California Department of Toxic Substances Control

Community Protection and Hazardous Waste Reduction Initiative

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Finally, DTSC wishes to acknowledge the expert services of our facilitator, Mr. Greg Bourne, of the University of California Davis, Extension Collaborative Center, for assisting DTSC in carrying out this Initiative. During this Initiative DTSC hosted presentations from a variety of stakeholders representing the views of industries and communities. However, the presenters' views and information were not verified and do not necessarily reflect the views and opinions of DTSC.

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Abbreviations and Acronyms

AA:	Alternative Analysis
BCP:	Budget Change Proposal
Cal/EPA:	California Environmental Protection Agency
CC:	Cleanup Complete
CEI:	Compliance Evaluation Inspection
CERS:	California Environmental Reporting System
CUPA:	Certified Unified Program Agency
CPHWR:	Community Protection and Hazardous Waste Reduction Initiative
CWM:	Chemical Waste Management
DTSC:	Department of Toxic Substances Control
EERD:	Enforcement and Emergency Response Division
EI:	Environmental Indicator
EJ:	Environmental Justice
EJTA:	Environmental Justice and Tribal Affairs
EPA:	U.S. Environmental Protection Agency
FY:	Federal Fiscal Year
GW:	Groundwater
HH:	Human Health
HWMP:	Hazardous Waste Management Program
HWTS:	Hazardous Waste Tracking System
LAB:	Lead-acid battery
LQB:	Large Quantity Generator
OCI:	Office of Criminal Investigations
P2:	Pollution Prevention
PC:	Post-Closure
RCRA:	The Resource Conservation and Recovery Act of 1976
SB 14:	Hazardous Waste Source Reduction and Management Review Act of 1989

Abbreviations and Acronyms (continued)

SCP: Safer Consumer Products

SEP: Supplemental Environmental Project

SNC: Significant Non-Complier

SQG: Small Quantity Generator

TSDF: Treatment, Storage, and Disposal Facility

UW: Universal Waste

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Executive Summary

Introduction

This report reflects the work of the Community Protection and Hazardous Waste Reduction Initiative (CPHWRI). The information gathered will inform ongoing efforts to reduce hazardous waste in the state of California and support current conversations around Governance and Fiscal Reform.

Timeframe of initiative. The initiative launched in January 2016 and the Advisory Committee held their first meeting the following March. Its work was concluded in July 2017. DTSC acknowledges that the goal of the Initiative was to release this report by the end of that year. Regrettably, multiple challenges at DTSC deterred timely release of the report. Nevertheless, the content remains relevant and important. DTSC is grateful to the advisory committee members and stakeholders who pushed for its release, and hopes that, despite the delay, readers will recognize the value in the information in this report.

Key Elements of the Initiative

Advisory committee and stakeholder engagement**.** The Advisory Committee represented a wide range of stakeholders, including industry, community-based and environmental justice organizations, as well as academia. DTSC and the Committee engaged the public throughout a year-long series of virtual and in-person discussions, where feedback was received for consideration.

Analyze hazardous waste data and trends. Baseline data were generated and analyzed using DTSC's Hazardous Waste Tracking System (HWTS), and includes data collected from 1995 through 2015. While the rate of hazardous waste generation decreased during this timeframe, the total tonnage continued to exceed 1.7 million tons. Overall, waste disposed to landfills increased, while waste disposed outside of landfills and out-of-state declined slightly, but the report notes that significant work is needed to reduce hazardous waste generation. In 2015, contaminated soil from site cleanups was the largest hazardous waste generated in the state, followed by waste and mixed oil from a variety of sources such as industrial operations and small auto shops.

Pilot project identification. The committee established criteria to ensure that pilot projects could meet the critical hazardous waste reduction needs of the state and that project completion and long-term maintenance might be feasible. It prioritized proposals based on factors such as how much waste might be reduced because of the proposed project, whether the project focused on a hazardous waste type that was particularly toxic or acutely hazardous, and whether it was economically feasible. Additional considerations were given to return on investment and environmental impacts. Due to limited state resources, the scope was later narrowed to include projects that could secure support from project proponents. The projects that were ultimately selected were those that focused on contaminated soil, organic solvent wastes, petroleum refinery wastes, and lead-acid battery waste.

Current opportunities to reduce hazardous waste generation and manage hazardous waste more effectively. The Initiative found that opportunities to reduce hazardous waste generation from lead-acid batteries and management improvements have been taken, but as economic consumption of these materials continues, the need to significantly reduce waste will remain. For example, the lead-acid battery industry has implemented new technology and procedures to improve emission control, optimization, new battery technology, and employee safety. While the rate of lead-acid battery recycling is high, the industry accounts for about 90 percent of the reported 1.6 million tons of lead consumption in the United States in 2015.

Similarly, there are opportunities to explore treatments that remove contaminants from soil, such as Super Critical Water Oxidation (SCWO), soil washing treatment of metal contaminated soil, and Evaporative Desorption Technology. These technologies could allow DTSC and other agencies that oversee cleanups to reuse contaminated dirt, resulting in lower impacts to both communities and landfills.

Source reduction opportunities have not been fully explored by the oil refinery industry, owing in part to barriers around market factors such as demand and regulatory impediments. Just five percent of process improvements could result in a reduction of up to 3,455 tons/year. Opportunities remain for the industry to make improvements and partner with policy makers and regulators in paving the way toward improvements that would benefit environmental justice communities.

Finally, businesses that generate organic solvent waste have demonstrated willingness to participate in efforts to achieve source reduction and promote changes industry-wide. These changes include a high emphasis on adopting best management practices for maintenance and handling, and improving storage and materials management.

Conclusion

Hazardous waste and other competing impacts in EJ communities. Hazardous waste is generated, transported, and stored primarily in environmental justice communities. These are largely lower-income communities of color that bear a disproportionate burden of multiple environmental hazards, such as toxic air, water, and soil from high traffic, agriculture, industrial waste, and waste facilities.

California should be responsible for its own waste. Many residents, advocates, and industries agree that we must find solutions that reduce or eliminate waste completely – and not simply shift the burden of hazardous waste to other in-state or out-of-state environmental justice communities. California needs to take responsibility for the waste it generates. This report outlines myriad opportunities to not only reduce the waste currently being stored, but to prevent it from ever entering the economy in the first place.

Opportunities to take action**.** Many opportunities were identified that could support this vision. Some would require legislative and regulatory improvements to remove barriers or provide economic incentives. Others require support and guidance. Ultimately, these pilot projects require sponsorship funding through public or private organizations.

Thank you to all who contributed. DTSC appreciates the contributions of the Advisory Committee, communities, and experts who participated in the research and drafting of this report. Their work laid the groundwork for programmatic improvements and successful research outcomes within DTSC and will be further accentuated by the passing of Governance and Fiscal Reform this summer. We look forward to engaging with our stakeholders on the results of this report and next steps to advance the work of the Initiative.

Introduction/Background

Over the past four decades there have been many efforts related to the planning and siting actions that impact the placement and operation of hazardous waste facilities in California. Beginning in the mid-1980s, at a time when industrial use of organic solvents was prevalent, the limited number of hazardous waste disposal and incineration facilities within California and nationwide, and the difficulty in gaining consensus in the siting of new facilities, compelled DTSC and environmental agencies in other states to develop strategies to reduce the amount of wastes generated. The most substantive strategy was to reduce solvents and other hazardous wastes that required incineration as an alternative to siting new facilities. In California, this policy direction ultimately resulted in the Hazardous Waste Reduction and Management Review Act of 1989 (Senate Bill 14, Stats. 1989, ch. 1218 (Roberti) (SB 14)) and the formation of DTSC's Pollution Prevention Program.

The intent of SB 14 was to reduce hazardous waste generation at its source, reducing the need to treat, store, or dispose of it either in California or elsewhere. DTSC's Pollution Prevention Program implemented requirements for California's largest hazardous waste generators to prepare and submit source reduction plans every four years and to report on the reduction in wastes they were able to accomplish through their source reduction efforts. Senate Bill 1916 (Stats. 1998, ch. 881 (Sher)) subsequently directed DTSC to increase outreach, education, and technical assistance to businesses to reduce their generation of hazardous waste. The waste reduction efforts in the 1980s and 1990s were largely successful in reducing hazardous wastes, and as a result, reduced the need to site and construct additional hazardous waste management facilities, including incinerators, in California.

In 2008, DTSC's Green Chemistry authority was enacted (Assembly Bill 1879, Feuer, Chapter 559, Statutes of 2008 and SB 509, Chapter 560, Statutes of 2008). These bills together implement two key recommendations of the California Green Chemistry Initiative Final Report: to accelerate the search for safer products; and to create an online toxics clearinghouse. AB 1879 mandated DTSC develop and adopt the Safer Consumer Products Regulations and authorized DTSC to implement the Safer Consumer Products Program. Through its regulations, DTSC created a systematic, science-based process to evaluate Chemicals of Concern, and identify safer alternatives. Its regulations took effect on October 1, 2013.

In 2012, the resources that supported DTSC's pollution prevention efforts and its Pollution Prevention Program were reallocated to implement the newly formed Safer Products and Workplaces Program and to implement its Safer Consumer Products Program. All of DTSC's SB 14 related pollution prevention efforts were discontinued, and its remaining SB 1916 industry sector pollution prevention related activities were directed in support of its Safer Consumer Products Program. The statutes and regulations for SB 14 and SB 1916 are still in effect but were made optional for DTSC to implement and administer. The requirements applicable to large quantity hazardous waste generators also remain in effect. Every four years, all large quantity generators of hazardous waste must conduct a source reduction evaluation review and prepare a plan describing how they intend to further reduce the amount of hazardous waste they generate.

In 2013, when DTSC approved the expansion of one of California's two operating hazardous waste landfills, the Department announced an ambitious goal to reduce hazardous waste disposed in California landfills by 50 percent by 2025. In making the decision to approve the landfill expansion, DTSC recognized that the generation and disposal of hazardous wastes in California present an equity issue for communities where hazardous wastes are generated and where hazardous waste landfills are operated. While hazardous waste is generated throughout California, there are only two available disposal facilities in the state. California communities where hazardous waste disposal facilities are sited can bear a disproportionate burden of the safe and legal disposal of such wastes.

Soon after the landfill expansion decision, DTSC, using existing resources, began to develop a strategy to develop and achieve the ambitious goal. The strategy included engagement with stakeholders, including impacted communities and affected industries. DTSC found it difficult to sustain these efforts without additional resources, however, and sought additional resources through a Budget Change Proposal.

On July 1, 2015, resources were appropriated to DTSC to carry out the Community Protection and Hazardous Waste Reduction Initiative (Initiative). As described in the Budget Change Proposal (the basis for the appropriation), DTSC received $840,000 and 6.0 positions from the Toxic Substances Control Account for two years (through June 30, 2017) to develop, implement, and evaluate projects that reduce the generation of hazardous wastes that are treated or disposed in California.
In carrying out the Initiative, DTSC was to select three pilot projects focused on hazardous wastes that meet three conditions: They are generated in significant quantities in California; they can pose substantial risks or hazards to human health or the environment; and they are treated or disposed in California communities that are disproportionately burdened by multiple sources of pollution.

This report details DTSC's efforts in carrying out the Initiative which includes: the formation and membership of the advisory panel, the selection of the hazardous wastes and industry sectors to be evaluated, the methods used to identify pilot projects and evaluate information gathered, the information gathered related to each selected hazardous waste industry and type, and recommendations for future efforts to promote the reduction of hazardous wastes generated in communities that are disproportionately burdened by multiple sources of pollution in California.

Environmental Justice, Public and Stakeholder Engagement

The implementation of this Initiative was designed to incorporate and reflect DTSC's commitment to both Environmental Justice and to Public and Stakeholder Engagement.

Environmental Justice

The principles of environmental justice call for fairness, regardless of race, color, national origin, or income, in the development of laws and regulations that affect every community's natural surroundings, and the places people live, work, play and learn.

California was one of the first states in the nation to codify environmental justice in statute.[1] Beyond the fair treatment called for in code, leaders in the environmental justice movement work to include those individuals disproportionately impacted by pollution in decision making processes. The aim is to lift the unfair burden of pollution from those most vulnerable to its effects.

Environmental Justice and Hazardous Waste

The legacy of hazardous waste landfills near environmental justice communities is an issue that impacts and drives community concerns today and is a priority for DTSC's ongoing commitment to include communities in the decision-making process.

Through the efforts undertaken in the Initiative, DTSC recognizes that California must be both conscientious and open to meaningful input from impacted communities by addressing barriers to the permitting process, as well as to partnering with external stakeholders who have a role, from cradle to grave, in the generation and disposal of hazardous waste. Through the combined efforts of waste reduction and community-involvement, DTSC believes that families and communities near these landfills will be most effectively protected.

Public and Stakeholder Engagement

In the 2014-2018 Strategic Plan DTSC committed to develop and implement strategies to engage in a statewide dialogue to obtain ideas and input from DTSC's network of partners concerning DTSC's initiative to maximize the reduction in the state's hazardous waste by 2025 to reduce California's dependence on hazardous waste landfills and protect all impacted communities. This includes communities, the public, other government agencies, and other stakeholders. The Department believes that all parties have a right to be heard and that meaningful engagement is an obligation of public agencies. DTSC has an obligation to enable and empower impacted communities and other external partners and stakeholders toparticipate in DTSC's decision-making processes. To ensure an open and two-way

[1] Senate Bill 115 (Solis, Chapter 690, Statutes of 1999).

communication with external stakeholders, DTSC utilized several communication channels to engage the public throughout the Initiative.

Engagement in Public Meetings

To promote substantive public engagement, DTSC hosted and provided facilitation for ten public meetings between spring 2016 and spring 2017. These publicmeetings included eight meetings (half and full day) with the Advisory Committee and two broader Community meetings. The Advisory Committee meetings were intended to solicit and collect feedback and input from the group of nine diverse stakeholders ina public forum. One Advisory Committee meeting was held via a conference call with a town hall public comment period for interested members of the public. Although each Advisory Committee meeting provided an opportunity for public comment, the Community meetings were two-hour long sessions for any member of the public to provide input of the pilot project topics or overall Initiative efforts. Public comment was also made available at meetings via email and, whenever possible, meetings were webcasted live for viewing by the public. Additionally, DTSC posted meeting materials, including meeting agenda and other materials prior to each meeting on each the DTSC website for public review. Meeting summaries and recordings of each meeting were also subsequently posted on DTSC's website.

To promote participation and ensure two-way communications for all participants, regardless of language, DTSC offered to provide simultaneous and consecutive language interpretation services upon request for all ten meetings. Themeeting agendas and public notices were also translated into Spanish, posted on DTSC's website, and made readily available at each meeting.

Engagement through Online and Digital Communication

The Initiative actively sought to garner meaningful public input and participation at every level by way of open and public meetings and through online and other digital mediums. DTSC utilized a variety of electronic, online, and digital communications platforms to distribute projects updates, meeting notices, and other opportunities for public engagement. DTSC has provided comprehensive periodic updates available in the form of Community Updates. These updates highlight major milestones and programmatic efforts and share crucial information for interested stakeholders and members of the public. These updates were also translated into Spanish. Other online and digital platforms include:

- A public email inbox was reviewed by project staff every business day: cphwr@dtsc.ca.gov;
- An e-list with where subscribers received periodic e-mail notifications containing news and information such as meeting notices and agendas, project updates, and other items of interest (approx. 300 subscribers).

- A webpage on DTSC's public website, dtsc.ca.gov/hw-reduction, which stores:
  - Staff contacts;
  - Advisory Committee member biographies;
  - Pilot project proposals summaries;
  - Subscription to the E-List;
  - Meeting recordings, meeting minutes, and materials; and
  - Project updates.
  - Background on the Hazardous Waste Source Reduction and Management Act of 1989 (SB 14)
  - Appendices referenced in this report

DTSC also publicized meetings and other project updates and information on various social media outlets:

- Facebook: @CaliforniaDTSC
- Twitter: https://twitter.com/CaliforniaDTSC
- YouTube: https://www.youtube.com/user/DTSCgreen
- Eventbrite: https://www.eventbrite.com

Advisory Committee

Committee Formation

The Initiative committed DTSC to facilitate the formation and operation of a stakeholder advisory committee (Advisory Committee). The Advisory Committee, to be appointed by DTSC, was to be comprised of representation from the following groups:

- Communities impacted by hazardous waste generation
- Communities impacted by hazardous waste disposal
- Local government
- Hazardous waste disposal facility operators
- Businesses that are large quantity hazardous waste generators
- Statewide environmental advocacy organizations
- Statewide environmental justice advocacy organizations
- Statewide business advocacy organizations
- Academics who have researched pollution prevention

DTSC advertised broadly for possible applicants and received nineteen applications. With the assistance of a Selection Committee comprised of Kelly Moran (TDC Environmental), Tom McHenry (Gibson, Dunn & Crutcher LLP), Martha Arguello (Physicians for Social Responsibility-Los Angeles), DTSC selected the following list of Advisory Committee members:

Name	Type of Group	Affiliation
Cynthia Babich	Communities affected by HW generation, disposal	Del Amo Action Committee
Xonia Villanueva	Communities affected by HW generation, disposal	The People's Senate
Ingrid Brostrom	Statewide Environmental Justice Organization	Center on Race, Poverty & the Environment
Nick Lapis	Statewide Environmental Advocacy Organization	Californians Against Waste
Virginia St. Jean	Local Government	San Francisco Dept. of Public Health
Oladele Ogunseitan	Academic with research in pollution prevention	UC Irvine, Program in Public Health
Dawn Koepke	Statewide business advocacy organization	CA Council for Environmental and Economic Balance
Chuck White	HW disposal facility operators	Solid Waste Association of North America and California Waste Association
David Asti	Large Quantity HW Generator	Southern California Edison

More information on each Advisory Committee member can be found on DTSC's Internet web site at:
http://www.dtsc.ca.gov/HazardousWaste/CPHWRI/advcommembers.cfm.

Purpose of Committee

The purpose of the Advisory Committee was to provide DTSC with advice to the pilot efforts and on its public outreach and involvement efforts. The Advisory Committee was asked to provide guidance and consultation for the selection and evaluation of the pilot projects. The Advisory Committee was also asked to provide advice and recommendations on engaging the public on efforts of each of the pilot projects. Specifically, the Advisory Committee was asked to review DTSC's plans for engaging with the public to ensuring that DTSC's efforts were conducted openly, and that the public and all interested stakeholders would have an opportunity to engage in each pilot project and provide input, as they desired.

Advisory Committee Responsibilities

The primary responsibilities of the Advisory Committee were to:

- Work cooperatively with DTSC and other-Advisory-Committee-members from January 2016 through June 2017;
- Attend and participate in Advisory Committee meetings in Sacramento, or alternative locations if necessary, and participate in conference calls;
- Provide guidance and consultation to DTSC for selection and evaluation of up to three pilot projects;
- Share information regarding the projects with represented stakeholder groups or constituencies, and provide feedback to DTSC;
- Submit research, data, and information as requested related to: Economic factors influencing source/waste reduction; Regulatory tools available to support source/waste reduction; Environmental and community impacts of hazardous waste generation, treatment, and disposal; Available and potentialtechnologies and practices to reduce the generation of hazardous wastes;
- Review and comment on draft and final Reports in a timely manner; and
- Provide advice and recommendations on engaging the public to ensure inclusion and transparency.

Advisory Committee Solicitation, Appointments, and Process

The Advisory Committee member application submittal period took place from December 7, 2015, through January 8, 2016. The selection and notification of selected applicants occurred between January 8, 2016, and February 24, 2016. The first meeting of the Advisory Committee took place on March 17, 2016. Information related to all of the Advisory Committee meetings, and information provided to and received from the Advisory Committee and its members, can be found on DTSC's public Internet website at http://www.dtsc.ca.gov/HazardousWaste/CPHWRI/CPHWR-Documents.cfm.

Pilot Project Selection Process

DTSC planned the following steps to carry out the substantive elements of the Initiative:

1) Selection of Pilot Project Focus Areas – DTSC, in conjunction with the Advisory Committee, would select the three hazardous waste types or hazardous waste generating industries for which pilot projects would be identified and implemented, and results reported.
2) Gathering of Data and Information– DTSC would gather data and information related to each of the selected hazardous waste types or hazardous waste generating industries, including amounts generated and waste handling and disposal practices, as well as waste reduction activities or efforts being implemented already.
3) Solicitation for Pilot Projects – DTSC would disseminate a broad solicitation to businesses generating the selected hazardous wastes, or comprising the selected hazardous waste generating industry, offering to be identified as pilot projects under the Initiative.
4) Selection of Pilot Projects – DTSC, in conjunction with the Advisory Committee, would select Pilot Projects from the businesses responding to the solicitation.
5) Implementation of Pilot Projects – DTSC would oversee the implementation of the selected Pilot Projects.
6) Pilot Project Results – DTSC would report the results and findings from each of the Pilot Projects, and from that information, make recommendations for future waste reduction activities.

Baseline Data

Prior to selecting pilot projects, DTSC developed a set of baseline data on the generation, management, and disposition of hazardous waste in California. The primary source of this information is DTSC's Hazardous Waste Tracking System (HWTS), a data system that contains all relevant information on the movement of hazardous waste in California. Existing California law requires that, with few exceptions, all shipments of hazardous waste must be accompanied by a hazardous waste manifest. The manifest contains all of the relevant information about the shipment, including the name of the business generating it, the registered hazardous waste transporter that hauled it, and the authorized recycling, treatment, storage, or disposal facility (TSDF) that received it. Copies of these manifests must be sent to DTSC by both the generator of the hazardous waste and by the receiving facility. The copies of these manifests are scanned to retain their image, and the information from them is entered into the HWTS. Like all data tracking systems, DTSC's tracking system has inherent limitations due to the quality of information and system design characteristics, which are explained in the HWTS Disclaimer & Data Limitations Statement reproduced in Appendix G.

