

CALIFORNIA PETROLEUM REFINERY HAZARDOUS WASTE SOURCE REDUCTION 2002 ASSESSMENT REPORT



DEPARTMENT OF TOXIC
SUBSTANCES CONTROL



Arnold Schwarzenegger
Governor
State of California

Alan C. Lloyd, Ph.D.
Agency Secretary
California Environmental
Protection Agency

Maureen Gorsen
Director
Department of Toxic
Substances Control

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OUR COVER:

From north to south and from east to west, the state of California is blessed with diverse natural beauty. Under predominately blue skies, the State has everything—redwood forests, an abundance of clean water, desert sands, palm trees, vast farm lands, miles of mountain ranges and all creating a huge habitat. California also has oil reserves and oil refineries contributing to the State's industrial economy. We share a vision that California industry can coexist in environmental harmony with the state's valued air, land and water resources. Pollution prevention practices can be an effective tool enabling the achievement of this vision. The previous report front cover is centrally located over the California map, as a reminder of this industry's continuing efforts to prevent pollution.

The other two refinery images are courtesy of the ConocoPhillips, San Francisco refinery. The map of California is a courtesy of the University of Texas in Austin.

COVER DESIGN BY:

Arvind Shah, Diana Phelps, and Joanna Kruckenberg, California Environmental Protection Agency, Department of Toxic Substances Control, Office of Pollution Prevention and Technology Development.

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Prepared by
Arvind Shah, P.E.
Diana Phelps, Ph.D.

California Environmental Protection Agency
Department of Toxic Substances Control
Office of Pollution Prevention and Technology Development

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The mention of any products, companies, organizations or source reduction technologies, their source or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products, companies, or technologies.

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REPORT OVERVIEW

This is a fourth assessment of the California refinery industry's (Standard Industrial Classification (SIC) 2911) efforts to reduce its hazardous waste under the Hazardous Waste Source Reduction and Management Review Act of 1989 (the Act or SB 14). This report addresses the period from 1999-2006. It provides California refineries' hazardous waste source reduction achievements during 1999-2002 and source reduction projections for the 2003-2006 period. This assessment is based on a review of the 2002 source reduction documents prepared by the California refinery industry as mandated by SB 14. This report is the result of the Department of Toxic Substances Control's (DTSC) source reduction assessment of California's 17 primary refineries.

The California refinery industry is the largest hazardous waste producing industry in the State. DTSC made SB 14 assessments of the State's petroleum refineries from the inception of the Source Reduction Program in 1990 and continuing every four years thereafter. This report is based on a review of industry SB 14 documents covering the most recent reporting year 2002.

Based on the review of refinery 2002 Source Reduction (SB 14) documents, DTSC prepared an assessment on each refinery's and refinery industry's overall progress in reducing their hazardous waste at the source. This assessment report presents a profile for each of California's 17 largest refineries. Each profile contains individual refinery site information, its reduction accomplishments for major Category A and Category B waste streams from 1999 to 2002 and their projections for further reducing these major waste streams from 2003 to 2006. At the end of this report we have provided an overall data review and summary of the refinery-wide accomplishments for reducing hazardous waste. Table 2 presents individual refinery's Category A and Category B waste generation comparison for 1998 and 2002.

In order to provide improved clarity, DTSC changed waste stream terminology in its 2002 SB 14 guidance. Hazardous waste streams that are pretreated on site, and then subsequently discharged via the sewer system to a publicly owned treatment works (POTW) or to receiving water under a National Pollution Discharge Elimination System (NPDES) permit, are now referred to as Category A wastes. This type of waste stream was formerly called "aqueous waste." All other waste streams subject to SB 14, which were formerly called "nonaqueous waste", are now referred to as Category B wastes. Collectively, the California petroleum refineries reduced its generation of Category A and Category B wastes by more than 17 percent from 1998 to 2002.

California's 17 refineries (23 sites) collectively reported a waste reduction of nearly 95 million pounds or 36 percent of Category B during 1999 to 2002 period (see Table 3). Based on disposal cost of hazardous waste ranging from \$25 to \$600 per ton, these reductions are estimated to have saved the California refinery industry 1.2 to 28.5 million dollars.

