

**July 29, 2010**  
**Meeting of the Technical Advisory Group**  
**For Non-Water Site Specific Corrective**  
**Action Plans**

**Proposed Agenda for July 29, 2010 Meeting of the**  
**Technical Advisory Group**

- 10 am**    **1. Introductions/Review Proposed Agenda**  
                  Any changes to the Agenda  
                  Observations or Comment from the last meeting
- 2. Review Objectives for the BMP**  
                  a. February 8, 2010 draft  
                  b. Presentation to LEAs in September  
                  c. Workshop on October 11, 2010 following WMCP  
                  Monthly Meeting  
                  d. Final BMPs in December 2010
- 11 am**    **3. Discussion of a 'contingency approach' to determine costs**
- 1 pm**     **4. Discussion of discussion draft and causal events**

## **Discuss Objectives for the TAG and BMP**

- a. February 8, 2010 draft**
- b. Presentation to LEAs in September**
- c. Workshop on October 11, 2010**
- d. Final BMPs in December 2010**

## **TAG and Final Product:**

- CalRecycle Engineering Staff (Watson Gin- Lead) will prepare the BMPs based on input from a panel of experts (Technical Advisory Group or TAG) convened by CalRecycle. Additional opportunity for broader stakeholder comments and workshops will be provided. Attachment 1 provides a tentative schedule and workplan for development of the BMPs.

## TAG and Final Product

- The TAG will review BMP documentation prepared by CalRecycle, provide recommendations, and assist on specific requests for technical analysis and information. CalRecycle will strive to achieve consensus but consensus is not required. CalRecycle will accommodate TAG or public comments contrary to the final BMPs by posting such comments as appropriate.

## **'Contingency approach' to determine costs**

Other Suggestions/Comments

Recommend the following table be inserted as Attachment 2  
as a *cost estimating tool* to your proposed BMP:

Damage	Landfill Cover Corrective Action	Drainage System Corrective Action	Gas Collection System Corrective Action	Gas Monitoring System Corrective Action	Leachate Collection System Corrective Action	Site Security Corrective Action	Other Landfill Infrastructure Corrective Action
100%	\$ (AA)	\$	\$	\$	\$	\$	\$
90%	\$	\$	\$	\$	\$	\$	\$
80%	\$	\$	\$	\$	\$	\$	\$
70%	\$	\$	\$	\$	\$	\$	\$
60%	\$	\$	\$	\$	\$	\$	\$
50%	\$	\$	\$	\$	\$	\$	\$
40%	\$	\$	\$	\$	\$	\$	\$
30%	\$	\$	\$	\$	\$	\$	\$
20%	\$	\$	\$	\$	\$	\$	\$
10%	\$	\$	\$	\$	\$	\$	\$

AA-Title 27, Section 22101(b) (1) which is the cost of complete replacement of the final cover

## Discussion and comments on draft BMP document

Briefly go over discussion draft  
What content needs be added , useful?  
Suggestions to define each causal event

## Discussion Only

<u>Causal Event</u>	<u>BMP to Define or Characterize the Causal Event</u>	<u>Design Standard</u>
Earthquake	Maximum Credible Earthquake	Maximum Probable Earthquake
Flood	500-Year Flood	100-Year Flood
Precipitation	1000-Year 24-Hr Storm	100-Year 24-Hr Storm
Tsunami	Designated Inundation Zone	Not Applicable
Seiche	Within ½ Mile of Lake	Not Applicable
Fire	Designated Moderate or Higher Fire Hazard	Not Applicable

## Discussion Only

<u>Causal Event</u>	<u>BMP to Define or Characterize the Causal Event</u>	<u>Design Standard</u>
Tsunami	Designated Inundation Zone	Not Applicable
Seiche	Within ½ Mile of Lake	Not Applicable
Fire	Designated Moderate or Higher Fire Hazard	Not Applicable

### Tsunami

- BMP for the tsunami as a causal event is:
- Tsunamis are considered de minimis as a causal event if the landfill is located in an area that is not designated to be prone to be inundated by a tsunami by the Department of Conservation or local emergency response agency.
- For landfills located in an area that is prone to be inundated by a tsunami, the CA Plan needs to address the potential impacts and damage that may result.

### Seiche

- BMP for the seiche as a causal event is:
- Seiche is considered de minimis as a causal event, if the landfill is located greater than ½ mile away from a lake or a landlocked bay.
- Landfill that located within ½ mile of a lake or landlocked bay needs to identify the height of the wave and evaluate if the wave will inundate the landfill and cause any damage.

## Fire

BMP for a fire as a causal event is that landfills located within 1,000 feet of fire hazard zones determined by California Department of Forestry and Fire Protection (Cal Fire) or the local fire control agency as moderate, high, or very high must evaluate the potential damage to surface structures, vegetation and irrigation systems, and utilities.

- It is recommended that an assumption that 80% of the surface structures are destroyed if the landfill is located in a very high fire hazard zone, reduced by engineered systems to mitigate surface fires.
- For landfills located in high fire hazard zone, the recommendation is that an assumption that 70% of the surface structures are destroyed.
- For landfills located in a moderate fire hazard zone, the recommendation is that an assumption that 50% of the surface structures are destroyed.
- For landfills not located in the above zones, a contingency of 20% to replace surface structures is recommended.