The following pages present summary data for California hazardous waste generation and disposition. Please note that for all graphs, charts and tables presented, the data presented is from 1995 to 2015. Due to changes in regulations and hazardous waste management practices the data collected prior to 1995 is difficult to interpret and compare to more recent reporting years. Due to the timing of submittal and entry of manifest data, 2015 is the most current year for which the data set is complete.

Baseline Data Tables and Graphs

Table #1 below shows the rate of hazardous waste generation in California between 1995 and 2015 (the most current set of hazardous waste data). Although the table shows that the rate of generation of hazardous waste has decreased over that twenty-one-year period, the total tonnage of hazardous wastes annually generated in California still exceeds 1.7 million tons.

Table #1

Comparison of Landfilled Hazardous Waste for California and Out of State Destinations — Revised 07/24/2017

California Trends in Landfill Disposal of Hazardous Waste from Calendar years 1995 through 2015

Hazardous Waste Generated and Land Disposed in California and Out of State (in Tons)

					Land Disposed Out of State (all destinations)		Land Disposed in CA (all destinations)		CA Destinations-Land Disposed Hazardous Waste		
n	Calendar Year	Total Hazardous Waste Shipped (excludes Transfers)	Total California Generated HW to Land Disposal (including Asbestos)	Amount Land Disposed as Percent of Total Waste	Total Amount Disposed OOS	Amount of Land Disposed HW as a Percent of Total CA Generated HW to Land Disposal	Total Amount Disposed in CA	Amount of Land Disposed HW as a Percent of Total CA Generated HW to Land Disposal	Clean Harbors, Buttonwillow, CA	Chem Waste Management-Kettleman City, CA	Asbestos/ Municipal/ Mecca*/ or Other
1	1995	1,932,600	*823,100*	43%	361,200	44%	461,900	56%	59,200	183,000	100,500
2	1996	1,811,200	*665,500*	37%	264,400	40%	401,100	60%	45,400	144,400	116,500
3	1997	1,784,100	*629,300*	35%	158,600	25%	470,700	75%	68,800	177,900	138,900
4	1998	2,002,200	*744,600*	37%	210,300	28%	534,400	72%	74,900	239,900	154,000
5	1999	2,070,415	*844,200*	41%	237,200	28%	607,000	72%	108,800	289,200	186,100
6	2000	2,414,800	*1,072,000*	44%	221,600	21%	850,400	79%	99,200	520,800	211,900
7	2001	2,430,900	*1,165,700*	48%	257,300	22%	908,400	78%	112,000	615,300	162,400
8	2002	2,096,300	*867,000*	41%	193,400	22%	673,600	78%	136,200	409,000	115,000
9	2003	2,228,300	*998,600*	45%	273,100	27%	725,500	73%	139,200	434,100	135,600
10	2004	2,359,300	*1,083,000*	46%	305,400	28%	777,600	72%	183,700	396,600	176,600
11	2005	2,294,300	*975,000*	42%	333,100	34%	641,900	66%	148,100	339,300	134,900
12	2006	2,256,400	1,059,100	47%	204,800	19%	854,300	81%	220,400	508,500	109,600
13	2007	2,352,800	1,418,000	60%	392,200	28%	1,025,800	72%	288,800	658,700	64,400
14	2008	2,194,300	1,316,600	60%	471,200	36%	845,400	64%	310,400	458,600	67,400
15	2009	1,794,600	893,200	50%	289,200	32%	604,000	68%	185,500	365,200	49,900
16	2010	1,790,200	884,000	49%	384,600	44%	499,400	56%	259,700	171,900	65,700
17	2011	1,748,800	916,500	52%	501,300	55%	415,200	45%	278,100	68,300	67,100
18	2012	1,659,800	810,300	49%	405,000	50%	405,300	50%	325,600	16,600	61,900
19	2013	1,586,900	771,600	49%	434,500	56%	337,100	44%	262,800	10,600	62,600
20	2014	1,744,900	897,300	51%	510,100	57%	387,200	43%	309,500	16,600	58,900
21	2015	1,726,700	964,400	56%	491,500	51%	472,900	49%	343,500	91,700	34,800
AVERAGES:											
20 YEARS:	**1996 - 2015**	2,017,360	*948,800*	47%	326,900	35%	621,900	65%	195,000	296,660	108,710
15 YEARS:	**2001 - 2015**	2,017,630	*1,001,400*	50%	363,100	37%	638,200	63%	233,600	304,100	104,504
10 YEARS:	**2006 - 2015**	1,885,540	993,100	52%	408,400	43%	584,700	57%	278,400	236,700	86,142
5 YEARS:	**2011 - 2015**	1,693,420	872,000	51%	468,500	54%	403,500	46%	303,900	40,800	57,060
3 YEARS:	**2013 - 2015**	1,686,167	877,800	52%	478,700	55%	399,100	45%	305,300	39,600	52,100

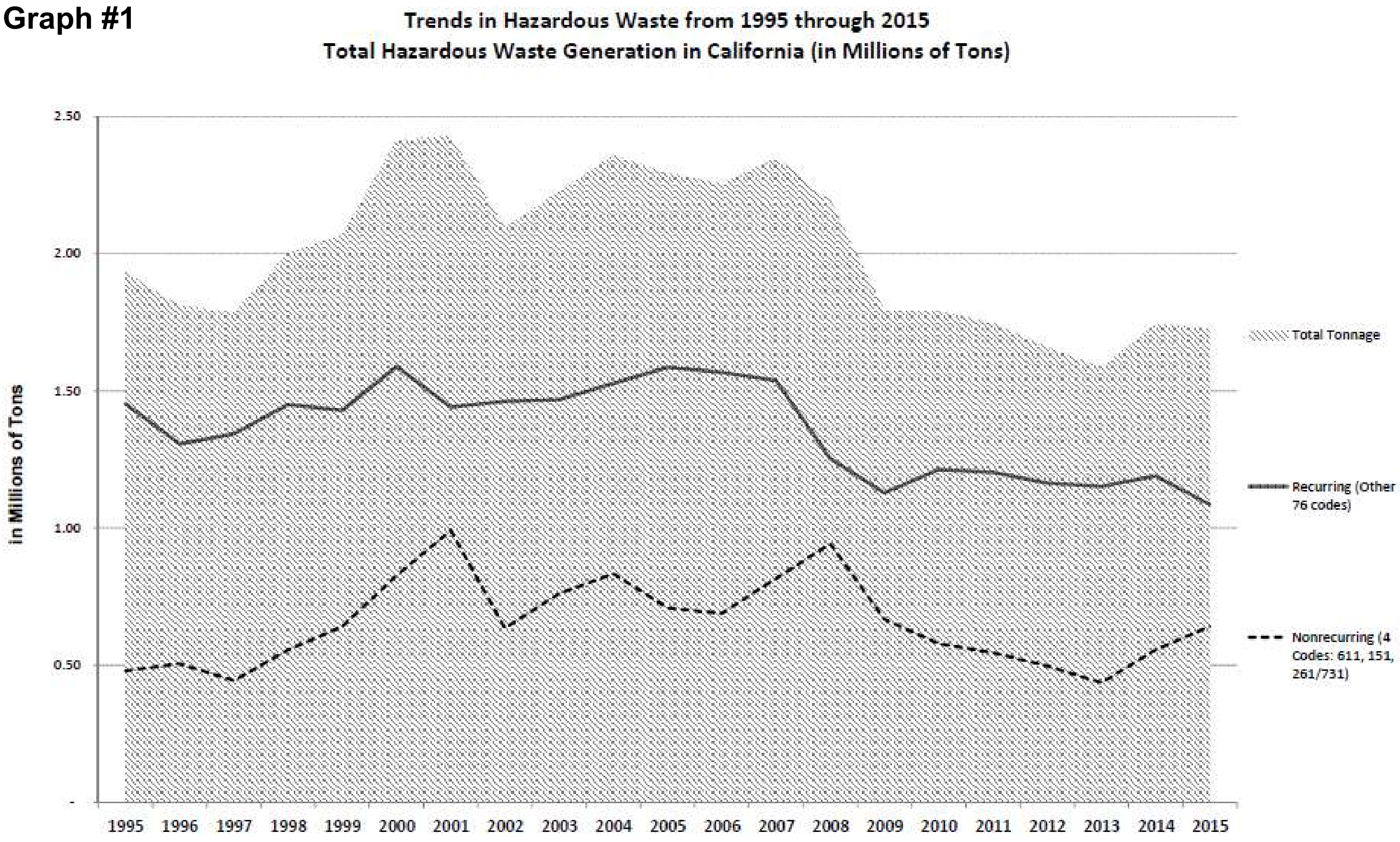
Notes: Tonnage amounts are adjusted to remove "phantom tons" from manifests greater than 130 tons (manifest errors).
Unknown EPA IDs assigned to state according to state EPA ID prefixes and /or State Abbreviations.
Tonnage from Unknown or Blank EPA ID numbers is shown as California tons.
*HW Tonnage Shipped to Western Environmental LLC, Mecca, CA (2003 through 2011).
DTSC stopped disposal at this facility in 2011.

Method Code:	Method Description	Manifest Years
D80	Landfill	Pre - 2007
H132	Landfill/surface impoundments	2007 - Current

HWTS datamart

Graph #1 below shows 1995-2015 HWTS data from Table #1 describing manifested hazardous waste generated in California and disposed to land (i.e., landfills or other allowed method, such as surface impoundment or waste piles, where the waste comes in direct contact with the land), both within California and out of state. The graph also separates the total tonnage into the categories of "Recurring" and "Nonrecurring." Recurring hazardous wastes are any hazardous wastes that are generated on an ongoing basis, such as from a manufacturing process. Non-recurring hazardous wastes are any hazardous wastes that are not continually generated at a site. Examples of nonrecurring waste are contaminated soil generated from site cleanups and asbestos generated from construction and building upgrades.

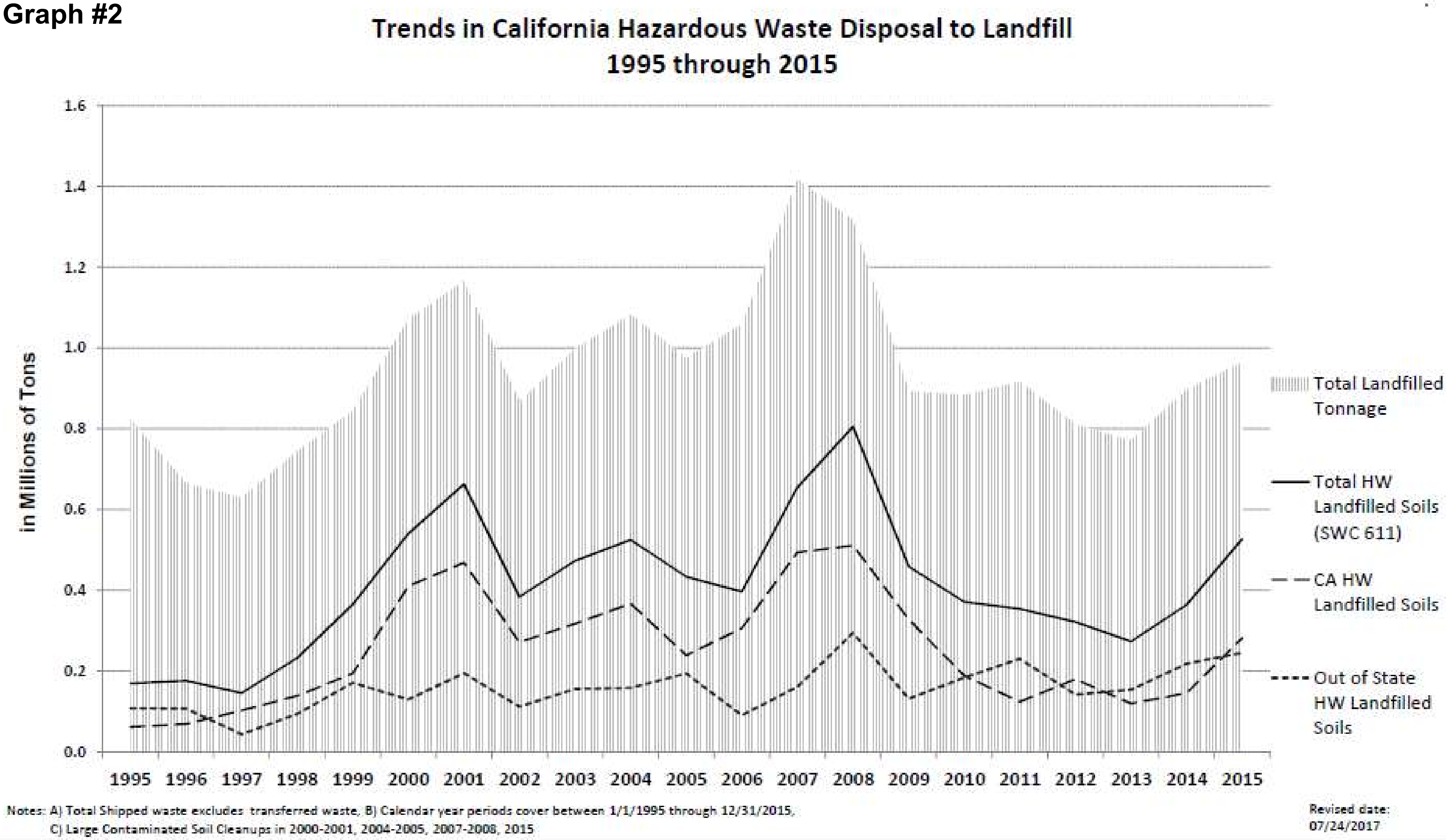
Graph #1



Notes: A) Total Shipped waste excludes transferred Waste, B) Calendar year periods cover between 1/1/1995 through 12/31/2015.

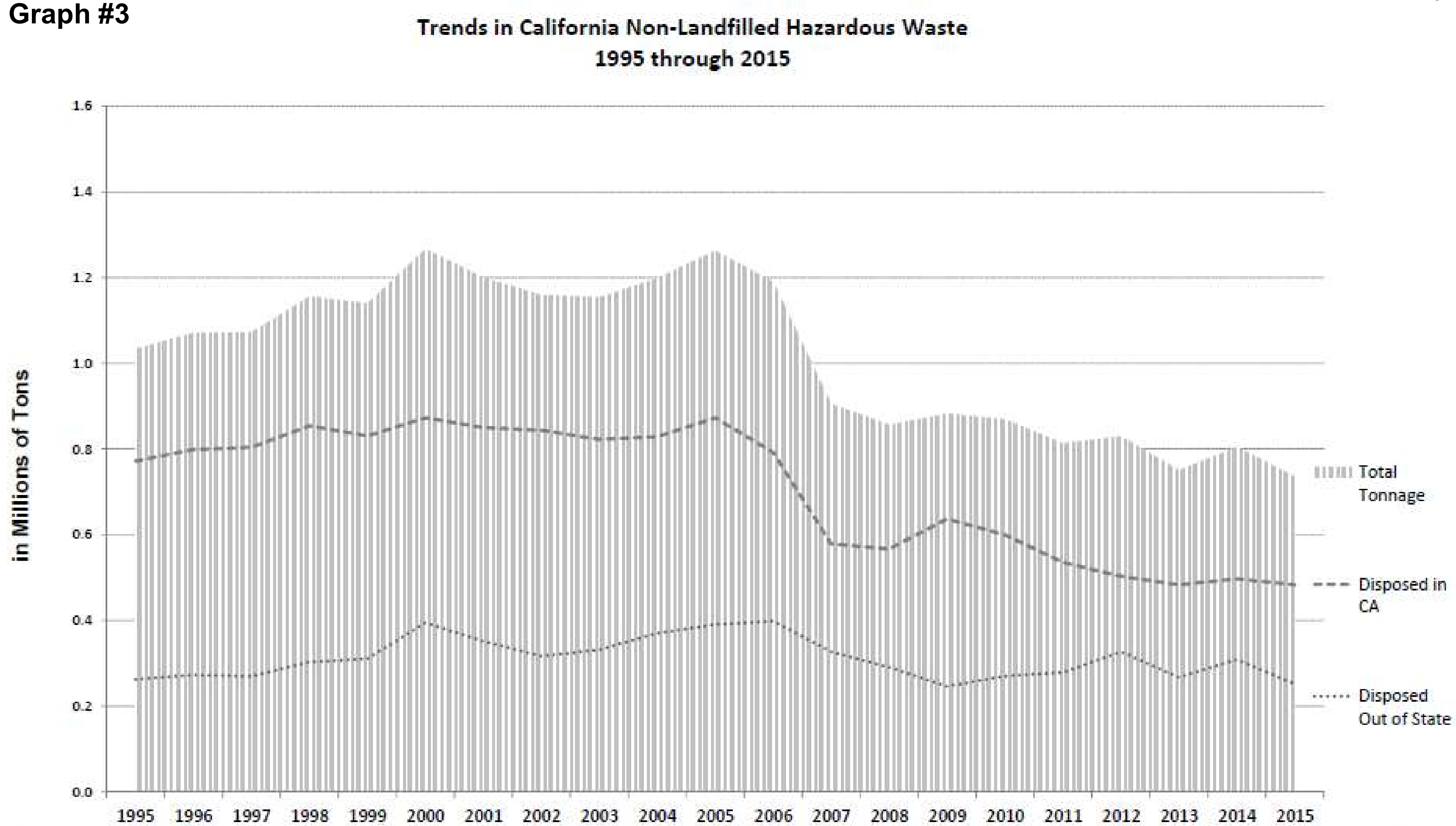
Graph #2 below presents data from Table 1 illustrating trends in hazardous wastes disposed to landfills from 1995 to 2015. This data suggests that although the amount of hazardous waste disposed to landfills is significantly less than in 2007, it is still a larger amount than it was in 1995. Other than sharp increases, the amount of disposal to landfills has not decreased over the 20-year period shown. There are significant opportunities for reducing waste generation disposed to land and landfills.

Graph #2



Graph #3 below presents data from Table 1 illustrating trends from 1995 to 2015 of hazardous waste generation for those wastes not shipped to landfills.

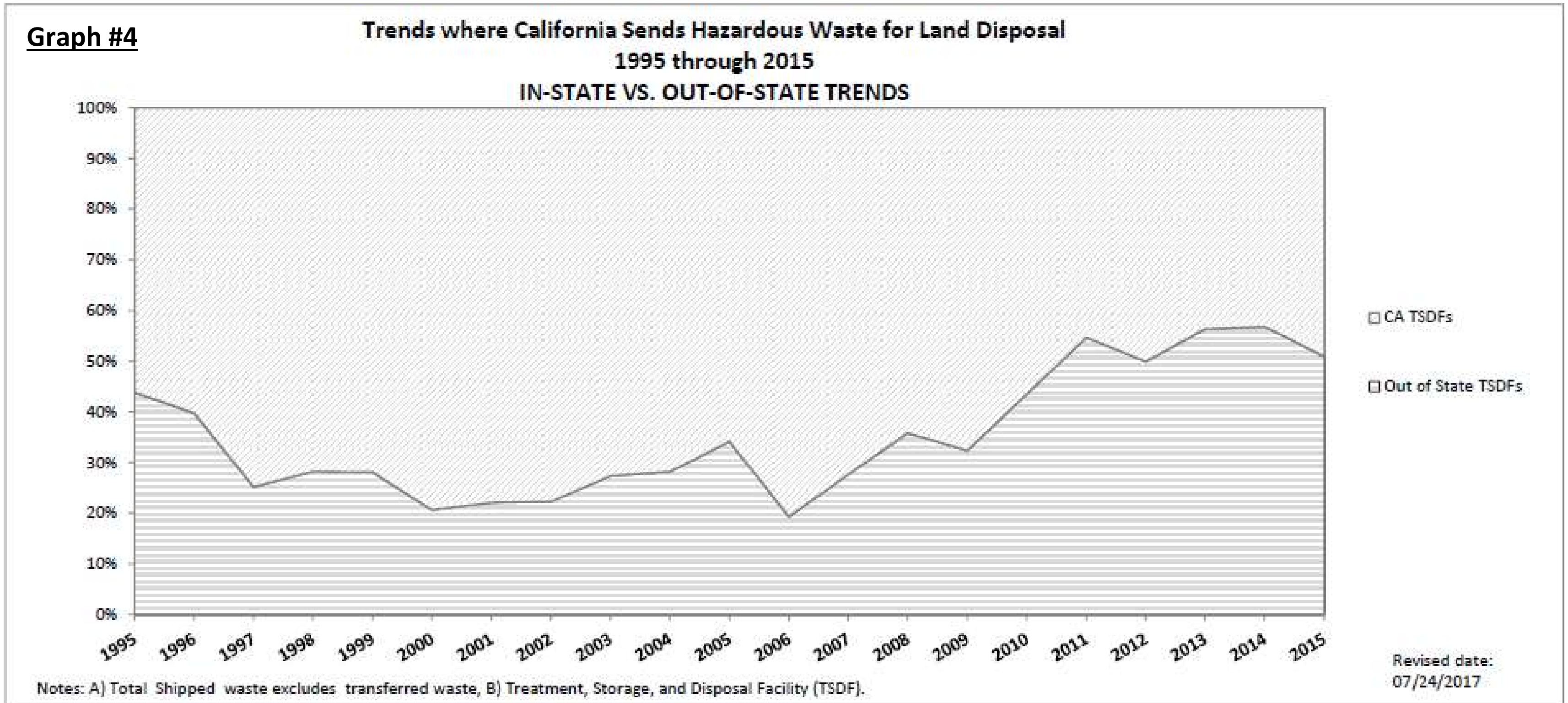
Graph #3



Notes: A) Total Shipped waste excludes transferred waste, B) Calendaryear periods cover between 1/1/1995 through 12/31/2015.