California's refinery industry projected a reduction of more than seven billion pounds of Category A and Category B wastes during the 2003-2006 period (see Table 4).

Statewide, the data show a significant reduction in the hazardous waste generated by California's refineries from 1998 to 2002. Although production was about the same (106 million tons of crude oil input in 1998, vs 105 million tons in 2002), statewide hazardous waste generation was 36 percent less (84 thousand tons in 2002 vs 131 thousand tons in 1998). For more detail, see the conclusion section following the profile discussions. Notably, most of this reduction is due to the source reduction activities by one refinery using process changes.

I. BACKGROUND

The Hazardous Waste Source Reduction and Management Review Act of 1989 (SB 14) is codified in Health and Safety Code Sections 25244.12 to 25244.24. This law applies to large quantity generators that produce over 12,000 kilograms (13.2 tons) of hazardous waste, or 12 kilograms (26 pounds) of extremely hazardous waste in 1990 and every four years thereafter. The law requires these generators to:

- Conduct source reduction evaluation of their facilities and prepare the following source reduction documents:
 - (1) Source Reduction Evaluation Review and Plan (Plan)
 - (2) Hazardous Waste Management Performance Report (Report)
 - (3) Summary Progress Report (SPR)
- Implement feasible methods for reducing the quantity and/or the hazardous characteristics of routinely generated hazardous waste.

The main purpose of requiring generators to review and implement source reduction practices is to reduce the quantity of hazardous waste generated in California and thereby to promote public health and safety and to improve environmental quality. However, source reduction can also help large quantity generators avoid future liabilities, and become more efficient in their use of resources. In short, source reduction is a win/win proposal for environment protection and business improvement.

The first set of source reduction documents was due on September 1, 1991. The data addressed in the SB 14 documents were accumulated for the reporting year 1990. Documents are completed every four years thereafter this date, provided that the above threshold is exceeded in the reporting year. The most recent SB 14 documents were due by September 1, 2003 for waste generated in the most recent reporting year 2002. A further purpose of SB 14 is to facilitate the sharing of information regarding successful source reduction measures throughout an industry sector. Source reduction, the preferred waste management approach, is defined as actions:

- Taken prior to the generation of waste, which results in a reduction of waste volume or toxicity, that do not include recycling, treatment or hazardous waste disposal; or
- That do not merely shift hazardous wastes from one environmental medium to another environmental medium.

The Plan, which is directed toward the future, must include information about the facility's operations, and provide waste generation data for the reporting year (i.e. 2002). The Plan must also include a list of potential source reduction measures for major waste streams, and describe the efforts taken to evaluate these measures. Major waste streams are defined as those waste streams that exceed five percent of the total weight

of routinely generated hazardous wastes. Major waste streams are separately categorized for both Category A (aqueous) and Category B (nonaqueous) wastes.

To develop and screen source reduction measures, generators must indicate in the Plan that they considered, at a minimum, the five approaches mandated by SB 14:

- (1) Input Changes, which include raw material or feedstock changes to reduce, avoid, or eliminate the use of hazardous materials in the production processes. This reduces the generation of hazardous waste within the production process.
- (2) Operational Improvement, which include loss prevention, waste segregation, production scheduling, maintenance operations, and overall site management.
- (3) Production Process Changes, which include changes in production methods or techniques; equipment modifications; changes in process operating conditions such as temperature, pressure; process or plant automation; or the return of materials or their components for reuse within existing processes.
- (4) Product Reformulations, which include changes in design, composition or specification of final or intermediate products.
- (5) Administrative Steps, which include inventory control, employee continued improvement programs, and good operating practices that apply to the human aspect of conducting day-to-day operations at the facility. These include employee training, procedures, incentives, bonuses and other such programs that encourage employees to focus on preventing the generation of hazardous waste.

The Report discusses past source reduction activities, waste stream generation, management practices, production and other factors that affected routine waste stream generation since the baseline year (previous reporting year: 1998).