## Flood

BMP for the flood as a causal event is:

- Flooding is considered de minimis as a causal event if the landfill is not located in the 500-year flood zone or the elevation of the landfill is above the depth of the flood event.
- For the purposes of determining corrective action, any landfill located within the 500-year flood zone needs to assess the potential damage resulting from the 500-year flood.

## Example of the 100-year versus 1000-year storm event

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
CENTRAL VALLEY REGION ORDER NO. R5-2004-0058  
WASTE DISCHARGE REQUIREMENTS FOR  
CRIMSON RESOURCE MANAGEMENT CORP. ASPHALTO STANDARD  
LEASE, ASPHALTO OILFIELD, KERN COUNTY

The California Regional Water Quality Control Board,  
Central Valley Region, (hereafter Regional Board) finds  
that:

12. The 100-year and 1000-year, 24-hour precipitation events calculated by DWR are 2.03 and 2.63 inches, respectively

## Example from Contra Costa County Flood Control and Water Conservation District

Storm Depth Estimation for Frequent Return Intervals  
for Contra Costa County, California

by

Contra Costa County Flood Control and Water Conservation District

March 8, 2010

We are frequently asked by engineers, architects, landscape architects, and planners to provide the 24-hour storm depth for storms less than the 5-year storms. Our standard Precipitation Duration-Frequency-Depth (DFD) Curves are published in drawing numbers B-158 through B-162. However, these only cover the 5-year through 100-year storm recurrence intervals.

*(As of the last editing of this document, the PDFs of these documents can be downloaded from <http://www.co.contra-costa.ca.us/index.aspx?nid=2455>)*

To estimate the storm depth for a storm smaller than the 5-year storm, probability-log paper can be used along with information from the DFD curves. The following is a step by step explanation of how to do this using an example. The example will be a site in San Ramon near the Bollinger Canyon Road intersection with Interstate 680. The desired rainfall amount is the 2-year 24-hour storm depth.

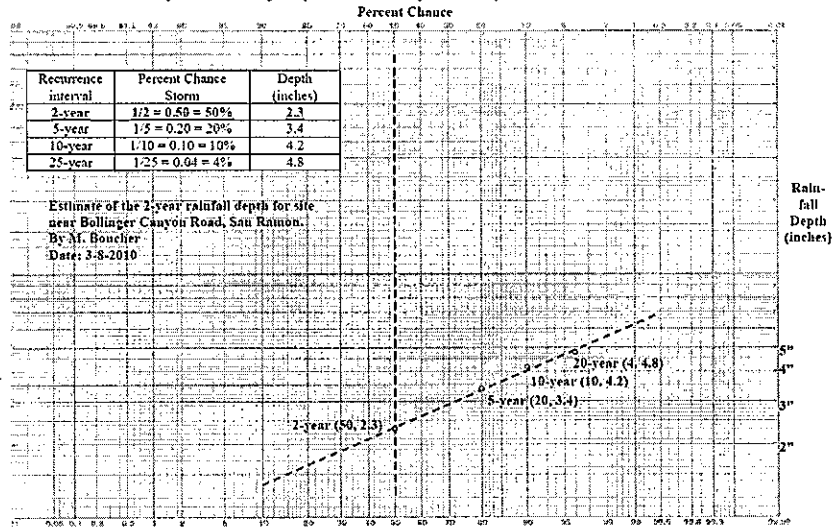
### Step 1 - Determine the MSP

The first step is to determine the Mean Seasonal Precipitation (MSP) for your site. Determine this from the Isohyet1 map found at the link above. The map with the GIS features provides smaller MSP intervals which is handy in some area of the county. Find your site location on this map and interpolate as needed between the isohyets to determine the MSP at your site. The site location for our example is within the circle in Figure 1 and has an estimated MSP of 21.0 inches.



## Example from Contra Costa County Flood Control and Water Conservation District

Figure 3 - Determining the 5-year 24-hour Storm depth from the 5-year DFD curves.



Storm Depth Estimation for Frequent Return Intervals  
Contra Costa County Flood Control and Water Conservation District

## Earthquake

BMP for the earthquake as a causal event is comprised of three elements:

- Use MCE to compare the design of the landfill to determine the potential damage due to ground movement and ground acceleration.
- Evaluate the potential effects of liquefaction if the landfill is located in a Seismic Hazard Zone.
- Evaluate for the potential damage from fault ruptures if the landfill is located within 200 feet of Holocene fault zones.

## **Wrap-up**

**Need comments on content and causal events**

**Next steps?**

**Another meeting before October?**

**Is end of year feasible?**

**Best Management Practices (BMPs) for Site-specific Non-water Release  
Corrective Action Plans  
(Discussion Draft June 2010)**

**California Department of Resources Recycling and Recovery (CalRecycle)**

Solid waste landfill owners or operators are required to provide financial assurance for corrective action based on the highest amount of either the water release corrective action or non-water release corrective action. The regulations also allow the landfill owner or operator to use the costs based on the non-water release site-specific corrective action plan (CA Plan) to determine the costs for the non-water release corrective action.

This document identifies the best management practices (BMPs) for the development of the CA Plan. The CA Plan is required to provide an assessment of the impacts due to causal events and the associated costs to remediate any impacts. BMPs define or characterize each causal event to be evaluated for potential damages to a landfill due to the causal event in the CA Plan. Also addressed is the requirement for containment and environmental monitoring and control systems to be maintained to standards, known releases, the requirement to use a third party to develop the plans, and frequently asked questions.