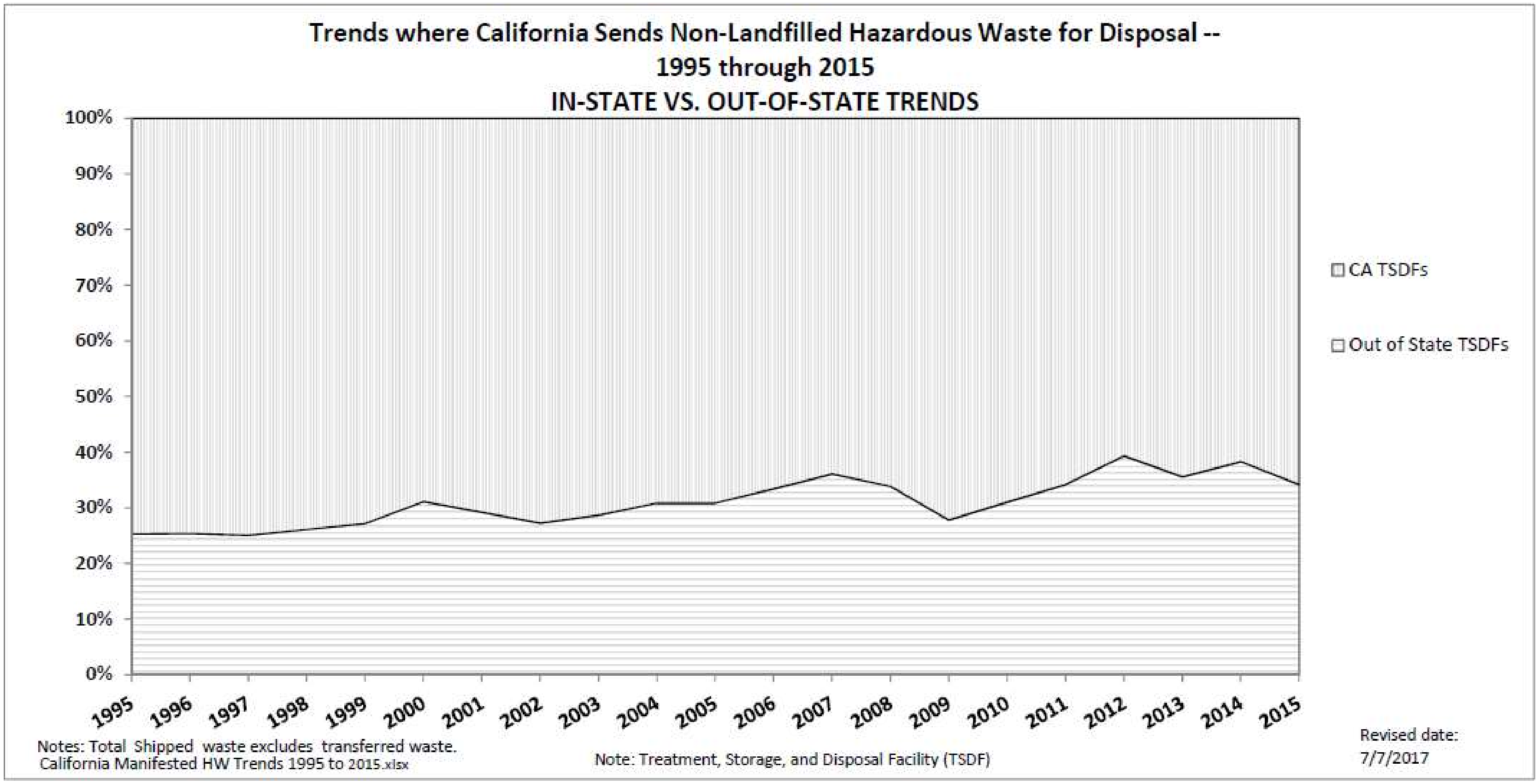
Revised date; 07/24/2017

Graph #4 below presents data from Table 1 illustrates the relative proportions of hazardous waste that was shipped to landfills in and out of state from 1995 to 2015. This data demonstrates that after a significant period of time where a larger proportion of California generated hazardous wastes were land disposed within California, the amount being shipped out of state for disposal has been increasing, returning to the relative proportions seen in 1995.



Graph #5 below presents data from Table 1 illustrating the relative proportions of California-generated hazardous waste that was shipped to facilities other than landfills in and out of the state from 1995 to 2015. The data indicates that the proportion of hazardous waste shipped to facilities other than landfills managed in-state versus out of state has remained relatively consistent since 1995.

Graph #5



Hazardous Wastes Generated in Largest Amounts

Table #2 below provides a list of the hazardous wastes generated in California in the largest amounts in 2015. The table also shows the disposition of the wastes as disposed in California, disposed outside of California, or recycled.

In 2015, contaminated soil from site cleanups was the largest hazardous waste generated in the state. Asbestos-containing waste was the sixth largest hazardous waste generated in the state. Waste oil and mixed oil was the second largest hazardous waste generated in the state. Waste oil and mixed oil come from a variety of sources, from industrial operations to small auto shops. This waste is highly recyclable. Contaminated soil and asbestos were the only two non-recurring wastes on the list.

The other hazardous wastes on the top list are generated by a variety of different industrial and manufacturing industries.

Table #2: California Hazardous Wastes Ranked by Quantity Generated (2015)

	Selected Wastes Generated in California (2015)		(in Converted Tons)		
CWC	**Waste Stream Description**	**Generated in CA**	**Managed* in CA****	**Managed Out-of-State**	**Recycled**
611	Contaminated soil from site clean-up	575,002	282,004	292,998	7,354
221	Waste oil and mixed oil	337,551	323,878	19,847	337,757
181	Other inorganic solid waste	224,680	105,633	119,712	23,062
352	Other organic solids	116,462	22,739	93,819	11,009
223	Unspecified oil-containing waste	57,160	30,741	26,468	27,990
151	Asbestos containing waste	54,996	38,101	16,895	26
214	Unspecified solvent mixture	34,257	9,120	27,214	24,029
133	Aqueous solution with total organic residues 10 percent or more	20,229	15,680	4,716	16,557
343	Unspecified organic liquid mixture	18,753	10,372	8,654	13,208
222	Oil/water separation sludge	18,640	10,896	7,748	8,785
331	Off-specification, aged or surplus organics	11,165	2,941	8,249	5,158
261	Polychlorinated biphenyls and material containing PCBs	10,301	804	9,498	3,330
591	Baghouse waste	10,280	8,022	8,336	2,254
212	Oxygenated solvents (acetone, butanol, ethyl acetate, etc.)	9,968	6,031	4,998	10,387
122	Alkaline solution without metals pH >= 12.5	7,749	5,586	1,654	3,404
171	Metal sludge (see 121)	7,034	2,010	5,023	3,493
132	Aqueous solution with metals (< restricted levels and see 121)	6,602	5,290	1,461	3,252
241	Tank bottom waste	5,525	2,175	3,349	2,253
571	Fly ash, bottom ash, and retort ash	4,360	727	3,632	169
211	Halogenated solvents (chloroforms, methyl chloride, perchloroethylene, etc.)	1,939	573	1,378	754
213	Hydrocarbon solvents (benzene, hexane, Stoddard, Etc.)	1,785	1,172	1,423	2,134
251	Still bottoms with halogenated organics	73	46	27	16
252	Other still bottom waste	49	5	44	21
	Total Tons:	**1,242,410**	**884,548**	**667,142**	**506,400**

* “Managed” includes not only disposal but other handling methods as well, including treatment and storage.

** The amount displayed as “Managed in CA” includes hazardous waste that is generated by a business in a different state and shipped to a facility in California for treatment, storage, or disposal.

CWC = California Waste Code

Pilot Project Focus Area Nominations

The Advisory Committee was asked to nominate candidates for waste types or industries to be considered one of the three from which pilot projects would be identified by DTSC under the Initiative. The Advisory Committee nominated the following list of waste types or industries described in Table #3 below:

Table #3

Project	Description
Legacy waste from petroleum refining, petroleum-contaminated soil, and groundwater	(1) Expand on work of pollution prevention advisory committee and determine BMPs, incentives for on-site recycling, and disincentives for off-site management. Use biennial reports as tool. (2) Have refineries pay cost for clean-up of legacy waste. Promote on-site treatment of legacy waste. (3) Remanufacture refinery waste to useful products that meet Green Chemistry definition.
Solvent waste	(1) Recycle solvents closer to point of generation. (2) Heavily tax use of hydrocarbon solvents and use money to pay for portable distillation and alternatives research. Exempt aqueous cleaning and on-site recycling from fees. (3) Segregate solvents for recovery and limit blending.
Asbestos	(1) Install asbestos thermochemical conversion equipment at the Azusa Land Reclamation Site. (2) Use the Safer Consumer Products Law to eliminate all forms of asbestos in products manufactured or sold in California.
Asbestos	Research BMP for long-term storage of asbestos, such as encapsulation, cementation, vitrification, or deep burial.
N-methylpyrrolidone	(1) List n-methylpyrrolidone as a Priority Product under the Safer ConsumerProducts Law. (2) Conduct a life cycle analysis for alternatives to n-methylpyrrolidone at the Western Digital Corporation facility in Fremont.
Automobile/metal shredder waste	Research ways to reduce volume and toxicity of auto/metal shredder waste. Rescind variances for auto/metal shredders to dispose of waste as nonhazardous and use as alternative daily cover.
Flares and pyrotechnics	(1) Develop a transportable treatment unit for on-site stabilization or destruction of explosives and capture fugitive emissions. (2) Change waste code to include explosives as universal waste for management by recycling facilities. (3) Incentivize research for non-explosive substitutes.
Portable gas cylinders	(1) Identify a region with a large number of retailers providing refill services of one-pound propane cylinders. (2) Recruit additional retailers. (3) Work with retailers to provide streamlined cylinder exchanges, including self-service vending machines. (4) Educate consumers about refillable propane cylinders. (5) Work with government to ban disposable cylinders. (6) Gather data about number of cylinders disposed. (7) Calculate greenhouse gas reductions from using refillable as opposed to disposable cylinders.
Portable gas cylinders	Use mobile units to crush spent portable gas cylinders and capture residual gases, such as the unit pilot tested in Yellowstone. Crushed cylinders have no hazardous gas remaining and can be recycled as scrap metal.
Flame retardants	(1) Use Green Chemistry Program to evaluate discontinuing production of flame-retardant chemicals. (2) Evaluate management of materials containing flame retardants and consider classifying as hazardous waste.
DDT and PCB contaminated soil and groundwater	Use super critical water oxidation (SCWO) transportable treatment unit for on-site treatment of contaminated soil and groundwater at the Del Amo site or other applicable site.
Petroleum-contaminated soil and groundwater	Use in-situ chemical oxidation for on-site treatment of contaminated soil and groundwater.
Contaminated soil	(1) Information sharing and relationship building between communities affected by hazardous waste disposal and communities impacted by contaminated sites. Develop community-generated proposals around soil treatment or removal options. (2) Incorporate community preferences in soil remedial action plans and other decisions.
Nitrate contaminated soil and groundwater	Work with the State Water Resources Control Board (SWRCB) to research options to determine the most cost-effective method to remediate nitrate-contaminated soil and groundwater in the Central Valley.

Note: During this same time, DTSC had informed the Advisory Committee that it was being directed to include lead-acid batteries as one of the pilot projects under the Initiative. The Advisory Committee may have nominated lead-acid batteries as well, had DTSC not already been directed to include them as a pilot project.

Pilot Project Selection Criteria

Considering the large number of nominated focus areas for the pilot projects, the Advisory Committee discussed the criteria it felt should characterize the projects to be selected. The following criteria were discussed:

Fundamental Pilot Project Aspects

The following criteria were discussed and selected by the Advisory Committee as being attributes of the potential pilot projects that were considered essential or fundamental to the pilot projects that should be chosen to be evaluated under the Initiative.

- **Technically feasible**
  The selected pilot project should be one that is considered technically feasible, in that it uses or incorporates existing technology, uses an accepted or demonstrated methodology, or the technology has been used and demonstrated to be effective.
- **Scalable**
  The selected pilot project should be one that is scalable, in that it should be something that has broad applicability to many businesses within an industry sector, multiple industries within California, or facets that more broadly apply to multiple communities within California.
- **Measurable**
  The selected pilot project should be one that is measurable, in that data should be able to be gathered during the pilot project that demonstrate actual reductions in the generation of hazardous waste, reductions in the disposal of hazardous waste to landfills, and reductions in the impacts of the generation or disposal of hazardous waste to communities in California.
- **Implementable**
  The selected pilot project should be one that is implementable, both within the available timeframe of the Initiative (i.e., able to be conducted and results measured prior to June 30, 2017) and within the project framework (i.e., within the scope, expertise and authority of the project staff, and focused on measuring the reduction of hazardous waste, rather than subject to evaluation by other programs in DTSC).
- **Benefits to environmental justice communities**
  The selected pilot project should be one that has nexus to, or can demonstrate clear benefits to, communities that are disproportionately impacted by multiple sources of pollution.

Prioritizing Selection Criteria

The Advisory Committee also identified a set of attributes of the potential pilot projects that were to be used to weigh candidate projects against each other and to establish the priority for each. These prioritizing criteria were:

- **Amount of Waste**
  The higher-priority pilot projects would be those that were focused on a hazardous waste that is generated in larger quantities.
- **Waste toxicity or hazard**
  The higher-priority pilot projects would be those that were focused on a hazardous waste that is more toxic or is more acutely hazardous.
- **Source elimination/reduction**
  The higher-priority pilot projects would be those that were focused on the elimination or reduction in the use of hazardous chemicals that were identified as the reason the hazardous waste was being generated.
- **Economic Feasibility**
  The higher-priority pilot projects would be those that were economically feasible. The Advisory Committee raised and discussed several concerns about how economic feasibility is calculated, including the costs that may or may not be included in the equation to include in the total costs versus the benefits of the project. At the time, there wasnot consensus within the Advisory Committee regarding how economic feasibility would be measured or applied.

Additional Pilot Project Selection Criteria Considerations

The Advisory Committee also discussed other factors that could be used to weigh candidate projects against each other and to establish the priority for each. Although these were discussed, the Advisory Committee did not rely on these factors in recommending pilot projects to DTSC.

- **Avoids disposal by other means**
  The potential pilot project achieves reduction in the landfilling of hazardous waste without contributing to disposal to water, air, or other land application.
- **Permanence**
  The potential pilot project achieves permanent reductions rather than temporary reductions.
- **Return on investment**
  The potential pilot project yields reduction of hazardous wastes that are proportional to the costs associated with the methods to achieve the reduction.
- **Long-term reductions**
  The reduction of hazardous wastes through the potential pilot project is only realized after a significant amount of time.
- **Short-term reductions**
  The reduction of hazardous wastes through the potential pilot project is realized more immediately or after only a short amount of time.
- **Impacts to other environmental media**
  The reduction of hazardous wastes through the potential pilot project results in detrimental impacts or releases of hazardous constituents to other environmental media (air, water, solid waste).
- **Shifting to other communities and states**

The reduction of hazardous wastes through the potential pilot project results in shifting all or a portion of the burden to another community, or to another state or country.

- **Single hazardous constituent versus multiple hazardous constituents**
The hazardous waste to be reduced through the potential pilot project is characterized by a single hazardous constituent as opposed to multiple hazardous constituents.

The following table provides a summary of the nominated pilot projects and the application of the Pilot Project Selection Criteria. The table was prepared by DTSC staff and was presented to the Advisory Committee for discussion and to aid the Advisory Committee in making its recommendations to DTSC.

Table #4 **Pilot Project Summary Sheet – Selection Process List**

PILOT PROJECT SUMMARY SHEET

Waste Stream	Proposer	Project Summary	Assessment of how the project meets the CPHWR Initiative objectives		Alignment with Selection Criteria and Staff Comments
			Hazardous Waste Reduction Potential	**Potential to Benefit to EJ Communities**	
Legacy waste from petroleum refining. Petroleum-contaminated soil and groundwater	Virginia St. Jean	(1) Expand on work of pollution prevention advisory committee and determine BMPs, incentives for on-site recycling, and disincentives for off-site management. Use biennial reports as tool. (2) Have refineries pay cost for clean-up of legacy waste. Promote on-site treatment of legacy waste. (3) Remanufacture refinery waste to useful products that meet Green Chemistry definition.	Contaminated soil is highest volume waste in CA. Potential for long-term reductions.	Refineries and contaminated sites often exist in EJ communities.	→ This project falls within the scope of the CPHWR Initiative. → On-site recycling technology is readily available and cost-effective. → Legacy waste would need different approach than process waste. → How would a Green Chemistry project be implemented?
Solvent waste	Virginia St. Jean	(1) Recycle solvents closer to point of generation. (2) Heavily tax use of hydrocarbon solvents and use money to pay for portable distillation and alternatives research. Exempt aqueous cleaning and on-site recycling from fees. (3) Segregate solvents for recovery and limit blending.	Increased on-site solvent recycling will reduce the amount of hazardous waste manifested. There may also be potential to reduce the actual amount of solvents used and reduce worker exposure to solvents.	This project would benefit communities near solvent recyclers and decrease risks from transportation.	→ Much work has been done to address solvent waste, but since it is generated in such large quantities there is room for improvement. → Solvent tax scheme may be outside of the scope of the CPHWR Initiative. → On-site recycling technology is readily available and cost-effective. → How can we ensure on-site recycling and management practices do not pose added risks to communities around generators?
Asbestos	Oladele Ogunseitan	(1) Install asbestos thermochemical conversion equipment at the Azusa Land Reclamation Site. (2) Use the Safer Consumer Products Law to eliminate all forms of asbestos in products manufactured or sold in California.	Involves land disposal, though the project would result in treatment to render waste non-hazardous and result in reductions in risk of future exposure.	The project would benefit communities near disposal but would have limited benefit to communities near generation.	→ This is a high-volume waste and addressing it would fall within the scope of the CPHWR Initiative. → Will time and cost be a factor in implementing this pilot project? → Asbestos is not in the current SCP Work Plan. would this project recommend inclusion in the next work plan? → What type of pilot project could be accomplished outside of SCP?

PILOT PROJECT SUMMARY SHEET

Waste Stream	Proposer	Project Summary	Assessment of how the project meets the CPHWR Initiative objectives		Alignment with Selection Criteria and Staff Comments
			Hazardous Waste Reduction Potential	**Potential to Benefit to EJ Communities**	
Asbestos	Virginia St. Jean	Research BMP for long-term storage of asbestos, such as encapsulation, cementation, vitrification, or deep burial.			
N-methylpyrrolidone (NMP)	Oladele Ogunseitan	(1) List NMP as a priority product under the Safer Consumer Products Law. (2) Conduct a life cycle analysis for alternatives to NMP at the Western Digital Corporation facility in Fremont.	Not a regulated hazardous waste; however, Cal/OSHA has a Permissible Exposure Limit of 1 ppm for air, 8-hour time-weighted average.	This pilot project would benefit workers in electronics manufacturing and communities around electronics manufacturers.	→ Are electronics manufacturers located in EJ communities? → NMP is not in the current SCP Work Plan; would this project recommend inclusion in the next Work Plan? → What type of pilot project could be accomplished outside of SCP? → NMP is used as a substitute for methylene chloride and other solvents. Is there a better alternative?
Automobile/ metal shredder waste	Xonia Villanueva	Research ways to reduce volume and toxicity of auto/metal shredder waste. Rescind variances for auto/metal shredders to dispose of waste as non-hazardous and use as alternative daily cover.	Auto shredder waste is currently being evaluated under SB 1249.	The project would benefit communities near generation and disposal.	→ Current work is underway pursuant to SB 1249 (2014). Under this bill, DTSC is collecting data from current operators regarding management of this waste to determine how to manage this waste stream best. Potential for waste reduction project may be determined after the work under SB 1249 is completed.
Flares and pyrotechnics	Virginia St. Jean	(1) Develop a transportable treatment unit (incinerator) for on-site management of explosives and capture fugitive emissions. (2) Change waste code to include explosives as universal waste for management by recycling facilities. (3) Incentivize research for non-explosive substitutes.	This is not a high-volume or high-toxicity waste, though it is a reactive/explosive waste.	It is not readily apparent how this project would benefit EJ communities.	→ Does the availability of existing treatment technology limit this pilot project? → Will the resistance to incineration limit this pilot project? → Will time and cost be a factor in implementing this pilot project?

PILOT PROJECT SUMMARY SHEET

Waste Stream	Proposer	Project Summary	Assessment of how the project meets the CPHWR Initiative objectives		Alignment with Selection Criteria and Staff Comments	
			Hazardous Waste Reduction Potential	Potential to Benefit to EJ Communities		
Portable gas cylinders	Nick Lapis	(1) Identify a region with a large number of retailers providing refill services of one-pound propane cylinders. (2) Recruit additional retailers. (3) Work with retailers to provide streamlined cylinder exchanges, including self-service vending machines. (4) Educate consumers about refillable propane cylinders. (5) Work with government to ban disposable cylinders. (6) Gather data about number of cylinders disposed. (7) Calculate greenhouse gas reductions from using refillable as opposed to disposable cylinders.	Empty canisters do not meet the definition of hazardous waste, though canisters with residuals may be considered an explosion hazard.	It is not readily apparent how this project would benefit EJ communities.	→ How does this pilot project add value to the efforts that are currently underway to address this waste? → How can product stewardship meet the goals of the CPHWR Initiative?	
Portable gas cylinders	Virginia St. Jean	Use mobile units to crush spent portable gas cylinders and capture residual gases, such as the unit pilot tested in Yellowstone. Crushed cylinders have no hazardous gas remaining and can be recycled as scrap metal.				
Flame retardants	Chuck White	(1) Use Green Chemistry Program to evaluate discontinuing production of flame-retardant chemicals. (2) Evaluate management of materials containing flame retardants and consider classifying as hazardous waste.	Materials containing flame retardants are not a regulated hazardous waste.	Risks associated with flame retardants are not specific to EJ communities.	→ How can this pilot project accomplish more than what is currently being addressed under SCP?	

