then the timing of the CAs can be modeled using statistical distributions to randomly assign a start year. ICF evaluated two methods for randomly generating the start year of a CA. The first method uses year ranges to spread CAs out over the life of the landfill. Under this method, the year ranges are specified, and then each CA start year is randomly selected from within the year range. To allow for the possibility of CAs occurring simultaneously at a single landfill, the year ranges would overlap. For example, the year ranges might be 2008 to 2038; 2023 to 2053; 2038 to 2068; 2053 to 2083; etc…. To ensure that landfills with differing numbers of CAs have their CAs spread out over the full modeling time horizon, different year ranges would have to be used for landfills with different numbers of CAs. Otherwise, for example, if fixed and identical year ranges were used for all landfills and a maximum of ten CAs is assumed, then a landfill with only three CAs would have all of those corrective actions occur in the first third of the model time horizon.

The second method assumes that a CA may occur in any year and that there is a probability of the CA occurring in each year. Thus in each year for each landfill, the model would simulate if a CA starts in that year. Using this method, both the timing of CAs and the occurrence or frequency of CAs are handled in the same way, which helps to simplify the model. This method would use the same probabilities to determine both the occurrence and timing of CAs; thus, the probabilities would be based on selected landfill characteristics.

Advantages and disadvantages of using statistical distributions under the first method to simulate CA timing:

+ The probability of a CA could change over time to reflect different probabilities of CAs at different stages in a landfill's life.

+ This method may tend to spread the timing of CAs out more than other methods.

– The overlap period between year ranges would have to be decided and could be controversial.

Advantages and disadvantages of using statistical distributions under the second method to simulate CA timing:

+ The probability of a CA could change over time to reflect different probabilities of CAs at different stages in a landfill's life.

+ This method could include a mechanism to account for the recent history of CAs so that landfills that have incurred a CA in the recent past would be less likely to incur another of the same type of CA for a few years. Adding this feature may slow down the time to re-calculate the spreadsheet and thus lengthen the time to generate the Monte Carlo results.

+ This method is likely to predict a realistic timing schedule of CAs.

– Expert judgment will be needed to determine the probability of CAs.

For purposes of the working model, ICF selected the second method so that the occurrence and timing of CAs are handled in the same way and so that a realistic timing of CAs is achieved. ICF also decided not to adjust the annual probability shortly after a CA is incurred as this unnecessarily complicates the model without clear benefit to the results.

3. Should Both Deterministic and Statistical Methods be Used for Different Types of Corrective Actions?

If deterministic methods are available for some types of CAs, how should other CAs be modeled? ICF decided that if some CA start years can be determined based on landfill characteristics or operational milestones, the remainder of the CAs should be modeled using method two described above.

4. Should CA Duration be Simulated Deterministically or Based on a Statistical Distribution?

The model could deterministically assign durations to each CA. Using this method, each type of CA would be assigned the same duration. Alternatively, the model could randomly select a duration from an appropriate statistical distribution. By randomly sampling from a statistical distribution, the model would more accurately reflect the variability inherent in the duration of CAs. From the standpoint of model results and conclusions to be drawn from the results, it is unclear to ICF whether there would be a significant difference between the two methods.

Advantages and disadvantages of using deterministic methods of setting CA duration:

+ Easiest to implement in the model and easy to change duration input values.

– Does not capture the expected variability of CA durations.

Advantages and disadvantages of using statistical distributions to determine CA durations:

+ Fairly easy to implement in the model and easy to change duration input values.

+ Consistent with using statistical distributions for determining other aspects of modeling CAs.

+ Would capture the expected variability of CA durations.

– Somewhat more complex to implement.

– The distributions would have to be determined and could be controversial.

Due to the narrow interval of durations for low- and medium-cost CAs and the fact that the model will use whole year durations, ICF recommended that the durations for these CAs be randomly selected from a uniform distribution. For high-cost CAs, there is scant information on the required duration of pump and treat groundwater remediation systems, although 30 years is a typical default value. Because there is little empirical data with which to develop a distribution, ICF recommended that the durations for high-cost CAs be randomly selected from a uniform distribution.

5. What are Reasonable Ranges for the Duration of Each Type of Corrective Action?

ICF designed the model with three types of CAs: low-, medium-, and high-cost CAs: low-cost corrective actions include installing additional groundwater monitoring and/or extraction wells, medium-cost corrective actions include installing an active gas collection system, and high-cost corrective actions include groundwater remediation. Given the specific activities defining each of these types of CA, ICF recommended that the duration of the CAs in the model be positively correlated with the costs.

Exhibit 3-17 shows recommended durations for each type of CA used in the model. The durations are based on professional judgment and not empirical evidence. Suggestions and rationales for adjusting these bounds are welcome.

EXHIBIT 3-17
Proposed Minimum and Maximum Durations of Corrective Actions

Corrective Action Type	Minimum Duration in Years	Maximum Duration in Years
Low Cost	1	3
Medium Cost	2	5
High Cost	20	35

Modeling the Costs of Corrective Actions in Fund Working Model. This section focuses on different ways the model can estimate the cost of a CA. Key questions for modeling the costs of CAs include the following:

(1) Can landfill characteristics be used to simulate the costs of CAs?

(2) Should CA costs be assigned deterministically or based on statistical distributions?

(3) What are reasonable ranges for the costs of each type of CA?

(4) How should the costs be distributed throughout the duration of the CA?

1. Can Landfill Characteristics be Used to Simulate the Costs of Corrective Actions?

The drivers of CA costs are landfill characteristics, such as those developed under Task 6 and described in Chapter 5. ICF drew from the list of landfill characteristics developed under Task 6 to categorize CA probabilities. In addition, ICF designed the model to estimate the costs of CAs based on the landfill characteristic of size for the medium- and high-cost CAs, because the costs of these types of CAs are affected by the size of a landfill. For example, one medium-cost CA could be the installation of a gas collection system, the cost of which is directly related to the size of the landfill. For low-cost CAs, the model treats all landfills the same with respect to the cost of these CAs; the size of the landfill is expected to be a factor in the number of low-cost CAs, but not a significant factor in their cost.

2. Should Corrective Action Costs be Assigned Deterministically or Based on Statistical Distributions?

CA costs are expected to be highly variable, even within the three types of CAs to be modeled. The cost of a CA could be assigned deterministically, by using look up tables, or stochastically, by basing the cost on a statistical distribution. Look up tables can contain different cost estimates for each of the three CA types modeled. The look up tables also could have different costs based on the size of the landfill and/or duration of the CA. CA costs based on statistical distributions would have different distribution parameters for each type of CA.

Advantages and disadvantages of deterministically assigning CA costs:

+ This method would be easy to implement.

+ The costs incurred for each CA type would be easy to change.

– This method is not very realistic and does not capture the variability inherent in CA costs.

– The relationship of the cost estimates to landfill size and CA duration are uncertain and likely to be controversial.

Advantages and disadvantages of stochastically determining CA costs:

+ This method would be easy to implement.

+ The mean and standard deviation of the distribution for determining CA costs for each type of CA would be easy to change.

+ This method is more realistic because it better captures the inherent variability of CA costs.

+ Using stochastic methods to determine CA costs is consistent with how the model simulates the frequency, timing, and duration of CAs.

– The relationship of the cost estimates to landfill size and CA duration are uncertain and likely to be controversial.

For purposes of the working model, ICF recommended that the model determine CA costs using statistical distributions to better simulate the variability of costs that may be incurred by different landfills.

3. What are Reasonable Ranges for the Costs of Each Type of Corrective Action?

Using either deterministic or stochastic methods, the costs of each type of CA must be characterized. If deterministic methods are used, a cost for each type of CA and each duration must be specified. Exhibit 3-18 shows an example of this method. Cost values are included in this table only for the durations described in Exhibit 3-17.

EXHIBIT 3-18
Example Look Up Table – Cost of Corrective Actions

Corrective Action Type	Cost of Corrective Actions by Duration in Years ($000s)								
	1	**2**	**3**	**4**	**5**	**20**	**25**	**30**	**35**
Low Cost	150	200	300						
Medium Cost		400	500	600	800				
High Cost						3,000	3,500	4,000	4,500

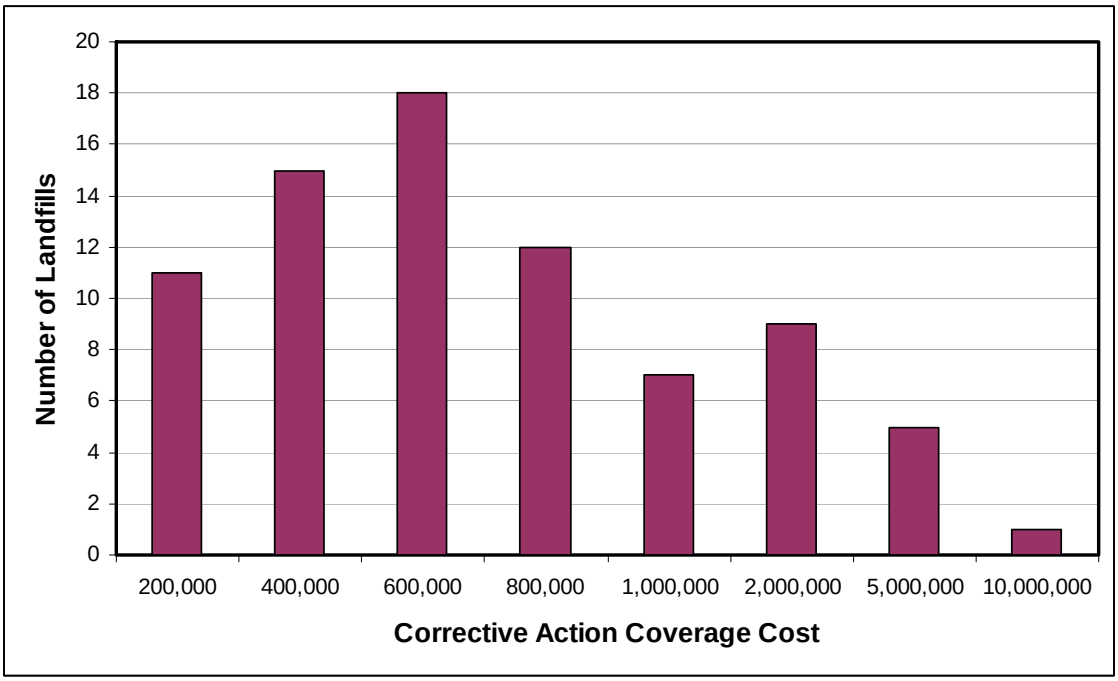
If stochastic methods are used, the distribution, mean, and standard deviation must be specified. Exhibit 3-19 shows an example of distributions, means, and standard deviations for each type of CA.

EXHIBIT 3-19
Example Statistical Distributions and Parameters for Estimating the Cost of Corrective Actions

Corrective Action Type	Landfill Size	Distribution	Mean Cost ($000s)	Standard Deviation of Cost ($000s)
Low Cost	All	Normal	$200	$50
Medium Cost	Small Medium Large	Normal	$400 $500 $600	$40 $50 $60
High Cost	Small Medium Large	Normal	$2,500 $3,000 $4,000	$800 $1,000 $1,250

The costs used in Exhibits 3-18 through 3-27 were developed from analyzing the range of costs currently reported for CA coverage by 78 permitted landfills[22] and considering the CA cost estimates used in the *MMSW Landfill Liability Report*.[23] The CA costs used in the model are all in current dollars and thus are not inflated nor discounted. The CA coverage costs reported by the 78 landfills are presented in Exhibit 3-20, which shows that 63 of the 78 cost estimates are at or below $1,000,000. Exhibit 3-20 also shows that six cost estimates are above $2,000,000 including one as high as $10,000,000.

EXHIBIT 3-20
Corrective Action Cost Estimates Reported by Landfills in the Study



Exhibits 3-21 through 3-27 show the range of costs that would be used if the distributions in Exhibit 3-19 are used. The vertical lines nearer the peak of each graph indicate one standard deviation from the mean. The vertical lines nearer the tails of each graph indicate two standard

[22] 78 of the 282 landfills have CA cost estimates on file with the Financial Assurance Unit of the Waste Board.

[23] The *MMSW Landfill Liability Report, Methods to Address Landfill Liabilities at Mixed Municipal Solid Waste Landfills* is a 1998 report evaluating landfill liabilities in Minnesota. Page 33 of the report contains a summary of the corrective action costs used: $3,000,000 for the installation and operation of a groundwater pump and treat system, $1,500,000 for the installation and operation of an active gas collection system, and $200,000 for augmenting the cover.

EXHIBIT 3-21
Distribution of Cost Estimates for Low-Cost Corrective Actions

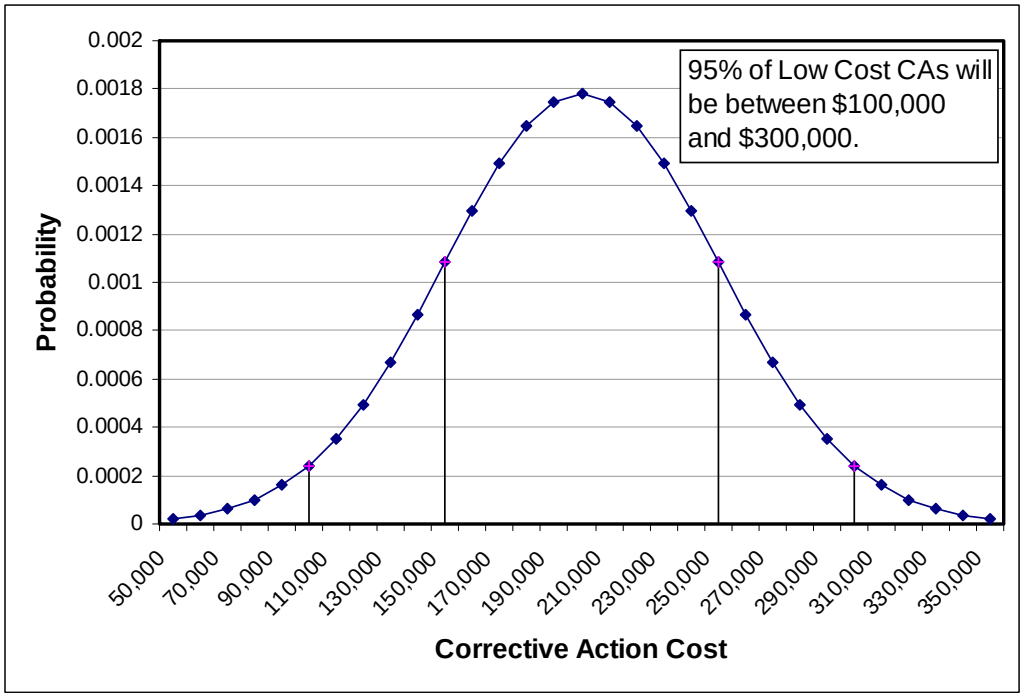


EXHIBIT 3-22
Distribution of Cost Estimates for Medium-Cost Corrective Actions for Small Landfills

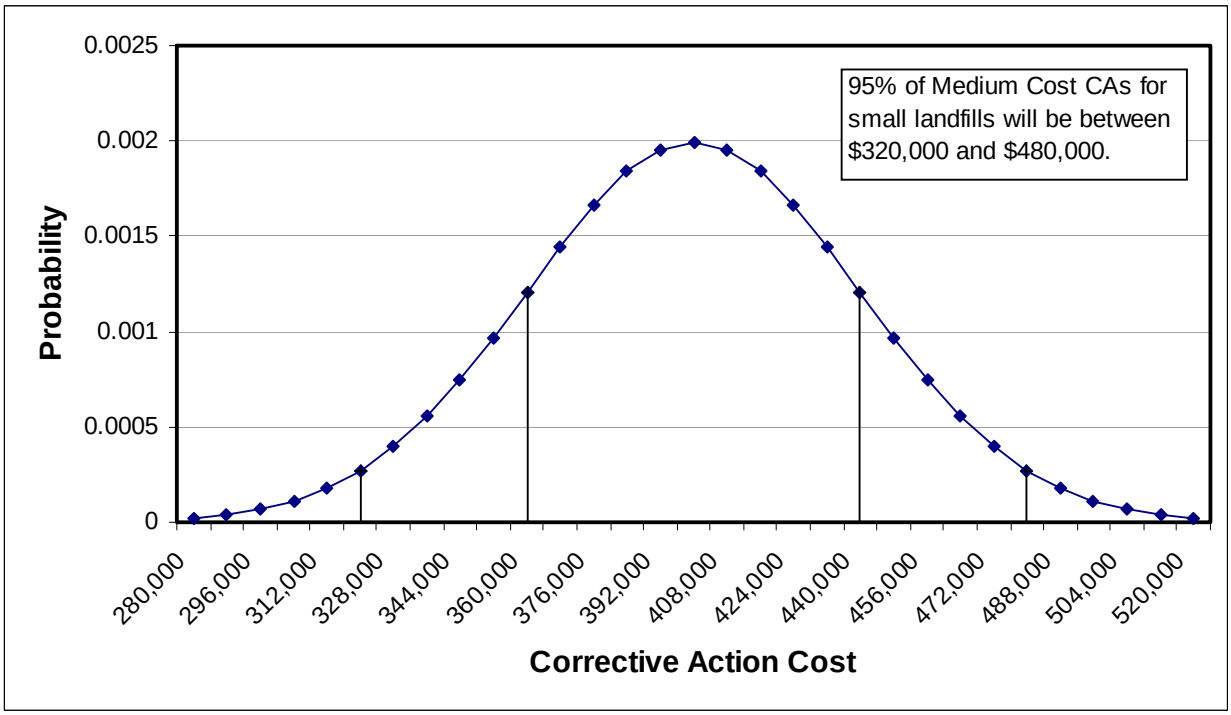


EXHIBIT 3-23
Distribution of Cost Estimates for Medium-Cost Corrective Actions for Medium-Sized Landfills

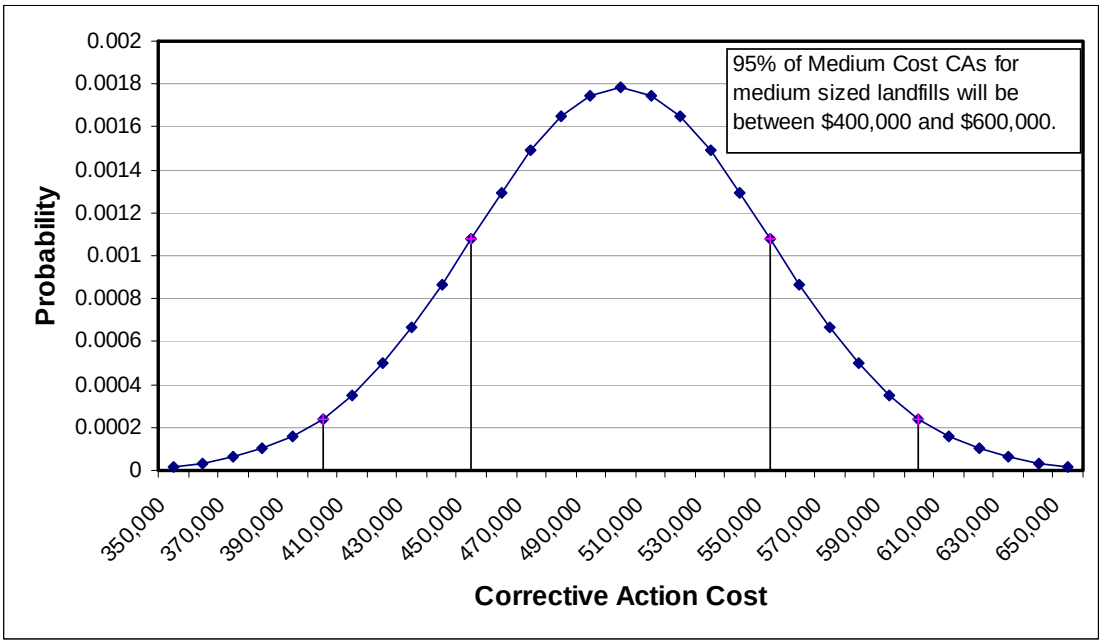


EXHIBIT 3-24
Distribution of Cost Estimates for Medium-Cost Corrective Actions for Large Landfills

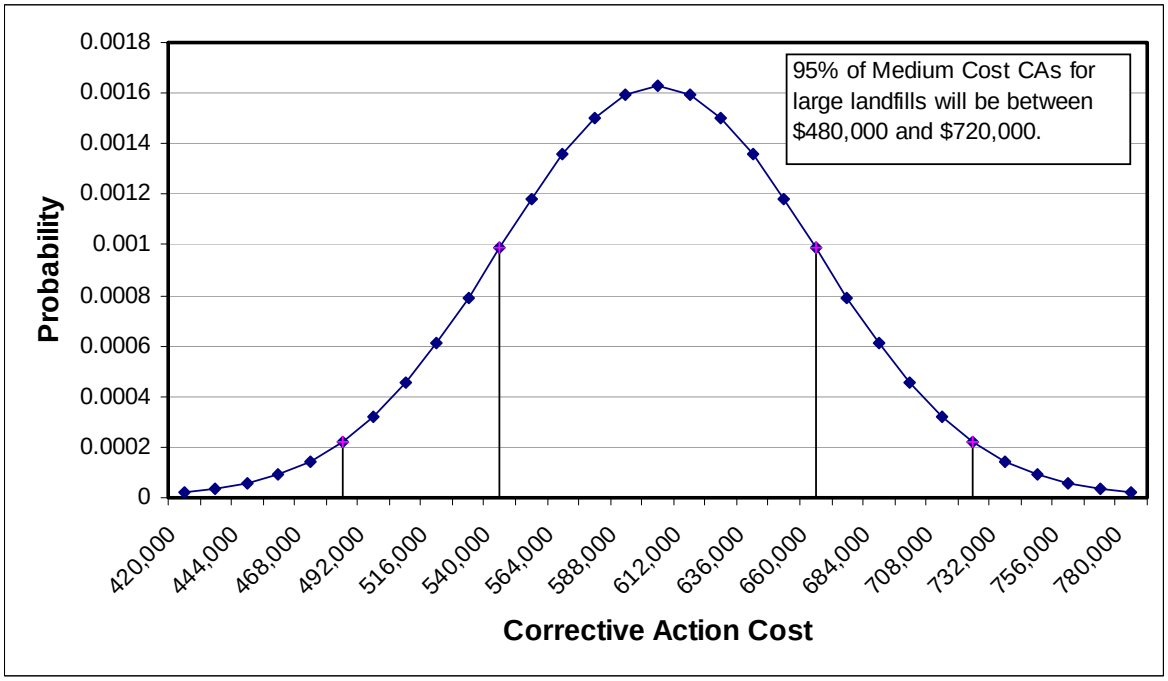


EXHIBIT 3-25
Distribution of Cost Estimates for High-Cost Corrective Actions for Small Landfills

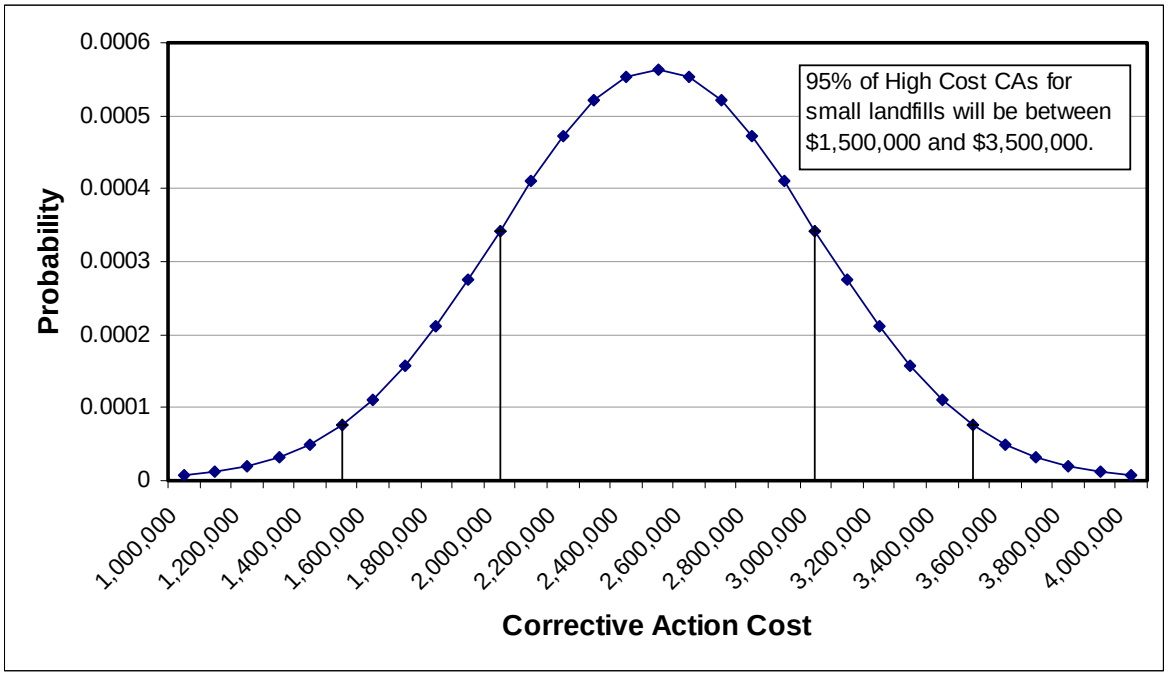


EXHIBIT 3-26
Distribution of Cost Estimates for High-Cost Corrective Actions for Medium-Sized Landfills