BMPs do not change the required minimum standards for the siting, design, and operation of a landfill or provide recommendations on the methods for the determination of potential damage, required corrective action, and associated costs. It is expected that standard practice and methods will continue to be used to determine the potential damage, the required corrective action activities, and associated costs. BMPs also do not address potential releases to groundwater or surface water. These releases should be part of the water release corrective action which is under the jurisdiction of the Regional Water Quality Control Boards. CalRecycle staff has prepared BMPs to assist owners and operators in preparing the CA Plan and to assist local enforcement agencies in the review of the CA Plan.

General Scope and Applicability of BMPs

Best management practices (BMPs) are practical and effective processes, practices, or techniques to achieve a desired outcome. They are offered as "good ideas" that may need to be adjusted to account for individual needs or site-specific circumstances. BMPs are **not** rules, regulations, or mandatory standards.

The scope of the BMPs is the site-specific non-water release CA Plan, prepared in lieu of final cover replacement or closure costs. Non-water release site-specific corrective action plans (CA Plan) and financial assurances (in lieu of final cover replacement or closure costs) are a major part of the regulations concerning long-term postclosure maintenance,

corrective action, and financial assurances (see: [www.calrecycle.ca.gov/Laws/Rulemaking/Postclosure/Phase2/default.htm](http://www.calrecycle.ca.gov/Laws/Rulemaking/Postclosure/Phase2/default.htm)).

The desired outcome for BMPs for the non-water release site-specific CA Plan is to develop accurate cost estimates and establish financial assurances to ensure that known or reasonably foreseeable corrective actions at solid waste landfills are accounted for by the owner or operator with minimal risk to the State from divestiture or default and that the outcome is based on sound science, engineering, and professional standards of practice.

BMPs do not change the required minimum standards for a solid waste landfill (Class II or III landfill). BMPs are recommendations to define or characterize a reasonably foreseeable corrective action due to causal events. A causal event may be defined as an established design standard that is not used for a Solid waste solid waste landfill, an example is the seismic design standard for a Class I hazardous waste landfill.

### Technical Advisory Group

A technical advisory group (TAG) was established to assist CalRecycle staff in the development of the draft BMPs by providing comments, recommendations, and technical analysis and information. TAG is comprised of stakeholder groups including local enforcement agency and the environmental community and technical experts in the following areas: seismic, slope stability/soils, landfill cap design and repair, systems for monitoring and collecting landfill gases, leachate systems, erosion due to storms and flooding, and landfill fires. BMPs may not reflect the views or opinions of the TAG.

### What is Correction Action?

Corrective Action means an activity, including restoring the integrity or establishing the adequacy of a damaged or inadequate containment structure or environmental monitoring or control system, to: bring a landfill into compliance with the applicable requirements, prevent a reasonably foreseeable release, or remediate a known release to the environment. The types of structures and systems would include, but not be limited to, cap and cover system, landfill gas monitoring and collection system, slopes, roads, run-on and run-off control (drainage) systems, vegetation and irrigation systems, and environmental monitoring and control systems. Corrective action does not include routine maintenance. Routine maintenance should be part of the postclosure maintenance plans.

Postclosure maintenance plans are required to include activities and associated costs for maintenance and for replacement (when the useful life ends) of equipment and structures, including the final cover. Equipment and structures would include the landfill gas and leachate monitoring and control systems and drainage systems (27 CCR Sections 21815 and 21840). These activities and estimates are required to be addressed in the CA Plan to ensure that all necessary replacement costs are accounted

for and if the item is considered routine postclosure maintenance and not corrective action.

Current regulations under 27 CCR Sections 20917-20945 require all active sites to have landfill gas monitoring and control systems in compliance with the more definitive closed site standards. Furthermore, California Air Resources Board (CARB) pending landfill methane capture regulations will require monitoring and control systems at solid waste landfills. These requirements should minimize reasonably foreseeable landfill gas releases. However, should postclosure land use change, property boundaries be rezoned toward the fill area, or offsite land use is changed to more sensitive use, additional landfill gas monitoring and control measures and financial assurances may be required in the CA Plans. Additionally, landfills with long-term landfill gas violations are required to address the gas violations as a 'known release' in the CA Plan.

### **Background/ Regulatory Framework**

The regulations (27 CCR §22221) require the owner or operator of a solid waste landfill to provide financial assurance for corrective action. The owner or operator is required to provide a cost estimate for initiating and completing corrective action for known or reasonably foreseeable releases to water and a cost estimate for the non-water release corrective action. The highest cost estimate, for water release corrective action or non-water release corrective action must be used to determine the amount of required financial assurance.

The cost estimate for the non-water release corrective action can be determined in following ways:

- Costs for replacing the final cover (This cost may be determined by either of the following methods.)
  - Cost of removing the existing cover and installing the new cover
  - Providing the greater of the most recently approved or recently submitted closure cost estimate adjusted for current costs and the entire landfill
- Costs for implementation of a site-specific non-water release corrective action plan.