PILOT PROJECT SUMMARY SHEET

Waste Stream	Proposer	Project Summary	Assessment of how the project meets the CPHWR Initiative objectives		Alignment with Selection Criteria and Staff Comments	
			Hazardous Waste Reduction Potential	**Potential to Benefit to EJ Communities**		
DDT and PCB contaminated soil and groundwater	Cynthia Babich	Use supercritical water oxidation (SCWO) transportable treatment unit for on-site treatment of contaminated soil and groundwater at the Del Amo site or other applicable site.	Contaminated soil is highest-volume waste in CA.	Contaminated sites often exist in EJ communities.	→ Addressing this waste stream would fall within the scope of the CPHWR Initiative. → Can SCWO effectively deal with non-liquid waste? → Does pretreatment, such as soil washing, have potential for a pilot project without the SCWO component? → Are there legal considerations restricting access to site waste? → Are there other candidate sites? → How does the process monitoring component differ from other treatment technologies?	Because contaminated soil is the highest-volume waste in CA and contaminated sites often exist in EJ communities, a pilot project that demonstrates new or improved mechanisms to reduce waste generated from soil remediation without leaving waste in place would benefit communities near contaminated sites, communities near hazardous waste disposal facilities, and communities impacted by transportation of hazardous wastes. → How can a pilot project be implemented in a short time frame and within the remedial action approval process? → Will cost limit the implementation of a pilot project? → Are there any legal considerations?

PILOT PROJECT SUMMARY SHEET

Waste Stream	Proposer	Project Summary	Assessment of how the project meets the CPHWR Initiative objectives		Alignment with Selection Criteria and Staff Comments
			Hazardous Waste Reduction Potential	**Potential to Benefit to EJ Communities**	
Petroleum-contaminated soil and groundwater	David Asti	Use in-situ chemical oxidation (ISCO) for on-site treatment of contaminated soil and groundwater.	Contaminated soil is the highest-volume waste in CA. Potential for long-term reductions.	Contaminated sites often exist in EJ communities.	→ Addressing this waste stream would fall within the scope of the CPHWR Initiative. → ISCO is a proven and accepted treatment technology for volatile organic compounds (VOCs). → Can a pilot project demonstrate ISCO's effectiveness on other types of contaminants? → Can a pilot project be implemented that enhances ISCO's effectiveness or decreases its costs?
Contaminated soil	Ingrid Brostrom	(1) Information sharing and relationship building between communities affected by hazardous waste disposal and communities impacted by contaminated sites. Develop community-generated proposals for soil treatment or removal options. (2) Incorporate community preferences in soil remedial action plans and other decisions.	It is not readily apparent how this project would reduce hazardous waste.	This project specifically addresses EJ communities.	→ Can this be a stand-alone project? → Can this be combined with another contaminated soil project? → How does this go beyond DTSC's work to strengthen community involvement in all program areas?
Nitrate-contaminated soil and groundwater	David Asti	Work with SWRCB to research options to determine the most cost-effective method to remediate nitrate contaminated soil and groundwater in the Central Valley.	Nitrate is not regulated as a hazardous waste even though it is a widespread groundwater contaminant.	The Central Valley is an EJ area.	→ How can this pilot project go beyond the work that is underway by SWRCB?

Table #5 - PILOT PROJECT ASSESSMENT SHEET

Waste Stream	Proposer	Proposed Project Components	Within DTSC Authority and Scope or CPHWR Initiative	Fundamental Pilot Project Requirements					Additional Pilot Project Selection Considerations			
				Technically Feasible	Scalable	Measurable	Implementable	Beneficial to EJ Communities	Reduce High volume waste	Reduce high toxicity waste	Source elimination/ reduction	Economic feasibility
Solvent waste	Virginia St. Jean	Recycle solvents closer to point of generation.	X	X	X	X	X	X	X	X		X
		Heavily tax use of hydrocarbon solvents and use money to pay for portable distillation and alternatives research.										
		Recover solvents for reuse by segregation and distillation. Disincentivize blending for fuel recovery/incineration.	X	X	X	X	X	X	X	X		X
Petroleum refinery waste	Virginia St. Jean	Expand on work of pollution prevention advisory committee and determine BMPs, incentives for on-site recycling, and disincentives for off-site management. Use biennial reports as tool.	X	X	X	X	X	X	X		X	X
		Promote on-site batch treatment of petroleum-bearing waste (including contamination soil and debris) as opposed to landfilling. Determine if waste can be re-processed.	X	X	X	X	X	X	X			X
		Determine feasibility of returning refinery process waste to refinery process. Use green chemistry principles to produce refinery products.	X		X	X		X				
	Ingrid Bronstrom	Build on the past work of the Pollution Prevention External Advisory Committee. Identify ways to promote use of BMP's, including developing new regulatory structures, financial structures, and incentives/disincentives.	Not financial structure aspect	X	X	X	X	X	X		X	X
Asbestos	Oladele Ogunseltan	Install asbestos thermochemical conversion equipment at the Azusa Land Reclamation Site.	X	X		X						
		Use the Safer Consumer Products Law to eliminate all forms of asbestos in products manufactured or sold in California.										
	Virginia St. Jean	Research BMP for long term storage of asbestos, such as encapsulation, cementation, vitrification, or deep burial.	X	X	X	X	X					
Petroleum contaminated soil	David Asti	Use in-situ chemical oxidation (ISCO) for on-site treatment of contaminated soil and groundwater.	Only sites under DTSC oversight	X	X	X	X	X	X			X
DDT/PCB contaminated soil	Cynthia Babich	Use super critical water oxidation (SCWO) transportable treatment unit for on-site treatment of contaminated soil and groundwater at the Del Amo site or other applicable site.	X	X	X	X	Many site factors to consider	X	X	X		Cheaper alternatives available
Contaminated soil	Ingrid Brostrom	Information sharing and relationship building between communities affected by hazardous waste disposal and communities impacted by contaminated sites. Develop community generated proposals for soil treatment or removal options.	Can be incorporated as project element of any soil pilot project.									
		Incorporate community preferences in soil remedial action plans and other decisions.										

Due to limited state resources, the scope was later narrowed to include projects that could secure support from project proponents

List of Selected Pilot Project Focus Areas

After discussion, the Advisory Committee recommended the following pilot project focus areas to be part of the Initiative:

- Contaminated soil
- Organic solvent wastes
- Petroleum refinery wastes

These three pilot project focus areas were selected by the Advisory Committee based on their alignment with the scope and authority of the Initiative, the fundamental pilot project criteria, and the additional selection criteria identified by the Advisory Committee. In a letter from the Department of Finance dated February 17, 2016, DTSC was directed by the Governor to evaluate lead-acid batteries through the Initiative as funds were being appropriated to address environmental contamination that resulted from the operation of Exide Technologies, a lead-acid battery recycling facility in the City of Vernon, California. Lead-acid batteries thus became a fourth pilot project focus area of the Initiative.

Pilot Project Summaries

The following sections presents information related to the individual pilot project efforts. The Pilot Project Summaries are not presented in any order of priority. They are representative of the data collected by DTSC and priorities set by the Advisory Committee. Information provided here could be used to make final decisions about which pilot projects to implement.

Lead-Acid Battery Waste

DTSC evaluated the processes involved in lead-acid battery management, including manufacturing of lead-acid battery products as well as the generation, collection, transportation, and treatment or recycling of spent lead-acid batteries.

[Note: This project did not attempt to evaluate whether lead-acid batteries should be identified as a "Priority Product" under DTSC's Safer Consumer Products Program. The data collected in this project has been made available to DTSC's Safer Consumer Products Program and used to inform any evaluation or assessment it develops.]

Background

Extensive use of lead in a multitude of applications, both historically and in modern times, has left an environmental legacy. Although significant steps have been taken to reduce exposure to lead, sensitive populations (e.g., children, workers at lead recyclers,and the communities surrounding those facilities) remain at risk from lead exposure.

According to the federal Centers for Disease Control, lead exposure can affect nearly every system in the body. It is an especially potent toxin for children; in fact, there is no known safe blood lead level for children.

As the evidence regarding the serious and cumulative impacts associated with lead exposure has mounted over the last 30 years, state and federal requirements have been implemented to reduce exposure to lead. Examples of restrictions placed on lead include the phase-out of leaded gasoline, elimination of lead solder in cans, limitations and abatement of lead-based paint, and limitations on the use of lead in plumbing systems. However, significant uses of lead remain, and those uses bring with them threats to public health from lead poisoning.

Like all battery technologies, lead-based batteries have a finite useable lifespan, and must be recycled or legally disposed of when they are no longer serviceable. Even though the recycling rate is high, given the very high volume of lead-based batteries used, even a small portion that are not recycled or legally disposed of is cause for concern. Monitoring workers' blood lead levels at battery recycling facilities is required. Lead smelting, including the secondary smelting of lead from recycled batteries, has contributed significantly to urban lead levels and has been shown to have caused contamination in areas surrounding the facilities.

According to the US Geological Survey, the lead-acid battery industry accounted for about 90 percent of the reported 1.6 million tons of lead consumption in the United

States during 2015.[2] As the single biggest ongoing use of lead, a comprehensive approach is called for to ensure Californians and our environment are adequately protected from threats posed by lead exposures from automotive battery use, management, recycling, and disposal.

Because they contain lead and sulfuric acid, spent lead-acid batteries are identified as hazardous waste in California. If they are destined for disposal, they are fully regulated as a hazardous waste management activity and subject to all hazardous waste management requirements. However, to encourage the recycling of spent lead-acid batteries, the Legislature enacted statute to prohibit their disposal and require battery dealers to accept spent lead-acid batteries from consumers.[3] To facilitate the Legislature's direction, and allow dealers to accept spent lead-acid batteries (hazardous wastes) from consumers, DTSC adopted regulations that included handling and transportation requirements that are less prescriptive than the regulations for other hazardous wastes.[4] Processing lead-acid batteries for recycling by draining the electrolyte, crushing, smelting or other physical methods is a fully regulated hazardous waste activity that requires a hazardous waste treatment permit.

Exide Technologies Facility, City of Vernon, California

The Exide facility is in the City of Vernon, about five miles southeast of downtown Los Angeles. The facility occupies 15 acres in a heavily industrial region withsurrounding residential areas. Exide's operations included treatment and recycling of spent lead-acid batteries. Lead smelting occurred at the site since the early 1900s.
Exide purchased the facility in 2000.

The Exide facility permanently suspended its operations in 2013 and the facility closed in 2015 when, among several other enforcement-related activities, DTSC notified Exide that its application for a new permit would be denied. DTSC then ordered Exide to clean up neighboring residential properties and conduct its own testing for lead. DTSC's analysis of the affected area indicated that the facility's operation may have resulted in release of lead across an area of southeastern Los Angeles County, resulting in contamination extending approximately 1.7 miles from the facility and potentially impacting as many as 10,000 properties, including residences, parks, and schools.

In August 2015, the Legislature and the Governor approved $7 million of emergency funding to test up to 1,500 residential properties, parks, schools, and daycare centers in the surrounding community; develop a comprehensive cleanup plan; and begin cleanup of sites with the highest levels of lead contamination and the greatest potential for

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[2] U.S. Geologic Survey, Minerals Commodities Summary: Lead (2016) (available at: http://minerals.usgs.gov/minerals/pubs/commodity/lead/mcs-2016-lead.pdf).

[3] Assembly Bill 3204 (Assembly Environmental Safety and Toxic Materials Committee, Chapter 209, Statutes of 1988).

[4] See Article 7 of Chapter 16 of Division 4.5 of Title 22, California Code of Regulations, Sections 66266.80 and 66266.81.

exposure. On April 20, 2016, the Governor announced the allocation of $176.6 million for DTSC to sample up to 10,000 residential properties within a 1.7-mile radius and clean up approximately 2,500 properties with the highest level of lead and the greatest potential for exposure. To date, DTSC has overseen the testing of 22,770 properties and secured access agreements to test nearly 5,900. DTSC has also established an Advisory Group of community leaders, residents, business leaders, scientists, and elected officials to help guide facility closure and cleanup efforts and supports a technical advisor for the Group. DTSC is currently working on a Cleanup Plan and the accompanying environmental review document, an Environmental Impact Report, for the soil cleanup work for approximately 2,500 residential properties.

Because of the off-site impacts related to Exide's operation, as DTSC identified potential pilot projects related to contaminated soil, the evaluation of remediation and treatment technologies for soil contaminants such as lead was viewed as a priority to pursue. A bench scale study on lead-contaminated soils that was performed at the Exide Residential Property is covered later in this report.

Quemetco Facility, City of Industry, California
The Quemetco facility treats and recycles spent lead-acid batteries. The facility was constructed at its present location in 1959. Lead is recovered from automotive batteries and other lead-bearing materials. The battery casings are crushed into small plastic chips which are recycled, and the battery acid is also recovered and utilized in the water treatment process. Communities within one mile of the facility include Hacienda Heights, Avocado Heights/La Puente, and Wildwood Mobile Country Club. DTSC is the lead agency overseeing the ongoing environmental investigation and cleanup at the facility, including a soil sampling program within a quarter mile of the facility. For additional information on the cleanup and investigation refer to the DTSC website at: http://www.dtsc.ca.gov/HazardousWaste/Projects/Quemetco.cfm.

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Data and Information Gathering

Although spent lead-acid batteries are considered hazardous waste in California, they are eligible to be managed under a less restrictive set of management requirements than other hazardous wastes. Persons handling spent lead-acid batteries remain eligible for the less restrictive requirements provided they do not do any of the following: store more than one ton of the batteries at any location for more than 180 days; store any amount of batteries for longer than one year; or remove the electrolyte from the batteries. Persons that generate more than 10 batteries per year, or who store or transport more than 10 at one time, may still manage them under the relaxed standards but must keep records about the batteries. Anyone shipping more than 10 batteries at a time must accompany the shipment with either a legible hazardous waste manifest or a legible bill of lading. Each generator, transporter and storage, recycling, or disposal facility must retain its copies of either of those documents for three years.

DTSC places information from all hazardous waste manifests into HWTS. This is where DTSC obtains its data on the amount of hazardous waste generated in the state. However, any shipment under a bill of lading is not captured, and DTSC has no information available to account for the shipment or handling of spent lead-acid batteries, or the amounts generated. DTSC requires generators of waste lead-acid batteries to retain copies of all hazardous waste manifests and bills of lading for at least three years. DTSC no longer requires these entities to submit an annual battery report. For purposes of the Initiative and this report, DTSC relied on information provided by the battery industry as well as other sources of information, such as the U.S. Geological Survey.

General Information[5]

Lead-acid Battery Chemistry

Lead-based batteries all use the same basic chemistry. The active material of the positive plate mainly consists of lead dioxide, and the active material of the negative plate is finely dispersed metallic lead. These active materials react with the sulfuric acid electrolyte to form lead sulfate on discharge and the reactions are reversed on recharge. Batteries are constructed with lead grids to support the active materials. Individual cells are connected in series within a single plastic case. The nominal voltage of a cell is 2.0 volts.

Components of Lead-based Batteries

Typical lead-based batteries are composed of the following:

- Lead and lead dioxide – average 60 percent of the total weight)
- Electrolyte: diluted sulfuric acid – average 30 percent of the total weight
- Other components, like alloying components and polymers (polyethylene separators, polypropylene battery case) – average 10 percent of the total weight

Weight and Life Cycle of Lead-based Batteries

The average total weight of a lead-based battery for a compact passenger car is 18-20 kilograms. The lifetime of an automotive battery heavily depends on usage patterns and the climate in the area of use. Typical life cycle is estimated to be five to seven years.

Uses of Lead-acid Batteries

Lead-based battery technologies are used in a wide variety of applications, from small lead-based batteries used in electronics, appliances, and toys, to large arrays of batteries used for energy storage in the power grid, and even to huge storage batteries

[5] Adapted from "A Review of Battery Technologies for Automotive Applications," Association of European Automotive and Industrial Battery Manufacturers, 2016 (available at https://eurobat.org/sites/default/files/a_review_of_batteries_for_automotive_applications_-_full_report_0.pdf).

used in submarines. However, the predominant uses of lead-based batteries are for automotive applications and for storage to address the variability in the sources that produce electricity.

Automotive Applications[6]

Automotive applications are the most commonly encountered and well-known lead-acid battery applications among consumers. Automotive applications have historically been concentrated on conventional internal combustion engines, where the size and type of battery has been predicated upon the starting demands of the engine. Automotive applications have become increasingly diverse as start-stop vehicles, various types of hybrid vehicles, and electric vehicles have been accounting for a growing share of the automotive market. Lead-acid batteries are one of several types of batteries used in automotive applications. Another commonly used battery type in automotive applications is lithium ion. Lead-based batteries are used in virtually all types of automobiles but are currently the most-used mass market technology for conventional internal combustion engine vehicles. They are also used in combination with other battery technologies in both hybrid vehicles and full electric vehicles and are anticipated to continue to be used for the foreseeable future. Industry experts believe that other battery types, such as lead-carbon and sodium-nickel chloride batteries, may become increasingly used in automotive applications. Research continues on a wide variety of existing technologies, as well as new battery types, to improve performance, cost, and safety in automotive applications. However, it appears that lead-based batteries will remain the most widely used energy storage technology in automotive systems for the foreseeable future.

Grid Storage

Lead-acid batteries are currently the dominant grid storage system worldwide. The market for grid storage is expanding, as investment in renewable energy sources continues to grow. Because of the intermittent nature of renewable energy generating technologies such as solar and wind energy systems, storage capacity is needed to optimize the performance and economic benefit of these systems. This application of lead-acid batteries has already exceeded the demand for lead-acid batteries in automotive applications, and it will continue to be the primary driver of lead-acid battery demand for the foreseeable future.

Project Summary

Under the Initiative, lead-acid battery waste was approached from two different directions: the generation and management of spent lead-acid batteries as a hazardous

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[6] Ibid.

waste in themselves; and hazardous wastes generated as a result of the manufacture of lead-acid batteries.

Generation and Management of Spent Lead-acid Batteries

The following information pertains to the generation and management of spent lead-acid batteries as a hazardous waste. Hazardous wastes generated as a result of the manufacture of lead-acid batteries is presented later in the report.

Informational Presentations from Industry

In conducting the Initiative, DTSC received several informational presentations from members of the battery industry. Each of these presentations is summarized below:

Trojan Battery Company
This manufacturer of deep-cycle batteries discussed its technology and operations, including product design innovations that Trojan claims has resulted in longer battery life and lower volumes of lead per battery. In addition, Trojan described steps it has taken to decrease employee exposure, monitor blood-lead levels in employees, and improve employees' working environment.

Johnson Control Industries
This battery manufacturing and recycling company, also known as Johnson Controls, discussed recycling operations including its South Carolina recycling facility. It detailed the emission control systems that have been installed at the facility and described air monitoring equipment there that is intended to ensure compliance with air quality standards and to demonstrate that no emissions are escaping the facility.

Doe Run
Doe Run, a mineral mining and lead recycling company, discussed its historical lead-mining operations and current lead-acid battery recycling activities in Missouri, as well as new battery technology the company is working to develop.

Hammond Group
This specialty chemical company presented on its lead oxide chemistries and performance additives. Hammond said its battery chemistry research has led to batteries with longer life, more discharge/recharge cycle capacities, and higher performance standards than previous batteries. Hammond said it works directly with battery manufacturers to design specific chemistries that are finetuned to particular battery applications with the intent of optimizing battery life.

Advanced Battery Concepts
This battery research and manufacturing company presented on its GreenSeal battery technology, a redesign and reconfiguration of the traditional lead-acid battery. Advanced Battery Concepts said its redesign of the battery has resulted in a product with the same performance specifications as a traditional lead-acid

battery, using a fraction of the traditional amount of lead and reducing overall battery weight.

Aqua Metals

This battery recycling company said it has developed a lead recycling process that utilizes a wet plating approach and does not rely on high-temperature smelting. Because of this, Aqua Metals said its recycling facilities do not create particulate emissions to air and can be operated with less risk to workers and the environment.

Informational Presentations from Other Stakeholders

Other stakeholders also provided presentations to the Advisory Committee regarding lead-acid batteries.

Lead-acid Batteries: The Legacy and the Promise

On November 14, 2016, Ms. Jane Williams, Executive Director of California Communities Against Toxics, made a presentation to the Advisory Committee on the prevalent and continuing environmental contamination attributable to lead smelting and recycling, and to lead-acid battery manufacturing and handling. The primary messages from the presentation were:

- Lead-acid batteries have caused considerable soil contamination in California;
- Lead-contaminated soils in California exacerbate lead poisoning that affects tens of thousands of children;
- Attempts to control emissions from secondary lead smelters are not effective in protecting public health; and
- Lead-acid batteries will be replaced, and millions of tons of lead will need to be managed in the future.

Impacts of Toxic Substances on Families and Communities

On May 5, 2016, Ms. Xonia Villanueva, representing The People’s Senate, provided a presentation to the Advisory Committee on the impacts that releases of and exposure to toxic substances have on communities and the lives and well-being of impacted communities. Although it is being summarized here because of its relationship to the lead-acid battery recycler Exide and the impacts that its historical releases of lead have had on the communities surrounding Exide, the presentation’s information and message equally apply to the other pilot project discussions. The primary message of the presentation is that industries’ use of hazardous chemicals often results in releases (both allowed and illegal) that can have significant detrimental impacts on communities, and that communities’ expectation is that environmental regulatory programs protect them from these exposures and impacts.

The following information pertains to hazardous wastes generated as a result of the manufacture of lead-acid batteries.

Battery Manufacturers

In its research, DTSC identified four manufacturers of lead-acid batteries in California. These manufacturers, as generators of more than 1,000 kilograms (over one ton) of hazardous waste per month, are all subject to source reduction planning requirements under SB 14. In August of 2016, source reduction documents were requested from the four manufacturers of lead-acid batteries in the state. In addition, DTSC reviewed HWTS data for hazardous waste generated by lead-acid battery manufacturers.