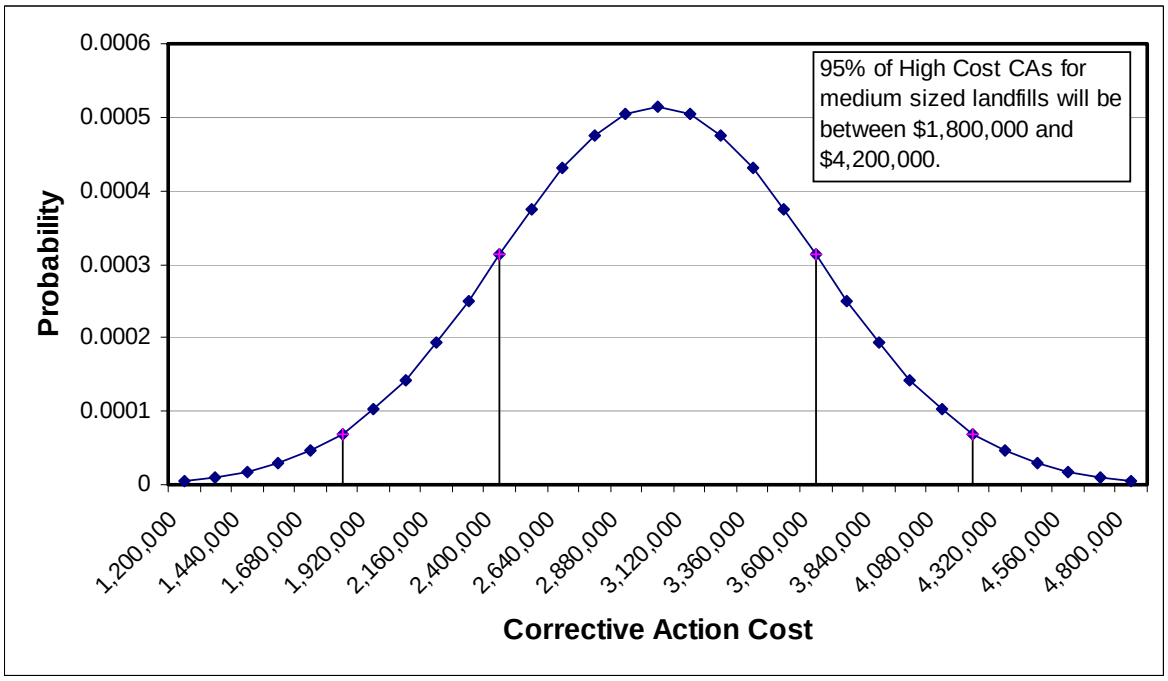
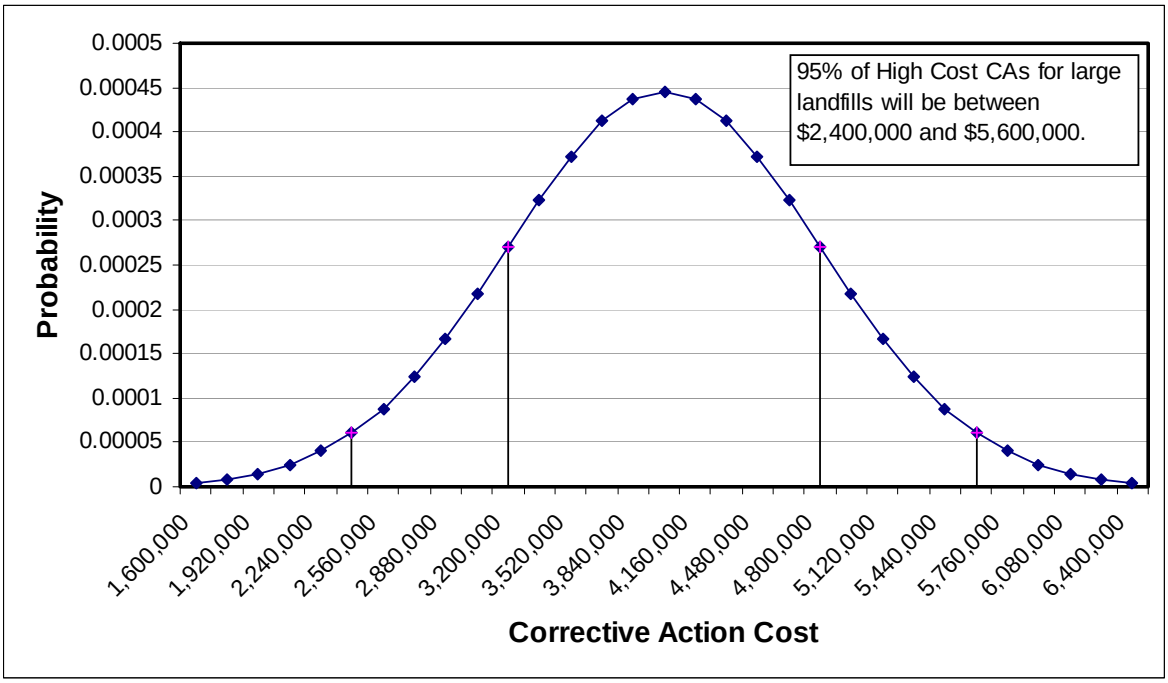


EXHIBIT 3-27
Distribution of Cost Estimates for High-Cost Corrective Actions for Large Landfills



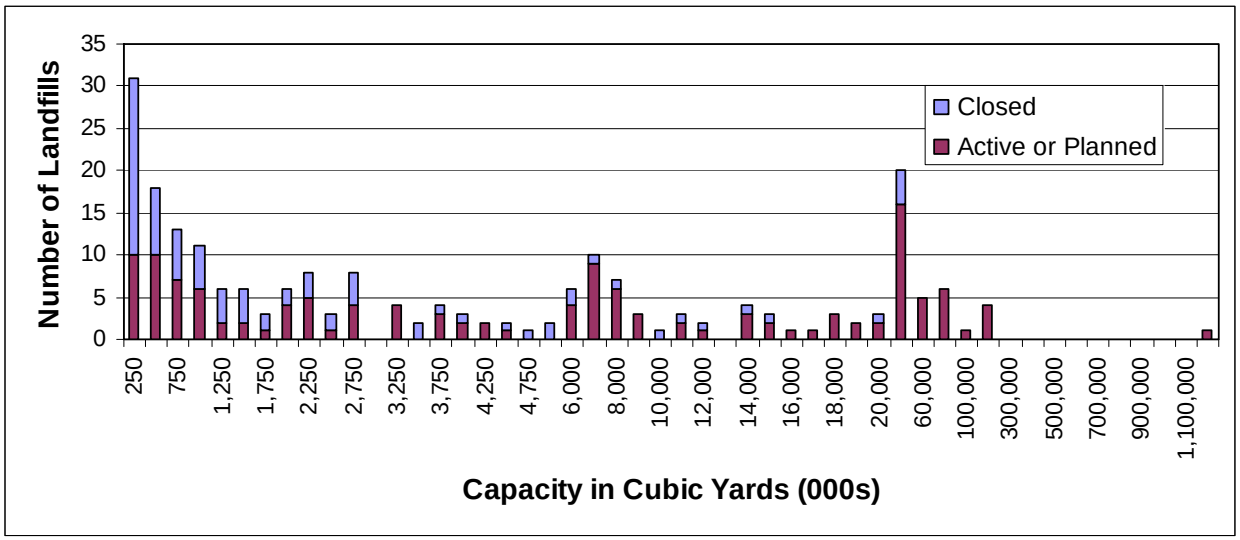
deviations from the mean. Ninety-five percent of the cost estimates used in model runs will come from within two standard deviations of the mean. To better capture the variability of CA costs and to account for costs of both CIWMB and SWRCB CAs, ICF recommended using statistical distributions to determine the costs of each CA.

Exhibit 3-28 shows landfill size definitions based only on the distribution of sizes and not operational or other landfill characteristics. Exhibit 3-29 shows the distribution of 229 of the 282 landfills by size in cubic yards that was used to develop the size categories. Any suggestions or rationale for changing these definitions is welcome.

EXHIBIT 3-28
Landfill Size Category Definitions

Landfill Size Category	Lower Bound (millions of CY)	Upper Bound (millions of CY)
Small	0	0.5
Medium	0.5	30
Large	30	> 30

EXHIBIT 3-29
Number of Landfills in Each Size Range in Cubic Yards



4. How Should the Costs be Distributed Throughout the Duration of the CA?

The CA costs could be evenly distributed across the CA duration or the costs could be weighted toward the beginning of the CA.

Advantages and disadvantages of evenly distributing CA costs across the duration of the CA:

+ This method would be easy to implement and understand.

+ No professional judgment is required to determine the allocation.

– This method does not realistically model the distribution of costs, especially for longer and more expensive CAs.

Advantages and disadvantages of weighting the distribution of CA costs toward the beginning of the duration of the CA:

+ This method more realistically models the distribution of costs, especially for longer and more expensive CAs.

– This method is more difficult to implement.

– Professional judgment would be required to determine acceptable allocation schemes.

Although weighting high-cost CA costs toward the beginning of the duration is more realistic, ICF believes that model results would not be significantly different using this method.

Exhibit 3-30 shows a possible allocation of costs weighted toward the first five years of a CA. Other possibilities for modeling the cost allocation include extending the year weighting to more than two years and varying the weights between the initial years instead of keeping them constant.

EXHIBIT 3-30
Cost Allocation Weights for Long-Duration Corrective Actions

Duration of Corrective Action (Years)	Cost for 1st through 5th Years	Cost for Remaining Years
20	10.0% @ year	2.8% @ year
25	10.0%@ year	2.2% @ year
30	10.0% @ year	1.8% @ year
35	10.0% @ year	1.5% @ year

3.3.3.3 How ICF Simulated Performance Defaults in Fund Working Model

A default for purposes of the working model means the simulated failure of an owner/operator of a landfill in the study universe to timely perform required PCM and/or CA. This definition does not require that an owner/operator file for bankruptcy or declare (or be declared) insolvent. Rather, this definition of default recognizes that an entity in financial distress may have issues that interfere with its willingness or ability to expend money at a given point in time. This definition is similar to that used by those who study defaults professionally.[24]

Key questions for modeling performance defaults include the following:

(1) Should both privately and publicly owned landfills be considered as potential candidates for performance defaults?

[24] Sreedhar T. Bharath & Tyler Shumway, *Forecasting Default with the KMV-Merton Model* (December 17, 2004).

Sanjiv R. Das, Darrell Duffie, & Nikunj Kapadia, *Common Failings: How Corporate Defaults are Correlated*, FDIC Center for Financial Research Working Paper No. 2004-04 (September 2004).

Dun & Bradstreet Corporation, *Business Failure Record: 1996 Final and 1997 Preliminary* (undated). This is the last edition produced of this report.

Douglas W. Dwyer, Ahmer E. Kocagil, & Roger M. Stein, *The Moody's KMV EDF ™ Riskcalc ™ v3.1 Model: Next-Generation Technology for Predicting Private Firm Credit Risk* (April 5, 2004).

Moody's Investors Service, *Historical Default Rates of Corporate Bond Issuers, 1920-1999* (January 2000). Note that municipal debt issuers are not included.

Til Schuermann & Samuel Hanson, *Estimating Probabilities of Default*, Federal Reserve Bank of New York, Staff Report No. 190 (July 2004).

Todd B. Walker, *Estimating Default with Discrete Duration and Structural Models* (First Version: October 2005).

(2) Should PCM and CA obligations both be considered as potentially subject to performance defaults?

(3) How should we model performance default rates and durations?

(4) What do we know about default rates?

1. Should Potential Performance Defaults Be Included for Both Privately and Publicly Owned Landfills?

Reasons for treating both privately-owned and publicly-owned landfills as potential candidates for performance defaults include the following:

- Both types of entities are subject to financial distress[25]
- Both types of entities are subject to financial assurance requirements
- A landfill may be owned or operated by either type of entity, or both, at any given point in time or over time[26]

Reasons for treating publicly and privately-owned landfills differently in terms of default include the following:

- public entities typically have longer lifetimes than private entities, and are more likely to endure than private entities
- public entities -- but not private entities -- can raise funds through taxing authorities and sale of bonds, both of which may be limited by state laws, such as the Paul Gann Initiative [Proposition 218 in 1996] which limits authority of local governments to impose taxes and property-related assessments, fees, and charges; requires the majority of voters to approve increases in general taxes, and reiterates that two-thirds must approve a special tax.

For purposes of the working fund model, ICF recommends that both privately- and publicly-owned landfills be treated as potential candidates for default. See Section 3 below for further discussion.

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[25] See, the U.S. Government Accountability Office "State and Local Governments: Persistent Fiscal Challenges Will Likely Emerge within the Next Decade," GAO-07-1080SP (July 18, 2007). Orange County is considered the largest municipality in U.S. history to have declared bankruptcy.

[26] A landfill owner and operator may be the same entity or different entities, with some publicly-owned landfills being operated by private entities as well as some publicly operated landfills on privately owned land (although the latter arrangement currently is much less common than the former arrangement).

2. Should the Model Address Performance Defaults of Both PCM and CA Obligations?

Reasons for treating both PCM and CA obligations as potentially subject to default:

- Financial distress can require delays and/or cutbacks in expenses across the board, including environmental outlays, whether for PCM or CA

- Some types of PCM and CA are the same. Depending on LF design/construction and applicable regulations, an expenditure for operating a landfill gas collection system may be considered as PCM at one LF (where such a system already was installed) while that expenditure may be considered CA at a different LF (where such a system was not initially required).

There are different perspectives that could provide rationales for treating PCM and CA differently in terms of default:

- Some might believe that because PCM expenditures are nearly certain to occur while CA expenditures are much less predictable, a landfill owner/operator could be more likely to default on CA than on PCM

- Some might believe that because CA expenditures may be much greater in magnitude than PCM expenditures over a short time period, a landfill owner/operator could be more likely to default on CA than on PCM

- Some might believe that because CA expenditures may be more urgent and attract more attention than PCM outlays, a landfill owner/operator could be less likely to default on CA than on PCM

For purposes of the working model, ICF decided to treat both PCM and CA as potential candidates for default. ICF is not aware of compelling data that would support an alternate approach.

3. How to Model Performance Default Rates?

ICF recommended a relatively simple approach to simulating the effects of performance defaults for the working model, given limited budget and calendar time. The working model includes two types of defaults:

(1) "random" defaults and
(2) event-driven defaults

Random defaults capture the reality that financial distress can appear seemingly without cause, although there may be endogenous causes such as poor planning, poor decisions, poor execution, and even financial fraud on the part of senior management. **Event-driven defaults** capture the reality that an exogenous cause – such as orders to perform CA; severe and lasting

earthquakes, floods, drought, windstorms, and fires – may lead to financial distress by requiring increased outlays and/or by depressing revenues.

Both types of defaults could affect more than a single LF. Financial distress at a county, for example, could cause defaults at multiple landfills where the county has responsibility; similarly, financial distress at a private solid waste landfill company could cause defaults at different landfills owned by that firm. The 282 LFs in the study universe are the responsibility of 116 parties (i.e., 36 private sector and 80 public sector parties), as follows:

- There are a total of 71 facilities with 36 private sector responsible parties: 41 landfills are associated with 6 responsible parties, leaving 30 other landfills and 30 responsible parties for a total of 36 private sector responsible parties. Waste Management, Inc./USA Waste has 15 facilities and Allied Waste/BFI 13.

- There are 211 facilities with 80 public sector responsible parties: 158 landfills are associated with 27 responsible parties, leaving 53 other landfills and 53 responsible parties for a total of 80 public sector responsible parties. The county of San Bernardino has 20 facilities, the County of Kern 15, the County of Riverside 12, and the County of Imperial 9, and the Federal government has 17.

Event-driven defaults may reflect regional traumas such as severe earthquakes, flooding, drought, fires, windstorms, and rainstorms. These severe, although rare, events can result in financial distress for both privately- and publicly-owned landfills in a defined geographic area.

ICF assessed whether the model should apply default rates to each individual LF or to the parties responsible for the LFs. Because CA-driven defaults will occur, just as CA does, on an individual LF basis, ICF sought a solution for random defaults that could be implemented on an individual LF basis.

ICF also considered whether to use a different default rate for LFs (or responsible parties) in the government sector versus LFs (or responsible parties) in the private sector. After completing our research into data on default rates, ICF decided to apply virtually the same rates to public and private sector parties.

Random Defaults. ICF designed the model to account for random defaults by applying a default rate[27] per year to each landfill responsible party in our study of 1% for private sector and 1% for the public sector.

ICF was encouraged by comments to use default rates that reflect historic data showing higher rates of financial distress associated with smaller organizations. Firm failure rates have been found to decrease as firms increase in size, as measured by their net worth. A range of estimated annual failure rates for different size firms for the period 1984 through 1990 (latest

[27] The rate (or a distribution of potential rates with the same mean) will be chosen to represent an average institutional default rate, and may vary by year based on available data between, say, 0.2% and 2%, for example.

available data) is provided in Exhibit 3-31 below.[28] As shown in the exhibit, the failure rate decreases significantly as net worth increases. Nevertheless, ICF does not have readily available the net worth data needed to implement this approach. In addition, ICF expects that various stakeholders may have different perspectives on the appropriate way to handle businesses with operations beyond the state of California (e.g., should out-of-state resources count).[29] Some view the risks posed by large commercial companies as a concern, while others view large commercial firms as bringing financial stability to an industry that previously had a large participation of small businesses with few assets.

EXHIBIT 3-31
Estimated Firm Failure Rates by Firm Size

Net Worth ($ million)	Failure Rate (%)
0-10	1.53
10-20	1.24
20-100	1.02
100-400	0.81
400-1 billion	0.55
> 1 billion	0.14

ICF resolved these issues by using a 1% random default rate for the LFs for which there was a single responsible party, private or public. For the 6 private parties responsible for 41 LFs, ICF calculated a rate of .15% for each LF by dividing the 1% rate by 6.83 which is the average number of LFs per party (41 LFs ÷ 6 parties = 6.83). This result was consistent with the lower bankruptcy rates associated with larger entities shown in Exhibit 3-31. ICF used a similar procedure for the 27 public sector entities responsible for 158 LFs (average of 5.85 LFs per entity). The corresponding rate of .17% was assigned to each of the 158 public sector LFs (1% ÷ 5.85 = .17%).

Event-Driven Defaults. The working model handles event-driven defaults as follows:

(1) for landfills simulated to undergo CA, ICF applies a multiple (e.g., twice) of the random default rate per year during the CA period to account for potential CA-driven defaults (i.e., cost shocks) , and

(2) for other event-driven defaults (e.g., severe rain/wind storms, flooding, wildfires, earthquakes), ICF applies a 1% default rate per year to a group of 6-10 landfills (e.g., those in the same county, for simplicity), to capture a 1 in a hundred years event.

[28] Source ICF Incorporated, *Analysis of Assurance Provided by Current and Proposed Financial Assurance Mechanisms*, prepared for U.S. Nuclear Regulatory Commission (November 1992).

[29] Some landfills in the study cohort are owned by commercial companies that are nationwide in scope. For example, of the 300 landfills nationwide owned by Waste Management/USA Waste, 15 are on the list of 282 LFs that are the focus of this study.

An alternative approach to simulating CA-driven defaults would have been to compare the magnitude of each simulated CA "cost shock" to estimated revenue or assets for each LF responsible party. Such an approach requires detailed financial data for all the responsible parties and projections of such data into the future. This latter approach goes well beyond what is feasible and necessary for the working model.

4. What Should be the Duration of Performance Defaults?

The model must not only simulate the year when a default starts but also how long the default lasts. It may make sense for the duration to vary with the type of default : random defaults would have the shortest duration, CA-driven defaults would last longer, and regional disaster defaults would last the longest. Or CA-driven defaults might last longer than regional defaults. The working model will let CIWMB staff change the default durations for further analyses. The working model assigns default durations up to 5 years.

The CIWMB asked ICF to consider including in the model the possibility of permanent defaults, which are defaults that have no end dates. In other words, a permanent default indicates simulating that a responsible party never returns to paying for PCM and/or CA. ICF believes that such scenarios are only remotely possible because the 282 study landfills and the property they sit on will retain some net value. ICF also believes that parties responsible for the LFs will continue in one form or another. Nevertheless, ICF included permanent default as an option in the working model, which applies a 1% rate to all defaults in a given year to simulate the occurrence of permanent defaults.

5. What Do We Know Now About Default Rates?

Default rates are low in absolute terms. One reason for a low default rate is the nature of the solid waste disposal "business." This business shares certain characteristics with public utilities such as water, sewer, and power companies. These businesses have certain features of so-called "natural monopolies." These businesses tend to have steady demands that are relatively predictable but require substantial capital investments. The 282 LFs subject to financial assurance exclude firms that chose to close prior to 1988; "survivor bias" should give the 282 LFs better default performance than a cohort of LFs that included those LFs closed prior to 1988. Because default data for solid waste disposal are not readily available, ICF based our approach on more inclusive default datasets.

Private Sector Default Rates. The analysis of corporate defaults has had many researchers trying different predictive models out on various datasets. Recent studies ,for example, have included the following:

- One study identified 842 defaults between January 1, 1981 to December 31, 2002 associated with 6,776 large U.S. corporations, using credit rating histories from Standard & Poor's (reported average annual default rate of 1.66%).[30]

[30] Til Schuermann & Samuel Hanson, *Estimating Probabilities of Default*, Federal Reserve Bank of New York, Staff Report No. 190 (July 2004).

- Another study included 916 publicly-traded firms in the industrial machinery and instrument sector from 1962 to 2004, of which 67 filed for bankruptcy and 153 were classified as defaulting.[31]

- Another study included 241 defaults for 1,990 publicly-traded non-financial North American firms over the period January 1987 to October 2000, finding that the means of annual default probabilities ranged from 0.69% to 3.11% as the U.S. entered the 2000-2001 recession.[32]

- An often-cited study compiled data on 15,018 firms (excluding financial firms) publicly traded in the U.S. with 1,449 defaults covering the period 1980-2003.[33]

- Moody's KMV offers a proprietary service for predicting defaults drawing on data for over 51,000 private U.S. and Canadian firms and 3,764 defaults over the period 1989-2002.[34]

Dun & Bradstreet Data. Dun & Bradstreet (D&B) previously published nationwide failure rates in its *Business Failure Record*. The statistical information published in the *Business Failure Record* represents the most comprehensive data available on business failures. Dun & Bradstreet has produced a statistical series on business failures since the 1920s. These data are not estimates; they represent complete tallies of business failures. This series was revised in 1984 adding the agricultural, financial, and nonfinancial services sectors, thereby making comparisons between pre- and post-1984 data not meaningful. Business failures do not represent total business closings, which consist of both business failures and business discontinuances. As defined in D&B's statistics, business failures consist of businesses involved in losses to creditors. In contrast, businesses that discontinue operations for reasons such as loss of capital, inadequate profits, ill health, retirement, etc. were not recorded as failures by D&B if creditors are paid in full. Exhibit 3-32 shows some D&B reported failure rates for 1996-1997.

Exhibit 3-32 shows a much higher rate of failures for California than the U.S. as a whole in 1996 and 1997. Most states had reported failure rates less than 1% in those years. In addition to California, other high failure rate states in 1996 and 1997 (latest published data) included Arkansas, Colorado, Hawaii, Idaho, Kansas, Oklahoma, and Washington. ICF chose to show in Exhibit 3-32 the failure rates for electric, gas, and sanitary services as a possible proxy for MSW

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[31] Todd B. Walker, *Estimating Default with Discrete Duration and Structural Models* (First Version: October 2005).

[32] Sanjiv R. Das, Darrell Duffie, & Nikunj Kapadia, *Common Failings: How Corporate Defaults are Correlated*, FDIC Center for Financial Research Working Paper No. 2004-04 (September 2004).

[33] Sreedhar T. Bharath & Tyler Shumway, *Forecasting Default with the KMV-Merton Model* (December 17, 2004).

[34] Douglas W. Dwyer, Ahmer E. Kocagil, & Roger M. Stein, *The Moody's KMV EDF ™ Riskcalc ™ v3.1 Model: Next-Generation Technology for Predicting Private Firm Credit Risk* (April 5, 2004).

EXHIBIT 3-32
Dun and Bradstreet Reported Failure Rates, 1996-7

	1996	1997
U.S.	.80%	.88%
California	1.49%	1.76%
Electric, Gas, and Sanitary	.61%	.75%
Transportation	.69%	.74%

disposal. We also included transportation services in Exhibit 3-32 on the theory that parties responsible for MSW disposal may also operate fleets of collection trucks. Although the failure rates for those two industries appear quite similar, with only two years of data reported ICF believes that solid inferences should not be drawn. ICF hesitates to draw failure rates from these 1996-7 Dun and Bradstreet data for this study because of the large divergence between U.S. and California rates and because only two years of data are readily available.

Exhibit 3-33 shows more extensive, nationwide failure rate data from Dun & Bradstreet for the period 1984-1997 (and related statistics calculated by ICF).

EXHIBIT 3-33
Dun & Bradstreet Failure Data (1984-1997)

Year	Failure Rate
1997	.88%
1996	.80%
1995	.82%
1994	.86%
1993	1.09%
1992	1.10%
1991	1.07%
1990	.74%
1989	.65%
1988	.98%
1987	1.02%
1986	1.20%
1985	1.15%
1984	1.07%
Mean	96%
Median	1.00%
25%-ile	.83%
75%-ile	1.08%

EXHIBIT 3-33
Dun & Bradstreet Failure Data (1984-1997)

Year	Failure Rate
Min	.65%
Max	1.20%
Variance	280.38
Std Dev	16.74

The above data series shows how failure rates vary over the time period, from a low of 0.65% in 1989 to a high of 1.2% in 1986 with an average failure rate close to 1%

Moody's Data. Moody's publishes data on default rates of corporate bond issuers, drawing upon its proprietary database of ratings and defaults for industrial and transportation companies, utilities, financial institutions, and national governments that have issued long-term debt to the public.[35] Bond issuers represent a subset of businesses that are larger than businesses which do not issue bonds to the public. Although Moody's does not report the data by industry sector, Moody's does calculate one-year default rates for its entire universe. ICF calculated statistics for this series, which are presented in Exhibit 3-34, for the period: 1970 to 1999.