### **What must the CA Plan contain?**

The non-water release site-specific corrective plan must include an evaluation of the known or reasonably foreseeable non-water release corrective action as a result of each known or reasonably foreseeable causal event. Causal events include earthquakes, flooding, tsunamis, seiche, fire, precipitation, and degradation of or otherwise inadequate containment structure or environmental monitoring or control system. The CA Plan must include the following, pursuant to 27 CCR Section 22102:

- An evaluation of the known or reasonably foreseeable non-water release corrective action needed as a result of each known or reasonably foreseeable causal event;
- Cost estimates, prepared pursuant to 27 CCR Sections 22101(c)-(f), for all known or reasonably foreseeable corrective actions described in the plan. The cost estimate with the highest amount must be used to determine the amount of financial assurance required pursuant to 27 CCR Section 22221(b)(2);
- An evaluation of the long-term performance of the final cover system to ensure that it will continue to meet the requirements of 27 CCR Section 21140 without the need for corrective action; and
- Provisions to restore the integrity or establish the adequacy of a damaged or inadequate containment structure or environmental monitoring or control system, to bring a landfill into compliance with the applicable requirements.

#### Design Standards to Define Causal Events

Based on the causal event, various potential impacts and corrective action activities would be required as shown in Attachment 1. CalRecycle staff has determined that reasonably foreseeable corrective action activities based on design standards above the minimum design standards is an appropriate guide for preparation of the CA Plan and cost estimates. This approach also provides an incentive for owners or operators to use siting and design standards that are more stringent and protective than the minimum standards for solid waste landfills to minimize potential damage and resulting corrective action due to causal events.

It was suggested that the minimum design standards for a solid waste landfill be used to define or characterize a causal event. CalRecycle staff rejected the suggestion since applying the existing minimum design standards would result in no corrective action for the causal event, which is inconsistent with the intent of the regulations.

An example under this approach, is that owners or operators of landfills designed to withstand the Maximum Probable Earthquake would be required to conduct an analysis of the potential additional damage from an earthquake that is considered the Maximum Credible Earthquake and to identify the required activities and costs needed to restore the landfill to comply with the applicable CalRecycle standards. For this causal event, the existing site-specific stability analyses in Joint Technical Document or Closure/Postclosure Maintenance Plans for the representative final cover, interim slope, liner, and global configurations may be required to be updated, revised, or be replaced with a new analysis for evaluation of an earthquake that is considered MCE as part of the CA Plan.

The flooding and precipitation causal events are amendable to this approach since landfills are required to be designed to specific standards as shown in Attachment 1. Other causal events including, tsunami, seiche, and fire do not have required design standards and are addressed by other approaches.

**BMPs for Causal Events and Known Release**

The following discuss BMPs on how to address the causal events in the CA Plan. As mentioned, causal events include earthquakes, flooding, tsunami, seiche, fire, and precipitation. The location of a landfill is a critical factor to determine if there will be any impacts due to a causal event and to what extent. An objective of the CA Plan is to provide cost estimates for corrective action. Solid waste landfills, as well as all structures, are required to be designed and engineered to be able to withstand specific conditions caused by events. To determine if corrective action is necessary, an evaluation must be conducted to determine if the design of the landfill can withstand certain events. This BMP contains recommendations for defining or characterizing each causal event so that the required evaluations can be conducted with standard methodologies or standard practices. Potential impacts of the causal events can be found in Attachment 1.

The recommendation for defining or characterizing each casual event is provided in the following table.

<b><u>Causal Event</u></b>	<b><u>BMP to Define or Characterize the Causal Event</u></b>	<b><u>Design Standard</u></b>
Earthquake	Maximum Credible Earthquake	Maximum Probable Earthquake
Flood	500-Year Flood	100-Year Flood
Precipitation	1000-Year 24-Hr Storm	100-Year 24-Hr Storm
Tsunami	Designated Inundation Zone	Not Applicable
Seiche	Within 1/2 Mile of Lake	Not Applicable
Fire	Designated Moderate or Higher Fire Hazard	Not Applicable

**Known Releases**

The CA Plan requires an evaluation of the known or reasonably foreseeable non-water release corrective actions needed as a result of each known or reasonably foreseeable causal event (27 CCR Section 22102(a)). The most likely non-water known release to be evaluated is likely to be a long-term landfill gas violation. Others may include corrective action related violations under the Inventory of Facilities Violating State Minimum Standards (see: <http://www.calrecycle.ca.gov/SWFacilities/Enforcement/Inventory/Default.aspx>).

If there is a known release due to a past causal event, the CA Plan must address the known release, remediation activities, and associated costs.

### Earthquakes

An earthquake is a reasonable foreseeable causal event in California. Earthquakes can cause damage to structures due to ground motion, liquefaction, or fault rupture. Design standards are used to ensure that a structure will withstand the ground movement and shaking resulting from a certain size earthquake taking into consideration the proximity and the geology between the location of the structure and faults. The seismic design standard for a Class III landfill is the Maximum Probable Earthquake, commonly referred to as MPE. Other landfills such as the Class I or II are required to be designed to withstand a stronger seismic event, the Maximum Credible Earthquake (commonly referred to as MCE). CalRecycle staff did not find any other design standard for earthquakes that is readily used for the design of structures.

### MPE versus MCE

The MPE may be defined as the largest earthquake a fault is predicted to be capable of generating within a specified time period. MPEs are most likely to occur within the time span of most development and are commonly used. The time period is 100 years for a Class III solid waste landfill.