The SPR summarizes key data and major waste stream information spanning eight years. The current 2002 SPR covers the 1999-2006 period. Source reduction accomplishment and projection data are entered into the SPR directly from the generators' previously prepared Plans and Reports. The SPR also summarizes generators' total hazardous waste quantities for year 1998 and 2002. Starting September 1, 1999 and every four subsequent years, SB 14 generators are required to submit their completed SPR to DTSC. Out of the three SB 14 documents, the SPR is the only SB 14 document that must be submitted to DTSC.

SB 14 requires DTSC to select two categories of generators by Standard Industrial Classification (SIC) code every two years for source reduction planning assessment. For this fourth SB 14 cycle, generators subject to SB 14 were required to prepare documents by September 1, 2003 for the 2002 reporting year. As part of this assessment, during 2003-2004 letters were sent to the major California refineries

operating under SIC code 2911, requesting SB 14 documents submittal to DTSC for a technical and completeness review. Based on this SB 14 document review, DTSC contacted several refineries to obtain additional information during the 2004-2005 period. This is the fourth California refinery industry assessment report since SB 14's implementation in 1990. All these assessments are available upon request.

II. INTRODUCTION

A. General Industry Background¹

California is the fourth largest oil producing region in the United States, behind federal offshore production, and the states Texas and Alaska. In 2002, all California refineries received roughly 1377 million barrels (a petroleum barrel is equal to 42 U.S. gallons) of crude oil. Of this total, roughly 661 million barrels came from in-state oil production (48 percent), combined with oil from Alaska: 303 million barrels (22 percent), and foreign sources: 413 million barrels (30 percent).

California is a major refining center for West Coast petroleum markets with combined crude distillation capacity totaling approximately two million barrels per day, ranking the state third highest in the nation. California ranks first in the U.S. in gasoline consumption and second in jet fuel consumption.

A large network of crude oil pipelines connects producing areas with refineries that are located in the San Francisco Bay area, Los Angeles area and the Central Valley.

Refineries can be classified as topping, hydroskimming or complex. Topping refineries are the least sophisticated and contain only the atmospheric distillation tower and possibly a vacuum distillation tower. The topping refiner's ability to produce finished products depends on the quality of the petroleum being processed. A hydroskimming refinery has reforming and desulfurization process units in addition to basic topping units. This allows the refiner to increase the octane levels of motor gasoline and reduce the sulfur content of diesel fuel. Complex refineries are the most sophisticated refinery type and have additional process units to "crack" the heavy gas oils and distillate oils into lighter, more valuable products.

Using a variety of processes including distillation, reforming, hydrocracking, catalytic cracking, coking, alkylation, and blending, the refinery produces many different products. The four basic groups are motor gasoline, aviation fuel, distillate fuel and residual fuel². On a statewide average, about 12 percent of the product from California's refineries is aviation fuel, 13 percent is distillate fuel and 9 percent is residual fuel.

Complex refineries have the highest utilization rate at approximately 95 percent. Utilization rate is the ratio of barrels input to the refinery to the operating capacity of the refinery. Complex refineries are able to produce a greater proportion of light products, such as gasoline, and operate near capacity because of California's large demands for gasoline.

¹ Source: California Energy Commission

² Distillate fuel: light fuel oils distilled during the refining process.

Residual fuel: heavier oils that remain after the distillate oil are distilled away.

During the last seven years several refineries experienced mergers and/or acquisitions resulting in name changes. Some small refineries were closed after 1995. California's seventeen primary petroleum refineries reported generating nearly 13 million tons of hazardous waste in 2002. Due to its volume of generated hazardous waste, the petroleum refining industry has been a primary focus for DTSC's efforts to reduce waste, using pollution prevention practices.

Refineries, like many other industries, incur costs due to materials purchase, labor, energy and compliance requirements. Hazardous waste pollution prevention practices can reduce all of these costs, but most directly affected are environmental compliance and waste management costs. By avoiding waste generation, businesses avoid waste treatment and disposal costs, permit fees, and the potential impacts associated with fines and future liability. In short, pollution prevention practices enable businesses to improve their long term market position while contributing to a strong economy. At the same time they are providing the very best protection for the public health and environment. Pollution prevention is a win/win for business and for the environment.