EXHIBIT 3-34
Moody's Corporate Bond Issuers Default Rates

Year	One-Year Default Rate
1999	2.19%
1998	1.27%
1997	0.68%
1996	0.54%
1995	1.07%
1994	0.57%
1993	0.96%
1992	1.33%
1991	3.29%
1990	3.52%
1989	2.42%
1988	1.31%
1987	1.49%
1986	1.90%
1985	1.06%

[35] Moody's Investors Service, *Historical Default Rates of Corporate Bond Issuers, 1920-1999* (January 2000). Note that municipal debt issuers are not included.

EXHIBIT 3-34
Moody's Corporate Bond Issuers Default Rates

Year	One-Year Default Rate
1984	0.91%
1983	0.95%
1982	1.03%
1981	0.16%
1980	0.34%
1979	0.09%
1978	0.35%
1977	0.35%
1976	0.17%
1975	0.36%
1974	0.27%
1973	0.45%
1972	0.45%
1971	0.28%
1970	2.72%
Mean	1.08%
Median	0.93%
25%-ile	0.35%
75%-ile	1.33%
Min	0.09%
Max	3.52%
Variance	0.87%
Std Dev	0.93%

In addition, and relevant to the long time frame of analysis for this study, Moody's also presents its calculations of "average cumulative default rates" from 1 to 20 years for the 80-year period 1920-1999. Cumulative default rates are based on analyzing the experiences of cohorts of issuers. For example, Moody's calculated that the default rate for all corporate bond issuers was 13.98% after 20 years. Although these data are not directly applicable to the study, they illustrate an important point – over very long periods of time, the cumulative risk of default can become very significant.

Public Sector Defaults. Data on public sector defaults are much more limited than data on corporate defaults. As a result, attention to this topic waxes and wanes over time. The metrics used in analyzing and reporting public sector defaults are designed for the financial markets and are not well suited for use in this type of study. Default data are reported only as cumulative default rates for a cohort of bonds issued within a given time frame. Just as

commercial companies represent diverse sectors of the economy, municipal obligations reflect a variety of sectors and regions, including general obligation and revenue bonds, including certificates of participation related to assets as diverse as waste management facilities, prisons, roads/bridges, recreational, and health facilities. The smaller number of recorded municipal defaults can make it difficult to identify underlying trends due to statistical noise.[36]

Fitch Data. A 2003 study by Fitch Ratings determined that cumulative default rates for bonds issued between 1987 and 1997 were much lower (i.e., 0.14%) than default rates on bonds issued between 1979 and 1986 (i.e., 1.5%). See Exhibit 3-35. For bonds issued in the entire period of 1979-1997, the cumulative default rate was 0.84%. Fitch's 2003 study also determined default rates by sector and found that the cumulative default rate on environmental facility bonds

EXHIBIT 3-35
Fitch's Cumulative Municipal Default Rates
(Through 2002)

Year of Issuance	Cumulative Default Rate
1979	0.84%
1980	0.98%
1981	0.99%
1982	1.33%
1983	2.59%
1984	2.22%
1985	2.73%
1986	1.72%
1987	0.91%
1988	1.16%
1989	0.92%
1990	0.65%
1991	0.37%
1992	0.35%
1993	0.36%
1994	0.39%
1995	0.36%
1996	0.50%
1997	0.46%
Mean	1.04
Median	0.91

[36] See Richard Cantor and Eric Falkenstein, "Testing for Rating Consistency in Annual Default Rates," *The Journal of Fixed Income* (Sept. 2001).

EXHIBIT 3-35
Fitch's Cumulative Municipal Default Rates
(Through 2002)

Year of Issuance	Cumulative Default Rate
25%-ile	0.43
75%-ile	1.25
Min	0.35
Max	2.73
Variance	0.57
Std Dev	0.76

issued from 1979-1994 increased to 0.89% from the 0.31% found in its earlier 1999 study.[37] Fitch stated that the increase reflected deregulation of flow control in the mid-1990s. Unfortunately, Fitch does not calculate annual default rates which could be compared to the rates shown in Exhibit 3-34. Instead, Fitch reports its calculations using a cumulative default metric; Fitch calculates defaults for yearly cohorts of municipal issuers that indicate a rate of default over a certain time period (e.g., 10 years). Fitch's metric also cannot be meaningfully compared to the average cumulative default rates for corporate issuers calculated by Moody's.

Moody's Data. Moody's published its first formal default study of municipal bond issuers in 2002. Moody's used a parallel definition of default as used for corporate bond issuers. Moody's calculates one-year and multi-year cumulative default rates.[38] However, Moody's analysis was limited to those bonds for which it supplied ratings. The resulting self-selection bias is clear and acknowledged by Moody's. As a result, Moody's database includes only 18 defaults, whereas Fitch's analysis included 2,339 cases of municipal defaults between 1980 and 2002. (Fitch has had much more involvement in rating municipal obligations than has Moody's.) Thus ICF does not recommend using Moody's default data for this study.

3.3.3.4 Modeling How Landfills will Provide Funds in Fund Working Model

The model assumes that the money for the fund will most likely be in the form of a tip fee from active landfills that will potentially use the fund. This section addresses the issue of how the model will determine when and how much operating landfills contribute to the fund. The contract restricts ICF to consider funding only from operating landfills; no funds are to be modeled as coming from closed landfills.

[37] *Municipal Default Risk Revisited*, Fitch Ratings Special Report (June 23, 2003) and *Default Risk & Recovery Rates on U.S. Municipal Bonds*, Fitch Ratings Special Report (Jan. 9, 2007).

[38] See *Moody's U.S. Municipal Bond Rating Scale*, Moody's Investors Service Special Comment (Nov. 2002) and *Request for Comment*.

Key questions for modeling the landfill contributions to the fund include the following:

(1) What should be the timing of payments to the fund?

(2) Should each landfill contribute the same dollar amount, should the amount be based on landfill characteristics, or should there be a base amount for all operating landfills with an incremental amount added based on landfill characteristics identified under Task 6?

1. What Should be the Timing of Payments to the Fund?

Two general options for the timing of payments into the fund are front-loaded (e.g., lump sum) payments and periodic payments over a longer time frame. For example, a front-loaded fund might have operating landfills pay a total of $40 million or about $1.00 per ton of waste disposed for a single year (about $200,000 per operating LF). An example of periodic payments is annual payments of between $0.05 and $0.15 per ton of waste disposed in each year. Variations on these two options include a front-loaded payment made over several years, and changing the time intervals for the periodic payments. The simplest forms of each option are one lump-sum payment and annual payments. A third option that combines the characteristics of the first two options, is to have periodic payments until the fund reaches a specified balance, and then payments would be suspended until the fund balance was reduced to a specified threshold, at which time payments would resume. This option could use higher contribution amounts, for example $0.10 to $0.15 per ton disposed, that would allow the fund balance to reach a desired level more quickly than a fund using lower payments over a longer time frame.

Advantages and disadvantages of lump-sum payments:

+ The fund is fully funded after the first year.

+ Analogous to insurance product premiums.

+ Longer time for earnings to accumulate on fund balances.

– Landfills may not be able to afford the full amount in one year. Lump sum payments might be on the order of $200,000 per open landfill.

– If withdrawals from the fund are higher than anticipated, alternate funding sources or another lump sum payment would be required.

– The fund would have higher interest rate risk.[39]

[39] In this context, interest rate risk is the risk that prevailing levels of real interest rates will be too low to generate fund earnings needed to attain fund balance targets. A lump sum is considered to have a higher interest rate risk because it depends on more years of investment returns than a fund based on periodic payments.

– There may be perceived equity issues between large and small landfills.

Advantages and disadvantages of periodic payments:

+ Landfills may be better able to afford and plan for the periodic amounts.

+ The fund would be less susceptible to interest rate risk.

+ A predictable amount of money would flow into the fund in each year.

– Administrative costs of the fund are likely to be higher with periodic payments due to the collection and processing of the payments.

– Sufficient funds may not be available in the first five to ten years if there are more defaults than anticipated.

– Less accumulation of earnings on unexpended balances in the near term.

Advantages and disadvantages of annual payments that are suspended and resumed when the fund balance reaches specified thresholds:

+ Landfills may be better able to afford the periodic amounts.

+ Being able to resume contributions as necessary would allow for an overall lower fund balance than a lump sum method.

– Administrative costs of the fund are likely to be higher due to the collection and processing of the payments.

– Sufficient funds may not be available in the first five to ten years if there are more defaults than anticipated.

– It may be politically difficult to resume contributions once suspended.

Due to the anticipated difficulty of landfills making lump-sum payments and potential equity issues, ICF is not using lump-sum payments in the fund model. Since annual payments would be easier for landfills to incorporate into their tipping fee schedules and to implement on an ongoing basis, ICF recommended using annual payments based on throughput for each landfill in the fund model. At a minimum, the fund model will allow for annual contributions to be suspended and resumed at specified fund thresholds.

2. Should Each Active Landfill Contribute the Same Amount or Unit Amount, Should the Amount be Based on Landfill Characteristics, or Should the Model Use a Base Amount for All Operating Landfills with an Incremental Amount Based on Landfill Characteristics Identified Under Task 6?

The second key question addresses the amount that each active landfill should contribute and whether that amount should be based on landfill characteristics or if each landfill should contribute the same amount.

Advantages and disadvantages of each landfill contributing the same amount:

+ There would be no uncertainty about the amount each landfill would contribute.

+ Appears equitable on its face.

+ Little expert judgment would be required to determine the necessary contribution amount.

– This method may be perceived as not fair to smaller landfills, who may find it harder to allocate funds for the contribution, unless the contribution amount is a unit amount based on the amount of waste received or other size-related characteristic.

– If one type of landfill is perceived to be more likely to default, then this method may be perceived as being unfair to the other types of landfills. For example, if small landfills are more likely to default and thus require the use of the fund, then larger landfills may perceive they are contributing more than their fair share.

Advantages and disadvantages of each landfill contributing an amount based on landfill characteristics:

+ This method might be perceived as being fair on an ability to pay basis.

– There could be controversy about the amount each active landfill should contribute.

– Landfills paying higher contribution amounts may pass those costs on to their customers, thus creating potential equity issues in the public at large.

– Landfill characteristics are not good predictors of which landfills might default. A landfill with many Task 6 risk proxy factors may be no more likely to default than a landfill with few Task 6 risk proxy factors. Landfill characteristics are not believed to be correlated with defaults, and thus should not be used to determine contributions to a pooled fund.

Advantages and disadvantages of each landfill contributing a base amount with an incremental amount added based on landfill characteristics:

+ This method might be perceived as being fair on a risk-of-needing-to-use-the-fund basis.

– There could be controversy about the formula to determine the incremental amounts.

– Landfills paying higher contribution amounts may pass those costs on to their customers, thus creating potential equity issues in the public at large.

– Landfill characteristics are not good predictors of which landfills might default. A landfill with many Task 6 risk proxy factors may be no more likely to default than a landfill with few Task 6 risk proxy factors. Landfill characteristics are not believed to be correlated with defaults, and thus should not be used to determine contributions to a the fund.

Since landfill characteristics are not believed to be correlated with defaults and significant equity issues are associated with this option, ICF did not recommend basing the contribution amount on landfill characteristics. ICF believed that, of the options discussed, the most equitable, efficient, and effective way to fund a pooled fund, given the high percent of closed landfills, is to use contributions based on the tons of waste disposed at operating landfills. Therefore, for purposes of the working model, ICF recommended using the same contribution unit amount (X cents per ton) that is based on the tons of waste disposed ("throughput") at all landfills.

3.3.4 Results of the Model

The purpose of this section is to present estimates of the state fund balance over time under various assumptions about relevant factors. Any assessment of the adequacy of a state fund must take into account two key facts:

(1) The demands on the state fund will result from events for which current estimates of likelihood and timing of their occurrence and their costs are very uncertain.

(2) The supply of funds to the state fund is uncertain because it is a function of the amount of future land disposal of solid waste.

Thus, it is essential to design a model that can account for these uncertainties. We do so by constructing a model based on principles of probability and statistics which can simulate particular aspects of the solid waste situation about which there are great uncertainties. This approach, referred to as stochastic (or Monte Carlo) simulation, permits the user to see the effects of uncertainty on estimates of the future fund balance.

Because of the great uncertainties involved in projecting future facility releases and future waste disposal, ICF designed a model that would make it possible to test the effects of

various alternative assumptions regarding technical and policy matters, and be easy to update and change as new information becomes available and as the policy process deals with new issues. ICF's goal in developing this model is, in addition to examining the adequacy of the state fund, to create a tool that can be used to enlighten the debates that inevitably surround complex regulatory issues.

The working model and the results presented here should be understood as simulations and not predictions. The model lets ICF and CIWMB test various "what if" scenarios. Despite using real data related to the 282 LFs, the model is not predicting environmental or financial events for any specific LFs. The long time-frame, the many uncertainties, and the lack of fully applicable historical data require a simulation approach, not a predictive one. Furthermore, the model has been built to meet the needs of this study. We have avoided unnecessary or immaterial precision in the model's design; rather, we have endeavored to build a flexible tool that can assess a variety of "what ifs."

The level of resolution of a model is often a controlling factor in its applicability to various issues. For example, the status of PCM and CA is modeled at every simulated facility. The year the CA began, the cost of the CA, and the expected duration of the CA are all simulated at the facility level. Consequently, the simulation of these values can depend on other facility-level characteristics and can influence other facility-level values. The analysis could have been more detailed or less detailed. For example, the status of PCM and/or CA could have been simulated at each disposal unit (e.g., landfill cells) at each facility. On the other hand, an example of less detail would be performing the analysis on groups of facilities. In choosing the level of detail for various aspects of the working model, the need for resolution was balanced against the availability of detailed data and the costs of increased complexity and increased computer requirements. In general, all important factors influencing coverage and costs have been resolved at the facility level.

As discussed above, the working model was designed as a policy analysis tool to assess various "what if" scenarios. It does not attempt to predict the future. It has a level of resolution sufficient for its purpose but not comparable to a risk assessment tool. For example, the model focuses on landfills as a whole, not their individual units (if any). Nevertheless, ICF endeavored to make the model "realistic" by using readily available information about the 282 LFs subject to FA. Moreover, rather than develop independent distributions of data describing key variables, ICF maintained the integrity of each LF by drawing on data integrated by landfill.

Each of the 282 simulated LFs is represented by the following data:

ownership type
operational status (capped or not)
size (permitted capacity)
annual rainfall
urban/rural setting
expected year of LF closure
estimated PCM cost/year
annual probability of CA, by type

annual default probability
depth to groundwater
percent of landfill that is lined

As one option for characterizing the population of LFs, ICF could have taken available data for each variable and developed a statistical distribution. Then the model could have "sampled" a value randomly from each statistical distribution to populate the universe of LFs. However, ICF rejected that approach for two primary reasons: (1) data gaps were relatively few, meaning that ICF could use actual data without having to impute many missing values and (2) that approach would not necessarily capture correlations between and among the variables. Prior study[40] had identified that the variables were not necessarily independent and some correlations were found to be statistically significant. Therefore, ICF assembled available data for each variable for each LF, thus preserving the integrity of the relationships among the variables as much as possible. Data gaps were filled using statistical techniques.

The State Fund Working Model ("Model"), like all models, is a simplified representation of a complex situation. The Model is constructed in a manner so that it represents, to the greatest extent possible, behavior in the real world. However, because the Model is a simplification, special care must be exercised in its use.

To use the Model to assess the performance of a state fund, the followings steps are performed:[41]

- develop a Base Case set of assumptions and data describing the most likely future configuration of the state fund;

- investigate the sensitivity of the Model results to the assumptions and data employed; and

- perform simulations of potential alternative configurations of the fund.

The Base Case provides the best estimate of the likely performance of the state fund. Consequently, careful consideration was given to the choice of inputs used to define it. The Base Case also supplies a standard against which all subsequent Model runs can be compared.

Once a Base Case is defined, the sensitivity of the results to the assumptions and data employed must be examined. Because the Model simulates a simplified world, it is important to identify the effects that the simplifications have on the results.

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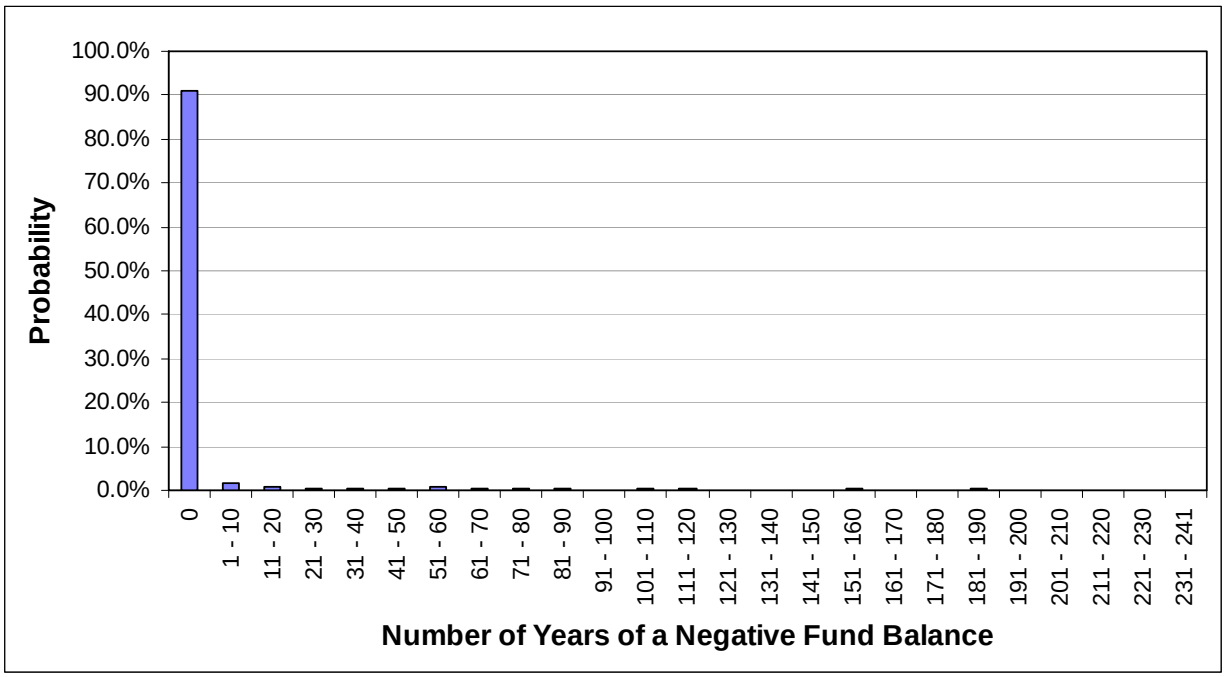
[40] GeoSyntec Consultants Inc., *Landfill Facility Compliance Study* (August 2004).

[41] Not described here is the need to test the Model to ensure it is operating in the manner in which it is intended. This step, often referred to as "debugging," is performed prior to the first actual use of the Model. However, by its nature, debugging is an ongoing process throughout the use of a model.

ICF defined the Base Case as the lowest contribution amount per ton that generates at least a 90% probability of fund success (given other parameter values). Exhibit 3-36 shows that there is a 91% probability that at 7.8 cents per ton disposed the Base case fund design will have sufficient funds over the modeling period to meet the demand of defaulted PCM and CA.

EXHIBIT 3-36
Probability that Annual Fund Balance is Adequate in all Model Years



The exhibits in this section show the costs associated with PCM and CA as well as the fund balance and contributions to the fund. Exhibit 3-37 shows the fund balance throughout the modeling period for one case representing a median cost scenario. The exhibits in this section represent one, out of many, possible median cost outcomes for the fund. This particular median cost scenario was selected because the outputs highlight several attributes of the fund over time.

Exhibit 3-38 shows the potential and actual fund contributions during the modeling period. Fund contributions are the total tons of waste disposed multiplied by the per ton contribution rate (e.g., 7.8 cents/ton). The actual fund contribution amounts show the years in which fund contributions were required to maintain the fund above a the desired balance. Exhibit 3-38 shows one period when the fund required no contributions.

EXHIBIT 3-37
Fund Balance in Each Year of the Modeling Period for the Median Cost Scenario

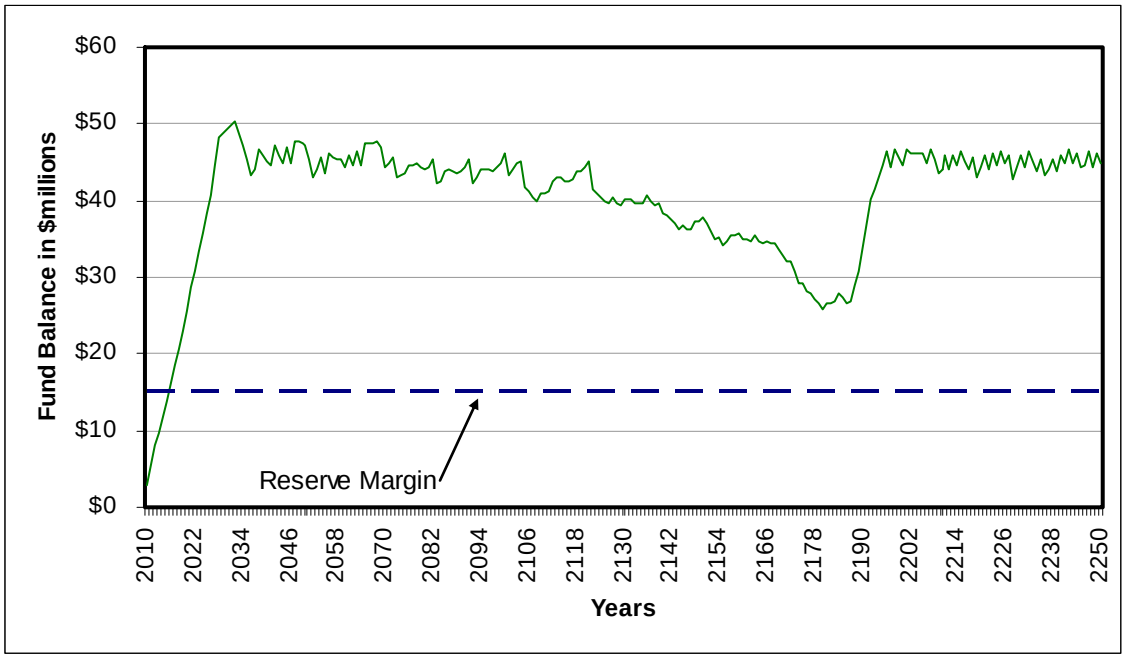
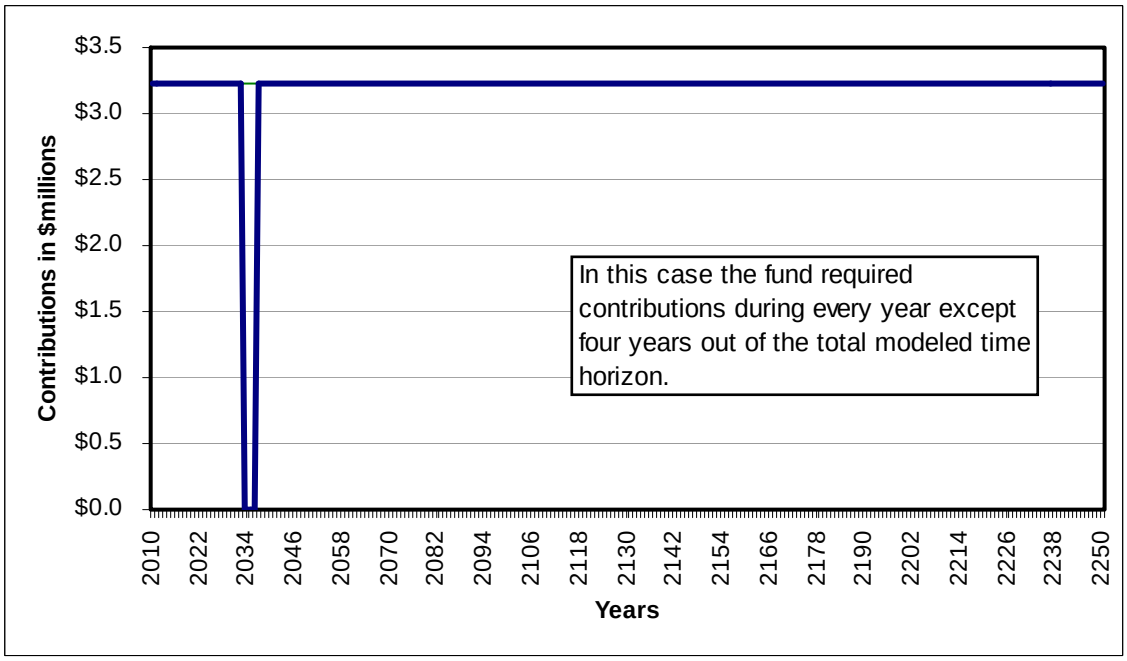


EXHIBIT 3-38
Fund Contributions for the Median Cost Scenario



Exhibits 3-39 and 3-40 show the defaulted CA costs in each year and the cumulative defaulted CA costs, respectively. Exhibit 3-39 shows that the fund rarely will need to cover over $2 million per year in defaulted CA; rather, most defaulted CA costs range between $500K and $1 million per year.