MCE may be defined as the largest hypothetical earthquake that may be reasonably expected to occur along a given fault or other seismic source produced under the current tectonic setting or the largest earthquake a fault is capable of generating. MCEs are used in the design of structures such as dams, bridges, and hazardous waste landfills.

On a voluntarily or RWQCB-required basis, more Class III landfills are designed to the MCE standard which minimizes potential corrective action due to damage from an earthquake and the associated costs. These costs should already be accommodated as part of routine postclosure maintenance. Fortunately, there are very few sites on or within 200 feet of Holocene fault zones where fault rupture would likely result in the need for substantial reconstruction corrective action activities and costs.

Liquefaction occurs when loose granular materials such as sands and silts below the water table can behave like a liquid when shaken by an earthquake. The landfill structure itself is composed of compacted soils and should not be saturated with water. The concern arises from the possibility of liquefaction in the soils which support the landfill structure. Soils in the state of liquefaction can liquefy and lose their ability to support structures or experience a loss of bearing strength. The California Geological Survey and US Geological Survey (USGS) have identified areas of California that are susceptible to liquefaction and landslides due to earthquakes. If a landfill is located within a "Seismic Hazard Zone" a site specific evaluation should be conducted for liquefaction and landslides.



"Seismic Hazard Zones" have been established by the USGS and the California Geological Survey in order to provide the general public, land-use planners, utilities and lifeline owners, and emergency response officials, tools in which to assess their risks from earthquake damage. The hazard zone maps can be found at the USGS and California Geological Survey's website

<http://www.conservacion.ca.gov/cgs/shzp/Pages/Index.aspx>

Damage to landfills from earthquake may be due fault displacement or to secondary hazards such as slope instability or liquefaction of the foundation. Potential modes of damage MSW landfills associated with the primary seismic hazard include:

- disruption of liner and cover systems;
- disruption of the landfill gas control system; and
- disruption of surface water and drainage control systems.

Secondary modes of damage to the containment systems of MSW landfills that are subject to strong ground motions include:

- damage due to liquefaction and lateral spreading of the foundation;
- damage due to seismically--induced settlement of the foundation; and
- damage due to seismically-induced landslides.

(Reference: RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, EPA/600/R-95/051, April 1995)

BMP for the earthquake as a causal event is comprised of three elements:

- (1) Use MCE to compare the design of the landfill to determine the potential damage due to ground movement and ground acceleration.
- (2) Evaluate the potential effects of liquefaction if the landfill is located in a Seismic Hazard Zone.
- (3) Evaluate for the potential damage from fault ruptures if the landfill is located within 200 feet of Holocene fault zones.

### **Flooding**

Flooding is a reasonably foreseeable causal event, based on the document, "California's Top 15 Weather Events of 1900's" by the National Weather Service Forecast Office (<http://nimbo.wrh.noaa.gov/pqr/paststorms/california10.php>), nine of the 15 events were associated with flooding. Several agencies implement programs regarding flooding, the U.S. Geological Survey, California Department of Water Resources, Federal Emergency Management Agency, and local flood or water districts. These agencies are excellent sources of information on potential flood and storm events for a specific location, including potential height of the flood waters. Damages at landfills due to a flood is caused by inundation or washout of slopes, drainage systems, and other structures; including soil erosion or structure failure due to the force of the moving water. The location, elevation and design of a landfill, including the level of maintenance of the run-on and run-off control systems are major factors in determining if a flood will adversely affect the landfill.

The required design standards for flooding are:

27 CCR § 20260 (c ): New Class III and existing Class II-2 landfills shall be designed, constructed, operated, and maintained to prevent inundation or washout due to floods with a 100-year return period. MSW landfills are also subject to any more-stringent flood plain and wetland siting requirements referenced in SWRCB Resolution No.93-62 (i.e., see Sections 258.11, 258.12, and 258.16 of 40CFR258).

The return period is commonly referred to as the recurrence level or for the 100-year return period, also commonly referred to as the "100-year flood". Flood maps for the 100-year and 500-year flood are readily available from FEMA. The FEMA maps are used to determine if flood insurance is required and the potential for various degrees of flooding. FEMA has indicated that moderate flood hazards are areas between the 100-year and 500-year flood and minimal flood hazards are areas above the depth of the 500-year flood. Flood zone maps may be obtained from the FEMA website at: [www.fema.gov](http://www.fema.gov) .

BMP for the flood as a causal event is:

- Flooding is considered de minimis as a causal event if the landfill is not located in the 500-year flood zone or the elevation of the landfill is above the depth of the flood event.
- For the purposes of determining corrective action, any landfill located within the 500-year flood zone needs to assess the potential damage resulting from the 500-year flood.

### Tsunami

A tsunami is a sea wave that is generated by an earthquake, landslide, volcanic eruption, or even by a large meteor hitting the ocean. The California coast has experienced several tsunamis, some causing significant damage. It is anticipated that the types of damage caused by a tsunami would be similar to those resulting from an earthquake or flood. An excerpt below from the Department of Conservation website illustrates the impacts of a tsunami resulting from an earthquake in Alaska in 1964. The Department of Conservation has generated maps identifying areas that may be affected by a tsunami. The intended uses for the maps are for emergency planning (such as coastal evacuation planning) purposes and to assist cities and counties in identifying their tsunami hazard. The maps identify areas of California that may be inundated by a tsunami.