B. Profiles

This assessment report contains detailed information on all 17 refineries. This information is uniformly reported based on the categories listed below. Readers can evaluate like information categories across the profiles, and gain some insight into refinery operations and their accomplishments and projections to reduce hazardous waste for the eight year span (1999 to 2006). Readers are cautioned against making strict comparisons between refineries due to differences in feedstocks, processes, products, and other refinery-specific factors. The categories listed in each profile include:

- (1) Site Information—Contains general site-specific information such as location, crude feed capacity and principal products, number of employees, years of operations and other descriptive information.
- (2) Accomplishments—This section discusses in detail each of the seventeen refineries overall hazardous waste reduction of their entire waste production for the reporting years 1998 and 2002. It also provides information on the progress of all measures selected in 1999 for major generated waste streams. For each of the major waste streams information was presented on the waste stream source. The profile also discusses each of the seventeen refinery's accomplishments reducing their major Category A (aqueous) and Category B (nonaqueous) waste streams identified in their 1998 Source Reduction Plan and/or 2002 Hazardous Waste Performance Report.
- (3) Projections—This section discusses each of the 17 refinery's selected source reduction measures for their major Category A and Category B waste streams from their 2003 source reduction documents. It also presents the refinery's overall goal to reduce waste during next four years (from 2003 to 2006).

- (4) Charts and Graphs of hazardous waste generation/reduction are presented.

The rest of this report contains the following sections:

- (5) Conclusions—This section provides information on the refinery industry's achievements for reducing hazardous waste.
- (6) Recommendations—This section provides comments on the way that the refineries presented their information and presents data on their hazardous waste reduction success. It also offers suggestions for conducting facility source reduction evaluations and improvements for preparing future source reduction documents.
- (7) Tables
- (8) Charts, Figures

C. Refinery Industry Source Reduction History 1990 to 2002

The Hazardous Waste Source Reduction and Management Review Act of 1989 (SB 14) is codified in Health and Safety Code Sections 25244.12 to 25244.24. This law applies to large quantity generators that produce over 12,000 kilograms (13.2 tons) of hazardous waste, or 12 kilograms (26 pounds) of extremely hazardous waste in 1990 and every four years thereafter.

SB 14 requires DTSC to select two categories of generators by Standard Industrial Classification (SIC) code every two years for making source reduction planning assessments.

In 1991, DTSC selected the petroleum refinery industry [comprised of refineries (15) and oil exploration companies (3) with SIC codes 2911, 1311 and 1381] for a 1990 hazardous source reduction assessment. The following are the highlights from DTSC's first Assessment of the Petroleum Industry Facility Planning Efforts, dated December 1993.

- Prior to the SB 14 program, during 1990, the petroleum industry (15 refineries and three oil exploration companies) reported generation of more than 265,000 tons of Category A (aqueous) and 7,900 tons of Category B (nonaqueous) hazardous waste.
- After conducting a source reduction evaluation of their sites (facilities), the refineries and oil exploration companies collectively selected 67 and 16 implementable source reduction measures respectively for Category B wastes.

- It was projected that by implementing all the 83 selected source reduction measures, the petroleum industry could reduce at least 20 percent amounting to avoiding the generation of up to 73,000 tons of hazardous waste during the 1991-1994 cycle.
- Based on the current disposal cost (1993) of petroleum waste ranging from \$100 to \$230 per ton, this hazardous waste reduction could save the petroleum industry \$7 to \$17 million in annual disposal costs.
- Wastewater (Category A) was not addressed in the review and DTSC's Assessment report. SB 1133 passed on September 5, 1991 which required generators to determine if the total quantity of wastewater generated (Category A) exceeds five percent of the total hazardous waste generated at the site, then conduct an additional calculation without counting the wastewater to address the remaining hazardous wastes (Category B) separately to determine major hazardous waste streams.