Exhibits 3-41 and 3-42 show the defaulted PCM costs in each year and the cumulative defaulted PCM costs, respectively. Exhibit 3-41 reveals annual defaulted PCM costs peaking at over $3.5 million per year after starting off much lower. Annual defaulted PCM costs decline late in the modeling period, ranging from about $1.5 million to $2.25 million per year.

Exhibits 3-43 and 3-44 show the total (PCM and CA) defaulted costs in each year and the cumulative defaulted costs, respectively. Exhibit 3-43 shows the impact of defaulted PCM costs on all defaulted costs, as the graph looks similar to Exhibit 3-41 in shape.

Exhibits 3-45 and 3-46 show the annual and cumulative total defaulted costs by landfill owner type. Does Exhibit 3-45 indicate that, in general, public landfill estimates of PCM are higher than the estimates from private landfills? Or, instead, that there are three times as many public LFs as private ones? Exhibit 3-46 presents the relative contributions of public and private sector LFs to total cumulative defaulted costs, with the bulk coming from the public sector.

Exhibit 3-47 shows the cumulative total defaulted costs by landfill size category. As most landfills fall into the medium size category, these LFs dominate the results.

Exhibit 3-48 shows the cumulative total defaulted costs by whether the LF is located in an urban area or not; as shown, a majority of the defaulted costs originates with urban LFs.

Exhibit 3-49 shows that the vast majority of defaulted CA costs arises from closed LFs. Most LFs are projected to close by 2052. Defaulted CA costs at open LFs constitute a minor portion of fund demands.

Similarly, Exhibit 3-50 illustrates that little of the demand for funds will come from LFs in the first 30 years of PCM. Most LFs will be past the first 30 years of PCM by 2080. This model run does not include any ending dates for PCM, which contributes to the dominance of post-30 PCM.

EXHIBIT 3-39
Defaulted Corrective Action Costs in Each Year of the Modeling Period for the Median Cost Scenario

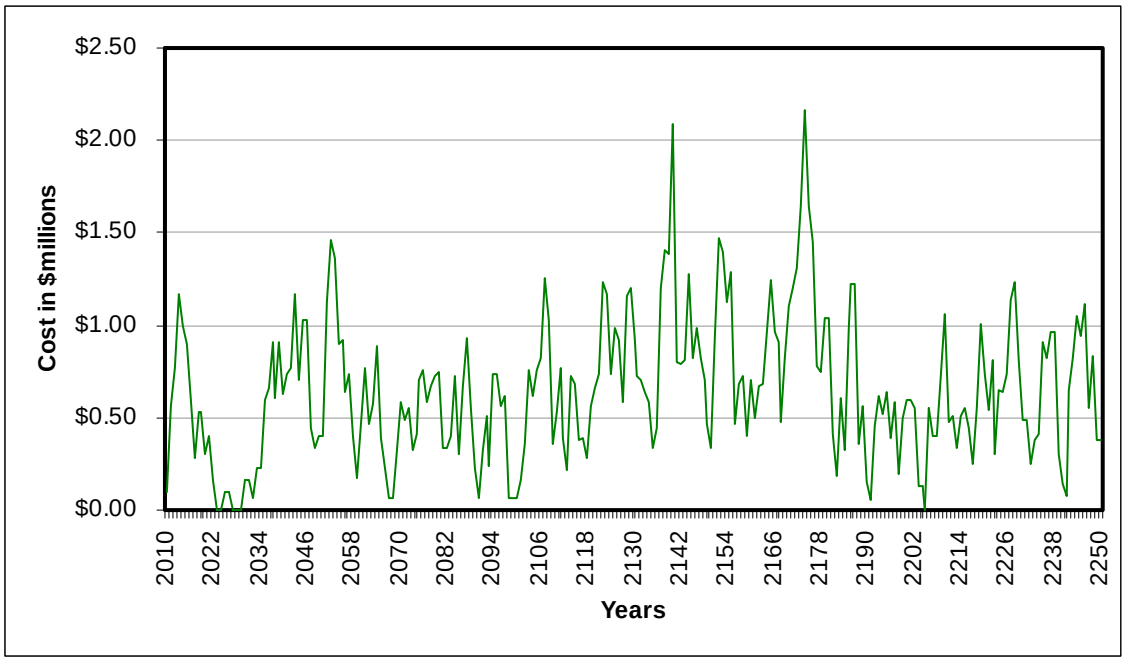


EXHIBIT 3-40
Cumulative Defaulted Corrective Action Costs for the Median Cost Scenario

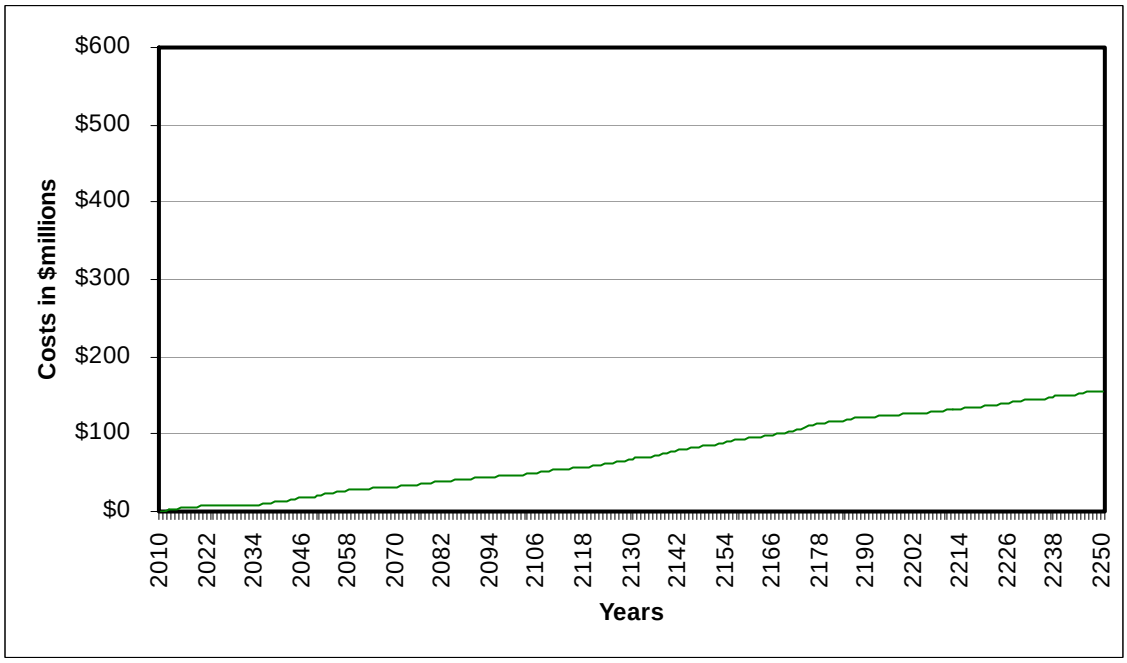


EXHIBIT 3-41
Defaulted Postclosure Maintenance Costs in Each Year of the Modeling Period for the Median Cost Scenario

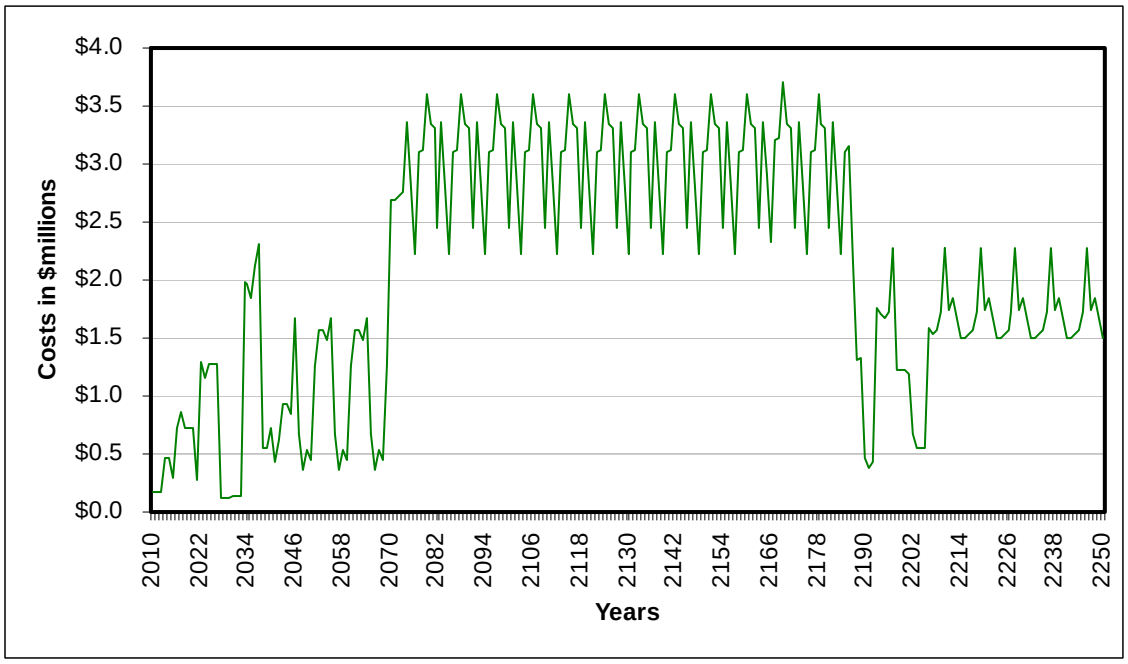


EXHIBIT 3-42
Cumulative Defaulted Postclosure Maintenance Costs for the Median Cost Scenario

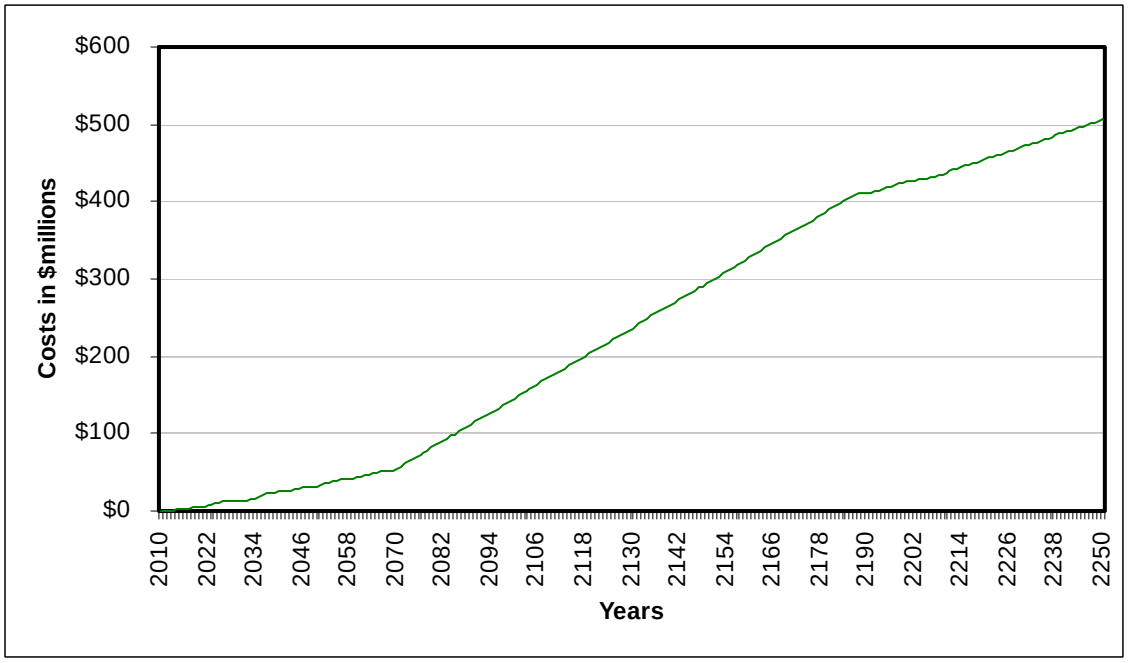


EXHIBIT 3-43
Total Defaulted Costs in Each Year of the Modeling Period for the Median Cost Scenario

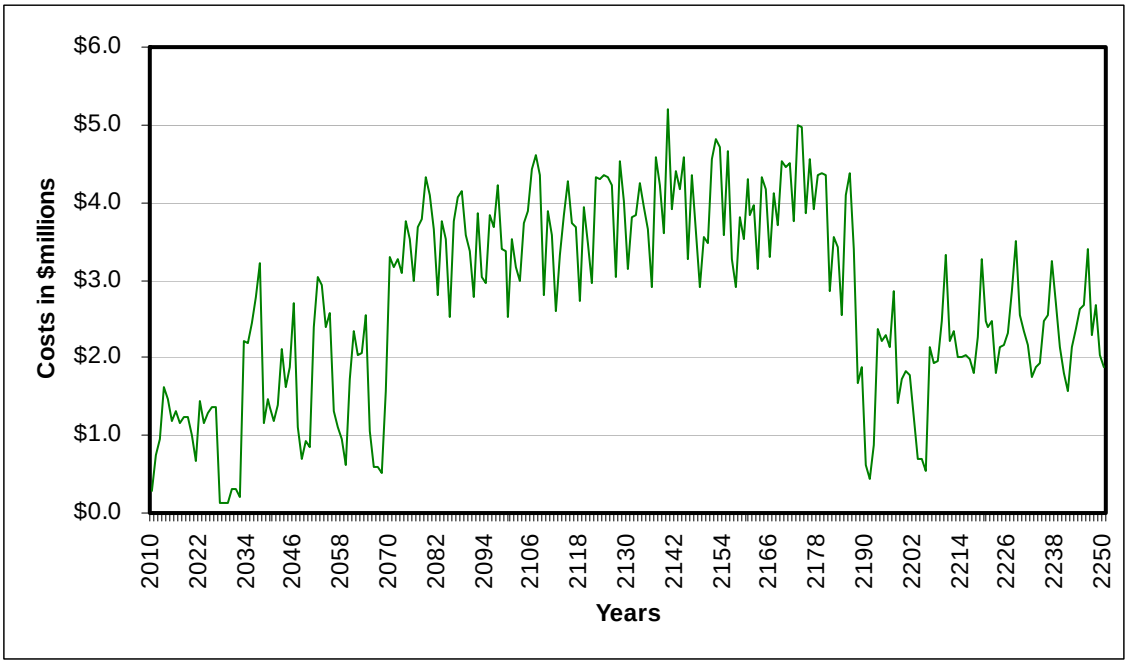


EXHIBIT 3-44
Cumulative Total Defaulted Costs for the Median Cost Scenario

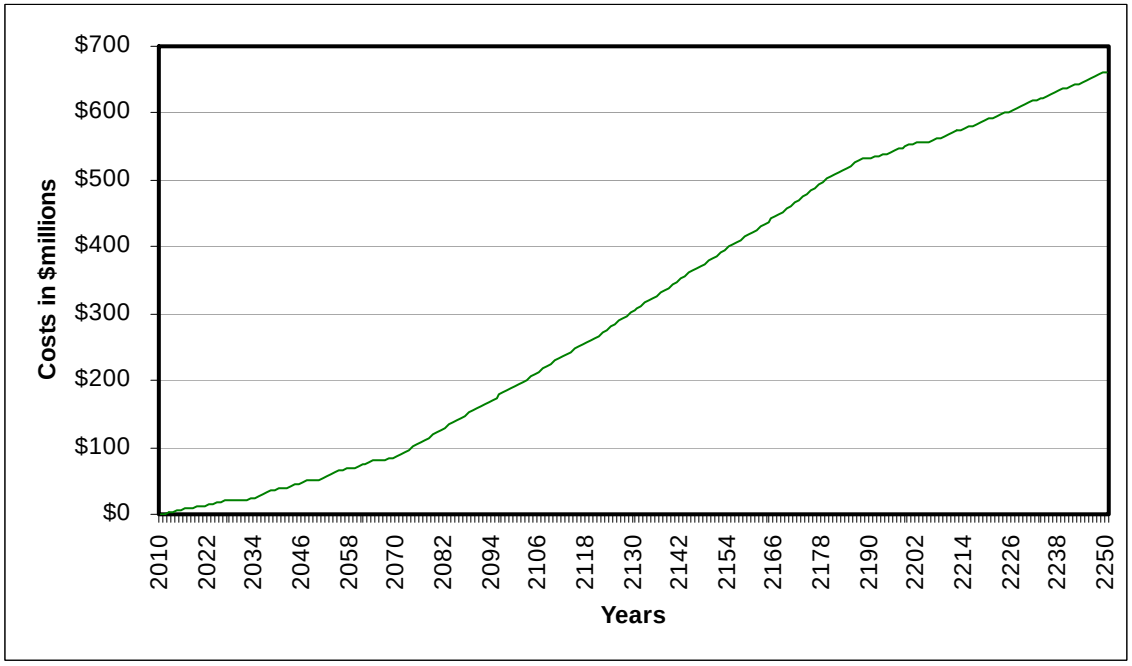


EXHIBIT 3-45
Annual Total Default Costs by Owner Type for the Median Cost Scenario

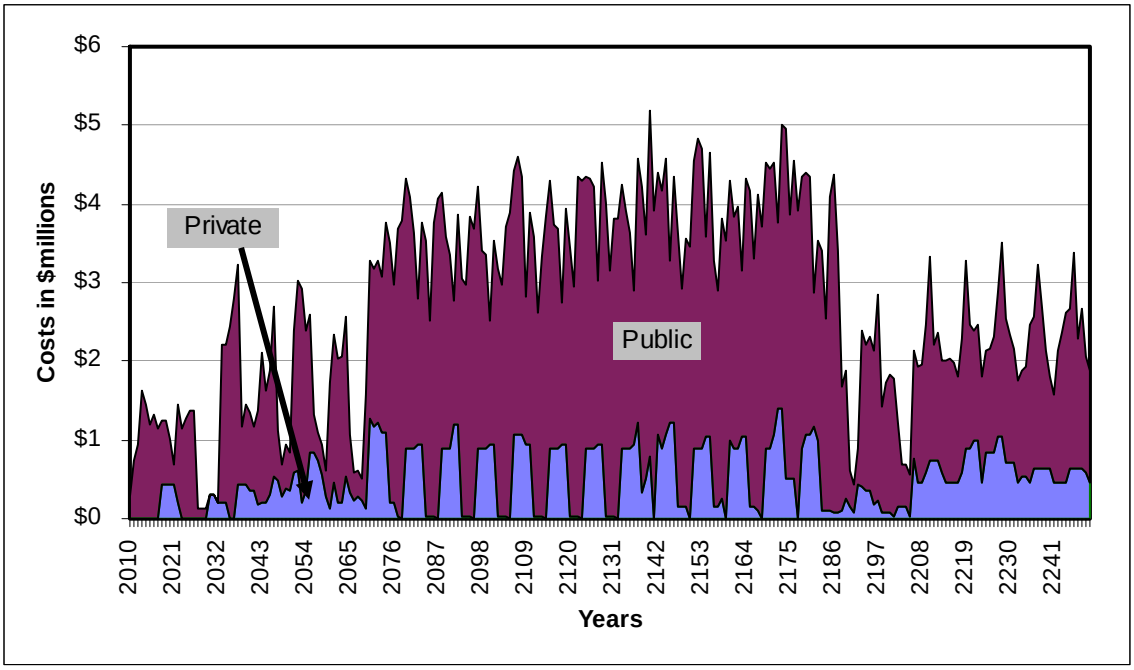


EXHIBIT 3-46
Cumulative Total Default Costs by Owner Type for the Median Cost Scenario

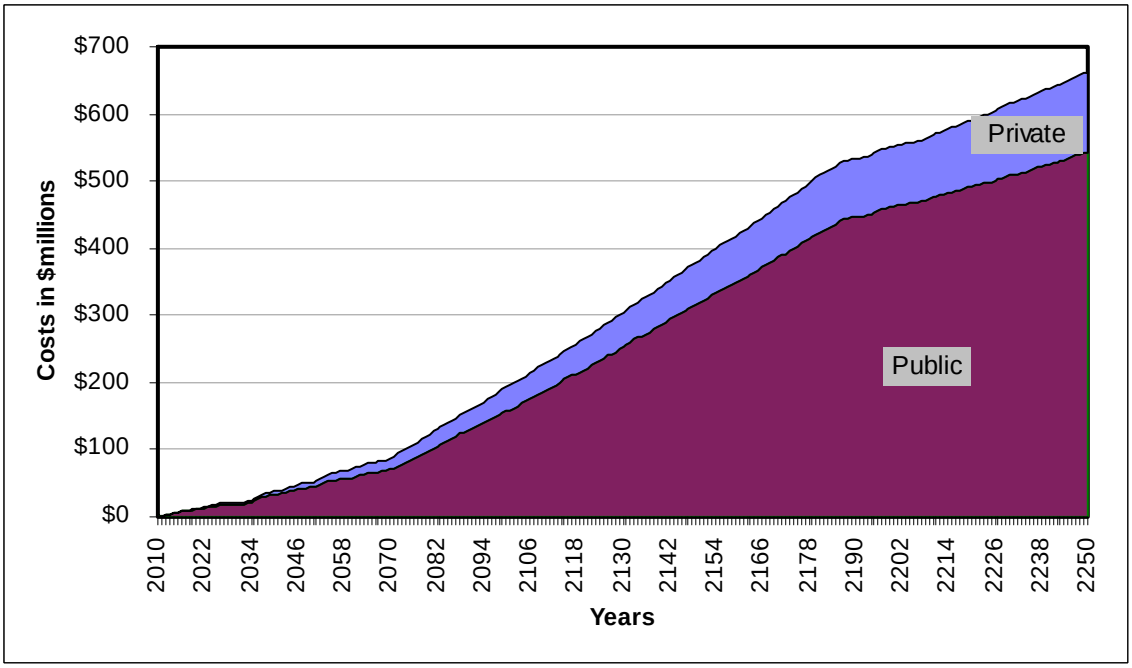


EXHIBIT 3-47
Cumulative Total Default Costs by Landfill Size Category for the Median Cost Scenario

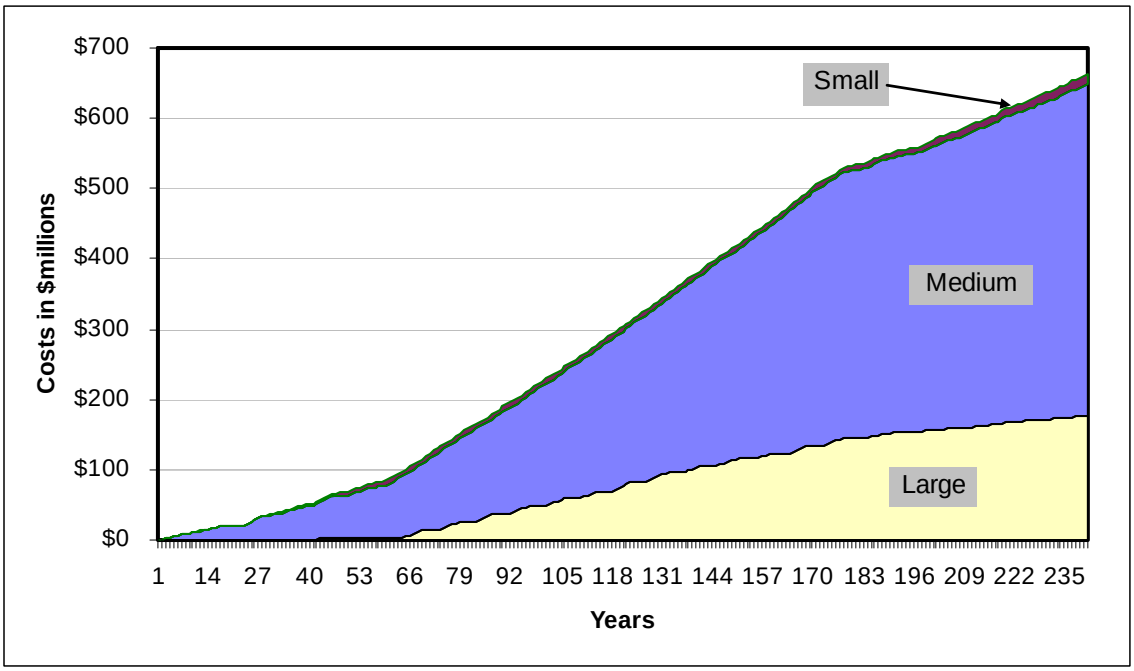


EXHIBIT 3-48
Cumulative Total Defaulted Costs by Proximity to Urban Areas

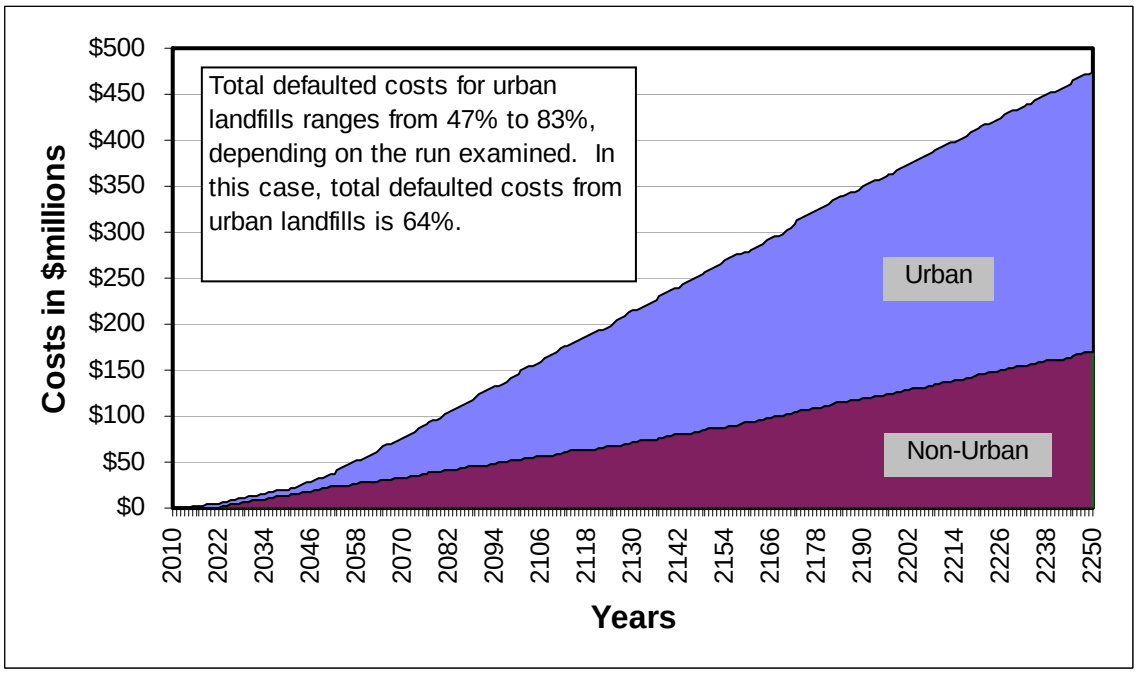


EXHIBIT 3-49
Cumulative Total Defaulted Corrective Action Costs by Operational Status