Battery Manufacturer Source Reduction Activities

In August of 2016, source reduction documents were requested from the four manufacturers of lead-acid batteries in the state. The requests specifically asked for copies of the documents the manufacturers were mandated to prepare under the requirements of SB 14. These documents include reports that summarize previously completed and anticipated efforts by the recipient to reduce their generation of hazardous waste. Three of the four contacted companies provided DTSC with the requested information.

Findings Related to Battery Manufacturing Companies

Based on a review of the source reduction documents, several practices were identified that reduced the generation of hazardous waste. Most waste reduction measures came in the form of waste segregation, housekeeping practices, and employee training. Process improvements also resulted in waste reductions. However, since each facility has a different process stream, it does not appear that an improvement at one facility could be applied to other facilities. Additionally, the largest waste reduction was seen in wastewater process streams, which do not result in any reduction of hazardous waste being sent to landfills.

Alternative Battery Technologies

The history of the use of lead in society, and the legacy of public health and environmental damage that it has left, demonstrates that if lead continues tobe the center of battery technology, the potential for public health and environmental damage remains. Available health data demonstrate that lead exposure, even at low levels, can result in significant health effects.

Children are particularly sensitive to lead exposure, because their frequent hand-to-mouth behaviors and tendency to get dirty and ingest foreign substances increase their rate of intake of lead-contaminated media. In addition, infants and young children have a higher rate of absorption of ingested lead into the gastrointestinal system, about 50 percent compared to 5 percent to 15 percent for adults. Certain nutritional deficiencies, such as calcium and zinc deficiencies, which tend to be more prevalent in children, also enhance the absorption of lead. Finally, since children are growing more rapidly than adults, both physically and developmentally, they are more susceptible to the adverse biochemical effects of lead. Child exposure to lead is associated with decreased intelligence; reduced short-term memory; reading disabilities; deficits in vocabulary, fine motor skills, reaction time, and hand-eye coordination; and effects on children's hematopoietic, renal, and gastrointestinal systems.

As discussed previously, the primary applications of lead-acid batteries, and therefore the focus of possible alternative battery chemistry or designs, are automotive and grid storage. For battery technologies, the application and its specific demands and design specifications determine eligible battery technologies. Different vehicle designs require automotive and industrial batteries with different performance profiles and characteristics. For example, low-temperature discharge power is a key requirement for cranking the internal combustion engines in conventional vehicles. This feature is not as important for powering electric vehicles, which require high-voltage batteries for which energy density and cycle life are of primary importance.

Currently there are several battery technologies that are utilized in vehicles in both the United States and in Europe, from automotive batteries for internal combustion engine cranking and start-stop functionalities to industrial traction batteries for hybrid, plug-in hybrid, and electric vehicles.

Where a single battery system cannot cope with all requirements at the same time, different combinations of several battery types are installed to operate at different voltage levels. For example, all hybrid, plug-in hybrid, and electric vehicles are currently equipped with both an industrial traction battery and an auxiliary lead-based automotive battery, which is used to support the on-board electronics and safety features.

The following battery technologies are used in automotive applications:

- Lead-based batteries
    - For conventional vehicles, start-stop, and basic micro-hybrid vehicles
    - As auxiliary 12-volt batteries in all hybrid and electric vehicles
- Nickel metal hydride batteries
    - For the propulsion of hybrid vehicles only
- Lithium-ion batteries
    - For the propulsion of hybrid, plug-in hybrid, and full electric vehicles
- Sodium-nickel chloride batteries
    - For the propulsion of plug-in hybrid and full electric vehicles (primarily heavy commercial vehicles and public transport)

There are other large-format battery technologies, but these are currently not used in automotive applications. These include:

- Nickel-cadmium batteries
- Nickel-iron batteries
- Nickel-zinc batteries
- Sodium-sulfur batteries

At this time, lead-based batteries continue to be the primary technology that is being mass-marketed for conventional vehicles, as well as for start-stop and micro-hybrid vehicles. Their performance in cold and hot conditions and their low combined cost have resulted in them being the automotive industry's preferred battery technologies. Combined with their low self-discharge rate, reliability, safety, and a well-established manufacturing and recycling industry in both the United States and Europe, this indicates that lead-based battery technology is likely to be the most used technology for at least the next decade. The further advancement and development of lithium-ion batteries could see an expansion of their use in limited automotive applications (primarily where weight saving offsets their increased costs and lesser performance in cold conditions).

Interim Waste Reduction Strategies

Because lead-based battery technology is likely to continue to dominate the battery market for the foreseeable future, and because alternative, non-lead battery technologies may not be available or commercially viable in the near-term, other options to reduce the impacts of lead-acid batteries on public health and the environment should also be explored in the interim, as alternatives to lead and other toxic metals-based technologies are researched. Interim strategies include:

- Reduced lead per battery – All other factors remaining the same (including the number of lead-acid batteries being installed annually), a decrease in the amount of lead needed in each battery could result in a significant decrease in the amount of lead being managed as spent lead-acid batteries, as well as a significant decrease in the amount of lead that has the potential to be released as a result of its use, waste management, and recycling.
- Extended service life – As with the reduction of lead needed in each battery, an increase in the service life of lead-acid batteries beyond the current average of five to seven years could decrease the amount of lead being managed as spent lead-acid batteries and could also decrease the amount of lead that has the potential to be released as a result of its use, waste management, and recycling.
- Lead reclamation technologies – To date, the primary reclamation method to recover lead from lead-acid batteries has been smelting in a furnace. Smelting results in significant emissions that require considerable pollution control technologies to limit airborne emissions. Although there have been advances in pollution control technologies over the years, none of them currently achieve zero emissions. Other types of lead reclamation technologies that do not rely on smelting and can eliminate the airborne releases of lead should be developed and commercialized.

- <u>Pollution control technologies</u> – As discussed previously concerning the operation of the Exide and Quemetco battery recycling facilities, limitations in pollution control measures and technology resulted in releases of lead into the surrounding community. At a minimum, if this type of lead recycling facility is to remain in operation, the elimination of, lead emissions to the environment, or at least or significant reduction in those emissions, must be achieved. The lead recycling industry must continue to develop and invest in pollution control measures and technologies that can reduce the releases of lead into the environment.

Pilot Project Proposals

DTSC solicited the battery industry to suggest possible pilot projects that could demonstrate measurable reductions in either the amount of spent lead-acid batteries generated in California, or in the potential impacts of lead from the manufacturing, use, collection, and reclamation.

As a result of this solicitation, BCI members Doe Run, Hammond Group, and Advanced Battery Concepts submitted pilot project proposals for innovative technologies with applications to various stages in the life cycle of lead-acid batteries, from lead extraction, to manufacturing, to improvements in battery service life and performance, to recycling and recovery of battery components.

A brief summary of each proposal follows (See Appendix E for the proposals that DTSC received):

1. Doe Run proposes a collaborative effort to further demonstrate the feasibility of its hydrometallurgical processes for lead-based battery recycling, including its Flubor and Co-products processes, to achieve hazardous waste reduction goals and to confirm parameters including:
   - Efficacy of the process chemistry
   - Integrity of the process at various throughput levels
   - Testing of equipment performance at or near commercial scale
   - The quality and marketability of end products produced
   - Evaluation of capital and operating costs

2. The Hammond Group proposes a cooperative pilot project with DTSC to investigate the hazardous waste reduction potential and reduced lead utilization of several its Charge Acceptance Improvement technologies compared to traditional technologies.

3. Advanced Battery Concepts proposes engaging with DTSC to conduct two related pilot projects concerning its Greenseal battery technologies. The first would evaluate the Greenseal battery technologies with respect to reductions in lead utilization and “source reduction” compared to traditional battery designs. The second would evaluate Greenseal technologies with respect to reductions in worker and community risk compared to traditional battery manufacturing.

Observations and Opportunities

The following reflects recommendations stemming from the deliberations of the committee.

- Even though there are currently very few alternative battery chemistries, continue to support and encourage the development of safe alternative battery technologies and chemistries (for both automotive and grid storage) that do not rely on current lead-based battery technology and that do not, themselves, result in public health or environmental impacts.
- Explore partnerships with automobile manufacturers and renewable energy providers to better understand their energy performance requirements and specifications that continue to reinforce a reliance on lead-acid batteries. Identify opportunities that could encourage technology alternatives.
- Continue to support the Safer Consumer Products Program's efforts to evaluate lead-acid batteries for consideration as a Priority Product.
- In the interim, until new technologies are available, support the battery industry's efforts to improve the design and function of lead-acid batteries that could serve to provide some amount of short-term improvements:
    - Battery recycling/lead reclamation technology that reduces or eliminates airborne emissions of lead (to protect both workers and surrounding communities) during recycling activities
    - Battery recycling technology that facilitates recycling, reduces occupational and public health risk, reduces environmental risk, or reduces impacts on global climate change
    - Battery design efforts that result in a reduction of the total amount of lead needed for each lead-acid battery (reduces the amount of lead needed, reducing its potential for release at all points of its management)
    - Battery design/chemistry that results in the extension of service life for each lead-acid battery in use (reduces the number of waste lead-acid batteries)
    - Battery manufacturing technologies that result in source reduction and waste minimization (to protect both workers and surrounding communities) or reductions in contribution to global climate change (energy footprint).
    - Lead-specific extraction technologies that improve the ability to extract lead from slag or other media (such as mining waste/tailings/ore) while reducing releases to surrounding communities and detrimental environmental impacts.
- Assist the battery industry in setting up, implementing, and measuring the benefits of the pilot project proposals they submitted.

Contaminated Soil Waste

This effort focused on hazardous waste-contaminated soil and included (1) data gathering; (2) identification and possible implementation of effective remediation technologies; and (3) analyzing the available data and making recommendations.

Data Gathering

The data gathering portion of this project involved collecting available data related to contaminated soil generation and management, both directly and through solicitation from soil remediation technology vendors, responsible parties, other governmental agencies (local, state, and federal, as well as other nations), academia, affected communities and community advocates, and other interested stakeholders.

Identification and Evaluation of Pilot Proposal(s)

This portion of the effort involved the solicitation and evaluation of substantive proposals for pilot-scale implementation of candidate soil remediation technologies. The types of proposals to be considered would include not only proposals from remediation technology vendors, but also proposals that could require DTSC to seek participation or partnerships, or the securing of additional financial resources. Proposals would need to be identified and selected within a time frame during the Initiative that allows for the proposal to be initiated and its progress evaluated, although they would not need to be fully completed within the planned time frame of the Initiative. Advisory Committee members on multiple occasions expressed concern that a reduction in contaminated soils disposed in hazardous waste landfills would result in reducing cleanup standards or allowing contamination to remain in place. DTSC focused its efforts to identify potential pilot projects on those proposals that could achieve substantive reduction in the generation of contaminated soils without modifying cleanup goals or leaving contamination in place.

Quantity of Hazardous Waste-contaminated Soils Generated in California

Contaminated soils are typically the largest category of hazardous waste generated in California, and by far the largest category of hazardous waste disposed to landfills both in California and out of state. In 2015, based on HWTS data, of 575,000 tons of contaminated soils disposed to landfills, 282,000 tons were disposed in landfills in California and 293,000 tons were disposed to out-of-state landfills.

Contaminated soils are generated at sites in California that have been impacted by releases of hazardous materials. The most comprehensive database for tracking hazardous waste generated in California is DTSC's HWTS. Although comprehensive, HWTS has data limitations that are discussed within the HWTS Disclaimer and Data Limitations Statement found in Appendix G of this Report. In 2015, the HWTS reported 575,000 tons of contaminated soils generated in the state (based on State Waste Code 611, i.e., Contaminated Soils). Following are averages of contaminated soils generated in California for five recent time ranges: a) 20-year average (1996-2015): 479,254 tons; b) 15-year average (2001-2015): 526,094 tons; c) 10-year average (2006-2015): 501,400 tons; d) five-year average (2011-2015): 414,300 tons; and e) three-year average (2013-2015): 436,400 tons (see Table below).

Hazardous Waste SWC 611 Generated and Disposed in California and Out of state (in Tons)

The table and graph below provide 1995-2015 HWTS data describing manifested hazardous waste, consisting of contaminated soils generated in California and disposed to land. The data is presented for contaminated soil disposed to land within California, as well as contaminated soil disposed to land out of state. The data for contaminated soil disposed in-state is segmented by destination facility in California.

Table #6

California Trends in Hazardous Waste Disposal of Contaminated Soils from Clean-up from 1995 through 2015 Revised 07/24/2017

Hazardous Waste SWC 611 Generated and Disposed in California and Out of State (in Tons)

HWTS data Excludes Transferred H141

					HW Contaminated Soil Disposed Out of State (OOS)		HW Contaminated Soil Disposed in CA (all destinations)		CA Destinations			
n	**Calendar Year**	Total Hazardous Waste Shipped (excludes Transfers)	Total California-Generated HW-Contaminated Soil from Site Clean-up (SWC 611)	Amount HW Contaminated Soil as a Percent of Total Waste	Total Amount Disposed OOS	Amount of Disposed HW Soil as a Percent of Total CA Generated Contaminated Soil	Total Amount Disposed in CA	Amount of Disposed HW Soil as a Percent of Total CA Generated Contaminated Soil	Clean Harbors, Buttonwillow, CA	Chem Waste Management-Kettleman City, CA	Other / Municipal or Older/ Westmoreland	Western Environmental *Mecca, CA
1	**1995**	1,932,600	*257,267*	13.3%	184,976	71.9%	73,552	28.6%	17,552	38,730	3,196	-
2	**1996**	1,811,200	*262,040*	14.5%	179,737	68.6%	83,078	31.7%	9,076	50,793	8,867	-
3	**1997**	1,784,100	*205,350*	*11.5%*	89,434	43.6%	115,916	56.4%	22,692	57,348	22,131	-
4	**1998**	2,002,200	*292,493*	14.6%	126,585	43.3%	165,909	56.7%	21,585	112,499	4,222	-
5	**1999**	2,070,415	*407,692*	19.7%	191,335	46.9%	216,357	53.1%	31,003	160,696	1,157	-
6	**2000**	2,414,800	*618,825*	25.6%	183,055	29.6%	435,770	70.4%	28,947	355,553	26,107	-
7	**2001**	2,430,900	*769,247*	31.6%	262,032	34.1%	507,215	65.9%	22,802	443,887	1,187	-
8	**2002**	2,096,300	*449,258*	21.4%	161,331	35.9%	287,927	64.1%	22,881	247,516	-	-
9	**2003**	2,228,300	*518,775*	23.3%	186,498	35.9%	332,277	64.1%	32,028	284,766	46	23
10	**2004**	2,359,300	*575,121*	24.4%	168,614	29.3%	406,507	70.7%	112,454	254,004	-	0
11	**2005**	2,294,300	*472,912*	20.6%	210,892	44.6%	262,020	55.4%	78,125	160,660	-	262.46

California Trends in Hazardous Waste Disposal of Contaminated Soils from Clean-up from 1995 through 2015

Revised 07/24/2017

Hazardous Waste SWC 611 Generated and Disposed in California and Out of State (in Tons)

HWTS data Excludes Transferred H141

12	**2006**	2,256,400	446,072	19.8%	98,479	22.1%	347,593	77.9%	65,585	239,648	-	18,790
13	**2007**	2,352,800	673,281	28.6%	174,740	26.0%	498,541	74.0%	96,868	394,411	-	2,205
14	**2008**	2,194,300	817,730	37.3%	301,593	36.9%	516,137	63.1%	206,349	303,870	-	4,210
15	**2009**	1,794,600	567,889	31.6%	135,918	23.9%	431,971	76.1%	96,982	229,996	-	103,620
16	**2010**	1,790,200	437,159	24.4%	210,456	48.1%	226,703	51.9%	120,814	66,748	-	38,429
17	**2011**	1,748,800	392,046	22.4%	257,404	65.7%	134,642	34.3%	116,973	6,240	-	10,614
18	**2012**	1,659,800	370,019	22.3%	189,804	51.3%	180,215	48.7%	179,133	345	-	-
19	**2013**	1,586,900	312,995	19.7%	193,042	61.7%	119,953	38.3%	118,730	208	-	-
20	**2014**	1,744,900	421,168	24.1%	273,815	65.0%	147,352	35.0%	142,901	1,939	-	-
21	**2015**	1,726,700	575,002	33.3%	292,998	51.0%	282,004	49.0%	221,225	59,631	-	-
AVERAGES:												
20 YEARS: 1996 - 2015		2,017,361	479,254	23.5%	194,388	43.2%	284,904	56.8%	87,358	171,538	3,186	8,908
15 YEARS: 2001 - 2015		2,017,633	519,911	25.7%	207,841	42.1%	312,070	57.9%	108,923	179,591	82	11,877
10 YEARS: 2006 - 2015		1,885,540	501,336	26.4%	212,825	45.2%	288,511	54.8%	136,556	130,304	-	17,787
5 YEARS: 2011 - 2015		1,693,420	414,246	24.4%	241,413	58.9%	172,833	41.1%	155,793	13,673	-	2,123
3 YEARS: 2013 - 2015		1,686,167	436,388	25.7%	253,285	59.2%	183,103	40.8%	160,952	20,593	-	-

Notes: Tonnage amounts are adjusted to remove "phantom tons" from manifests greater than 130 tons (manifest errors).

Unknown EPA IDs assigned to state according to state EPA ID prefixes and /or State Abbreviations.

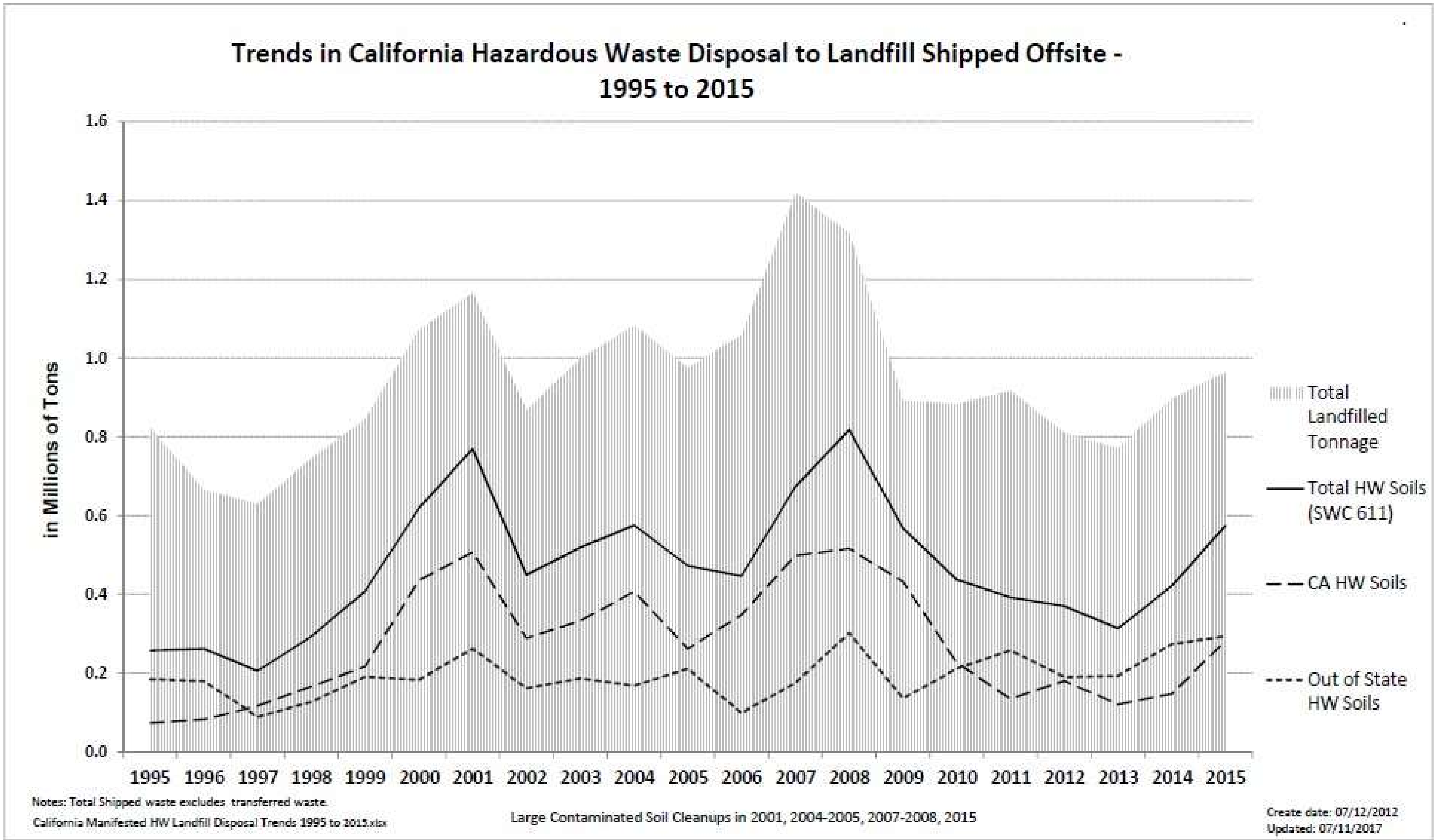
Tonnage from Unknown or Blank EPA ID numbers is shown as California tons.

* HW Tonnage Shipped to Western Environmental LLC, Mecca, CA (2003 through 2011). DTSC stopped disposal at this facility in 2011.

Waste Code	State Waste Code Description
611	Contaminated soil from site clean-up

HWTS Datamart

Graph #6


Trends in California Hazardous Waste Disposal to Landfill Shipped Offsite - 1995 to 2015
in Millions of Tons
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Total Landfilled Tonnage
Total HW Soils (SWC 611)
CA HW Soils
Out of State HW Soils
Notes: Total Shipped waste excludes transferred waste.
California Manifested HW Landfill Disposal Trends 1995 to 2015.xlsx
Large Contaminated Soil Cleanups in 2001, 2004-2005, 2007-2008, 2015
Create date: 07/12/2012
Updated: 07/11/2017

Data Limitations

Although HWTS is DTSC's most robust source of hazardous waste data, with respect to contaminated soils there are limitations:

1) The HWTS data aggregates all hazardous waste soils under a single waste code, 611. Contaminants at different sites can vary widely. There is no way to sort the HWTS contaminated soil data into subcategories based on contaminant types, and therefore no way to identify what types of contaminants are responsible for any portion of the total contaminated soils volume, or to target efforts on the largest contaminant types.