1964 3/28	Gulf of Alaska - Alaska Peninsula	Crescent City	6.3	10 dead, 35 injured, 52 homes and 172 businesses damaged or destroyed. \$15 million in damages.
		Klamath River		1 killed, \$4,000 damages to dock and boats at Requa. Damage reported at least 2.6

		Trinidad	Observed	km from mouth of Klamath River. 5.4m above MLLW.
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Reference:

[http://www.humboldt.edu/~geology/earthquakes/tsunami!/n\\_coast\\_tsunamis.html](http://www.humboldt.edu/~geology/earthquakes/tsunami!/n_coast_tsunamis.html)

Tsunamis are considered a reasonable foreseeable causal event if the landfill is located in an area designated by the Department of Conservation to be prone to be inundated by a tsunami. In a 2003 report prepared by GeoSyntec Consultants, Inc, it was reported that 17 landfills were located in a coastal setting. The report can be downloaded at : <http://www.calrecycle.ca.gov/Publications/default.asp?pubid=1046>

The maps identifying the inundation areas in California can be downloaded at the following web site:

[http://www.conservation.ca.gov/cgs/geologic\\_hazards/Tsunami/Inundation\\_Maps/Pages/Statewide\\_Maps.aspx](http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/Inundation_Maps/Pages/Statewide_Maps.aspx)

General information on tsunamis can found at

[http://www.conservation.ca.gov/cgs/geologic\\_hazards/Tsunami/Pages/About\\_Tsunamis.aspx](http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/Pages/About_Tsunamis.aspx)

BMP for the tsunami as a causal event is:

- Tsunamis are considered de minimis as a causal event if the landfill is located in an area that is not designated to be prone to be inundated by a tsunami by the Department of Conservation or local emergency response agency.
- For landfills located in an area that is prone to be inundated by a tsunami, the CA Plan needs to address the potential impacts and damage that may result.

## Seiche

A seiche is a wave on the surface of a lake or landlocked bay caused by atmospheric or seismic disturbances and may be defined as an occasional rhythmic oscillation of water above and below the mean level of lakes or seas, lasting from a few minutes to an hour or more. Seiches are uncommon but have been known to have occurred on Lake Tahoe and the Great Lakes. Damages anticipated resulting a seiche would be similar to those from an earthquake or flood.

BMP for the seiche as a causal event is:

- Seiche is considered de minimis as a causal event, if the landfill is located greater than ½ mile away from a lake or a landlocked bay.
- Landfill that located within ½ mile of a lake or landlocked bay needs to identify the height of the wave and evaluate if the wave will inundate the landfill and cause any damage.

## **Precipitation**

There are case studies that document damages to landfills caused by storms. Damage to the cover, drainage system, slope, and roads can occur due to erosion of soil and inundation by water (Sunrise Mountain in Nevada, Jim Hogg County Landfill in Texas and Crown Vintage Landfill in New Jersey, and the Anderson report). These examples were primary of closed landfills that may not have been maintained, but they are indications that storms are capable of causing significant damage to a landfill. Although every landfill is unique in its design and location, precipitation is a reasonable foreseeable causal event.

Landfills are required to maintain systems to control run-on and run-off due to precipitation during its active life and into the postclosure period. The systems are required to protect against a 100-year, 24-hour storm event (Class II landfills). Class I landfills are required to be designed to withstand the Probable Maximum Precipitation rain event and Class II landfills are designed to withstand the 1000-year, 24-hour rain event. Since solid waste landfills can be either a Class II or Class III as determined by the RWQCB, staff recommends that the Class II design standard be used to define the causal event.

BMP for precipitation as a causal event is the design standard for a Class II landfill which is the 1000-year, 24-hour rain event.

## **Fires**

Damage at landfills can be caused by wild fires or subsurface fires. The potential for these fires to occur is dependent on the location of the landfill for wild fires or the introduction of oxygen into the landfill cell. Wild fires have been documented to destroy or damage all or portions of the landfill gas collection and monitoring systems, vegetation and irrigation systems designed to protect the cap and cover, drainage systems, and utility conveyance systems (reference OC, Republic and WM). The potential damage is dependent on mitigating circumstances such as whether the structures are buried to be protected from fires and if there are engineered mitigation measures such as fire breaks to protect against surface fires.

Subsurface fires are caused due to the presence of oxygen and can cause damage to the landfill gas collection systems and potentially the cap. The postclosure maintenance plan should contain provisions for subsurface fires. If not, subsurface fires should be addressed in the CA Plan.

The fire hazard zone maps can be downloaded at:

[http://www.fire.ca.gov/fire\\_prevention/fire\\_prevention\\_wildland\\_zones\\_maps.php](http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_zones_maps.php)

BMP for a fire as a causal event is that landfills located within 1,000 feet of fire hazard zones determined by California Department of Forestry and Fire Protection (Cal Fire) or the local fire control agency as moderate, high, or very high must evaluate the potential damage to surface structures, vegetation and irrigation systems, and utilities.

- It is recommended that an assumption that 80% of the surface structures are destroyed if the landfill is located in a very high fire hazard zone, reduced by engineered systems to mitigate surface fires.
- For landfills located in high fire hazard zone, the recommendation is that an assumption that 70% of the surface structures are destroyed.
- For landfills located in a moderate fire hazard zone, the recommendation is that an assumption that 50% of the surface structures are destroyed.
- For landfills not located in the above zones, a contingency of 20% to replace surface structures is recommended.