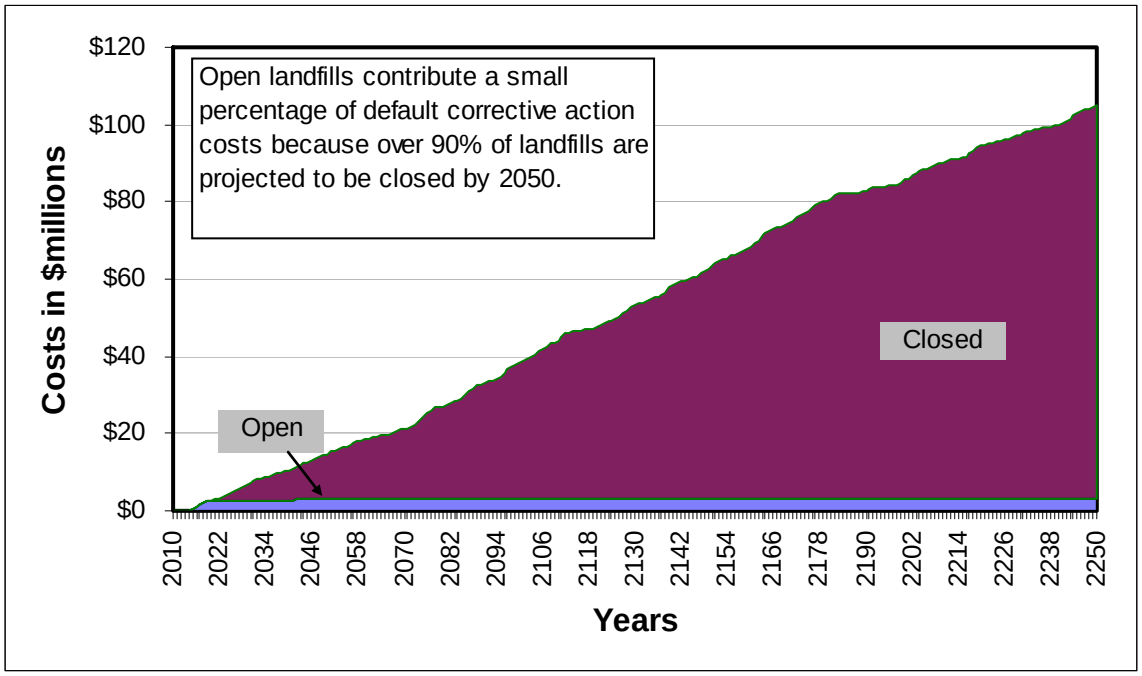
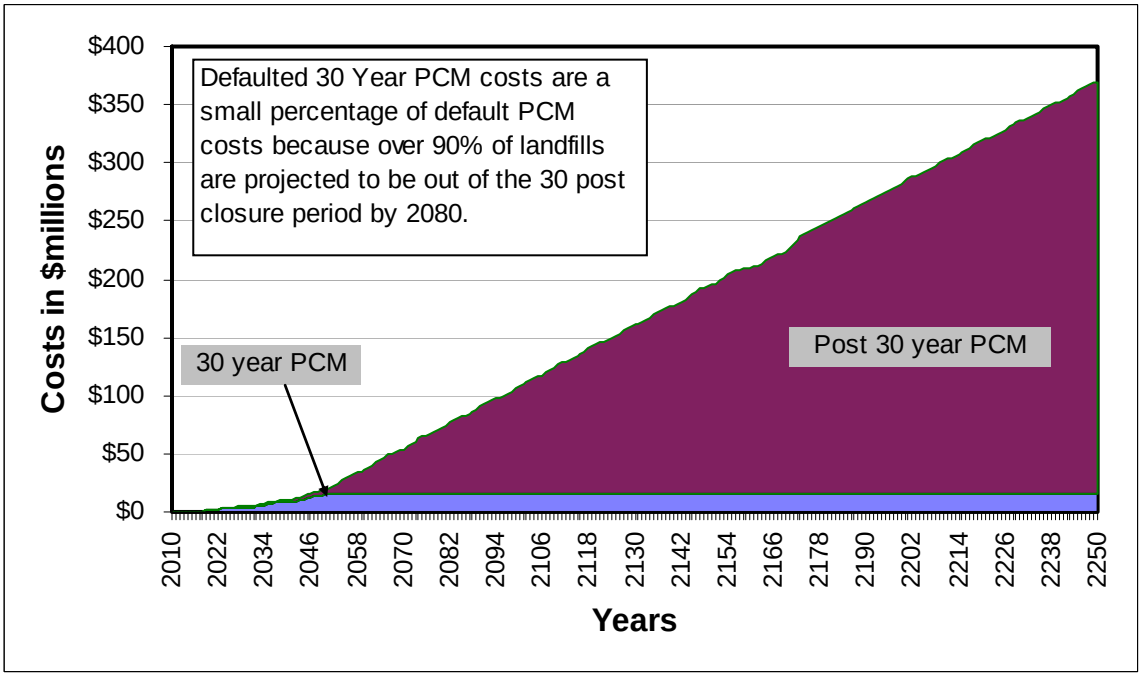


EXHIBIT 3-50
Cumulative Total Defaulted PCM Costs by 30 Year Period and Post 30 Year Period



Exhibits 3-51 and 3-52 show the annual and cumulative total PCM and CA costs, not just defaulted amounts, estimated for all landfills in the study. The purpose of these exhibits is to show the magnitude of PCM and CA costs estimated in the model so that the CIWMB can better evaluate how well the model is estimating these costs as compared to other methods used to estimate these costs. Exhibit 3-51 shows total costs climbing to over $90 million per year and leveling off as more LFs enter their PCM periods. Exhibit 3-52 dramatically demonstrates that PCM costs dominate CA costs in the Base Case.

Exhibit 3-53 graphs the number and probability of CAs for each of the three types of CAs. High-cost CAs have higher probabilities of fewer (but more expensive) CAs. Conversely, low-cost CAs occur in much greater numbers and more frequently than high-cost CAs.

Exhibit 3-54 displays the number of LFs in default status for any given year. For most of the modeling period, no more than 10 LFs per year are in default mode; however, in the early years, as few as one landfill might experience a default. As shown, for much of the modeling period, about 5-10 LFs per year would need attention from the fund.

Exhibit 3-55 summarizes the parameters that define the Base Case, the Median Case, and sensitivity values, and Exhibit 3-56 displays sensitivity analysis results.

EXHIBIT 3-51
Annual Total Corrective Action and Postclosure Maintenance Costs for the Median Cost Scenario

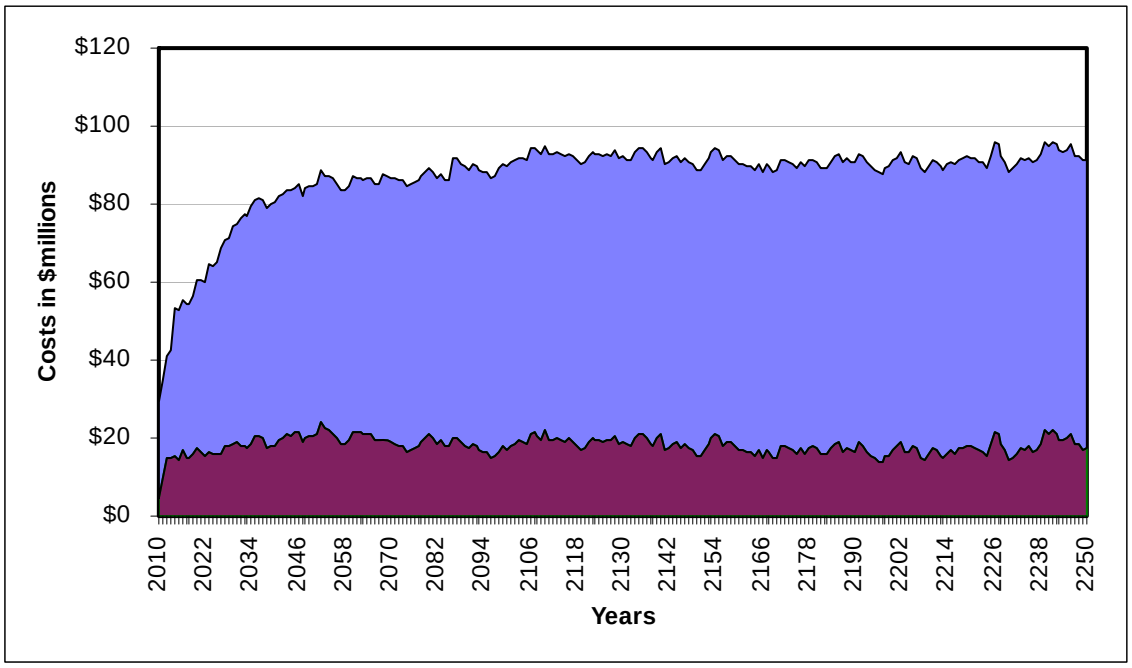


EXHIBIT 3-52
Cumulative Total Corrective Action and Postclosure Maintenance Costs for the Median Cost Scenario

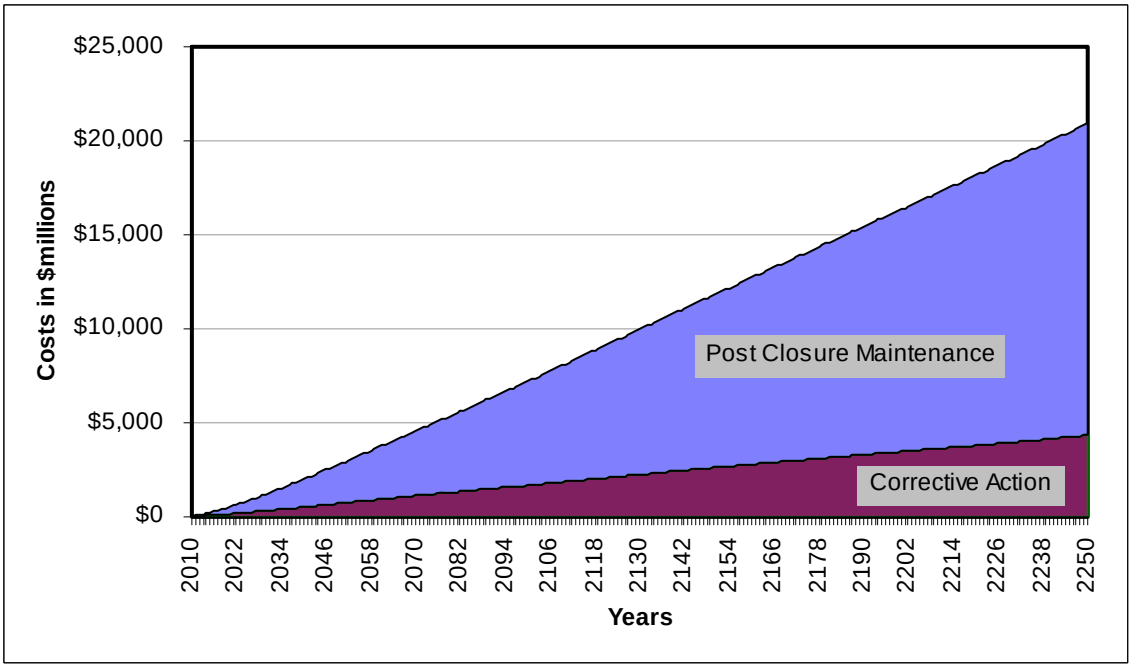


EXHIBIT 3-53
Probability of a Landfill Incurring a Number of Corrective Actions by Corrective Action Type

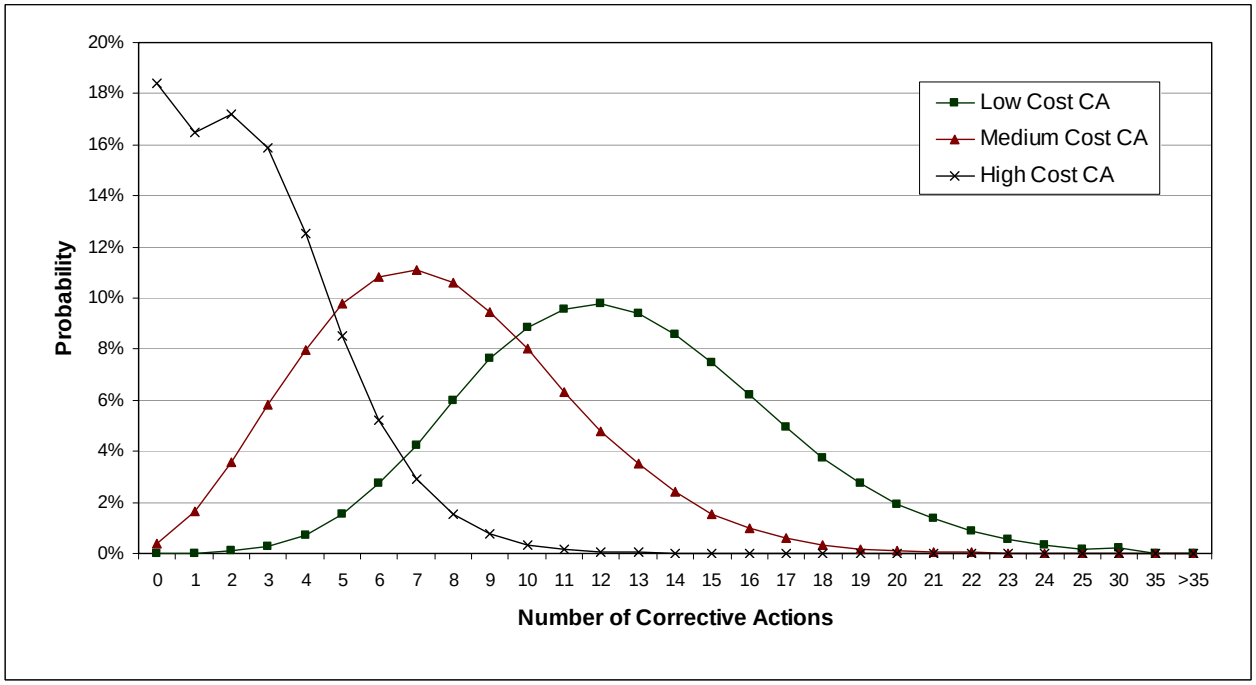


EXHIBIT 3-54
Number of Landfills with a Default in Each Year

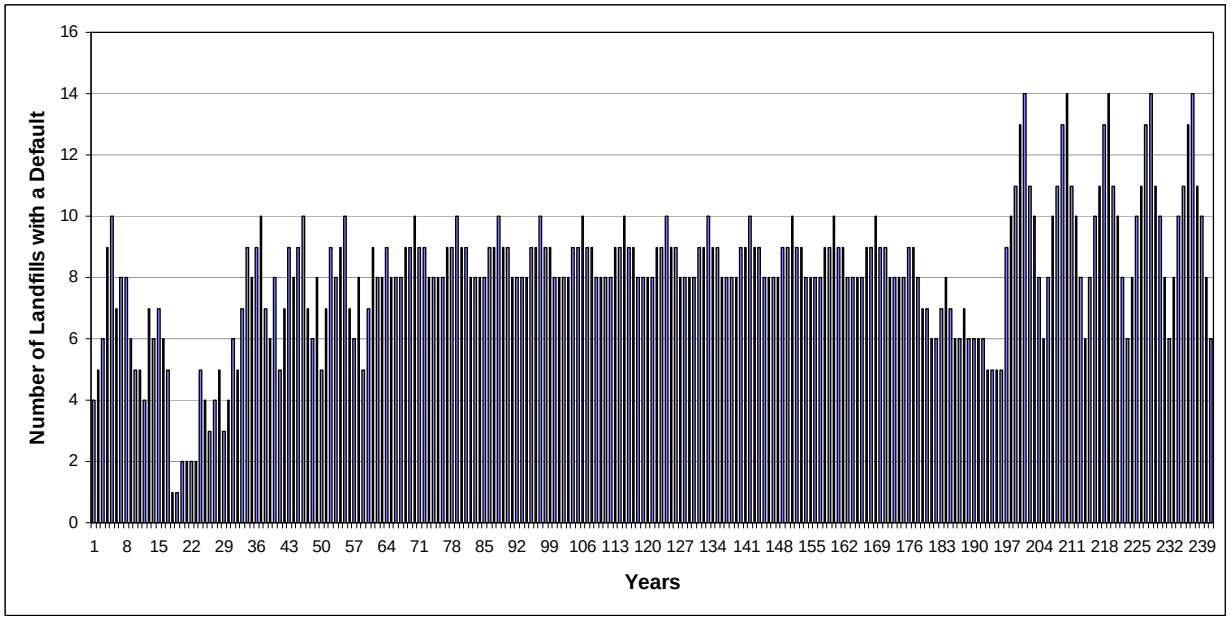
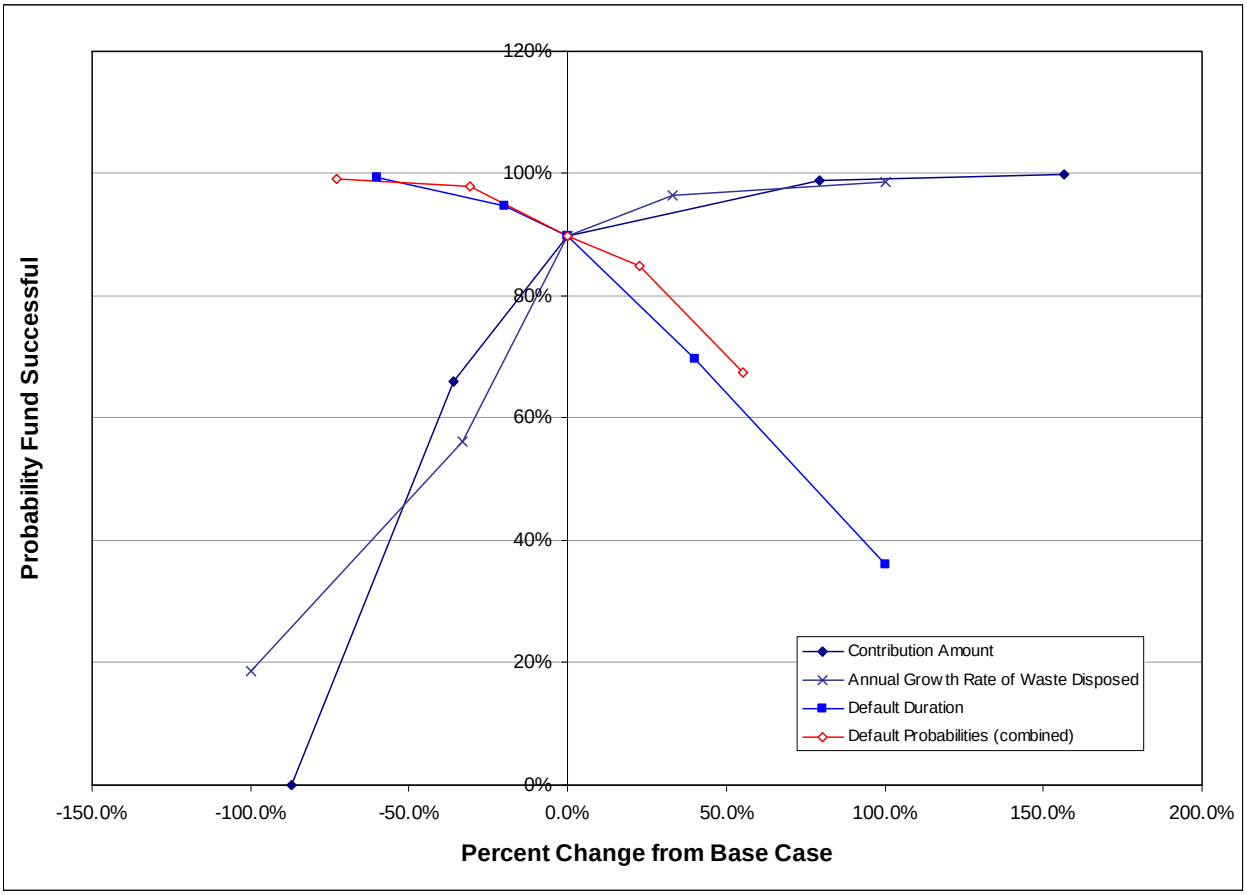


EXHIBIT 3-55
Parameters Defining Base Case and Sensitivity Analysis

Parameter	Base Case	Median Case[1]	Sensitivity Values				
			Minimum	1st Quartile	Median	3rd Quartile	Maximum
Fund Contribution Amount ($/ton)	0.078	0.078	0.01	0.05	0.078	0.14	0.20
Million Tons of Waste Disposed in First Model Year[2]	42	42	38	40	42	46	50
Annual Growth Rate of Waste Disposed	0[3]	0	- 1.5%	- 0.5%	0	0.5%	1.5%
Minimum Fund Expense	$50,000	$50,000	$20,000	$40,000	$50,000	$70,000	$100,000
Fund Expense(% of fund value)	1%	1%	0	0.5%	1%	1.25%	1.5%
Fund Interest Rate							
Minimum	1.5%	2.5%	1.5%	2%	2.5%	3%	3.5%
Maximum	3.5%	2.5%	1.5%	2%	2.5%	3%	3.5%
Fund Threshold Values							
Suspend Contributions	$50MM	$50MM	$30MM	$40MM	$50MM	$75MM	$100MM
Resume Contributions	$45MM	$45MM	$25MM	$30MM	$45MM	$60MM	$75MM
Reserve Margin	$15MM	$15MM					
Default Probabilities							
Single Landfill Owners	1%	1%	0.1%	0.5%	1%	1.2%	1.5%
Private Owners, Mult. LF	0.15%	0.15%	0.02%	0.1%	0.15%	0.2%	0.25%
Public Owners, Mult. LF	0.17%	0.17%	0.02%	0.1%	0.17%	0.2%	0.27%
Probability Multiplier for Any LF With a High-Cost CA	2x	2x	1x	1.8x	2x	2.2x	3x
Group Default	1%	1%	0.5%	0.8%	1%	1.2%	1.5%
Duration of Defaults (years)	5	5	2	4	5	7	10
Percent of Defaults that are Permanent	1%	1%	0	0.5%	1%	1.5%	2%
Corrective Action Cost Standard Deviations	See Exhibit X	All set to 1					
Corrective Action Durations							
Low Cost	See Exhibit Y	2					
Medium Cost		3					
High Cost		30					

1. The median case is used to generate outputs from one run.
2. The first quartile value is based on projected disposal in 2011 based on historical recycling and generation growth rates. The 3rd quartile value is based on the historic annual average growth rate of waste disposed of 1.9%. The median value is the tons of waste disposed in 2005, which is the most recent available data.
3. Zero percent growth rate of disposal assumes that increased recycling and diversion offset the growth in disposal due to population increases.

EXHIBIT 3-56
Sensitivity Analysis of Four Parameters to which the Model is Most Sensitive



INTERPRETATION OF MODEL RESULTS

The Working Model is a stochastic (i.e., probability-based) model. This means that the results it produces are probability distributions. The ability to produce distributions differentiates the Model from other models which produce single values or point estimates. This ability helps to make the Model a powerful tool, but demands of the user an increased level of sophistication to interpret the results.

Before describing how the Model results are interpreted, several terms must be defined. A single run of the Model produces a set of results. The results for a run are driven by the inputs used to specify the run, and by the data and relationships built into the Model. Runs differ from one another in terms of the inputs used. The underlying Model data and relationships remain unchanged.

A single run is made up of numerous iterations, or sequential options of the Model under the same set of inputs. During each iteration, the Model performs all the calculations necessary to estimate fund balance over time. The results from one iteration to the next will vary because they depend on events which occur probabilistically. The occurrence of the probabilistic event is modeled using random numbers. These probabilistic events are the sole basis for differences among iterations within a single run.

The results of each iteration in a Model run are statistically independent. Each iteration is analogous to a strictly controlled experiment, and the results of the numerous iterations can be combined into an estimate of the distribution of the fund balances over time. Although the outcomes of the controlled experiments may vary, the variance may be attributed to random factors.

For example, a given Model run may be made up of 2,000 iterations. This means that for each of 240 years, the Model will estimate the fund balance (and everything else as well) a total of 480,000 times. The model determines the number of years in each iteration when the fund balance is negative. The 2,000 estimates of the number of years of a negative fund balance can be described in terms of their distribution. The distribution can be graphed and its nature summarized by various statistics.

The greater the number of iterations in a given Model run, the greater the confidence that the distributions generated and summarized as Model output resemble the actual distributions which would result from the Model assumptions and parameters. In other words, the larger the number of independent observations of the characteristics of a state fund, the better the characterization of the state fund, given the accuracy of the techniques used for measuring the attributes of the characteristics. There is value in performing numerous iterations, but only up to a point. Of course, added iterations contribute to computer costs for running the Model.