2) HWTS contains information only for contaminated soils that are hazardous waste-. Cleanup levels for contaminants in soil are typically much lower than hazardous waste identification thresholds (often by orders of magnitude). Contaminants in soils can also be hazardous chemicals for which there are no hazardous waste criteria, yet they may still pose potential public health and environmental harm and require cleanup. Nonhazardous contaminated soils are managed similarly to hazardous waste-contaminated soils, except that they may be sent to disposal facilities that can receive nonhazardous wastes.

Cleanup Process Overview

The cleanup of contaminated sites can be overseen by DTSC, U.S.EPA, a Regional Water Quality Control Board, or a local agency (such as a Certified Unified Program Agency). The cleanups overseen by DTSC and U.S. EPA are carried out according to the authority and requirements identified in Chapter 6.8 of the California Health and Safety Code, Section 25356.1 (state law) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (federal law). Cleanups overseen by DTSC and U.S. EPA are required to be consistent with Subpart E of the National Oil and Hazardous Substance Pollution Contingency Plan (NCP, 40 Code of Federal Regulations 300.400 et seq.).

The cleanup process is multi-phased, and consists of the following processes:

- Site assessment – A site assessment evaluates potential or confirmed releases of hazardous substances that may pose a threat to human health or the environment. After a site is identified, a series of assessments evaluates the potential need for remedial cleanup.
- National Priorities List (for federal cleanups) – Sites are scored and ranked based on the degree of threat they pose to human health or the environment. Sites that score above a threshold number are placed on the National Priorities List (NPL), which is the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL guides U.S. EPA in determining which sites warrant further investigation.

- Remedial investigation/feasibility study – The remedial investigation serves as the mechanism for collecting data to characterize site conditions, determine the nature of the waste, assess risk to human health and the environment, and conduct treatability testing to evaluate the potential performance and cost of the treatment technologies that are being considered. The feasibility study is the mechanism for the development, screening, and detailed evaluation of alternative remedial actions.
- Remedy decisions – The remedy decision is the specific cleanup action that is to be implemented.
- Remedial design/remedial action – Remedial design is the phase in the site cleanup where the technical specifications for cleanup remedies and technologies are designed. Remedial action follows the remedial design phase. It involves the actual construction or implementation phase of the cleanup.
- Post-construction completion – Post-construction completion is the term used for several activities generally undertaken at sites following the construction of response actions. These activities include operation and maintenance, long-term response actions and institutional controls.

In California, the remedy that is selected for contaminated media is based on the results of a Feasibility Study. As identified above, a Feasibility Study is the mechanism for the screening and evaluation of alternative remedial actions for a particular project. The Feasibility Study involves an evaluation of the cleanup alternatives using the following nine evaluation criteria:

Threshold Criteria (the criteria each alternative must satisfy to be eligible for selection)

1) Overall protection of human health and environment
    - How well the alternative provides protection of human health and the environment
2) Compliance with applicable or relevant and appropriate requirements
    - Regulatory or statutory requirements that apply to a specific chemical, a specific action, or a specific location

Primary Balancing Criteria (technical criteria that form the basis for the detailed analysis of alternatives)

3) Long-term effectiveness and permanence
    - An assessment of the magnitude of the residual risk and the adequacy and reliability of controls

4) Reductions in toxicity, mobility, and volume through treatment
    - Treatment process used and materials treated
    - Volume of materials destroyed or treated
    - Degree of expected reductions
    - Degree to which treatment is irreversible
    - Type and quantity of residuals remaining
5) Short-term effectiveness
    - Protection of community during remediation
    - Protection of workers during remediation
    - Environmental impacts
    - Time until remedial action objectives completed
6) Implementability
    - Ability to construct and operate the technology
    - Reliability of the technology
    - Ease of taking additional cleanup actions if needed
    - Ability to monitor effectiveness of remedy
    - Ability to coordinate and obtain approvals from other agencies
    - Availability of services and materials
7) Cost
    - Capital required
    - Cost of operating and maintaining the alternative
    - Measured in present worth

Modifying Criteria (criteria that are assessed after public comment is received)

8) State acceptance
9) Community acceptance

A remedy selection document (i.e., Remedial Action Plan, Removal Action Work Plan orRecord of Decision) recommends a preferred alternative based on an evaluation using the nine criteria. The remedy selection document then becomes subject to public review, comment, and amendment if necessary, prior to approval.

Additional Requirements Governing Remedial Actions in California

The California Health and Safety Code (See Section 25356.1(d)(3) and (5)) specifies how remedy selection should be evaluated relative to land disposal and cost. Subparagraph (3) states, "The department or the regional board shall **not** select remedial action measures that use off-site transport and disposal of <u>untreated</u> hazardous substances or contaminated materials if **practical** and **cost-effective** treatment technologies are available." Subparagraph (5) states, "In evaluating the cost-effectiveness of proposed alternative remedial action measures, the department or the regional board shall consider, to the extent possible, the total short-term and long-term costs of these actions and shall use, as a major factor, whether the deferral of a remedial action will result, or is likely to result, in a rapid increase in cost or in the hazard to public health or the environment posed by the site. Land disposal shall not be deemed the most cost-effective measure merely on the basis of lower short-term cost."

Contaminated Soil Treatment Technologies Researched by DTSC during this Initiative

1) **Super Critical Water Oxidation**
2) **Soil Washing Treatment of Metal Contaminated Soils**
3) **Evaporative Desorption Technology**

<u>Super Critical Water Oxidation (SCWO)</u>

On April 20, 2016, Ms. Jane Williams, Executive Director of California Communities Against Toxics, provided a presentation to the Advisory Committee on Super Critical Water Oxidation (SCWO). In her presentation, she detailed the history of its development in the context of the Department of Defense's (DoD) proposal to destroy stockpiled chemical weapons at nine sites across the United States. DoD's original proposal was to use incineration to destroy the weapons, but their proposal met with significant community concerns. Those concerns were expressed to Congressional representatives, resulting in the passage of law that established the Assembled Chemical Weapons Assessment (ACWA) Program. Under ACWA, DoD requested proposals to destroy the weapons that were alternatives to incineration. SCWO was one of the technologies proposed that was found to be capable of destroying complex organic chemicals such as polychlorinated biphenyls (PCBs), dioxins, and similar environmentally persistent chemicals. In her presentation, Ms. Williams advocated for the use of SCWO as one of the Initiative's pilot projects because its capability has been demonstrated, and the criteria it was required to meet under the ACWA Program aligns with the pilot project selection criteria. She also pointed out that SCWO's research and development costs had already been paid for by DoD and that General Atomics, the company that developed SCWO, is in California and has a pilot plant on its campus near San Diego that could conduct CPHWR pilot tests.

On April 20, 2016, General Atomics also provided a presentation to the Advisory Committee on SCWO. General Atomics is the company that developed the SCWO technology. General Atomics represented that SCWO could be applied to contaminated soils provided the soils are mixed with water to form a slurry prior to treating the soils with the SCWO treatment.

On May 5, 2016, General Atomics provided another presentation on SCWO to the Advisory Committee, outlining how it would carry out a pilot project for treating DDT-contaminated soil using the SCWO technology.

On May 25, 2016, DTSC staff and the Advisory Committee members attended a site visit at General Atomics' campus in La Jolla, California, near San Diego. Prior to attending the SCWO demonstration DTSC staff drafted an issue paper which evaluated the SCWO technology, below is the text from the DTSC's draft issue paper:

INTRODUCTION:

Super Critical Water Oxidation (SWCO) has been identified by the Community Protection and Hazardous Waste Reduction (CPHWR) Advisory Committee members as a technology of interest for the treatment of hazardous waste streams, including contaminated soil. The following is a brief overview of the SCWO process and considerations relevant to the CPHWR Initiative.

SCWO PROCESS:

- *SCWO is an energy intensive process that uses high temperature (650 °Celsius) and pressure (218 atmospheres) to cause thermal degradation and oxidation of an organic waste product entrained in a liquid feedstock.*
- *The SCWO process is optimized for a liquid waste stream with high concentrations of hazardous organic constituents.*
    - *If the feedstock does not have a sufficient heat value an additional fuel source, such as diesel, will need to be mixed with the feedstock.*
    - *Alternatively, an additional waste stream with a high heat value, such as spent solvent, can be blended with the feedstock.*
- *During the SCWO process, the organic feed stock is completely oxidized, andgas and water are the effluent products.*
- *The SCWO process will not oxidize inorganic compounds such as metals or silicate soils.*

Feasibility Considerations

POTENTIAL FOR CREATION OF DIOXINS AND FURANS:

- *Dioxins and furans are created as byproducts of incomplete combustion.*
- *Temperatures above 850°C to 1,000°C are required to destroy dioxins and furans.*
    - *Since the SCWO reactor operates at 650°C the potential for dioxin and furan creation exists.*
- *Other factors that can contribute to the creation of dioxins and furans are the presence of metals, such as copper, and insufficient heating times.*

[According to General Atomics, the SCWO reactor does not create dioxins and furans because of the "quenching" process. General Atomics did not have effluent analytical results to confirm that dioxins and furans are not created by the SCWO reactor.]

APPLICABILITY TO SOIL:

- *Material fed into the SCWO reactor must be in a liquid form. For soil to be used as a feedstock it would need to be mixed with a large amount of water to create a slurry. This would increase the total volume of hazardous waste prior to treatment.*
- *The SCWO reactor would not be effective on particles over a certain size. To ensure effective operation a pre-treatment stage would be required to remove large particles and other debris.*
- *Special design considerations may be required to ensure that the soil particles do not corrode or scour pipes and valves in the SCWO reactor.*
- *Post-treatment of the effluent would be required to separate the soil portion from the slurry.*

[According to General Atomics, they have never used the SCWO reactor on a feedstock that would not undergo complete oxidation, such as soil. General Atomics stated that they could design for this but have not done so yet.]

APPLICABILITY TO AGRICULTURAL LAND WITH DDT CONTAMINATION:

A pilot test of the SCWO reactor should demonstrate that the technology can be scaled and implemented on more than just the proposed site (ECI). The ECI site *contains DDT contaminated soil but does not contain the range of contaminants that are often seen at DDT contaminated site.*

- *Prior to the widespread use of DDT, lead-arsenate pesticides were the most commonly used pesticides in the country.*
- *Many agricultural properties with DDT contaminated soil also have inorganic contamination from historical lead-arsenate pesticide use.*
- *If the SCWO process is proposed for contaminated soils containing both DDT and inorganics contamination, the inorganics would need to be addressed separate from the SCWO process.*

COST:

An order of magnitude cost estimate from General Atomics indicated that a treatability study of the SCWO reactor for contaminated soil may cost between $110,000 and $285,000. A treatability study would include a several-day demonstration at the General Atomics pilot plant in San Diego and treat a feedstock of 400 kilograms of soil (approximately two 55-gallon drum). A full scale SCWO reactor (not including laboratory analytical or operating costs) would cost between $3,000,000 and $5,000,000.

Soil Washing Treatment of Metal Contaminated Soils

Another cleanup technology that was explored during the Initiative was soil washing treatment that was applied to metal contaminated soil sites.

On November 14, 2016, Dr. Jim Wells, an environmental geologist, and a technical advisor to the Exide Advisory Group made a presentation to the Advisory Committee on soil washing and its potential to significantly reduce the amount of contaminated soils that need to be managed as hazardous waste and shipped to landfills for disposal. Dr. Wells explained the opportunity that soil washing holds for reducing the amount of contaminated soils waste, the theory behind it, its prevalence of use in Europe where landfill restrictions are in place, and the root of the challenges faced by alternative remediation approaches being found in the Superfund Feasibility Study process.

Soil washing is a water-based process for mechanically scrubbing soils ex-situ to remove undesirable contaminants. The process removes contaminants from soils in one of two ways: 1) by dissolving or suspending them in the wash solution (which is later treated by conventional wastewater treatment methods); or, 2) by concentrating them into a smaller volume of soil through simple particle size separation techniques (similar to those used in sand and gravel operations). Soil washing systems incorporating both removal techniques offer the greatest promise for application to soils contaminated with a wide variety of heavy metal and organic contaminants. The concept of reducing soil contamination using particle size separation is based on the finding that most organic and inorganic contaminants tend to bind, either chemically or physically, toclay and silt soil particles. The silt and clay, in turn, are attached to sand and gravel particles by physical processes, primarily compaction and adhesion. The washing process separates the fine (small) clay and silt particles from the coarser sand and gravel soil particles, effectively separating and concentrating the contaminants into a smaller volume of soil that can be further treated or disposed. More aggressive "attrition scrubbing" can also be employed to remove adherent contaminant films from coarser particles. The clean, larger fraction can be returned to the site for reuse. This set of assumptions forms the basis for the volume reduction concept upon which most soil washing technology applications are developed.

Prior to presenting the results from the soil washing treatment and analyses reports, the following general information is provided for reference as definitions of hazardous waste concentrations and risk assessment screening level concentrations for lead (Pb) in soils:

State hazardous waste concentrations, total = **1,000** milligrams Pb/kilogram of soil (mg/kg);

Federal and state hazardous waste concentrations, soluble = **5.0** milligrams/liter (mg/l, Federal, Toxicity Characteristic Leaching Procedure (TCLP); **5.0** mg/l (State, Waste Extraction Test (WET))

The following screening level concentrations for lead in soils are typically used by risk assessors and risk managers in California. These California Human Health Screening Levels (CHHSLs) concentrations are issued by California Environmental Protection Agency's Office of Environmental and Human Health Office (OEHHA). The revised (September 17, 2009) CHHSLs for lead and lead compounds are **80** mg/kg soil for residential property, and **320** mg/kg soil for commercial/industrial property.

Below are synopses of the conclusions made from bench scale studies of the soil washing treatments at two different project sites: the McClellan Air Force Base, and the Exide Residential Property.

Application and Use of Soil Washing in California

<u>McClellan Air Force Base</u>

Soil Washing and Solidification/Stabilization Work Implementation Plan – Final (Report), Air Force Base (AFB) Conversion Agency – DD-McClellan, dated 1/23/02

This Report was a study for ex-situ treatment of soil containing metal contaminants, specifically lead. Within the Report cited above is an Appendix D that contained a Results Report (Treatability Study Results, Small Arms Firing Range and PRLS-004, McClellan Air Force Base, California, dated November 14, 2001 (Results Report)). PRLS-004 is an acronym for Potential Release Location S-004 that is identified in the Report as a former storage area of unknown materials located on the McClellan AFB.

Below are two abbreviated tables from the Results Report referenced above that identify soil samples and total lead concentrations from the two McClellan AFB subject areas:

Small Arms Firing Range Residual Soil Lead (mg/kg)

Trial # 1	Trial # 2	Trial # 3	Average Concentration
1,473	1,715	1,615	1,601

All soil fraction samples exceeded the state total lead concentration (i.e., 1,000 mg/kg)and the federal and state soluble levels for lead (i.e., 5.0 mg/l).

The Results Report recommended a further stabilization treatment step for soils from the Small Arms Firing Range.

PRSL-004 Residual Soil Lead (mg/kg)

Trial # 1	Trial # 2	Trial # 3	Average Concentration
295	294	267	286

All soil fraction samples (based on sieve mesh size) were less than the state total lead concentration (i.e., 1,000 mg/kg) and the federal and state soluble levels for lead (i.e., 5.0mg/l).

The Results Report stated that the washed soil will have an average composite residual total lead concentration of approximately 300 mg/kg. Results indicate that the soil will meet both the TCLP and DI-WET standard of 5 mg/l for lead following soil washing only. Based on the current CHHSL screening levels for lead (i.e., 80 mg/kg for residential property and 320 mg/kg for commercial/industrial property) the average total lead of 300 mg/kg would be allowed for a commercial/industrial property use but would not be allowed for residential property use. When soil contaminants are left in place at concentrations above unrestricted use levels (i.e., residential property use) a deed restriction, otherwise known as a land use restriction, is required by DTSC. The land use restriction would place requirements on the property owner for: soil management, annual inspections, and notices to DTSC and other parties in the case of property transfers.

Exide Residential Property

DTSC carried out a bench scale treatability study (bench scale study) for soils with elevated concentrations of lead from properties surrounding the former Exide Technologies (Exide) Battery Recycling Facility, located in Vernon.

Study criteria were: (1) determine soil and contaminant characteristics for the Preliminary Investigation Area (PIA) shallow soil samples; (2) determine the amount of clean soil (less than 80 mg/kg lead) that can be segregated from the impacted soil and can be used as backfill at remediated properties; (3) determine residual lead concentrations and leachability in the treated soil and residual soluble lead in the wash water; and, (4) based on results of treatment, evaluate costs for integration of the soil washing component into the Remedial Action Plan.

Exide PIA, Soil Washing Bench-scale Test Results

	Unified Soil Classification	Weight	
		Dry (grams)	%
Combined Sampling Results (Samples # 1 through # 10)	Organic Matter	349.8	0.80
	Gravel	1,238.3	2.84
	Coarse Sand	951.4	2.18
	Medium Sand	6,912.2	15.87
	Fine Sand	5,627.7	12.92
	Very Fine Sand	5,462.6	12.54
	Silt/Clay	23,020.3	52.84
	Entire Sample (all fractions)	43,562.29	100.00

In summary, ten soil samples from a variety of locations in the Preliminary Investigation Area were tested for the Soil Washing Study. The combined soil sample results indicate that only the gravel fraction of the soil samples appeared to be amenable to soil washing and contained lead below the target of 80 parts per million (i.e., mg/kg), the DTSC Residential Soil Screening Level. The gravel fraction makes up only approximately 3 percent of the total soil.

Exide PIA, Unit Cost Estimate Comparison, Excavation, Treatment, Disposal and Backfill, Alternatives 3, 3A and 3A1

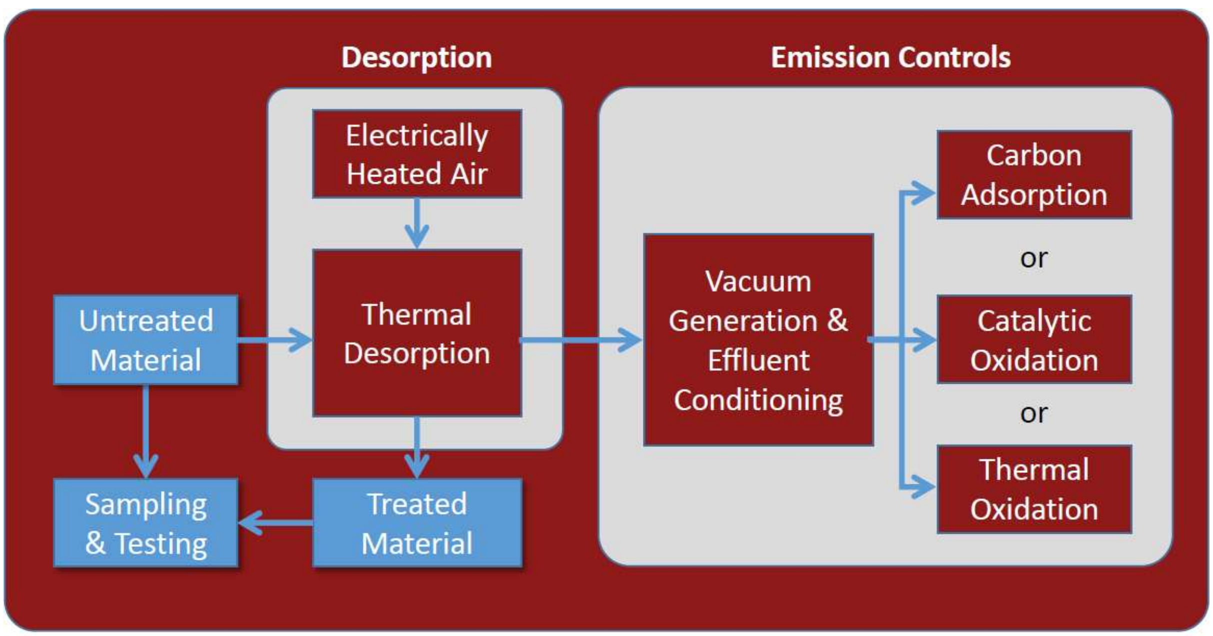
Alternative	Description	Items	Units	Unit Cost ($/ton)	Cost Per Home	Percent Increasee
3	Risk Based Removal and Off-site Disposal	Excavation, Disposal, & Backfill	88	$312.27	$27,480.00	NA
3A	Soil Washing and Off-site Disposal (Plant Capacity – 50 tons/hr)	Excavation, Soil Washing, Disposal, & Backfill	88	$552.70	$48,638.00	76.99%
3A1	Soil Washing and Off-site Disposal (Plant Capacity – 25 tons/hr)	Excavation, Soil Washing, Disposal, & Backfill	88	$606.70	$53,390.00	94.29%

Evaporative Desorption Technology (EDT)

On June 2, 2016, Reterro, a contaminated soil remediation company headquartered in Livermore, California, provided presentations to DTSC staff. On February 15, 2017, Reterro provided another presentation to DTSC staff and available Advisory Committee members. Reterro has developed a soil remediation technology, Evaporative Desorption Technology, which is summarized below.

Summary of information provided by Reterro:

Evaporative Desorption Technology (EDT) is a patented, flameless, electric, ex-situ, batch, low-temperature thermal desorption, soil remediation technique performed statically in a closed chamber under vacuum.



Blue-shaded boxes indicate operations outside of the Reterro processing equipment.