### Evaluation of the Final Cover System

The regulations (27 CCR § 22102(a)(3)), also require that the CA Plan, including updates and revisions, contain an evaluation of the long-term performance of the final cover system to ensure that the final cover system will continue to meet the requirements of 27 CCR §21140 without corrective action. Should the final cover no longer comply with 27 CCR §21140, repair or partial to complete replacement may be required. The permeability of final cover systems will likely degrade with time depending on the site and design and potentially to a less protective permeability level than the original design standard. Under such circumstances, non-water release corrective action would not be required unless the degradation results in violation of the applicable 27 CCR §21140 final cover performance standards.

The requirements of 27 CCR §21140 are:

- (a) The final cover shall function with minimum maintenance and provide waste containment to protect public health and safety by controlling at a minimum, vectors, fire, odor, litter and landfill gas migration. The final cover shall also be compatible with postclosure land use.
- (b) In proposing a final cover design meeting the requirements under section 21090, the owner or operator shall assure that the proposal meets the requirements of this section. Alternative final cover designs shall meet the performance requirements of (a) and, for MSWLF units, 40 CFR 258.60(b); shall be approved by the enforcement agency for aspects of (a).
- (c) The EA may require additional thickness, quality, and type of final cover depending on, but not limited to the following:
  - (1) a need to control landfill gas emissions and fires;
  - (2) the future reuse of the site; and
  - (3) provide access to all areas of the site as needed for inspection of monitoring and control facilities, etc.

## Degraded/Inadequate Containment or Environmental Monitoring and Control Systems

The regulations require that each CA Plan provide an analysis of the adequacy of the design, capacity, or component useful life of the containment or environmental monitoring and control systems as a causal event. Containment systems (e.g., final cover) and monitoring and control systems (e.g., landfill gas, leachate, and drainage systems) may significantly degrade or have inadequate design to prevent leachate, gas, or waste releases.

Repair or replacement of these systems or components will be required as part of the CA Plan if needed for compliance with applicable performance standards. Applicable standards include: 27 CCR §§20917-20945 (landfill gas) for all sites; for active sites, 27 CCR §§21600(b)(4) (design), 20790 (leachate), 20820 (drainage); and for closed sites, 27 CCR §§21140-21160 (final cover, grading, stability, leachate) and 21190 (postclosure land use).

## Active vs. Closed Landfills

The financial assurance requirements for corrective action apply to active, closed, and closing solid waste landfills. It may be appropriate to have the CA Plan address the planned closed landfill configuration as defined in the closure and postclosure maintenance plans for the landfill if the landfill is active because of the anticipated long-term or indefinite postclosure maintenance period (when causal events are most likely to occur). Under this approach the operator would need to demonstrate that the landfill configuration at any time during its active life would not result in a higher CA Plan cost estimate than the closed landfill configuration.

Alternatively, the operator may submit a CA Plan for the active landfill configuration as described in the Joint Technical Document, scaling back from full build out to progressive cumulative development phases provided the CA Plan addresses the configuration prior to the next plan update. Under this approach, updated CA Plan and significantly higher financial assurances would be required for new development phases and upon submittal of final closure and postclosure maintenance plans.

## Frequently Asked Questions

A set of frequently asked questions regarding the CA Plan and its preparation (CA Plans are required to be prepared by licensed third-party professionals pursuant to 27 CCR Section 22102(c)) and the responses are provided below:

1. In practice the "entity responsible for the design of the solid waste landfill" usually comprises a team of firms, consisting of a primary consultant, subconsultants, and contractors. The "entity" or engineer of record (PE or CEG) that signs off on the

JTD/Closure Plan is typically the primary consultant. In this scenario, would the subconsultants and contractors be excluded from being on the third party team?

No. The regulations would only exclude the entity (primary consulting firm) and the engineer of record (PE or CEG).

2. We have had a case where a firm who designed our landfills and is the engineer of record was recently purchased as a subsidiary of another company. Would the parent company be excluded from being a third party preparer despite not being involved in the design work?

No, the regulations would not exclude the parent company from being a third party preparer. The only regulatory restriction related to subsidiary/parental relationships is that associated with the owner/operator (Section 22102(c)(1)(D)).

3. Similarly to number 2, a parent company who designed the landfill acquires a firm that was clearly eligible to be a third party preparer prior to the acquisition. Does the firm lose its eligibility status under the new ownership?

This one depends on the meaning of "acquires."

If the acquired firm remains a separate entity it would not lose its eligibility.

If the acquired firm is subsumed by the "entity responsible for the design of the solid waste landfill" the acquired firm would lose its eligibility.

4. Section 22102 refers to the entity/engineer of record in the JTD/Closure Plan of the most recent SWFP. Throughout the life of a landfill, many different entities/engineers may have played a role in the design of the landfill and signed off on the JTD. Does the phrase "most recently issued SWFP" mean that previous entities/engineers that are not referenced in the most recently issued SWFP are now eligible third party preparers?

Yes, previous entities/engineers not referenced in the most recently issued SWFP would be eligible.