4. UMBRELLA POLICIES OF INSURANCE FOR FINANCIAL ASSURANCE OF POSTCLOSURE MAINTENANCE AND/OR CORRECTIVE ACTION

Task 4 involves developing a mandatory insurance product for the 282 permitted landfills in the study universe that would provide financial assurance for defaults of PCM and CA on the parts of private sector and public sector responsible parties and their FA mechanisms. In other words, the insurance is to make up for *any* shortfalls in funding PCM and/or CA *regardless of the cause*. A need for more funding of PCM and/or CA may be due to one or more of the following causes:

- external causes (e.g., severe weather, fire, earthquakes)
- incorrect design of engineered controls
- faulty materials (e.g., liner(s), cover, gas and leachate collection systems)
- faulty installation of engineered controls
- inadequate maintenance and repair of engineered controls
- inadequate cost estimates
- FA mechanism/provider default

This section describes the desired insurance product, key issues to be resolved, and reactions from the marketplace.

This chapter is organized as follows:

4.1 Desired Coverage
4.2 Issues to Resolve
4.3 Feedback from the Insurance Marketplace

4.1 DESIRED COVERAGE

Based on discussions with the CIWMB staff on the desired scope of the insurance product, ICF first defined PCM, CA, and default, as follows:

- Postclosure Maintenance means all activities undertaken at a closed solid waste management unit to maintain the integrity of containment features and to monitor compliance with applicable performance standards. This is work that is performed regularly or periodically to deal with routine wear and tear of containment features. It does not include repairs of containment features damaged as a result of major events, such as floods, stormwater runoff, earthquakes, or fires; nor does it include repairs of containment features damaged due to poor design, improper installation, or inadequate maintenance.

- Corrective Action means activities undertaken at an active or closed solid waste management unit needed to remediate a known release that has occurred to the environment, or activities that would need to be undertaken at an active or closed unit

to restore the integrity of damaged containment, gas extraction, and drainage features. It can include non-routine repairs, such as repairing covers and drainage systems damaged as a result of major events, such as floods, stormwater runoff, earthquakes, or fires; as well as repairs of containment features damaged due to poor design, inadequate materials, improper installation, or inadequate maintenance.

- Default is a failure to perform PCM and/or CA combined with insufficient FA. This determination must be documented by an official letter (e.g., from the CIWMB) informing the insurer that the insured has "failed to perform" and that the insured's FA demonstrations "do not appear sufficient" to fund required activities. Receipt of that letter by the insurer constitutes notice.[1] A default ends upon receipt of an official letter to the effect that a responsible party and/or its FA provider have cured the failure to perform. The insurer may request that the agency declare the default cured based on specified information.

If the responsible party defaults its obligation to perform PCM and/or CA, the CIWMB will look first to the FA provider to supply needed funding up to the relevant ceilings. Should the FA be insufficient, the insurer will be required to pay as needed for completing PCM and/or CA, unless the responsible party ends its default and resumes performance and demonstrating FA, or is replaced by a new responsible party.

ICF recommends allowing the insurer to find a new responsible party to take over the landfill if there is a potentially "permanent" default. The insurer would have a strong financial incentive to find a replacement responsible party. The insurer would need to find a bona fide party because otherwise, if the new party failed to perform, the obligation would go back to the insurer; so there is little risk that the insurer will find a financially marginal, replacement responsible party. In general, ICF believes that permanent defaults will occur very rarely because we believe that most landfills will be attractive to someone at some price who can become the new responsible party.

4.1.1 Reasons for Funding Shortfalls

Funding shortfalls most likely will be due to insufficient cost estimates on which FA is based. Despite all the regulatory precautions, cost estimates may turn out to be too low. The insurance is intended to cover any funding shortfalls, including those due to inadequate or incomplete cost estimates. Typical reasons why cost estimates are too low, inadequate, or incomplete include the following:

- some necessary activities/steps and required resources omitted by cost estimate

- numbers of units and unit costs for necessary activities/steps underestimated

[1] To avoid appearing arbitrary and capricious, the letter could include supporting rationale as to why the agency has arrived at the default determination. The CIWMB should not give the insurer an opportunity to contest the default designation.

- optimistic assumptions about CA and PCM
- indirect costs and profit omitted; costs not fully-loaded (i.e., not full costs)[2]
- inadequate or zero contingency
- did not anticipate factors such as severe weather, labor issues, and similar material adverse events

In addition, although a great cost estimate may be developed for reasonably foreseeable releases, an actual CA may entail costs beyond what was foreseen. Inadequate cost estimates may be more of an issue for CA than for PCM, because individual facility FA mechanisms for CA are based on the costs of all reasonably foreseeable CAs; however, the funds needed to manage actual CAs may differ from the estimates for reasonably foreseeable CAs. With respect to PCM, a cost estimate may turn out to be inadequate because of the need for more years of PCM than anticipated, among other reasons.

Other reasons for funding shortfalls include potential issues with FA mechanisms and providers. For example, investment returns and principal in trust funds or government funds may be impaired by a serious and/or lengthy downturn in the financial markets. Or trust funds and enterprise funds may still be accumulating pay-ins. Or an FA provider may be unable to honor its guarantees.

4.1.2 Cancellation, Termination, Non-renewal, and Voiding/Rescission

Current CIWMB regulations for PCM and CA insurance state that the insurer may not cancel, terminate, or fail to renew a policy except for failure to pay premiums. These are excellent baseline requirements that reflect the California Insurance Code (see Division 1, Part 1 Chapters 9 & 10). However, as a result of similar provisions being used around the country and other trends,[3] insurers have been making greater use of voiding/rescission powers in state insurance codes that allow insurers to extract themselves from policies under the theory that there was fraud or misrepresentation on the part of the insureds. ICF recommends plugging that option.[4] In addition, to reduce the possibility of cancellation due to failure to pay premiums, premium payments can be front-loaded so that after a 1-3 year period, all premiums will have been paid.

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[2] See U.S. EPA, *Full Cost Accounting for Municipal Solid Waste Management: A Handbook* (EPA 530-R-95-041, Sept. 1997),

[3] See Richard E. Stewart and Barbara D. Stewart, "The Loss of the Certainty Effect," *Risk Management and Insurance Review* (Vol. 4, 2001).

[4] ICF urges CIWMB to modify its regulations governing cancellation or nonrenewal by insurers to track 40 CFR 280.109(a)(2), which allows termination only for failure to pay premiums or for misrepresentation. In that way, California may benefit from the ruling in *Zurich American Insurance Co. v. Whittier Properties, Inc.*, 356 F.3d 1132 (9th Cir. 2004).

4.1.3 Timely Payout to CIWMB

Proposed CIWMB regulations for FA using insurance also can be employed for the umbrella insurance product. Thus, if either PCM or CA activities are ordered by the CIWMB, EA, or other government entity or court of competent jurisdiction as a result of failure by the operator or other authorized person to conduct such activities, the policy should guarantee that the insurer shall be responsible for paying out funds to the CIWMB for deposit into a special account established by the CIWMB for PCM or CA activities of the facility in excess of funds available from FA mechanisms for PCM and/or CA. The policy should further guarantee that the insurer shall, without delay, pay to the CIWMB the amount the CIWMB requests, up to an amount equal to the face amount of the policy, regardless of any remaining premiums to be paid. CIWMB requests for payment should be based on estimated expenses of PCM and/or CA activities in excess of funds available from FA mechanisms as determined by the CIWMB. Any payments made by the insurer to the CIWMB that exceed the actual expenses incurred in performing the insured activity will be repaid to the insurer at the completion of the insured activity

4.1.4 Draft Endorsement

Based on discussions with the CIWMB staff, ICF drafted a specimen endorsement form which appears as Exhibit 4-1. An endorsement functions as an integral part of an insurance policy. The key features of the endorsement include:

- definitions of PCM, CA, and default, as shown above
- coverage required for "all costs" of PCM and/or CA in excess of the funding available from the insured's FA mechanism(s)
- no exceptions, exclusions, conditions, or limits on payments due to *causes* of funding shortfalls and defaults
- first dollar coverage; no deductible, copayment, or insured self-retention to affect payments from insurer
- no cancellation, termination, or nonrenewal by insurer except for nonpayment of premium or misrepresentation; no cancellation, termination, or nonrenewal by insured (mandatory coverage)

Given these specifications, there are (at least) three other points to consider: (1) implications of the potential length of the program, (2) claims management, and (3) setting and raising premiums. ICF comments on each of these points next.

<u>Length of Program</u>. ICF believes that it is unreasonable to expect any insurer (or group of insurers) to sign up for an insurance program that could last for over two hundred years. Therefore, ICF recommends that the CIWMB should think of contracting out for this program in,

for example, five- or ten-year renewable increments, at least until more experience is obtained. A contract also can include provisions relating to adjustments in pricing, given considerable uncertainty about the potential liabilities of this program.

Claims Management. One component of the standard insurance paradigm has reportedly been a frustration to the CIWMB and other stakeholders: insurers treat requests for money as "claims" to be "adjusted," whereas the CIWMB desires to have its "claims" be simply, totally, and rapidly paid. A claims adjuster normally works for the insurer, evaluates the merits of each claim, and recommends to the insurer how to settle the claim. Furthermore, insurers typically prefer to fulfill claims similar to PCM and/or CA by hiring contractors to perform the work and supervising their spending (or arranging for others to do so). This can extend the time before the insurer starts disbursing money, which always helps the insurer's bottom line.

Insurers typically "manage" claims by such practices as reserving the right to select its own contractor (e.g., to perform CA and/or PCM), to review and approve rates for paying its contractors and invoices for the activities they perform, and related controls over expenditures. This can be a source of friction with regulatory agencies, which may have a different view about the proper conduct of PCM and/or CA. The hands-on management by the insurer may or may not be desired by the responsible public agency (e.g., LEA, CIWMB, SWRCB), which may itself prefer to procure and/or pay the contractor using proceeds provided by the insurer. ICF recommends that claims management not be outsourced to the insurer or that acceptable regulatory checks and balances be included in the policy and the program contract.

Setting/Raising Premiums and Retrospective Assessments. If cancellation, termination, and non-renewal is permitted for failure to pay premiums, and failure to pay premiums is a symptom of financial distress, then insurance coverage could disappear just when it is most needed. (CIWMB has addressed this possibility in §22248(h) for PCM/CA insurance.) Moreover, if the insurer has unfettered power to raise premiums, it can encourage insureds to stop paying premiums by significantly raising the price of coverage, thus leading to cancellation, termination, or non-renewal. ICF recommends that premiums be front-loaded and that there be controls on premium magnitudes in the contract between the umbrella insurer(s) and the CIWMB. If defaults prove to be much greater than anticipated, the contract should allow the insurer to collect some amount of retrospective assessments from its insureds. ICF believes that it is important to balance an insurer's need to make money on its insurance programs (or at least not lose money) with the notion that insurance entails some risk of loss for the insurer. This suggests allowing the insurer some flexibility to adjust premiums to reflect loss experience but not guaranteeing that the insurer will necessarily make money.

4.2 OTHER ISSUES TO BE RESOLVED

This section discusses the following issues that may pose concerns to insurers and others considering the proposed product/program:

- due diligence
- claims made vs. occurrence coverage
- defaults and moral hazard

- limits of liability
- covered perils and exclusions

4.2.1 Due Diligence

An insurer undertaking this program will want to conduct underwriting "due diligence" for a sample or all 282 covered facilities.[5] Estimated one-time underwriting expenses of about $3-$5K per facility would sum to $846K to $1.41 million. (If the insurance contract changes hands, more due diligence should be expected.) A responsible insurer needs to understand the status of the covered facilities, their responsible parties, and which FA mechanisms are being used.

The 282 LFs in the study universe are the responsibility of 116 parties (i.e., 36 private sector and 80 public sector parties), as follows:

- There are a total 71 facilities with 36 private sector responsible parties: 41 landfills are associated with 6 responsible parties, leaving 30 other landfills and 30 responsible parties for a total of 36 private sector responsible parties. Waste Management, Inc./ USA Waste has 15 facilities and Allied Waste/BFI 13.

- There are 211 facilities with 80 public sector responsible parties: 158 landfills are associated with 27 responsible parties, leaving 53 other landfills and 53 responsible parties for a total of 80 public sector responsible parties. The county of San Bernardino has 20 facilities, the County of Kern 15, the County of Riverside 12, the County of Imperial 9, and the Federal government has 17.

Operational status of the 282 LFs is summarized in Exhibit 4-1, which shows that about 45% of the LFs that would join the program are closed, including many smaller LFs. Thus, these facilities already are in the PCM period.

EXHIBIT 4-1
Operational Status of Permitted Landfills

	Total	Private Sector	Public Sector
Currently Open	154 (55%)		
Currently Closed	128 (45%)		
Total	282 (100%)		

[5] The facility cohort includes a larger number of individual units that vary in key features, although all permitted units at a facility are covered by the same FA mechanism(s) for PCM and/or CA.

Exhibit 4-2 summarizes current use of FA mechanisms for the 282 LFs. Exhibit 4-2 shows that the pledge of revenues is the most used FA option, with over half of the LFs using this mechanism for PCM. The trust fund is distant second. The pattern is different for FA mechanisms being used for CA; however, ICF expects changes in the data as more facilities address FA for reasonably foreseeable CA.

EXHIBIT 4-2
Use of FA Mechanisms for PCM and CA

	PCM FA Mechanisms		**CA FA Mechanisms**	
	#	**$**	**#**	**$**
Trust Fund	26	484.6M	4	7.3M
Enterprise Fund	36	168.1M	21	13.9M
Sale of Government Securities	0	0	0	0
Letter of Credit	17	81.1M	11	5.7M
Surety Bond	9	82.4M	17	10.8M
Pledge of Revenues	154	779.2M	15	22.5M
Financial Means Test	2	10.7M		
Corporate Guarantee	13	105.6M		
Insurance	8	82.6M	6	6.1M
Government Financial Test	0	0	0	0
Government Guarantee	0	0	0	0
Federal Certification	17	69.5M	0	0
Total	282	1,864M	74	67.4M

Source: CIWMB, Sept. 2007.

Exhibit 4-3 shows statistics calculated by ICF for current PCM and CA cost estimates. The cost estimates show a median of $2.2 million for PCM for all LFs; no substantial differences appear between the PCM cost estimates from private sector and public sector LFs. The median cost estimate for CA is just above $575K and no substantial differences appear between the CA estimates from private sector and public sector LFs.

EXHIBIT 4-3
Statistics for Current PCM and CA Cost Estimates

	PCM Cost Estimates		
	ALL	**Private Sector**	**Public Sector**
Mean	$6.6M	$7.8M	$6.2M
Median	2.2M	3.1M	1.9M
Maximum	188.4M	83.4M	188.4M
25%-ile	877K	853K	884K

EXHIBIT 4-3
Statistics for Current PCM and CA Cost Estimates

75%-ile	6.7M	8.8M	6.3M
Std Deviation	15.0M	12.9M	15.7M
	CA Cost Estimates		
	ALL	**Private Sector**	**Public Sector**
Mean	$864.7K	$662.2K	1.0M
Median	575.1K	441.4K	629.7K
Maximum	9.9M	4.1M	9.9M
25%-ile	257.1K	245.9K	380.5K
75%-ile	899.2K	774.9K	926.3K
Std Deviation	1.3M	739.1K	1.6M

Another area of due diligence relates to the CIWMB program rules. For example, the rules for ending PCM will affect the insurer's potential liability for covering PCM defaults. A less obvious concern may center on the FA rules for known CAs and for reasonably foreseeable CAs. The regulations do not seem totally clear to ICF regarding what happens when the need for CA arises at a facility that previously demonstrated FA only for reasonably foreseeable CAs. As ICF interprets the regulations, parties are responsible for demonstrating FA for completion of known CAs, so that when a CA becomes known, the facility must prepare a cost estimate and provide FA for the known CA. What is less clear is whether the facility must also demonstrate FA for other reasonably foreseeable CAs at the same time and/or whether the facility must "replenish" the FA for reasonably foreseeable CAs to make up for any money moved to the FA for the known CA.[6] If ICF were the insurer, we would want to know precisely how FA for CA will work, or if that still is a work in progress.

4.2.2 Type of Coverage

ICF recommends a "claims made" concept of coverage as opposed to an "occurrence" basis for coverage. A "claims made" arrangement aligns better with the notion of re-competing or renegotiating the program contract periodically. A "claims made basis" makes the insurer liable only for qualifying claims made during the period when the insurer is responsible for the program; an occurrence basis would make the insurer liable for any claims due to occurrences happening when the insurer is responsible for the program, even if the claims do not appear until after the policy period ends. ICF expects that insurers will prefer the claims made policy. Type of coverage is not reflected in the draft endorsement prepared by ICF, pending feedback from the insurance marketplace.

[6] Replenishment is required under the petroleum UST FA program, which requires FA prospectively for remediating future releases.

4.2.3 Defaults and Moral Hazard

Although making the insurance mandatory eliminates issues of adverse selection, the type of coverage desired by the CIWMB entails a risk of moral hazard. Because a performance default includes both being unable as well as unwilling to perform, there is the danger that insureds will be more likely to put themselves in the position of being unable or unwilling to perform by virtue of being covered by the insurance. Insurers typically address this "moral hazard" though the use of deductibles, self-insured retentions, and copays, but those options would undermine what the CIWMB would like to accomplish.

4.2.4 Potential Limits of Liability

It is common practice in the insurance industry to establish dollar limits of liability in policies and endorsements, although the California Insurance Code does not seem to require that policies include such limits (see Division 1, Chapter 4). CIWMB regulations for PCM and CA insurance provide that policies be issued at face amounts at least equal to the most recently approved cost estimates. Options for policy limits for the umbrella insurance include the following:

(a) No specified dollar limits.

(b) Limits based on the most recent, approved cost estimates.

(c) Set limits at some multiple of (e.g., twice) the most recent cost estimates.

(d) Establish a schedule of dollar limits for different size LFs that would be unlikely to be exceeded (e.g., 90-95%) by actual PCM and/or all CA expenditures.

The best option would be to avoid having any liability limits at all for PCM; the insurance should cover any defaults until the waste no longer poses a threat. Although cost estimates for PCM may be reasonably complete, especially after pending revisions to the cost estimating regulations, a dollar limit for PCM would require knowing for how long the PCM would be necessary. That is unknowable at present. For CA, the insurance should cover all defaulted CA activities until an NFA-type letter is issued by the responsible regulator. Some CAs may require lengthy time periods and large expenditures to complete with uncertain end dates. Some LFs may require multiple CAs. However, insurers may not be willing to offer coverage with no limits.

Basing the limits on recent approved cost estimates may create a risk that the umbrella insurance will leave CA and/or PCM under-funded because (a) the LF may require more than 30 years of PCM and (b) the regulations do not require LFs to estimate and assure the costs of all potential CAs, just those that have commenced or those that are reasonably foreseeable. Setting policy limits at a multiple of the cost estimates provides better assurance but appears arbitrary and may nonetheless still not be enough coverage. Coming up with an appropriate schedule of fixed dollar limits has the same difficulties and risks of under-coverage; results from the working model may offer guidance and a basis for such limits, on the other hand.

4.2.5 Potential Exclusions for Certain Perils and Causes of Default

Another common insurance industry practice is to exclude certain claims from coverage. For example, an insurer might want to exclude from coverage those failures to perform PCM and/or CA that result from earthquakes, on the theory that separate earthquake insurance coverage should cover such damages; a variation on this example would be to exclude coverage of defaulted CA if the need for CA were due to an earthquake. Or an insurer might want to exclude failures to perform PCM and/or CA due to strikes and other labor issues. Regardless, ICF recommends that no exclusions from coverage due to the *cause* of a default be acceptable. The desired coverage is of an "all perils" nature, not "named perils" only. Whether wind, flood, earthquake, ice, hail, drought, fires, or hurricanes (or combinations thereof) cause a need for more funding of PCM and/or CA should not be an issue affecting the coverage. The CIWMB shouldn't need to assess the cause(s) and pursue parties potentially responsible (e.g., consultants, contractors, and materials suppliers) for greater needed funding because the umbrella insurance does not cover them. The point of the insurance is to protect the taxpayer by making up any shortfalls. The insurer can be given a right of subrogation to pursue parties the insurer believes should reimburse it for payments made. The costs and rewards of pursuing subrogation should primarily accrue to the insurer not to the CIWMB. That is the best way to ensure adequate financial coverage to protect the state's taxpayers. However, exclusions of issues (e.g., conventional commercial auto insurance, workers compensation) outside the required scope of coverage would be acceptable.

4.3 FEEDBACK FROM THE INSURANCE MARKET

American Risk Management Resources Network, LLC (ARMR) interviewed representatives of major U.S. environmental insurers to assess their initial response to the concepts outlined above and to solicit suggestions on how to best structure excess or umbrella insurance coverage over mandatory "primary" FA mechanisms for California landfill PCM and/or CA.

4.3.1 Background

It is the opinion of ARMR that the principal direct damages resulting from the failure of a landfill or its components may be environmental, mechanical/structural, or both. Although the repair of a failed structure might be covered by an appropriately designed commercial property or inland marine insurance policy, such policies routinely exclude coverage for pollution-related losses. Thus, the potential for environmental contamination associated with the failure of any landfill component suggests that the most complete insurance coverage would come from some type of environmental insurance policy. In the work summarized here, exploring the feasibility of umbrella insurance over mandatory FA instruments for landfill PCM and/or CA, ARMR therefore pursued discussions with environmental insurance underwriters, who, in all cases, concurred that the environmental insurance marketplace was the most appropriate insurance venue for underwriting this type of risk.

There are about ten companies currently underwriting environmental insurance in the U.S. ARMR interviewed representatives of four of the largest of these (all have A. M. Best Company ratings of A XI, or better). All four of these carriers are writing environmental impairment liability (EIL) insurance[7] policies with limits up to $50 million and policy terms of up to ten years. All four are currently writing "cost-cap"[8] type insurance policies and finite insurance[9] policies. Thus, the four selected carriers offer the most flexible underwriting and policy design available for environmental risk in the U.S. at this time.

ICF provided a "white paper," entitled "Umbrella Policies of Insurance for Financial Assurance of Postclosure Maintenance and/or Corrective Action," summarizing recommended parameters for a proposed umbrella insurance policy over mandatory FA instruments for PCM and/or CA for California landfills. A copy of the "white paper" was sent to each insurer for review.

As an operating landfill approaches closure, it is required to file a plan for PCM and "reasonably foreseeable" CA with the CIWMB. The plan will include a cost estimate for all tasks covered. The landfill operator must post evidence of FA (i.e., the capacity to fund the planned PCM and/or CA). This requirement can be met using various methods, including insurance, surety bonds, trust funds, etc. In the discussion below, such instruments, provided independently by each landfill operator, are termed, "primary" FA. Verifying the efficacy of submitted PCM/CA plans and the adequacy of associated cost estimates is in the public interest as well as to the benefit of any insurer providing umbrella coverage over primary FA. Given that plans and cost estimates are typically prepared by consultants retained by landfill operators, risk underwriting by an insurer provides an additional level of review that mitigates against minimalist plans and under-funded budgets.

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[7] Environmental impairment liability (EIL) insurance responds when damages are suffered as a result of a pollution incident. The incident may be historical, occurring prior to the policy's inception date, or "new," occurring after policy inception. In the former, case, policy language generally restricts coverage to conditions unknown to the insured at the time of application. Coverage may include third-party liability (i.e., relating to damages suffered by parties other than the insured) and/or first-party liability (i.e., remediation or cleanup costs).

[8] Cost-cap insurance, also known as remediation stop-loss coverage, is a specifically tailored EIL policy that covers remediation costs only for specified known conditions and a specified remedial project. Coverage "attaches" or commences only after the "known" or estimated remediation costs reported (as part of the application) have been incurred and paid by the insured. Thus, the policy responds only to cost overruns.

[9] Finite insurance is not insurance in the conventional sense, but a financial instrument where the insurer agrees to pay on behalf of the insured a specified future stream of cash flows based on an agreed net present value. Thus, if the insured needs to fund a 30-year operations and maintenance plan where the monthly or annual cash flows are known, it may arrange with an insurer to make these payments in exchange for receiving a net present value of the future obligation. Once the finite insurance contract has been negotiated, the insurer is generally obligated only to fund the pre-agreed cash flow. Depending on the contract, it may have no obligation to cover shortfalls arising from inflation, regulatory changes, performance shortfalls in a remedial plan, etc. Generally, finite insurance involves only the assumption of interest rate risk by the insurer.

4.3.2 Umbrella Insurance as Outlined in the ICF Document

ARMR provided copies of the document, "Umbrella Policies of Insurance for Financial Assurance of Postclosure Maintenance and/or Corrective Action," to five environmental insurers. These insurers were:

- AIG Environmental
- Ace Environmental
- Evanston Insurance Company (Investors Underwriting Managers)
- XL Environmental
- Zurich Environmental

ARMR asked each insurer to review the document and subsequently followed up with telephone discussions exploring the provision of insurance along the lines summarized. Discussions were held with four insurers; one declined to participate.

Insurance coverage as outlined in the ICF document is a single excess or umbrella insurance policy with the State of California or the CIWMB as the named insured. It is not entirely clear to the insurers interviewed whether a single policy covering both PCM and CA, or two policies (one covering PCM, the other covering CA) are envisioned. The policy would have the following parameters:

- Insurance is excess/umbrella over primary FA instruments.
- The insurance is intended to cover any shortfall in PCM and/or CA funding.
- All 282 permitted landfills in California are to be covered
- Five-ten year policy term.
- Claims-made policy form.
- "All perils" (as opposed to designated perils) coverage.
- No provision for contest by insurer of CIWMB claims for coverage is envisioned.
- Ideally, policy would have no limit of liability.
- No exclusions relating to cause of default. Exclusions of perils covered by other available insurance (auto, worker's compensation, etc.) would be acceptable.
- Coverage cannot be voided due to fraud or material misrepresentation.
- Claims would not be managed by insurer.