Reterro Core Competency Is Chlorinated Volatile Organic Compound (CVOC) & Total Petroleum Hydrocarbon (TPH) Removal

Catalytic Oxidation (Catox) Control	Granulated Activated Carbon	CVOC Catox Acid Scrubber
Refined Hydrocarbons	Perchloroethylene (PCE), Trichloroethylene (TCE), 1,1-dichloroethylene (DCE), 1,2-dichloroethane (DCA)	Higher Concentration CVOCs
Polynucleic Aromatic Hydrocarbons (PAHS)	Vinyl Chloride	Other Organochlorides
Semivolatile Organic Compounds (SVOCs)	Nitrobenzene, Aniline	
Benzene		

According to Reterro, cleanup performance of EDT is tunable (i.e., can be adjusted to meet different performance requirements) and capable of meeting the most restrictive remediation requirements.

Characteristics affecting applicability of EDT are listed below:

Site Characteristics	Soil Characteristics	Contaminant Characteristics
Project size	Plasticity & Density	Type(s)
Accessibility	Particle size distribution	Concentration(s)
Weather	Moisture content	Vapor pressure & boiling point
Operating restrictions	Humic content	Water solubility
Electrical service	Metals content	Thermal stability

Contaminant Removal and Destruction Certainty

- Remedial certainty
- Excavation reveals full extent and distribution of contamination
- EDT extracts the contaminant for destruction
- No migration of contaminants
- Independent third-party sampling and analysis
- System evidence of process effectiveness
- Effluent monitoring
- Oxidizer temperature differential
- Carbon loading
- Permanent data archive of system operating parameters

Secure Transfer and Elimination of Liability

- Proven and patented ex-situ thermal desorption with contaminant destruction
- Industry only process performance guarantee provided by the world's largest reinsurer, Munich RE
- Extensive validation
- Expedited liability transfer and regulatory closure
- Post remediation Pollution Legal Liability Insurance from A+/A rated insurers

Sustainable Performance

- Sustainability Life Cycle Analysis performed by WSP Parson Brinckerhoff, Reterro Life Cycle Analysis (LCA) (Final Results)
- Compared Dig and Haul versus Reterro EDT (four scenarios)
- Impact categories quantified
- Global Warming Potential (GWP)
- Primary Non-renewable Energy Demand (PNRED)
- Particulate Matter (PM)
- The Reterro method produces lower GWP, PNRED and PM impacts than Dig and Haul regardless of Reterro scenario.
- EDT is a Best Management Practice for Green Remediation Standards under ASTM E2893-13

<u>Reterro's Conclusions: Obstacles to Use of Its Treatment Technology</u>

- The full environmental impacts of dig and haul are rarely considered (e.g., full characterization of the impacts associated with on-site excavation, transport to landfill and transport of clean backfill).
- Placing certain contaminated soils in landfills is an archaic practice when readily available technologies exist that will render the soil suitable for reuse.
- The relatively low cost of landfill disposal makes the decision to utilize this practice too easy for most waste generators without considering the long-term environmental and liability impacts of this practice.

[End of summary of information provided by Reterro]

Community Dialogue on the Management of Contaminated Soil (Community Dialogue)

Cleanup of contaminated sites and the disposal of hazardous waste soils illustrate like no other hazardous waste management challenge the concern about equitable treatment for communities where hazardous wastes are generated and where hazardous waste landfills are operated. Not only do the California communities where hazardous waste disposal facilities are sited bear a disproportionate burden of the safe and legal disposal of hazardous waste-contaminated soils, the California communities in the vicinity of the contaminated sites also bear a burden of risk due to the potential exposure to the contaminants at the site where they have been released.

In some instances, however, this dynamic is being challenged. At the Del Amo Superfund site in southern Los Angeles County between the cities of Torrance and Carson, members of the surrounding community have expressed a strong interest in not exporting the contamination from their community to another community, whether in California or another state. This desire was championed by some members of the Advisory Committee, one of whom represents the community surrounding the site. They challenged, through the Initiative and the evaluation of waste reduction approaches that could be used to reduce the amount of hazardous waste-contaminated soils, the Advisory Committee to seek alternative cleanup technologies that could reduce or eliminate the hazardous chemicals at the site where it was released.

This challenge is further illustrated by the range of views that communities and their residents hold on the potential fate of soil which has been contaminated in their community. Some support sending the contaminated soil out of their community as part of reducing threats to public health and the environment locally. Others, such as those surrounding the Del Amo Superfund site, support treating contaminated soil locally rather than shifting burdens to other potentially impacted communities. The purpose of the Community Dialogue is to address the various complexities associated with decisions about the fate of contaminated soils, including their management, treatment, and disposal.

DTSC will work with the community representatives of the Advisory Committee, and other members of impacted communities, to accomplish the following through the Community Dialogue:

- Clarify the basis for various community perspectives on how best to handle contaminated soil.
- Provide a greater understanding of the technical options for managing contaminated soil, and the potential benefits and drawbacks.
- Develop guidelines for the role of communities in DTSC's decision-making processes associated with the fate of contaminated soil in their community.

Additionally, a Contaminated Soils Dialogue Group (CSDG) of 10-15 representatives from impacted communities reflecting a range of views on the issues associated with the fate of contaminated soil will be established. The composition and background of the CSDG will include a diversity of perspectives including, but not limited to:

- Receivers of hazardous waste
- A range of impacted waste streams
- Tribal community representation
- Representation from across California

A series of meetings will then be conducted to address the issues related to listed objectives. The design of the process will ensure opportunities for transparency and for feedback from community members and other stakeholders. All meetings will be sponsored by DTSC, working closely with the community representatives on the Advisory Committee on the agenda, logistics, data collection, and technical expertise needed to support the dialogue and ground rules governing the dialogue and other meetings. All meetings will be open to the public.

DTSC held the Community Dialogue series, in partnership with community representatives in the Fall of 2017. An overview and summary of the meetings is available at DTSC's website: https://dtsc.ca.gov/wp-content/uploads/sites/31/2019/04/Community-Dialogue_Meetings-Overview_-Final.pdf

Observations and Opportunities

- Each community near contaminated sites is different, and there has historically been a desire by communities to be more involved in cleanup decisions and for the impacted communities' preferences to carry more weight. Communities have continued to express strong concerns on this issue. There are opportunities to explore new or improved methods of community engagement at cleanup sites.
- There is also a growing desire for communication between communities impacted by contaminated sites and communities at sites where contamination may be destined. DTSC will explore opportunities to establish and foster this type of dialogue when it is requested.
- To support these goals, DTSC will facilitate a statewide Community Dialogue on the management of contaminated soil as described above.
- The external or indirect costs of excavation and disposal of contaminated soils are often not considered in evaluating cleanup options. An example of thismight be costs of community health care associated with the increased exposure from diesel emissions. There are opportunities to explore how to incorporate external costs to weigh against short-term costs, such as using life cycle assessment methods. DTSC could integrate a more comprehensive evaluation ofthe cost of cleanup options in the evaluation of cleanup costs (as part of Feasibility Study evaluations) for sites it is overseeing or cleaning up.
- Although the number and type of on-site treatment technologies may currently be limited, DTSC should explore ways to encourage research into new technologies that would destroy or eliminate contaminants from sites as an alternative to removal of contaminated soils. DTSC could also consider providing independent

evaluation of developing technologies to assist in demonstrating their effectiveness and facilitate their consideration in cleanup decisions.

Refinery Waste

Refineries were recognized by the Advisory Committee as having a substantial impact on environmental justice communities due to the large amount of waste generated, toxicity of the waste and emission, and the potential for economically feasible source reduction opportunities. Historically, refineries have demonstrated that source reduction can lead to reductions in hazardous waste generated and multimedia releases to the environment and are willing to participate in efforts to demonstrate source reduction achievements and promote changes industrywide.

Pilot Project Summary

The effort focused on petroleum refinery waste entailed: (1) data gathering; (2) identification and possible implementation of waste reduction opportunities or technologies; and (3) analyzing the available data and making recommendations.

Data Gathering

The data gathering portion of this project involved collecting available data about hazardous waste generation and management at petroleum refineries. DTSC collected the information in HWTS and other available sources, and solicited additional information from California refineries, the petroleum refining industry at large, other governmental agencies (local, state, and federal, as well as other nations), academia, communities affected by the operation of refineries, community advocates, and other interested stakeholders.

Identification and Evaluation of Substantive Proposals

This portion of the project involved the solicitation and evaluation of substantive waste reduction proposals, including the use of DTSC’s authority under SB 14 to review petroleum refinery Summary Progress Reports, Source Reduction Plans, and Hazardous Waste Management Reports. The types of proposals to be considered would include not only petroleum industry-sponsored proposals, but also proposals that would require DTSC to seek partnerships, or secure financial resources to support. Proposals would need to be identified and selected within a time frame during the Initiative that allowed for the proposal to be initiated and its progress evaluated, although they would not need to be fully completed within the planned time frame of the Initiative.

Background

Refinery waste accounts for roughly 4 percent of California's hazardous waste. This waste is generated from several refinery processes, such as crude oil processingand production of finished products. Hazardous wastes are then shipped under hazardous waste manifest to off-site treatment, storage, or disposal facilities. In 2014alone, approximately 69,100 tons (138,200,000 pounds) of hazardous waste was generated by petroleum refineries in California.

Although the specific wastes generated by petroleum refineries are varied, they are predominantly soils contaminated with hydrocarbons, and other organic hazardous wastes. The issues presented by each of them are similar, regardless of the refinery where they originate. In general, refinery wastes have a moderate potential to adversely impact human health and the environment owing to their mobility and toxicity and the potential for inadvertent release during the management of the waste (generation, storage, treatment, transportation, and disposal).

Data and Information Gathering

The following table provides 2015 HWTS data describing manifested hazardous waste generated in California by petroleum refineries. The listed refineries represent the 18 largest hazardous waste generators among California's refineries, and their hazardous waste generation represents 85 percent of the hazardous waste generated by all petroleum refineries in California.

Table #7

2015 California Facility Comparison of Petroleum Refinery Hazardous Waste by Disposal Method (in Tons)

Facility Name	Facility Tons	Percentage of Total Facility To	H132 Landfil	*Percentage Landfill to Facility Tons*	H040 Incineration (Out of State	*Percentage Incineration to Facility Tons*	Other Method Codes	*Percentage Other Codes to Facility Tons*	Facility City	Facility County	EPA_ID
ALON BAKERSFIELD PROPERTY INC.	3,564.32	5.2%	3,062.04	85.9%	448.63	12.6%	53.65	1.5%	BAKERSFIELD	KERN	CAD009108705
CHEVRON EL SEGUNDO REFINERY	6,044.09	8.7%	5,182.46	85.7%	4.72	0.1%	856.92	14.2%	EL SEGUNDO	LOS ANGELES	CAD009114919
CHEVRON USA INC RICHMOND REFINERY	12,184.92	17.6%	8,215.76	67.4%	72.03	0.6%	3,897.12	32.0%	RICHMOND	CONTRA COSTA	CAD008336901
DBA GREKA	0.15	0.0%	-	0%	-	0%	0.15	100%	SANTA MARIA	SANTA BARBARA	CAR000091488
KERN OIL & REFINING CO	229.51	0.3%	157.75	68.7%	-	0%	71.76	31.3%	BAKERSFIELD	KERN	CAD008354052
LUNDAY-THAGARD COMPANY	196.38	0.3%	75.85	38.6%	-	0%	120.53	61.4%	SOUTH GATE	LOS ANGELES	CAD099457087
PARAMOUNT PETROLEUM CORP	230.40	0.3%	208.25	90.4%	-	0%	22.15	9.6%	PARAMOUNT	LOS ANGELES	CAD008237679
PHILLIPS 66 CO LOS ANGELES REFINERY - WILMINGTON PLANT	3,506.59	5.1%	2,992.75	85.3%	122.46	3.5%	391.38	11.2%	WILMINGTON	LOS ANGELES	CAD009164021
PHILLIPS 66 COMPANY - SAN FRANCISCO REFINERY	14,612.37	21.1%	11,868.66	81.2%	2,193.04	15.0%	550.67	3.8%	RODEO	CONTRA COSTA	CAD063001770
PHILLIPS 66 SANTA MARIA REFINERY	305.34	0.4%	147.42	48.3%	48.04	15.7%	109.88	36.0%	ARROYO GRANDE	SAN LUIS OBISPO	CAD041520644
SAN JOAQUIN REFINING CO INC	33.82	0.0%	28.36	83.9%	3.43	10.1%	2.03	6%	BAKERSFIELD	KERN	CAD077227049
SHELL MARTINEZ REFINERY	3,215.99	4.7%	2,097.42	65.2%	360.81	11.2%	757.76	23.6%	MARTINEZ	CONTRA COSTA	CAT080010796
TESORO CARSON REFINERY	1,154.09	1.7%	1,017.06	88.1%	0.07	0.0%	136.96	11.9%	CARSON	LOS ANGELES	CAD008371098
TESORO REFINING & MARKETING CO LLC - GOLDEN EAGLE REFINERY	5,659.99	8.2%	5,047.86	89.2%	17.23	0.3%	594.90	10.5%	PACHECO	CONTRA COSTA	CAD990724916
TESORO REFINING & MARKETING COMPANY-LOS ANGELES REFINERY	1,478.06	2.1%	1,280.14	86.6%	0.29	0.0%	197.63	13.4%	WILMINGTON	LOS ANGELES	CAD008345464
TORRANCE REFINING COMPANY LLC	4,755.12	6.9%	3,122.34	65.7%	1.47	0.0%	1,631.31	34.3%	TORRANCE	LOS ANGELES	CAD990806317
VALERO REFINING COMPANY-CALIF	2,100.92	3.0%	1,121.81	53.4%	125.57	6.0%	853.55	40.6%	BENICIA	SOLANO	CAD008361883
VALERO RFNNG CO-CA WILMINGTON ASPHLT PLT	0.05	0.0%	-	0%	-	0%	0.05	100%	WILMINGTON	LOS ANGELES	CAD981373053
Combined 18 Facilities:	**59,272.11**	**85.8%**	45,625.93	**77.0%**	3,397.79	**5.7%**	10,248.40	**17.3%**			
OTHER 26 Facilities:	**9,831.10**	**14.2%**	8,179.99	**83.2%**	54.42	**0.6%**	1,596.68	**16.2%**			
Total Facility Tons:	**69,103.21**	**Total Tons:**	53,805.92	Landfill Tons	3,452.21	Incineration Tons	11,845.08	Other Code Tons			

Source Reduction Activities (identification and exploration of pollution prevention opportunities)

In September of 2016, eleven source reduction document requests were sent to California refineries who are subject to SB 14 requirements. The requests specifically asked for copies of the documents that each has prepared as required under SB 14. These documents included reports that summarize previously completed and anticipated efforts by the recipient to reduce the generation of hazardous waste.

Source and Waste Reduction Opportunities Identified[7]

Based on a review of the available source reduction documents, the following are the most common methods identified that reduced the generation of refinery waste and/or were planned for future implementation.

1) Employee training to minimize the release of petroleum products during routine facility operations
2) Increased efficiency of process equipment and new treatment technologies
3) Identifying recycling options for waste streams
4) Improved waste characterization

The following is a complete summary of all source and waste reduction methods identified in the SB14 plans:

1) Waste Reclassification (from BMPs), 2) Employee Training, 3) Better sizing of batches, 4) Reduced leaks/improved maintenance, 5) Improved storage and material management, 6) Physical cleaning methods instead of solvents, 7) On-site recycling, 8) Reuse rinse solutions, 9) Improved control systems, 10) Reusable (washable) rags and personal protective equipment.

The most significant waste reduction measures came in the form of improved housekeeping practices and employee training. Yearly reductions from all source reduction measures implemented for all refineries were approximately 67,391,744 pounds from all reported sources. This includes a reported reduction of approximately 8,474,141 pounds of manifested hazardous waste.

[7] Note: The information presented in this section was provided by the refineries as part of the SB 14 source reduction documents that were submitted to DTSC based on its requests. DTSC makes no representation as to the accuracy of the information presented or to the validity of claims made in the documents. DTSC's analysis was based exclusively on the information presented and assumed that the information presented is accurate and valid. The actual documents submitted per DTSC's request can be reviewed at Footnote and link to rec'd docs: U:\HWM_2\PPSD\Policy Implementation & Support Branch\Community Protection HW Reduction\ SB14_Source reduction requests & docs\ rec'd SB-14 documents.

This suggests significant reductions could occur if refineries were able to implement even a few of the source reduction opportunities identified. For example, implementation of process improvements totaling 5 percent reduction could lead to a reduction of 3,455 tons (6,910,000 pounds) per year.

Many reported potential reduction opportunities were not implemented due to scheduling, market factors, and demand. In some cases, technology advancements were identified to achieve further reductions. Most opportunities for waste reduction measures identified in the Refinery SB 14/source reduction plans are intended to be implemented when time and staffing permits, but respondents reported that several source reduction measures were not implemented because of regulatory challenges.

Data Analysis

Available staff time and resources limited the extent to which source reduction documents were reviewed and data verified. Full time staffing by several DTSC employees or contractors would be required to generate quantifiable data and make meaningful conclusions and recommendations from the source reduction documents. However, even with limited staff resources a cursory review of the source reduction documents identified many source reduction opportunities and ways to improve the data collection and review process.

Observations and Opportunities

- Explore ways to work with the industry sector and its industry associations to create or update and distribute guidance documents on Best Management Practices on how to reduce hazardous waste. Sharing of best practices between similar generators could result in additional, industry-wide reductions.

- Evaluate regulations pertaining to on-site treatment and recycling to determine if they create impediments to waste reduction. Retaining regulations that provide necessary public health and environmental protection is essential, but removal of unnecessary regulatory barriers could result in increased on-site treatment and recycling.

- Further identify best methods to train employees on waste reductions and work with the industry sector and its industry associations to distribute and evaluate the effect of improved employee training and equipment maintenance on measurable reductions in hazardous waste. Improved employee training and equipment maintenance could significantly decrease the amount of hazardous wastes generated.

- Provide businesses with information on available funds that could be used to pay for the reduction opportunities identified in their source reduction.

- Further research the possible effect that setting long-term numeric goals for reduction of specific waste streams could have. Such goals could be established either as aspirational or, alternately, as mandatory.

- More thoroughly evaluate the source reduction data that has been included in the source reduction reporting to validate the claimed source reduction and to better understand the reasons behind generators' decisions to pursue some source reduction opportunities and not others.

- Evaluate economic factors, such as fees, taxes, pollution control costs, tax credits or available investment capital to determine their effect on the decisions businesses make in how they generate, manage, and recycle hazardous waste.

Organic Solvent Waste

Organic Solvent Waste was identified by the Advisory Committee as having a substantial impact on environmental justice communities due to the large amount of waste generated at many locations. In addition, overall reduction in the toxicity of the waste has been demonstrated, as well as further potential for economically feasible source reduction opportunities. Historically, businesses generating solvent waste have demonstrated that source reduction can lead to reductions in hazardous waste and/or improved air and water quality. These businesses have shown a willingness to participate in efforts to demonstrate source reduction achievements and promote changes industry wide. DTSC has a long history of working collaboratively with solvent-industry business stakeholders ranging from small businesses to industry associations.

Pilot Project Summary

This effort is focused on organic solvent waste (e.g., halogenated solvents, oxygenated solvents, hydrocarbon solvents, unspecified solvent mix, and off-specification, aged, or surplus organics) and entails; (1) data gathering; (2) identification and exploring implementation of pilot-scale solvent recovery practices; and (3) analyzing the available data and making recommendations.

Data Gathering

The data gathering portion of this pilot project involved collecting available data related to hazardous waste generation and management at solvent manufacturing facilities. DTSC collected the information in HWTS and other available sources, and solicited additional information from the affected California organic solvent generators, the solvent industry at large, other governmental agencies (local, state, and federal, as well as other nations), academia, affected communities affected by the operation of solvent manufacturers, community advocates, and other interested stakeholders.

<u>Identification and Evaluation of Substantive Proposals</u>

This portion of the project would involve the solicitation and evaluation of substantive waste reduction proposals. The types of proposals to be considered would include not only California industry-identified or sponsored proposals, but also proposals that could require DTSC to seek participation or partnerships, or the securing of additional financial resources. Proposals were intended to be identified and selected within a time frame during the Initiative that allows for the proposal to be initiated and its progress evaluated, although they would not need to be fully completed within the planned time frame of the Initiative.

<u>Background</u>

Organic solvent waste accounts for roughly 5 percent of California's hazardous waste. This waste is generated from many industrial and commercial processes, such as parts cleaning and degreasing, paint stripping, dry cleaning, and chemical and pharmaceutical manufacturing. The waste is then shipped under hazardous waste manifest to off-site treatment, storage, or disposal facilities. In 2015 alone, approximately106,510 tons (213,020,000 pounds) of organic solvent waste was generated in California. Although there has been significant progress in reducing organic solvent waste generation, there are still many opportunities for further reduction; see table on the next page.

The following table provides HWTS data describing manifested hazardous waste solvents generated in California. The data represent the total hazardous waste generated by businesses using the California State Waste Codes: 211, 212, 213, 214 and 331.