5. The design engineer of record would be excluded from being a third party preparer. However, that engineer does not work alone. Would an individual from the design team be eligible as third party preparers assuming they left the entity and worked for another firm? Likewise, if the design engineer of record sought opportunities at another firm, could he/she be on the third party team provided this individual did not sign off on the corrective action plan.

Yes to both. An individual from the design team would be eligible as a third party preparer assuming they left the entity and worked for another firm. Likewise, if the design engineer of record sought opportunities at another firm, he/she could be on

the third party team provided this individual did not sign off on the corrective action plan.

6. Although Section 22102 explicitly refers to the JTD and Closure Plan, we assume that the entity/engineer of record for third party eligibility determination also extends to the PCMP. Is this correct?

Yes. Although Section 22102 does not explicitly refer to PCM plans it does reference Section 21780, which applies to both closure and PCM plans

7. Should the non-water Corrective Action Plan address impacts on groundwater or water quality?

No, the regulations require a separate water release corrective action plan and a non-water release corrective action plan. LEA, CalRecycle, and the Regional Water Quality Control Board will jointly respond to an event at a solid waste landfill. In the situation that an event results in a release that affects water quality, LEA and CalRecycle will refer any water problems to the Regional Water Quality Control Board who will be the lead agency to oversee the release (LEAs and CalRecycle do not have authority to address water quality issues).

8. What is the timeframe to be addressed as part of the corrective action (what is considered long term)?

The requirements for providing financial assurance for corrective action are in effect during the entire period that the landfill is active and/or subject to postclosure maintenance requirements.

9. How are engineering flaws or failures addressed as part of corrective action?

The regulations require that if an operator chooses to use the non-water release site-specific correction action plan, the plan must contain an analysis of the containment and environmental monitoring and control systems for adequacy with the applicable standards. If there are engineering flaws or failures that would prevent compliance with the applicable standards, the plan would need to address how the standards would be satisfied either through repair or replacement of the systems.

10. How does one calculate the change from the MPE to the MCE?

An analysis needs to be completed to estimate the amount of deformation and ground acceleration based on each event and compare that to the design of the landfill to determine if there will be any damage and, if yes, to what extent. It is not the intent of BMPs to recommend a methodology for this analysis. Methodologies that are standard practice will be considered acceptable.



## Attachment 1

### Causal Event, Potential Corrective Action, Design Standards And AB 2296 Study

Causal Event 27 CCR §22100(c)(2)	Potential Impact Requiring <sup>1</sup> Corrective Action §22100(c)(1)	Design Standards 27 and 22 CCR <sup>2</sup>	AB 2296 Study Risk Category <sup>3</sup>
<b>Earthquake</b> (seismic shaking, liquefaction, ground rupture)	Slope or containment failure with or without breach of cover system, including waste exposure; damage to environmental monitoring and control systems (gas, leachate, drainage).	Class III- MPE; not on Holocene fault;  Class II/I- MCE and >200' from Holocene fault	Low- MCE with FS>1.5  Medium- MPE FS 1.3-1.5  High- < MPE
<b>Flooding</b> (regional flood inundation)	Inundation/washout of monitoring and control systems; erosion; slope failure; increased leachate/gas generation with potential for public contact.	Class III/II/I- 100-year flood.	Low- >500yr Medium- 100-500yr High- <100yr
<b>Precipitation</b> (high intensity storm event)	Washout of monitoring and control systems; erosion; waste exposure; slope failure.	Class III- 100-year 24-hour Class II- 1000yr 24hr Class I- Probable Maximum Precipitation (PMP)	Low- 1000yr 24hr Medium- 100yr 24hr High- <100yr 24hr
<b>Tsunami</b> (seismic sea wave) <b>Seiche</b> (natural wave in lake or bay)	Similar to Earthquake, Flooding, Precipitation causal events.	NA	NA
<b>Fire</b> (surface wildfire or subsurface landfill fire)	Destruction of monitoring and control systems and release of gas and leachate; subsurface fire may also cause collapse and breach of cover systems and related systems damage.	NA	Surface fire hazard zones:  Low, Medium, and High.
<b>Degraded/inadequate containment or environmental monitoring and control system</b>	Containment systems and/or monitoring and control systems no longer capable of meeting applicable performance standards. Requires partial or complete replacement and/or upgrade and repair.	See footnote 2	Final Cover:  Low- >Subtitle D; Medium=Subtitle D; High- < Subtitle D.

<sup>1</sup> Impact will vary on a site-specific basis, including status as active or closed.

<sup>2</sup> For primary design standards see: SWRCB- 27 CCR 20310-20377 and Table 4.1 ([www.calrecycle.ca.gov/Laws/Regulations/Title27/Table4.htm](http://www.calrecycle.ca.gov/Laws/Regulations/Title27/Table4.htm)). CalRecycle applicable 27 CCR standards: 20917-20945 (landfill gas); Active Sites- 21600(b) (4) (design), 20790 (leachate), 20820 (drainage); Closed Sites- 21140-21160 (final cover, grading, stability, and leachate) and 21190 (postclosure land use); CaRecycle: Department of Resource Recycling and Recovery, formerly California Integrated Waste Management Board (CIWMB).

<sup>3</sup> Reference: [www.calrecycle.ca.gov/SWFacilities/Financial/2007Study/default.htm](http://www.calrecycle.ca.gov/SWFacilities/Financial/2007Study/default.htm).

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