None of the insurers ARMR interviewed were willing to commit without reservation to providing insurance with these parameters. All expressed the opinion that, at the very least, substantially more information on the details of the plan envisioned would be required before they could reach any decision on participating. Additionally, some of the insurers ARMR spoke with viewed certain of the specified parameters (insurance policy with no limit of liability, no

contest of CIWMB demand for claims payments, no claims management by insurer) as sufficiently onerous as to almost guarantee their refusal to participate.

One insurer viewed any requirement to write excess insurance over (a portfolio of) FA instruments as "… almost certainly unworkable for us …" due to a stringent prohibition against underwriting credit risk.[10] The insurer's view, in this case, is that their expertise is in environmental risk underwriting; there are other business entities (e.g., banks) that specialize in underwriting credit risk and have a competitive advantage in doing so; and so, as a matter of policy, they will avoid transactions driven by credit risk. Other insurers ARMR spoke with do not share this view. Another insurer viewed the likely diversity of quality in the primary FA as so problematic that the only way to successfully underwrite the credit risk would be to attach at a dollar amount corresponding to the posted FA for each landfill, so that insurance would attach *above* the level where credit risk is an issue. In this case, the insurance would have no provision for "dropping down" in the event of FA failure/exhaustion. The required FA would serve as a "deductible."

One insurer interviewed noted that if the umbrella insurance product outlined above attached only after the funds guaranteed by the FA device were actually expended, whether delivered by the party responsible for primary FA or not, the problem of underwriting credit risk is largely obviated [The ICF document specifies, on the other hand, an umbrella insurance product that "drops down" on the failure of primary FA for any reason, as well as exhaustion of the primary FA]. Under these conditions, insurers will be more willing to write excess/umbrella policies although other caveats noted above (policy limits, exclusions, cancellation/voiding coverage, claims management) remain. This means that, in the case of a cost-cap type insurance policy, insurers are willing to cover cost overruns, but not the estimated remediation budget established at the outset of the project.

Three of the insurers interviewed suggested they would not write insurance of the type outlined for terms of ten years. All three mentioned 1-3 year policies as more practical. Stated reasons for their reluctance to write policies with terms of 10 years were:

- Fundamental underwriting data (credit risk data, environmental risk data) can change substantially over periods much shorter than 10 years and thereby change the risk assumed by the insurer.

- Regulations relating to contaminant levels, monitoring methods and frequencies, permitted management methods, etc. can change over periods much shorter than 10 years and thus change the risk assumed under any insurance policy.

One insurer noted that the estimated underwriting budget ($3,000 to $5,000 per facility) was likely inadequate. This insurer expressed concern that properly underwriting the primary FA credit risk, the design and operation of the landfill, and the PCM/CA plans and budgets could easily require ten times the estimated quantity regardless of policy term.

[10] "Credit risk" insurance is an alternative to a letter of credit for certain short-term transactions.

All four insurers expressed concerns about covering shortfalls in FA payouts without restriction as to the cause of the shortfall. The requirement that the insurer pays claims without restriction was viewed as increasing "moral hazard"[11] and "morale hazard."[12]

One insurer noted that issuance of coverage that is truly "all risk" would require engineering and underwriting data that is presently unavailable and would be cost-prohibitive to obtain. This insurer noted that, for example, high quality data on earthquake risk would require the convolution of geophysical data with structural engineering (failure) data and demographic data (population density, school locations and size, traffic density) to assess most probable loss values. Similar data would be required for other failure modes. The insurer asserted that data of sufficient scope and quality were not readily available and would need to be developed by retaining consultants with expertise in seismology, geophysics, structural engineering, civil engineering, etc.

All the insurers ARMR spoke with were troubled by the apparent requirement that, upon request by the CIWMB, the insurer must make immediate and uncontested payment to cover a FA default or the exhaustion of a FA instrument. These concerns stem from the insurers' belief that they make money through careful insurance contract design (underwriting) coupled with making any claims payouts contingent on adherence to the contract terms and conditions. Related concerns were noted regarding the expressed prohibition against insurers managing claims. All insurers believe they derive financial and competitive advantage from their claims management expertise and that this restriction enhances the chance the insurer will pay claims not covered under the contract and reduces the potential to achieve a profit in writing PCM/CA insurance.

All the insurers insisted that they will not write any insurance contracts without a stated limit of liability.

Two insurers observed that the ability to cancel, rescind or deny claims due to fraud or material misrepresentation by the landfill operator/applicant must be available to them and is a central tenant of contract law in the U.S. They noted in particular that the right to cancel is insufficient and that the right to void coverage is important.

In summary, the basic parameters for an excess or umbrella insurance instrument as described in "Umbrella Policies of Insurance for Financial Assurance of Postclosure Maintenance and/or Corrective Action" were viewed as fundamentally unworkable by the four largest U.S. environmental insurers. The following section outlines several alternative ways that such insurance might be structured.

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[11] Moral hazard refers to any tendency of an insured entity, after the purchase of insurance, to facilitate loss so as to obtain the insurance proceeds.

[12] Morale hazard refers to the tendency of an insured entity to be indifferent to loss once insurance has been purchased.

4.3.3 Alternative Concepts

The concepts that follow were developed by ARMR except as otherwise noted.

Separate PCM and CA coverage.

ARMR believes that, when properly defined (as for example, in the ICF document reviewed here), PCM and CA are fundamentally different types of risk most appropriately covered by distinctly different types of insurance. Coverage for CA is essentially EIL insurance, which is readily available from environmental underwriters so long as the condition requiring CA has not yet occurred. ARMR's view is that the principal problem in providing this kind of insurance is in posting sufficient limits of liability. To insure a catastrophic event (failure of several landfills following, e.g. a major earthquake, and the accompanying consequential and time element damages) would require a limit of liability of > $100 million.[13] It is possible that a financial instrument similar to a "catastrophe" bond, where risk is transferred directly to capital markets, rather than indirectly, through an insurer or reinsurer, is the most efficient way to manage this type of risk. Another approach would be, as a matter of policy, to require that any operator filing a CA plan for unknown/unrealized conditions provide an EIL insurance policy either to back-stop primary FA (i.e., the EIL policy would act as umbrella insurance over the primary FA with a drop-down provision should the primary FA fail to perform) or to serve directly as primary FA. Alternatively, see "Coverage Pools," below.

Coverage for "known" or realized CA (i.e., where the failure has already occurred) is a different issue. In this case, an "event" has already occurred. A plan to remediate/restore has been developed, along with a budget for completing the plan. Presumably, FA for the CA has been posted. The State might incur expense if (1) the operator fails to fund the plan and the FA mechanism fails or (2) funds budgeted to complete the plan turn out to be inadequate. (1) is the credit risk issue noted above. (2) is essentially a "cost-cap" or "stop-loss" insurance problem. ARMR's opinion is that given enough data of sufficient quality (financial data on landfill operator, financial data on any entity providing FA), the credit risk problem is insurable (even) by environmental insurers. Insurance for remediation cost overruns is now a standard product and is currently available in the environmental insurance market. Combining the two coverages (credit risk and cost overrun risk) in a single product for a single facility is, in principle, practical. Accomplishing this for a portfolio of facilities is thus feasible, although underwriting will be expensive and time-consuming.

Coverage for PCM must fund known obligations, and the risks of cost overrun are (1) flawed PCM plan, (2) incorrect discounting of cash flows, and (3) cost overruns due to volatility or improper inflation of service or materials costs. This is basically a combination of

[13] Consider the costs of (1) repairing major structural damage to several large landfills, (2) remediation of associated contaminant releases, especially if groundwater is involved, (3) associated consequential damages, e.g. closure of major freeway interchanges nearby, shutdown of a high school and relocation of students, (4) costs of accessing alternative landfills while damaged facilities are repaired, etc. It is the consequential damages that drive the magnitude of the potential financial loss

malpractice risk (1) with a finite insurance problem (2-3). Again, the two types of coverage can, in principle, be combined. However, the difficulties in doing so on a portfolio basis are substantial.

Moreover, ARMR has substantial doubt that an entity as secure as the State of California can ever benefit by buying finite insurance (since, in this case, the buyer's financial security substantially exceeds that of the seller).

Conclusion – Contingent funding of unknown (unrealized) CA can be achieved through the use of conventional EIL insurance. This can be done on a portfolio basis given sufficient underwriting data (e.g. geophysical, structural/civil engineering, environmental data for each facility). The use of insurance to manage the risks associated with known (realized) CA and with PCM is more problematic, requiring the development of new insurance products. While it is certainly possible to develop such products in collaboration with selected underwriters, the costs and time for doing so will be substantial due to the volume of data required to properly underwrite the risks, the diversity of primary FA instruments to be evaluated, internal costs associated with negotiating coverage terms and conditions with regulators, etc.

Coverage pools

If a single insurer were willing to provide an umbrella policy over the FA of landfill operators, and that policy had a limit of liability of $300 million and a policy term of ten years, ARMR would regard it as a <u>fundamentally flawed transfer of risk</u> by the State. This is because ARMR believes there is no way to guarantee the financial viability of any insurer over a 10-year timeframe, particularly when its ability to fund a $300 million loss is at issue.

The State derives more security when the desired limit (e.g. $300 million) is put up through a pooled insurance arrangement. As a simple example, assume 3 insurers participate in a pooled structure posting a $300 million limit. The form of the policy would be negotiated jointly, with the buyer. Then, each insurer would accept one-third of the premium and be liable for one-third of all losses up to a maximum of $100 million each. The primary advantage of this arrangement to insurers is that none of them are required to assume the full risk of loss. The State benefits because insolvency risk is moderated and replacing one of three insurers is easier than replacing an entire program. If coverage is written for terms of 1-3 years, it is more likely that an insurer whose financial condition shows signs of weakening can be replaced prior to insolvency.

Difficulties with this approach include anti-trust issues and the need to negotiate policy structure with multiple insurers. It is likely that the most efficient way to implement a pooled insurance arrangement is through an underwriting manager who contracts with all participating insurers to underwrite on their behalf.

Self-insurance

The State is arguably financially more robust and more viable over an extended timeframe than any insurer. Thus, it may make sense for the State to self-insure the risks discussed here in whole or in part. "Self-insurance," in this context, means simply that the State assumes the obligation to pay any loss that may occur. This can be accomplished through prior funding (i.e., when funds are collected now in anticipation of paying future losses) or through contingent funding (i.e., funds to pay for a loss are collected after the loss). The risks to be funded are:

- PCM cost overrun risk. This is best funded by allocating some part of tipping fees collected to a State managed fund. The amount allocated and target funding level would be determined by an actuarial analysis of the cash flows required to fund PCM for each facility with provision for contingency (inflation, change in regulatory requirements, etc.) and to account for the inherent conflict of interest in landfill operators hiring engineering consultants to prepare their PCM plans and cost estimates.

- Unknown/unrealized CA risk. This is essentially catastrophe risk and is best funded with a contingent tax, where funds for a major loss are collected by imposing a tax after the loss. The problem here, of course, is that immediately following a major catastrophe, revenues which fund such taxes might well decline precipitously.

- Known/realized CA risk. As noted above, this is a cost overrun risk problem. If this risk is retained by the State, it should be pre-funded (not just "assured") by the responsible party with a risk premium included in each CA cost estimate. This premium could be retained by the State in a designated fund and refunded should the subject CA be completed on budget. The concept is analogous to requiring the operator to fund a fixed-cost (i.e., to pay the risk premium for avoiding the cost overrun risk) vs. a time-and-materials engineering plan (where the buyer of engineering services bears the cost overrun risk).

4.3.4 Conclusions

ARMR recommends that a program to transfer risk associated with the failure of FA for landfill PCM and/or CA be developed by considering the following (in priority order):

- Self-insurance by the State of California.

- Use of financial instruments analogous to cat bonds to insure risks associated with the catastrophic failure of one or more landfills.

- Use of an insurance pool (consisting of 3 or more insurers) to fund unknown/unrealized CA

It is possible, in principle, to develop hybrid insurance instruments, covering various combinations of credit risk, finite risk (to fund budgeted PCM), and remediation cost overrun risk. The cost of such development is significant and would need to be done in collaboration with at least one insurer. The time required to develop such new products would be substantial. Moreover, ARMR questions what benefit, if any, the State can derive through a finite insurance transaction due to the inverted security relationship in this case; normally, a buyer enters into a finite insurance transaction because the seller is financially more secure than the buyer.

EXHIBIT 4-1

DRAFT FOR REVIEW

ENDORSEMENT OF INSURANCE FOR
POSTCLOSURE MAINTENANCE AND/OR
CORRECTIVE ACTION

If additional space is needed, add attachment.

Insurer Name	**Address** **Phone Number**	**CA Insurer License Number** **or** **NAIC Number**
Insured Name	**Address** **Phone Number**	
Policy No. _____	**Amending Policy No. _____**	**Effective Date** **_____**

The insurance policy to which this endorsement is attached is amended to assure compliance by the insured, within the limits stated herein, with Title 27 of the California Code of Regulations, Division 2, Subdivision 1, Chapter 6..

In consideration of the premium stated, the insurer (the company) agrees to pay, within the limits of liability described herein, all costs for postclosure maintenance and corrective action in excess of the funding available from the insured's other financial assurance mechanisms. This insurance does not apply to injury to or death of the insured's employees while engaged in the course of their employment. It is understood and agreed that no condition, provision, stipulation, or limitation contained in the policy, this endorsement, or any other endorsement, thereon, or violation thereof, shall relieve the company from liability or from the payment of all costs for postclosure maintenance and corrective action in excess of the funding available from the insured's other financial assurance mechanisms. No deductible, copayment, or insured retention is applicable to this first dollar coverage endorsement, within the limits of liability herein described, irrespective of the financial condition, insolvency, or bankruptcy of the insured. However, all items, conditions, and limitations in the policy to which the endorsement is attached shall remain in full force and effect as binding between the insured and the company. The insured agrees to reimburse the company for any payment made by the company on account of any claim, and for any payment that the company would not have been obligated to make under the provisions of the policy, except for the agreement contained in this endorsement.

It is further understood and agreed that, upon failure of the company to pay as provided herein, the CIWMB may maintain an action in any court of competent jurisdiction against the company to compel such payment.

The limits of the company's liability for the amounts prescribed in this endorsement apply separately to each landfill and any payment under the policy because of any one default shall not operate to reduce the liability of the company for payments resulting from any other defaults.

Solid Waste Disposal Facilities Covered: *(Enter postclosure maintenance, known corrective action, financial assurance, and reasonably foreseeable corrective action amounts separately. If coverage is not offered, enter "N/A" as the amount. All amounts must total face amount.)*

Name and Address	**Solid Waste Disposal Facility Identification Number**	**Postclosure Amount**	**Known Corrective Action Amount**	**Reasonably Foreseeable Corrective Action Amount**	**Limit of Liability**

The insurer hereby issues to the insured this policy of insurance to provide financial assurance for Postclosure Maintenance, Known Corrective Action, and Reasonably Foreseeable Corrective Action, for the facility(ies) identified above. The policy provides that monies identified in the limits of liability (face amount) above will be available, as applicable, for the facility(ies) when needed. The insurer further warrants that this endorsement conforms in all respects with the requirements of Division 30 of the Public Resources Code; Title 27 of the California Code of Regulations, Division 2, Subdivision 1, Chapter 6; and the regulations of the California Department of Insurance and under the terms and conditions described in Division 1 of the California Insurance Code for the facility(ies) identified above, as applicable and as such regulations were constituted on the date shown below**. It is agreed that any provision of this endorsement inconsistent with such regulations is hereby amended to eliminate such inconsistency.**

This endorsement guarantees that funds will be available whenever defaults of insured activities occur. The policy also guarantees that once the defaults of insured activities begin, the insurer will be responsible for the paying out of funds to the operator or person authorized to conduct the insured activities, up to an amount equal to the face amount of the policy, that is in excess of the amount of financial assurance demonstrated for the landfills.

This endorsement guarantees that disbursements for expenditures will be granted only if the expenditures have been reviewed and approved in writing by the California Integrated Waste Management Board (CIWMB) or its designee.

Notwithstanding any other provisions of Division 30 of the Public Resources Code or Title 27 of the California Code of Regulations, Division 2, Subdivision 1, Chapter 6, if postclosure maintenance or corrective action is ordered by the CIWMB or its designee as a result of failure by the operator or person authorized to conduct such activities, this endorsement also guarantees that the insurer will be responsible for paying out funds to the CIWMB after available funds from the insured's financial assurance have been exhausted. This endorsement further guarantees that the insurer will, without delay, pay to the CIWMB the amount the CIWMB requests, up to an amount equal to the face amount of the endorsement. CIWMB requests for payment will be based on current estimated remaining expenses as determined by the CIWMB for postclosure maintenance or corrective action activities. Any payments made by the insurer that exceed the actual expenses incurred in performing the insured activity will be repaid to the insurer at the completion of the insured activity.

This insurance coverage allows assignment of the endorsement to a successor owner or operator of a covered solid waste disposal facility. Such assignment may be conditional upon consent of the insurer, provided that such consent is not unreasonably refused.

The insurer further agrees that it will not cancel, terminate, or fail to renew this endorsement except for failure to pay the premium or misrepresentation. If there is a failure to pay the premium and the insurer elects to cancel, terminate, or not renew the endorsement, the insurer will send notice by either registered or certified mail to the operator and the CIWMB. Cancellation, termination, or failure to renew may not occur, however, during the one hundred twenty (120) days beginning with the date of receipt of the notice by the operator and the CIWMB, as evidenced by the return receipts. Cancellation, termination, or failure to renew will not occur and the endorsement will remain in full force and effect in the event that on or before the date of expiration:

(1) The CIWMB or local enforcement agency deems the facility abandoned; or

(2) The permit is terminated or revoked or a new permit is denied by the CIWMB or local enforcement agency; or

(3) Postclosure maintenance and/or corrective action is ordered by the CIWMB, or any other State or federal agency, or a court of competent jurisdiction; or

(4) The operator is named as a debtor in a voluntary or involuntary proceeding under Title 11 (Bankruptcy) U.S. Code; or

(5) All delinquent premium payments have been brought current.

This endorsement shall be considered excess coverage. Whenever requested by the California Integrated Waste Management Board of the State of California, the insurer agrees to furnish to the CIWMB a certified copy of the original policy listed above, including all endorsements thereon.

<u>Definitions as Used in This Endorsement</u>

Face Amount means the total amount the insurer is obligated to pay under the policy. Actual payments by the insurer will not change the face amount, although the insurer's future liability will be lowered by the amount of the payments.

Postclosure Maintenance means all activities undertaken at a closed solid waste management unit to maintain the integrity of containment features and to monitor compliance with applicable performance standards. This is work that is performed regularly or periodically to deal with routine wear and tear of containment features. It does not include repairs of containment features damaged as a result of major events, such as floods, stormwater runoff, wind, earthquakes, or fires; nor does it include repairs of containment features damaged due to poor design, substandard materials, improper installation, or inadequate maintenance.

Corrective Action means activities undertaken at an active or closed solid waste management unit needed to remediate a known release that has occurred to the environment, or activities that would need to be undertaken at an active or closed unit to restore the integrity of damaged containment, gas extraction, and drainage features. It can include non-routine repairs, such as repairing covers and drainage systems damaged as a result of major events, such as floods, stormwater runoff, wind, earthquakes, or fires; as well as repairs of containment features damaged due to poor design, substandard materials, improper installation, or inadequate maintenance.

Default means a written determination on agency letterhead by the CIWMB or its designee informing the insurer that the insured has failed to perform postclosure maintenance and/or corrective action and that funding available through the insured's financial assurance demonstrations will be insufficient to complete postclosure maintenance and/or corrective action regardless of cause, with no exclusion or limitation. The insurer will be liable for any and all shortfalls in the insured's financial assurance for completing postclosure maintenance and/or corrective action. The CIWMB or its designee shall inform the insurer in writing when the default has ended, which relieves the Insurer of any further liability for that default.

The party below certifies and signs under penalty of perjury that the information in this document is true and correct to the best of his or her knowledge, and satisfies the requirements of Title 27, California Code of Regulations, Division 2, Subdivision 1, Chapter 6, and that the insurer is licensed by the California Department of Insurance to transact the business of insurance in the State of California as an ☐ admitted carrier or ☐ eligible excess or surplus lines insurer.

Authorized Signature of Insurer ➢	**Title**
Typed or Printed Name of Person Signing ➢	**Phone Number**
Notary Signature and Seal ➢	**Date**

Privacy Statement

The Information Practices Act (California Civil Code Section 1798.17) and the Federal Privacy Act (5 U.S.C. 552a(e)(3)) require that this notice be provided when collecting personal information from individuals.

AGENCY REQUESTING INFORMATION: California Integrated Waste Management Board.

UNIT RESPONSIBLE FOR MAINTENANCE OF FORM: Financial Assurances Section, California Integrated Waste Management Board, 1001 "I" Street, P.O. Box 4025, Sacramento, California 95812-4025. Contact the Manager, Financial Assurances Section, at (916) 341-6000.

AUTHORITY: Public Resources Code section 43600 et seq.

PURPOSE: The information provided will be used to verify adequate financial assurance of solid waste disposal facilities listed.

REQUIREMENT: Completion of this form is mandatory. The consequence of not completing this form is denial or revocation of a permit to operate a solid waste disposal facility.

OTHER INFORMATION: After review of this document, you may be requested to provide additional information regarding the acceptability of this mechanism.

ACCESS: Information provided in this form may be provided to the U.S. Environmental Protection Agency, State Attorney General, Air Resources Board, California Department of Toxic Substances Control, Energy Resources Conservation and Development Commission, Water Resources Control Board, and California Regional Water Quality Control Boards. For more information or access to your records, contact the California Integrated Waste Management Board 1001 "I" Street, P.O. Box 4025, Sacramento, California 95812-4025, (916) 341-6000.

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5. RISK SCREENING METHODOLOGY

5.1 INTRODUCTION AND PURPOSE

The purpose of Task 6[1] is to develop a method that is simple to use and can be applied to any landfill to determine whether its level of risk of postclosure maintenance (PCM) and/or corrective action (CA) is high, medium, or low. Such a method could have many different applications in financial assurance (FA) programs for PCM and CA. The level of risk of PCM or CA can be related to factors that do or potentially can affect a landfill's impact on the public health and safety, on the environment, or both. These factors are not the risks themselves but are instead those factors that govern the presence and extent of risks to the environment or public health and safety. Some examples of factors include seismic conditions, hydrology, landfill design and operating conditions, and proximity of human populations and sensitive habitats to landfills.

Given the complexity of modern landfills and the number of avenues of potential impact, many factors can be identified that govern the extent and degree of landfill impacts. The applicable factors could easily number 100 or more. However, the scope of this analysis is to identify and select a small number of factors that fulfills two conditions, namely: 1) when taken collectively, the factors govern most of the potential risks of landfills, and 2) the factors should have a quantitative basis and, equally important, the data and/or information can be accessed relatively easily.

5.2 EVALUATIVE METHODOLOGY

CalRecovery employed the following general steps in developing the screening methodology:

- Selection of factors
- Testing of factors
- Creation of method for applying factors to landfills

The basis of the development of the method was that described in the Revised Work Plan/Methodology and an initial list of factors for solid waste landfills provided by the Board staff early in the study.

5.3 SELECTION OF FACTORS

The CalRecovery analysis began with an initial list of factors for solid waste landfills that was provided by Board staff shown in Exhibit 5-1.

[1] ICF's subcontractor CalRecovery Incorporated took the lead in researching, analyzing, and documenting Task 6.

EXHIBIT 5-1
Initial List of Factors for the Risk Screening Analysis

Proximity to urban areas
Amount of waste in place
Type of waste in place
Hydrology
Seismic characteristics
Rainfall
Potential for flooding
Proximity to sensitive habitat
Compliance status

CalRecovery reviewed and analyzed the initial list of factors developed a listing of quantitative parameters related to each of the risks, and identified primary impacts or problems associated with each factor. As a result of this analysis and in consultation with Board staff, CalRecovery added several new factors to the list for consideration (namely, engineering controls, bioreactor landfills, slope stability, and fire). These new factors were added to account for: the importance of engineering design in controlling landfill risks; the advent of landfill bioreactor technology in the United States and California as a potential means of increasing the rate of stabilizing waste in landfills and subsequently of controlling environmental impacts of landfills; the potential of slope failures at landfills and their effects on humans, sensitive habitats, and landfill environmental control systems; and the potential adverse effect of off-site fires encroaching onto landfill sites and upsetting landfill environmental control systems. During the review and analysis process, some of the names of the factors were modified to better explain their meaning and/or intent.

The expanded list of factors (along with explanatory information relevant to the selection and purpose of the factors) was subsequently submitted to the AB 2296 consulting group for review and comment. As a result of comments received from the consulting group and in consultation with Board staff, CalRecovery modified the list of factors and the other accompanying information and produced a final listing of 13 factors. These 13 factors served as the universe of factors for use in the remainder of the analysis, including the determination of which of the 13 factors would be incorporated into the recommended proxy methodology. The final list of factors is presented in Exhibit 5-2.