Table #8

Trends in Manifested and Generated Hazardous Waste Solvents from (1995 through 2015) (SWC 211, 212, 213, 214, 331)

Hazardous Waste Manifested and Generated (in Tons)

(HWTS Data)

Revised 07/17/2017

n	Calendar Year	Total Hazardous Waste Manifested (includes transfers)	Total Hazardous Waste Transferred	Total Hazardous Waste Generated (excludes transfers)	Total Manifested Solvents (SWC 211, 212, 213, 214, and 331): Total Tonnage SWC 211	Total Tonnage SWC 212	Total Tonnage SWC 213	Total Tonnage SWC 214	Total Tonnage SWC 331	Total ManiestedSolvent Tonnage	Total Generated Solvents (SWC 211, 212, 213, 214, and 331): Total Tonnage SWC 211	Total Tonnage SWC 212	Total Tonnage SWC 213	Total Tonnage SWC 214	Total Tonnage SWC 331	Total GeneratedSolvent Tonnage
0	1995	2,083,733	151,135	1,932,598	6,221	11,157	9,600	31,089	5,695	63,761	5,747	8,088	5,126	28,506	4,502	51,969
1	1996	1,983,406	172,208	1,811,198	7,173	11,991	11,272	34,535	4,717	69,688	6,463	9,456	4,683	31,597	3,401	55,600
2	1997	1,966,776	179,934	1,786,842	20,369	11,945	12,349	40,925	6,629	92,217	19,612	9,871	5,708	38,406	4,930	78,528
3	1998	2,213,890	208,896	2,004,994	5,329	12,689	11,803	44,096	7,586	81,503	4,954	11,045	6,595	42,205	5,321	70,121
4	1999	2,287,308	216,893	2,070,415	5,975	13,928	9,411	47,083	8,054	84,452	5,657	12,141	6,108	45,650	5,611	75,167
5	2000	2,612,474	197,719	2,414,756	3,825	11,266	6,202	39,570	15,494	76,357	3,567	9,378	3,584	38,266	13,010	67,806
6	2001	2,629,289	198,357	2,430,932	2,219	9,495	5,502	40,785	15,142	73,143	1,902	8,027	3,189	39,764	12,683	65,565
7	2002	2,273,647	177,314	2,096,333	1,323	10,632	4,979	49,310	16,292	82,535	1,093	9,363	3,209	48,411	14,183	76,258
8	2003	2,412,527	184,225	2,228,302	1,517	10,092	5,036	39,759	9,765	66,168	1,282	9,029	3,867	39,065	8,151	61,395
9	2004	2,551,144	191,837	2,359,307	1,663	9,319	4,427	41,703	15,890	73,002	1,478	8,268	3,570	38,793	13,503	65,613
10	2005	2,495,323	201,053	2,294,271	2,271	9,403	4,648	46,204	18,204	80,730	2,151	8,291	3,888	42,625	16,107	73,061
11	2006	2,522,934	266,535	2,256,399	2,458	9,431	5,768	55,461	14,701	87,818	1,702	8,061	4,657	48,676	12,129	75,225
12	2007	2,738,433	385,648	2,352,785	2,285	9,880	7,714	75,426	17,069	112,375	1,743	7,276	6,341	52,579	11,123	79,061
13	2008	2,565,666	371,295	2,194,371	1,301	12,002	8,588	81,157	15,789	118,837	1,075	7,884	7,227	55,398	10,814	82,398
14	2009	2,135,940	341,356	1,794,584	941	12,117	6,934	58,533	14,108	92,633	741	7,502	5,339	38,110	9,207	60,899
15	2010	2,121,706	331,459	1,790,247	1,669	12,750	6,933	58,253	14,571	94,177	1,509	8,011	5,328	41,350	8,957	65,155
16	2011	2,095,208	346,395	1,748,814	871	12,650	7,108	61,790	14,868	97,287	716	9,817	5,701	43,795	9,274	69,304
17	2012	1,993,168	333,400	1,659,768	866	15,465	4,145	51,924	15,205	87,606	669	12,683	3,040	38,777	9,839	65,008
18	2013	1,924,704	337,790	1,586,914	1,713	16,455	3,339	48,826	17,446	87,780	1,531	13,766	2,239	35,743	11,041	64,320
19	2014	2,094,871	349,928	1,744,942	1,828	20,150	2,834	61,711	19,986	106,510	1,714	16,392	1,736	43,509	12,389	75,739
20	2015	2,080,278	353,616	1,726,662	2,124	17,389	3,671	54,654	22,468	100,305	1,951	11,029	2,595	36,335	11,190	63,099
AVERAGES																
20 YEARS: 1996 - 2015		2,284,935	267,293	2,017,642	3,386.03	12,453	6,633	51,585	14,199	88,256	3,075	9,864	4,430	41,953	10,143	69,466
15 YEARS: 2001 - 2015		2,308,989	291,347	2,017,642	1,670	12,482	5,442	55,033	16,100	90,727	1,417	9,693	4,128	42,862	11,373	69,473
10 YEARS: 2006 - 2015		2,227,291	341,742	1,885,549	1,606	13,829	5,704	60,774	16,621	98,533	1,335	10,242	4,420	43,427	10,596	70,021
5 YEARS: 2011 - 2015		2,037,646	344,226	1,693,420	1,480	16,422	4,220	55,781	17,995	95,898	1,316	12,737	3,062	39,632	10,747	67,494
3 YEARS: 2013 - 2015		2,033,284	347,111	1,686,173	1,888	17,998	3,282	55,064	19,967	98,198	1,732	13,729	2,190	38,529	11,540	67,720

Notes: Tonnage amounts are adjusted to remove "phantom tons" from manifests greater than 130 tons (manifest errors).
Showing Manifested Calendar Years: 1995 - 2015
Unknown EPA IDs assigned to state according to state EPA ID prefixes and/or State Abbreviations.
Tonnage from Unknown or Blank EPA ID numbers is shown as California tons.
Based on HWTS Trend Data 1995-2006 (as extracted in July 10, 2015)
Based on HWTS Trend Data 2007-2015 (as extracted in September 20, 2016)

State Code	Waste Code Description
211	Halogenated solvents (chloroforms, methyl chloride, perchloroethylene, etc)
212	Oxygenated solvents (acetone, butanol, ethyl acetate, etc.)
213	Hydrocarbon solvents (benzene, hexane, Stoddard, Etc.)
214	Unspecified solvent mixture
331	Off-specification, aged or surplus organics

HWTS Datamart

Although the industrial uses of organic solvents are varied, the problems associated with the use of solvents are similar regardless of the industry. In general, organic solvents have a high potential to adversely impact human health. The relatively high vapor pressure of many organic solvents can cause vapors to off-gas (even at low temperatures) which, combined with potential skin contact, can cause acute and chronic health conditions. Organic solvents also present a physical hazard in the workplace due to flammability.

Organic solvents are also common environmental contaminants. The high solubility of many organic solvents can result in widespread groundwater contamination when solvents are introduced into the environment.

Ultraviolet/Electron Beam Technology and Waste Reduction

On November 14, 2016, a representative from RadTech International (RadTech) presented information to the Advisory Committee on the use of ultraviolet and electron beam technology to reduce the amount of solvents necessary for products that traditionally have used organic solvents in significant quantities (examples include adhesives, nail polish, dental prosthetics and adhesives, coatings, and solar panels). The technology works through a chemical reaction initiated by ultraviolet or other light sources, causing the materials to react immediately to create a polymer. Its advantages are that there is reportedly no need for air pollution control devices, nearly zero emissions, no secondary environmental impacts (such as greenhouse gases), and no hazardous wastes generated.

Source Reduction Activities

In September 2016, forty-three source reduction document requests were sent out to industries reported to have generated organic solvent waste in the past. The requests specifically asked for copies of the documents prepared as required under SB 14. These documents included reports that summarize previously completed and anticipated efforts by the recipients to reduce their generation of hazardous waste.

Appendix F is a summary of the 2014 SB 14 reports for the Organic Solvent industries that lists implemented and identified pollution prevention opportunities.

The universe of organic solvent waste was first organized into the five most common solvents generated. These wastes are: halogenated solvents (California Waste Code (CWC) 211), oxygenated solvents (CWC 212), hydrocarbon solvents (CWC 213), unspecified solvent mixtures (CWC 214), and off-specification, aged, or surplus organic solvents (CWC 331). The remaining entities generating one or more of these wastes were prioritized into two categories. Category 1 included the twenty companies that reported the largest amount of organic solvent waste generated during the 2014 reporting period (according to data in HWTS). Category 2 included all generators of organic solvent waste that were physically located in the most vulnerable communities, represented by a Cal EnviroScreen score greater than or equal to 15. A Cal

EnviroScreen score greater than or equal to 15 represents communities above the 70th percentile of all communities in the state. *Note: Solvent recyclers and chemical manufacturers were removed from the list since their primary business is to process solvents that have been generated by solvent generators or manufacture materials into useful commodities and most of the waste they generate is the result of sludges produced from the refining process. Further refining and recycling options are being explored.*

Source and Waste Reduction Opportunities Identified[8]

Based on a review of the available source reduction documents, several practices were identified that reduced the generation of organic solvent waste. Most significant waste reduction measures came in the form of improved housekeeping and employee training. One notable housekeeping practice was to use vacuum cleaning as opposed to wet mopping. Wet mopping resulted in mop water classified as hazardous waste, so vacuum cleaning greatly reduced hazardous waste generation. Another notable practice was the use of reusable protective equipment as opposed to disposal protective equipment. Disposable protective equipment that contacts hazardous waste needs to be disposed of as hazardous waste. By using reusable protective equipment (which can be cleaned through laundering), there was a large decrease in the amount of hazardous waste generated. Waste waters from laundering operations are not regulated as hazardous wastes, although sludges from laundering facilities that clean industrial textiles are often identified and regulated as hazardous waste.

Solvent Waste Reduction Potential

Identified source and waste reduction measures not fully implemented include: 1) reclassification of hazardous waste to solid waste from the utilization of Best Management Practices (BMPs) and better record keeping), 2) Employee training, 3) Better sizing of batches, 4) Reduced leakage from better maintenance and handling procedures, 5) Improved storage and material management, 6) Physical cleaning methods instead of solvents, 7) On-site recycling, 8) Reuse of rinse solutions, 9) Improved control systems, and 10) Better inventory controls.

Yearly minimum reductions from all source and waste reduction measures proposed (but not implemented for all solvent waste generated businesses included in this evaluation) is 13,117,361 pounds (6,558.7 tons). This suggests that significant

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[8] Note: The information presented in this section was provided by solvent generators as part of the SB 14 source reduction documents that were submitted to DTSC based on its requests. DTSC makes no representation as to the accuracy of the information presented or to the validity of claims made in the documents. DTSC's analysis was based exclusively on the information presented and assumed that the information presented is accurate and valid. The actual documents submitted per DTSC's request can be reviewed at: U:\HWM_2\PPSD\Policy Implementation & Support Branch\Community Protection HW Reduction\ SB14_Source reduction requests & docs\ rec'd SB-14 documents.

reductions could occur if businesses that generate solvent waste could be motivated to implement even a small portion of the source reduction opportunities identified.

Data Analysis

Available staff time and resources limited the extent to which source reduction documents were reviewed and data verified. Full-time staffing by several DTSC employees or contractors would be required to generate quantifiable data and make meaningful conclusions and recommendations from the source reduction documents. However, even with our limited staff resources a cursory review of the source reduction documents identified many source reduction opportunities and ways to improve the data collection and review process.

Observations and Opportunities

- Explore ways to work with the industry sector and its industry associations to create or update and distribute guidance documents on Best Management Practices for how to reduce hazardous waste. Sharing of best practices between similar generators could result in additional, industry-wide reductions.

- Evaluate regulations pertaining to on-site treatment and recycling to determine if they create impediments to waste reduction. Retaining regulations that provide necessary public health and environmental protection is essential, but removal of unnecessary regulatory barriers could result in increased on-site treatment and recycling.

- Further identify best methods to train employees on waste reduction and work with the industry sector and its industry associations to distribute and evaluate the effect of improved employee training and equipment maintenance on measurable reductions in hazardous waste. Improved employee training and equipment maintenance could significantly decrease the amount of hazardous wastes generated.

- Provide businesses with information on available funds that could be used to pay for the reduction opportunities identified in their source reduction.

- Further research the possible effect that setting long-term numeric goals for reduction of specific waste streams could have. Such goals could be established either as aspirational or as mandatory.

- More thoroughly evaluate the source reduction data that has been included in the source reduction reporting to validate the claimed source reduction and to better understand the reasons behind generators' decisions to pursue some source reduction opportunities and not others.

- Evaluate economic factors, such as fees, taxes, pollution control costs, tax credits, or available investment capital, to determine their effect on the decisions businesses make in how they generate, manage, and recycle hazardous wastes.

Additional Considerations

The following are additional factors that should be considered in assessing the potential to reduce the generation and management of hazardous wastes in California:

Economic Factors

Economic factors, such as fees, taxes, pollution control technology costs, tax credits or the cost and availability of capital, can also play a role in waste reduction decisions.

Hazardous Waste Fees

DTSC's regulatory costs associated with the implementation of its Hazardous Waste Management Program are funded through the assessment of the following seven different fees that are collected either directly by DTSC, or by the California Department of Tax and Fee Administration (CDTFA) on behalf of DTSC.

- Disposal Fee – Fee is paid by California landfills based on the amount of hazardous waste that was disposed
- Generator Fee – Fee is paid by businesses that generate hazardous waste in California
- EPA ID Verification Fee – Fee paid by businesses that receive an identification number from DTSC with 50 or more employees
- Manifest User Fee – A fee is assessed on each hazardous waste manifest used.
- Facility Fees – Fees are paid annually by facilities that have a hazardous waste facility permit from DTSC
- Permitting Activity Fees – Fees paid by permitted hazardous waste facilities to pay DTSC's costs to process permit applications (DTSC received authority in 2016 to charge the permit review costs to fee for service, rather than a flat fee).

Two of these fees are directly related to hazardous waste generation and disposal:

Generator Fee: Every generator that produces five tons or more of hazardous waste is required to pay a Generator Fee to CDTFA for each generator site for each calendar year, or portion thereof. Facilities permitted under a full or standardized permit that pay annual Facility Fees are not required to pay the generator fee. Generators are required to report the amount of waste generated on a hazardous waste generator fee return provided by CDTFA. The rates are established as tiers and range from $220 for generators that generate more than 5 tons but less than 25 tons per year, up to $87,900 for generators that generate more than 2,000 tons per year. The fee is capped at 2,000 tons/$87,900 per year. The rates are adjusted annually to reflect increases or decreases in the cost of living as measured by the Consumer Price Index issued by the Department of Industrial Relations.

The following are exceptions to the Generator Fee:

1) Hazardous wastes recycled and used on-site.
2) Aqueous hazardous wastes treated in a unit that operates under a conditional exemption, conditional authorization, or permit by rule.
3) Hazardous wastes resulting from a government agency cleanup in which the release is caused by another person.
4) Household hazardous waste generated and disposed by a Household Hazardous Waste Collection Facility.
5) Hazardous wastes generated from solid waste load check programs.
6) Hazardous wastes from removal of a tank from an owner-occupied single-family residential site if the site was unknown to the buyer at the time of their purchase.

Disposal Fee: Persons who dispose of hazardous waste to land at an authorized hazardous waste disposal facility in California are required to pay a fee directly to the disposal facility. The disposal facility transmits the fee to the CDTFA for deposit into HWCA. The fee rates range from $5.72 per ton to $55.07 per ton for hazardous wastes, and up to $272.64 per ton for extremely hazardous waste and restricted hazardous waste. These rates are for calendar year 2016 and are adjusted annually to reflect increases or decreases in the cost of living as measured by the CPI issued by the Department of Industrial Relations.

The role that the hazardous waste-related fees play in generators' decisions regarding waste reduction or other policy directions is not clear or easily understood. The use of fees to incentivize generators' behavior was a significant topic of discussion in 1997, when the California Environmental Protection Agency convened a Fee Reform Task Force as required by SB 1222 (Sher, Chapter 638, Statutes of 1995).

The following information is an excerpt from the report produced by the Fee Reform Task Force:

> "When fees were first proposed as a funding source for the hazardous waste program in the 1970s, there were fewer statutory and regulatory requirements for hazardous waste generators, and for waste disposal. The primary consideration in developing the first disposal fee was how to fund the program without making the fee so onerous that it led to increased illegal dumping. Another consideration was to create an incentive to reduce the volume of waste disposed. The philosophy that fees were a useful tool to influence the behavior of hazardous waste generators grew in the 1980s. Later, the issue of whether disposal fees influenced where wastes were disposed (in-state or out of state) became a consideration in structuring the disposal fee.
>
> During the 1980s, the number of hazardous waste legislative bills grew rapidly; sometimes over 60 separate pieces of legislation passed in a session. Many of these laws provided separate funding mechanisms, some of which were based on the premise that those who benefitted from the program or service should pay for it.
>
> As the volume of disposed waste decreased, there was a need to shift from using the disposal fee as a primary source of revenue, to using broad based fees, targeted fees, and fee-for-service. Today there are several other incentives for generators to reduce their waste, including liability, cost of cleanup, public relations, the cost of managing and disposing of hazardous waste, enforcement, and the mandates for reducing the disposal of waste to land. In addition, there are more tools and knowledge available to companies which result in source reduction through recycling, changing, and improving processes, or improved technologies, etc. Finally, companies and the public are more knowledgeable about the issues of hazardous waste management. It would be difficult to assess which factors are most influential today.
>
> Historically, fees have also been intended to accomplish a variety of policy objectives with mixed results."[9]

DTSC was not able to further evaluate the role of fees on waste generation and reduction under the Initiative. It is important to note, however, that fees as well as other financial factors warrant further evaluation to determine the importance they may play.

Mandatory versus voluntary source reduction – California's SB 14 requires that generators develop a plan that identifies source reduction techniques they could use.

[9] "Report of the Task Force on Fee Reform for the Department of Toxic Substances Control," California Environmental Protection Agency, 1997.

Generators are not required to implement anything they identify. The program is voluntary. Whether and how to impose reduction mandates warrants further evaluation.

Mandatory versus voluntary technologies – Unlike air pollution law, where some control technologies are mandated, there are currently no requirements for generators to use alternative technologies to reduce hazardous waste generation, or to use less toxic or non-toxic alternatives. Whether and how to impose mandates on waste reduction technologies or less toxic alternatives warrants further evaluation.

Short term versus external costs – As with contaminated soils and cleanup costs, external or indirect costs of hazardous waste generation and management are often not considered in waste reduction decisions. Methods to incorporate external costs and balance those costs against immediate or short-term costs warrants further evaluation.

Local government role and involvement – The role of local government and Certified Unified Program Agencies (CUPAs) has expanded significantly since California's waste reduction laws were enacted. Local Green Business Programs have also evolved in many jurisdictions. These Green Business Programs have been instrumental in helping small to medium-sized businesses integrate many beneficial environmental, water and energy savings improvements, including source reduction methods. The role and benefits of CUPAs and local Green Business Programs in helping businesses in their jurisdictions to achieve waste reductions warrants further evaluation.

Local and regional government role and pollution prevention – Regional pollution prevention committees have disbanded as DTSC lost funding for Pollution Prevention activities. This was an opportunity for representatives of local interagency government staff (hazmat, wastewater, and air pollution control agencies) to work with large generators, disposal sites, and recyclers, and to stay current on new trends for pollution prevention and waste minimization techniques. Included in these committees were local utility representatives and industry association representatives. There is currently no government entity working with large businesses and industry towards pollution prevention outside of SB14.

Community Role and Involvement – There is no opportunity for the public to review or provide comments or feedback on the source reduction evaluation reviews and plans prepared by generators. The decisions made by these businesses related to the hazardous chemicals they use and the wastes they generate can impact the communities near them. Whether communities would like to have this type of opportunity, and if so, how to accomplish it, warrants further evaluation.

General Observations and Opportunities

This section presents a summary of DTSC's general observations and opportunities that have been identified in carrying out the Initiative. The opportunities represent both items that could be implemented more immediately, and items that would take longer, or more substantial funding, to implement.

[Note: Although DTSC has identified several areas where additional activities couldbe taken, DTSC's taking those actions, or further exploring any of the areas identified inthis report is dependent on resources being available and appropriated to DTSC for that purpose.]

- One key observation about California's SB 14 requirements is that generators are required to develop a plan that identifies source reduction techniques that could apply, but they are not required to implement anything they identify. The program is voluntary. Whether and how to impose reduction mandates should be further explored.
- Similarly, unlike for air pollution law where some control technologies are mandated, there is no requirement for generators to use alternative technologies to reduce hazardous waste generation, or to use less or non-toxic alternatives. Whether and how to impose technology mandates should be further explored.
- As with contaminated soils and cleanup costs, external or indirect costs of hazardous waste generation and management are often not considered inwaste reduction decisions. This is another opportunity to explore ways for external costs to be incorporated and balanced against short-term costs.
- Economic factors, such as fees, taxes, pollution control technology costs, tax credits or the cost and availability of capital, can also play a role in waste reduction and management decisions. More research is needed, however, to better understand the effect and interaction of those factors on generator decisions to reduce wastes.
- It is important to note that the role of local government and CUPAs has expanded significantly since California's waste reduction laws were enacted. The role and benefits of CUPAs in helping businesses within their jurisdictions to achieve waste reductions should be explored.
- Finally, there is no public review or input into the source reduction evaluation reviews and plans prepared by generators. The decisions made by these businesses related to the hazardous chemicals they use and the wastes they generate have the potential to impact communities near them. It is worth exploring whether communities would like to have this type of opportunity, and if so, how to integrate community involvement into the source reduction planning efforts.

Fund Sources

Although the resources for DTSC's efforts under the Initiative expire as of June 30, 2017, there are a variety of funds available through U.S. EPA and other entities that could be sought to pay for some future activities by DTSC to pursue any of the identified recommendations.

In addition, although there is current uncertainty about the continuity of some U.S. EPA programs, there is a variety of U.S. EPA grant and funding programs that could potentially provide support for continued effort on the Initiative. Most of these programs require a modest degree of "matching" financial commitment from participants. For example, source reduction grants that are part of the U.S. EPA Pollution Prevention Grant Program require a 5 percent financial match.

Possible U.S. EPA grants and funding programs include:

- Targeted Brownfields and Land Revitalization
- Multipurpose Grants
- Air Grants
- Environmental Justice Grants
- People Prosperity and the Planet Grants
- Pollution Prevention Grants
- Science to Achieve Results Program
- Small Business Innovation Research Grants
- Office of Land and Emergency Management Grants
- Fellowship and Research Associateship Grants

Other federal agencies, such as the Department of Energy, the Department of Defense, and the National Renewable Research Laboratory, also have grant programs, some of which may be potential sources of support for HWRI projects.