EXHIBIT 5-2
Factors That Potentially Affect Landfill's Impact on Public Health and Safety and the Environment

Siting/Climate Factors

Factor	Scoring Criteria	Controls/ Mitigations	Quantitative Parameter(s)	Primary Resource Potentially Impacted/Problem(s) (not relevant to model)
Seismic Characteristics	Designed for: • Max Credible Earthquake; 1.5 or above factor of safety (low impact (low)) • Most Probable Earthquake; below 1.5 factor of safety, but at least 1.3 (medium impact (medium)) • No design (high impact (high))	• Engineering design	• Ground acceleration, safety factors • Seismic zone maps	• Slope failure • Leachate seeps • Surface water/ground-water impact • LFG migration • Cap failure – vector control and uncontrolled emissions • Explosive concentration of gas • Landfill fire • Methane capture – greenhouse gases
Rainfall Intensity	Designed for: • 1000 year/24 hour storm (low) • 100 year/24 hours storm (medium) • Not designed for 100 year/24 hour storm (high)	• Engineering design	• Average annual rainfall • Rainfall intensity	• Slope failure • Leachate seeps • Surface water Impact • Erosion or a drainage system failure • LFG migration
Floodplain	• Location (base of landfill) within 100 year floodplain (high) • Location (base of landfill) within 500 feet of 100 year floodplain (medium) • Location (base of landfill) not within 500 feet of 100 year floodplain (low)	• Engineering design • Flood control measures	• Floodplain maps	• Groundwater • Surface water • Waste release

EXHIBIT 5-2
Factors That Potentially Affect Landfill's Impact on Public Health and Safety and the Environment

Siting/Climate Factors (continued)

Factor	Scoring Criteria	Controls/ Mitigations	Quantitative Parameter(s)	Primary Resource Potentially Impacted/Problem(s) (not relevant to model)
Fire (intrusion from off site)	• Adjacent land area with high fire hazard potential (high) • Adjacent land area with moderate fire hazard potential (medium) • Adjacent Land Area with low fire hazard (low)	• Addition of buffer area • Increased fire protection at facility	• Fire hazard severity zone maps	• Runoff • Groundwater • Surface water • Explosive concentration of gas • Landfill fire • Methane capture – greenhouse gases

Potential Factors - Landfill Design, Construction, and Maintenance

Factor	Scoring Criteria	Controls/ Mitigations	Quantitative Parameter	Primary Resource Potentially Impacted/ Problem(s) (not relevant to model)
Engineering Controls	• Combination of Subtitle D equivalent and non-Subtitle D equivalent design, or no Subtitle D design (high) • Subtitle D or equivalent design (medium) • Above Subtitle D design (low)	• 3rd party construction QA/QC	• Type/design of cover and bottom liner • Type/design of LFG control system • Factor of safety	• Groundwater • Surface water • Landfill gas (LFG) migration • Slope stability • Explosive concentration of gas • Landfill fire • Methane capture – greenhouse gases

EXHIBIT 5-2
Factors That Potentially Affect Landfill's Impact on Public Health and Safety and the Environment

Potential Factors - Landfill Design, Construction, and Maintenance (continued)

Factor	Scoring Criteria	Controls/ Mitigations	Quantitative Parameter(s)	Primary Resource Potentially Impacted/Problem(s) (not relevant to model)
Permitted Capacity	• Greater than 30,000,000 cubic yards (high) • Less than 500,000 cubic yards (low) • Between 500,000 and 30,000,000 cubic yard (medium)	• Engineering design	• Permitted capacity	• Groundwater • Surface water • LFG migration • Slope stability • Air quality • Explosive concentration of gas • Landfill fire • Methane capture – greenhouse gases
Type of Waste in Place	• Pre-Subtitle D, co-disposal waste (high) • MSW (medium) • Monofill, C&D (low)	• Engineering design • Waste screening procedures	• Permitted types of waste • Operational protocol and records	• Groundwater • Surface water • LFG migration • Explosive concentration of gas • Landfill fire • Methane capture – greenhouse gases
Slope Stability	• Side slopes 2:1 or steeper, or history of slope failure (high) • Side slopes between 2:1 and 4:1 (medium) • Side slope less steep than 4:1 (low)	• Decrease slope • Improve drainage • Improve landscaping	• History of slope failures • Existing and planned side slope angles	• Groundwater • Surface water • LFG migration • Slope failure • Liner/cover failure

EXHIBIT 5-2
Factors That Potentially Affect Landfill's Impact on Public Health and Safety and the Environment

Operational Practice

Factor	Scoring Criteria	Controls/ Mitigations	Quantitative Parameter	Primary Resource Potentially Impacted/ Problem(s) (not relevant to model)
Liquids Management/ Landfill Bioreactor Technology	• Permitted leachate recirculation (medium) • Bioreactor permitted (low) • Neither of the above (high)	• Engineering design	• Efficiency of leachate collection system • Efficiency of LFG collection • Leachate quality trends	• Groundwater • Surface water • LFG migration • Explosive concentration of gas • Landfill fire • Methane capture – greenhouse gases

Potential for Migration/Distance to Sensitive Receptors

Factor	Scoring Criteria	Controls/ Mitigations	Quantitative Parameter	Primary Resource Potentially Impacted/ Problem(s) (not relevant to model)
Hydrogeology	• Depth to groundwater (measured from base of landfill) • Less than 50 feet (high) • 50 to 100 feet (medium) • Greater than 100 feet (low)	• Engineering design	• Depth to groundwater of uppermost aquifer	• Groundwater • Surface water • Gas migration

EXHIBIT 5-2
Factors That Potentially Affect Landfill's Impact on Public Health and Safety and the Environment

Potential for Migration/Distance to Sensitive Receptors (continued)

Factor	Scoring Criteria	Controls/ Mitigations	Quantitative Parameter(s)	Primary Resource Potentially Impacted/Problem(s) (not relevant to model)
Proximity to Urban Areas	• In urban (high) • Not in urban (low)		• Property maps • Development plans	• Groundwater • Surface water • LFG migration • Landslides • Air quality • Odors • Explosive concentration of gas • Landfill fire • Methane capture – greenhouse gases
Proximity to Sensitive Habitat	• Sensitive species at location (high) • No sensitive species at location (low)	• Engineering design • Operations management • Formally managed habitat	• California natural diversity database	• Biota • Explosive concentration of gas • Landfill fire • Methane capture – greenhouse gases

EXHIBIT 5-2
Factors That Potentially Affect Landfill's Impact on Public Health and Safety and the Environment

Compliance Record for Release/System Upsets

Factor	Scoring Criteria	Controls/ Mitigations	Quantitative Parameter	Primary Resource Potentially Impacted/ Problem(s) (not relevant to model)
Compliance Status	• Current CA, cleanup or abatement orders (high) • Past history of CA or ongoing/repeat violations (medium) • Compliant (low)	• Engineering design • Operations management	• Correspon-dence from regulatory agency • Monitoring data	• Groundwater • Surface water • LFG migration • Slope failure • Explosive concentration of gas • Landfill fire • Methane capture – greenhouse gases

Some of the 13 factors are functions of parameters that in many cases exhibit trends when observed over long time periods. This characteristic means that their relative importance in comparison to the other factors and to assessment of landfill impacts over time might increase or decrease. Additionally, some factors are affected by or are random occurrences over time, which cannot be easily correlated or predicted. CalRecovery reviews these phenomena in the next section.

5.3.1 Temporal Issues

Several parameters have been identified that are relevant to predicting potential landfill environmental impacts and that also typically vary over long periods of time (e.g., a decade or more). These parameters are termed temporal parameters and are the focus of this subsection. Temporal parameters can affect the performance of landfills and, therefore, can influence the impact of landfills on the public health and safety, the environment, or both. The effects may be particularly strong if the trend over time is either steadily increasing or decreasing, as opposed to the case where cyclic variations approximately average out over a long time period. The temporal parameters are listed below:

- Human population
- Number of commercial and industrial businesses
- Disposed waste composition
- Changes in solid waste management and/or landfill regulations (California, Federal)

- Meteorology/climate (medium- and long-term cycles)

- New knowledge, data, and findings (e.g., as of yet unknown/unidentified risks related to landfill operations)

- Data availability and quality for projections (e.g., through steady improvement in data acquisition methods and technology over time)

The importance of each of the temporal parameters listed in the previous paragraph and their relation to a sampling of various conditions and characteristics of landfills is described in Exhibit 5-3. In addition, some specific examples of effects and causes are described in the exhibit for purposes of further illustration.

EXHIBIT 5-3
Examples of Potentially Affected Landfill Conditions or Characteristics and Causative Temporal Factors

Affected Landfill Condition/Characteristic	Temporal Parameter	Examples of Potential Effect	Examples of Specific Causes
Waste quantities, waste in place	• Human population • Number of commercial businesses and industries • Change in regulations that limit waste disposal	• Encroachment of human populations near landfills • Changes in quantities of generated emissions from landfills	• Changes in economy/economic conditions • Changes in business/industry demographics
Chemical and biological properties of disposed waste	• Disposed waste composition • Change in regulations that affect or change the characteristics of disposed waste	• Changes in quantities and composition of landfill gas • Changes in quantities and strength of leachate	• Implementation of high diversion/zero waste programs • Implementation of conversion technologies • Landfill bans for specific types of materials
Leachate generation; top cover and sidewall erosion	• Meteorology/climate • Change in regulations that affect or change the characteristics of disposed waste	• Changes in average rainfall and in intensity	• Global warming (greater or lesser storm frequencies/ intensities)

EXHIBIT 5-3
Examples of Potentially Affected Landfill Conditions or Characteristics and Causative Temporal Factors

Affected Landfill Condition/Characteristic	Temporal Parameter	Examples of Potential Effect	Examples of Specific Causes
Quantities and composition of landfill gas; quantities and strength of leachate	• New knowledge • Change in regulations that affect or change the characteristics of disposed waste • Change in regulations that allow waste additives to increase landfill gas production	• Newly identified dangerous chemical and/or biological toxins • New detection and/or monitoring methods may reduce risks associated with landfills and/or support predictive models	• New diseases (plant, animal, or human) • New manufacturing chemicals
Landfill emissions (extent, severity, and duration)	• Data availability and quality	• Early detection of potential adverse environmental impacts may reduce risk of pollution and corrective action costs, and/or support predictive models	• New, rapid, cost-effective, and/or more precise detection and/or monitoring systems

The discussion of temporal parameters has dealt with those that generally exhibit upward or downward trends over substantial periods of time. There are also temporal parameters that do not typically exhibit long-term trends but instead can be characterized as severe events that occur infrequently and often randomly. Examples of such events relevant to California include earthquakes and tornados. Among other potential effects, these types of events can cause physical damage to landfill environmental control systems, which in turn may cause adverse environmental effects that must be corrected.

One of the methods of minimizing unplanned effects of temporal parameters is to re-evaluate the factors that can affect a landfill's impact on the public health and safety and on the environment in terms of the potential influences that can be asserted by the temporal parameters. Therefore, the list of factors and their weightings (previously developed and discussed in Task 6) will require scheduled reviews and potential modifications over time. Suitable review periods would be every 3 to 5 years, or after any regulation is promulgated that would, for example:
(1) substantially affect landfill design, operations, and environmental control systems;
(2) substantially affect the quantities and characteristics of disposed waste; and/or (3) define new (i.e., previously unidentified and, therefore, previously unregulated) types of environment impacts.

Accurate and precise estimation of the effects of temporal parameters on factors affecting landfill performance and impacts can only be as good as the accuracy and precision of the available data and information. Fortunately, the California Integrated Waste Management Board (CIWMB, or Board) has a substantial number of programs, resources, and databases that can be

and are applied to quantifying and understanding temporal parameters. For example, the CIWMB receives annual reports from jurisdictions in California that report disposed and diverted waste quantities. Also, in recent years, the Board has regularly commissioned statewide quantitative waste characterization analyses, including determination of quantities and composition of disposed waste. The Board also analyses and uses demographic statistics (population, business activity indicators, etc.) for purposes of estimating and tracking trends in rates of generated, diverted, and disposed solid waste.

Both the CIWMB and the State Water Resources Control Board maintain substantial databases and records associated with permit applications, permits, compliance status, etc. for land disposal facilities located in California. These sources of information are substantial resources for tracking the designs, performance, and impacts of landfills in the state, as well as any trends that affect or might affect environmental impacts of landfills and adequacy of financial assurance programs.

In terms of future meteorological and climate change effects, the State of California and a host of State agencies, including the CIWMB and California Energy Commission, have recently instituted comprehensive analytical and predictive programs to understand, estimate, and potentially control or mitigate the influence of climate change on the environment and on various activities in the state, many of which are related to one degree or another to solid waste management.

While the availability of statewide data is generally good for purposes of analyzing temporal trends, the CIWMB would have to implement a dedicated program in the future to analyze and determine significant trends and their effects on issues and factors related specifically to landfill impacts on the environment, on public health and safety, and on financial assurance for landfills.

A temporal parameter currently with inadequate availability of data and information is "new knowledge." Acquisition of new knowledge is driven generally by scientific research and development (R&D). The extent and rate of acquisition of new knowledge is a strong function of the human and financial resources dedicated to the task. The majority of R&D in the United States related to solid waste management is carried out with public funding, almost exclusively at the state level of government. The State of California dedicates significant levels of human and financial resources for solid waste management. However, only a small portion of these resources is dedicated to R&D. In order to acquire new knowledge to better assess landfill impacts, monitor landfill operations and impacts, predict or identify new pollutants, and evaluate and select remedial measures, an R&D program for this purpose would have to be developed and implemented. The new knowledge thus obtained would be used to evaluate the adequacy of the factors and temporal parameters discussed in this chapter of the report and the extent and directions of any trends.

5.4 TESTING OF FACTORS

As a starting point for testing the appropriateness of the 13 factors for screening landfill environmental risks, CalRecovery selected 5 of the 13 draft factors as particularly dominant in

terms of impact: Proximity to Urban Areas, Permitted Capacity, Hydrology, Rainfall/Intensity, and Engineering Controls. These more dominant factors were selected based on, respectively, the importance of proximity in assessing off site impacts of landfill emissions on human receptors; the fact that potential landfill emissions (uncontrolled and controlled) and impacts are directly related to mass of waste; the well known, dramatic potential of water-related variables to create or facilitate adverse conditions that might result in substantial landfill impacts; and importance of landfill design in controlling landfill emissions and impacts.

The more dominant factors were each assigned a value (or weighting) of 10 to denote the highest risk possible and a value of 0 to denote the lowest risk possible. Only integer values are used in scoring. The maximum values for high risk associated with the other, less dominant factors were assigned maximum and minimum values relative to those (i.e., 10 or 0, respectively) for the more dominant factors, depending on the particular factor and CalRecovery's assessment of its importance in terms of estimating potential landfill risks relative to the other factors. In keeping with the rationale for selecting the use of and differentiation of more and less dominant factors, maximum and minimum values for the less dominant factors were selected to be less than and greater than those of the more dominant factors. Thus, the maximum value is 9 or less and the minimum value is one or more. The spread between the maximum value (highest risk) and minimum value (lowest risk) for each less dominant factor is a function of the particular factor and CalRecovery's assessment of its importance in terms of estimating potential landfill risks relative to the other factors.

Another consideration in the selection of scores for factors is the relative frequency of events. Generally, factors that are associated with infrequent events (e.g., earthquakes, fires) were not considered as important in estimating landfill risk as factors associated with on-going conditions (e.g., hydrology, rainfall/intensity).

The results presented in Exhibit 5-4 show the CalRecovery analysis and recommended weighting for the factors in light of the above rationale. As part of the testing and analysis, and as shown in the table, the selected values for factors were tested for reasonableness of the results by performing some sensitivity analyses using the spreadsheet model. Generally, CalRecovery considered the results of the scoring conditions reasonable if the test met two conditions: 1) high risk landfill conditions yielded substantially high total scores, and 2) the risk of landfills characterized by risky dominant factors was not decreased unduly (overly diluted) by low risk associated with the less dominant factors. Total scores were computed and compared for different conditions, including maximum and minimum values for the factors to represent different initial and boundary conditions.

In performing the testing exercise, CalRecovery examined the following scenarios and computed the numerical score if:

1. The subject landfill received scores that represented the highest risk for each factor -- Total Score = 100 (the sum of the highest risk case for the more dominant factors is 50, or 50% of the total). Thus, a score of 100 represents a potentially very risky landfill.

2. The subject landfill received scores that represented the lowest risk for each factor -- Sum = 16. There is clearly a distinction (84 points) between the worst case (very risky) landfill and the best case landfill (least risky).

3. The subject landfill received scores that represented the highest risk for each more dominant factors (total of 50) and the lowest score for each of the eight less dominant factors – Total Score = 66.

EXHIBIT 5-4
Scoring Factors and Weightings for Various Scenarios

									Test Case 1		Test Case 2 (Test 1 conditons, but excluding Fire factor)	
	Factor	**Level of Risk**			**Value**			**Dominant Factors Only**	**Highest risk score for dominant factors--lowest risk score for less dominant factors**	**Lowest risk score for dominant factors--highest risk score for less dominant factors**	**Highest risk score for dominant factors--lowest risk score for less dominant factors**	**Lowest risk score for dominant factors--highest risk score for less dominant factors**
		High	**Medium**	**Low**	**Highest Risk**	**Medium Risk**	**Lowest Risk**	**Highest Risk**	**Score**	**Score**	**Score**	**Score**
1	Proximity to Urban Areas	In urban area		Not in urban area	10		0	10	10	0	10	0
2	Permitted Capacity	Greater than 30,000,000 cu yd	500,000 to 30,000,000 cu yd	Less than 500,000 cu yd	10	5	0	10	10	0	10	0
3	Type of Waste in Place	Pre-Subtitle D, co-disposal waste	MSW	Monofill, C&D	6	4	2		2	6	2	6
4	Hydrogeology (from base of landfill)	Less than 50 ft	50 to 100 ft	Greater than 100 ft	10	5	0	10	10	0	10	0
5	Seismic Characteristics	No design	Most Probable Earthquake; below 1.5 factor of safety, but at least 1.3	Max Credible Earthquake; 1.5 or above factor of safety	6	4	2		2	6	2	6
6	Rainfall Intensity	Not designed for 100 year/24 hour storm	100 year/24 hours storm	1000 year/24 hour storm	10	5	0	10	10	0	10	0
7	Floodplain (from base of landfill)	Within 100 year floodplain	Location within 500 feet of 100 year floodplain	Location not within 500 feet of 100 year floodplain	6	4	2		2	6	2	6
8	Proximity to Sensitive Habitat	Sensitive species at location		No sensitive species at location	6		2		2	6	2	6
9	Compliance Status	Current CA, cleanup or abatement orders	Past history of CA or ongoing/repeat violations	Compliant	8	5	2		2	8	2	8
10	Engineering Controls	Combination of Subtitle D equivalent and non-Subtitle D equivalent design, or no Subtitle D design	Subtitle D equivalent design	Above Subtitle D design	10	5	0	10	10	0	10	0
11	Liquids Management/Landfill Bioreactor Technology	Neither	Permitted leachate recirculation	Bioreactor permitted	6	4	2		2	6	2	6
12	Slope Stability	Side Slopes 2:1 or steeper, or history of slope failure	Side Slopes between 2:1 and 4:1	Side Slope shallower than 4:1	8	5	2		2	8	2	8
13	Fire (intrusion from off site)	Adjacent Land Area with high fire hazard potential	Adjacent Land Area with moderate fire hazard potential	Adjacent Land Area with low fire hazard	4	3	2		2	4		
					100	49	16	50	66	50	64	46

Note: Gray-shaded rows denote dominant factors.

4. The landfill received scores that represented the lowest risk for each more dominant factor (total of 0) and the highest score for each of the less dominant factors (total of 50) -- Total Score = 50.

   In keeping with the general rationale described previously, a differential of approximately 15 points should exist between #3 and #4 above, i.e., a risky landfill in terms of the more dominant factors despite low values for less dominant factors should have a substantively higher score (should have more risk) than a landfill that has low risk for the more dominant factors, but high risk for the less dominant factors. This rationale and distinction was also one of the conditions that was used to refine maximum and minimum values assigned to the less dominant factors.

The scenarios, conditions, and results are summarized in Exhibit 5-4. The effect of variations in weightings for the factor "Fire" (small effect) also is shown in the table.

5.5 METHOD/MODEL FOR APPLYING FACTORS TO A LANDFILL

The risk of a particular landfill to the public health and safety and/or the environment can be ranked by computing the sum of the values for each risk factor. Landfills with high scores are considered more risky than those with low scores. The maximum score or level of risk is 100 and the lowest score or level of risk is 16. All factors have been retained in the assessment method. The list of factors used in the assessment method should be reviewed at least every 3 to 5 years as new data and information becomes available.

To calculate the relative risk for a landfill:

1. For each factor listed in Exhibit 5-5, consult the listed resources and determine the appropriate score for that factor based on the available data and information. For existing permitted landfills, much of the information will be available in solid waste permit applications and solid waste facility permit documents (including supporting site specific studies). Where information is missing with respect to the factors, the other types of listed resources listed in the table should be valuable in securing the required data and information. Most of the resources listed have web-based databases where information can be found and downloaded as a result of keyword searches, or observed and downloaded as a result of interactive entry of user information and conditions, and subsequent display of the results after data processing. Depending on the factor, acquiring the site specific data from the listed resources may require a substantial effort due to the number of variables, data entry and processing methods, and number of steps of user inputs. For example, if the California Department of Fish and Game web site is used to determine if a landfill is in a critical/sensitive habit, one will find that there are 262 protected areas statewide and 59 wildlife habitats listed in the California Wildlife Habitat Relationships system (27 tree, 12 shrub, 6 herbaceous, 4 aquatic, 8 agricultural, 1 developed and 1 nonvegetated).

2. After determining the appropriate score of each factor, sum the scores for the factors to obtain the total score for the subject landfill.

EXHIBIT 5-5
Resources Available for Obtaining Data and Information for Factors

Factor	Scoring Criteria	Resource for Quantitative Data/Information
Seismic Characteristics	Designed for: • Max Credible Earthquake; 1.5 or above factor of safety (low impact (low)) • Most Probable Earthquake; below 1.5 factor of safety, but at least 1.3 (medium impact (medium)) • No design (high impact (high))	• US Geological Survey, Custom Mapping and Analysis Tools • California Geological Survey • California Waste Management Board, Solid Waste Facility Permits • Regional Water Quality Control Boards, Reports of Waste Discharge
Rainfall Intensity	Designed for: • 1000 year/24 hour storm (low) • 100 year/24 hours storm (medium) • Not designed for 100 year/24 hour storm (high)	• Reports of Waste Discharge • Local Electric Utilities • State Meteorological Stations
Floodplain (from base of landfill)	• Location within 100 year floodplain (high) • Location within 500 feet of 100 year floodplain (medium) • Location not Within 500 feet of 100 year floodplain (low)	• Federal Emergency Management Administration, Map Service Center
Fire (intrusion from off site)	• Adjacent land area with high fire hazard potential (high) • Adjacent land area with moderate fire hazard potential (medium) • Adjacent Land Area with low fire hazard (low)	• Department of Forestry and Fire Protection, Fire Hazard Severity Zones
Engineering Controls	• Combination of Subtitle D equivalent and non-Subtitle D equivalent design, or no Subtitle D design (high) • Subtitle D or equivalent design (medium) • Above Subtitle D design (low)	• California Waste Management Board, Solid Waste Facility Permits • Regional Water Quality Control Boards, Reports of Waste Discharge
Permitted Capacity[a]	• Greater than 30,000,000 cubic yards (high) • Less than 500,000 cubic yards (low) • 500,000 and 30,000,000 cubic yard (medium)	• California Waste Management Board, Solid Waste Facility Permits
Type of Waste in Place	• Pre-Subtitle D, co-disposal waste (high) • MSW (medium) • Monofill, C&D (low)	• California Waste Management Board, Solid Waste Facility Permits, Solid Waste Information System • Regional Water Quality Control Boards, Reports of Waste Discharge

[a] Permitted capacity intervals used for scoring criteria are preliminary and may be modified after further analysis.

EXHIBIT 5-5
Resources Available for Obtaining Data and Information for Factors

Factor	Scoring Criteria	Resource for Quantitative Data/Information
Slope Stability	• Side slopes 2:1 or steeper, or history of slope failure (high) • Side slopes between 2:1 and 4:1 (medium) • Side slope less steep than 4:1 (low)	• California Waste Management Board, Solid Waste Facility Permits • Regional Water Quality Control Boards, Reports of Waste Discharge
Liquids Management/ Landfill Bioreactor Technology	• Permitted leachate recirculation(medium) • Bioreactor permitted (low) • Neither of the above (high)	• California Waste Management Board, Solid Waste Facility Permits • Regional Water Quality Control Boards, Reports of Waste Discharge
Hydrogeology	• Depth to groundwater (measured from base of landfill) • Less than 50 feet (high) • 50 to 100 feet (medium) • Greater than 100 feet (low)	• California Waste Management Board, Solid Waste Facility Permits • Regional Water Quality Control Boards, Reports of Waste Discharge
Proximity to Urban Areas	• In urban (high) • Not in urban (low)	• California Waste Management Board
Proximity to Sensitive Habitat	• Sensitive species at location (high) • No sensitive species at location (low)	• Department of Fish and Game, Biogeographic Information and Observation System, Internet Mapping Application Products and Solutions
Compliance Status	• Current CA, cleanup or abatement orders (high) • Past history of CA or ongoing/repeat violations (medium) • Compliant (low)	• California Integrated Waste Management Board • Regional Water Quality Control Boards

3. Determine the level of potential risk represented by the landfill based on the total score. High, medium, and low risk landfills are determined based on the score relative to the range of scores given in Exhibit 5-6.

EXHIBIT 5-6
Estimated Potential Risk of Landfill

Total Score	Potential Risk
16 to 35	Low
36 to 69	Medium
70 to 100	High

Given uncertainties inherent in this type of method of estimation and in available data, the precision of the computed scores is estimated to be in the range of +/- 10% to 15%.