In June 1997 DTSC published its second assessment report titled "Assessment of the Petroleum Industry Hazardous Waste Source Reduction Planning Efforts". This second assessment was based on a review of 1995 SB 14 documents prepared by 24 facilities. Many of the 18 facilities participating in the initial 1991 industry review were represented among the 24 - 1995 documents reviewed. The primary SIC code represented in the second assessment was 2911 (petroleum refineries). To a lesser extent, 1311 and 1381 SIC codes were included representing oil exploration facilities and storage and blending facilities. The following are the key 1995 findings:

- A total of 73 facilities were requested to submit source reduction planning documents for evaluation. Twenty four submitted their documents and reviews were completed. Of the 49 companies not completing documents, one closed its operations, one had sold part of its refinery to another entity and 47 claimed exemption to SB 14.
- In the calendar year 1994, the three large/prevalent waste streams generated by Petroleum Industry were: (1) Wastewater; (2) Oil/water separator sludge and (3) Spent catalyst.
- As mentioned previously, DTSC's first focus in 1993 was based on the review of eighteen sets of 1991 source reduction documents. This review enabled DTSC to project that the petroleum industry as a whole would have reduced 20 percent of its hazardous waste by implementing more than 80 source reduction measures during the 1991-1994 SB 14 planning cycle. Actual data from the 24 facilities participating in the second review based on 1995 SB 14 documents indicated a 32 percent reduction of hazardous waste generation during the 1991-1994 period. This amounted collectively more than 61,000 tons waste not generated annually.

- The above data included all hazardous wastes except for Category A (aqueous) hazardous waste treated in an onsite wastewater treatment plant.
- With 1996 hazardous waste disposal costs for petroleum waste ranging from \$125 to \$750 per ton, these reductions are estimated to have saved the petroleum industry \$7 to \$45 million annually.
- The petroleum industry reported they would implement 122 source reduction measures.
- Based on the review of 1995 planning efforts, it was projected that the industry Category B (nonaqueous) hazardous waste reduction can achieve an additional 31 percent, equivalent to more than 53,000 tons annually. This reduction amounts in a total annual savings of \$6 to \$40 million.
- Collectively, the industry reported that during the 1994 reporting year its generation of Category A waste was more than 16 million tons. Eleven out of 24 sites reported Category A waste in their SB 14 documents.
- These eleven sites, collectively, selected twelve source reduction measures for reducing Category A wastes.

The third assessment of the industry's hazardous waste source reduction conducted during 2000 was based on a review of its 1999 SB 14 source reduction documents. However, the assessment report "California Petroleum Refinery Hazardous Waste Reduction 1999 Assessment Report" was published in January 2004. DTSC reviewed Seventeen refineries' twenty-one sites SB 14 documents. The primary SIC code represented in the third assessment was 2911 (petroleum refineries). Key findings from the assessment report are as follows:

- This was the first SB 14 cycle where generators were required to submit a SPR to DTSC by September 1, 1999 and every four years thereafter.
- Nine of the twenty-one sites reported the generation of Category A waste during 1994. Ten of the twenty-one sites reported Category A waste in 1998.
- In Category A, the industry's waste generation was decreased by more than one million tons or seven percent during reporting year 1998 in comparison to 1994. During this same period, their Category B waste was reduced by eighteen percent, equivalent to more than 30,000 tons annually.
- The industry reported its total (Category A and Category B) hazardous waste generation during 1994 and 1998 years as more than 15.72 million and 14.55 million tons respectively—a decrease of 1.17 million tons by 1998.

- During both the 1994 and 1998 reporting years, the industry's overall Category A (aqueous) waste amounted to approximately 99 percent of their total waste generated (Category A and Category B).

In this, the fourth assessment, the refinery industry achieved better hazardous waste reduction results during reporting year 2002 in comparison to 1998. DTSC reviewed 23 sites representing seventeen California refinery 2002 SB 14 documents. The primary SIC code represented in this fourth assessment was 2911 (petroleum refineries). Notable results follow:

- The industry reported its total (Category A and Category B) hazardous waste generation during 1998 and 2002 years as approximately 16 million and 13 million tons respectively—a decrease of nearly 3 million tons.
- During both the 1998 and 2002 reporting years, the industry's overall Category A (wastewater) waste amounted to approximately 99 percent of their total waste generated (Category A and Category B).
- Sixteen out of twenty-three sites did not report any Category A waste generation during both the 1998 and 2002 reporting years. Some cited Health and Safety Code 25144 and claimed that the wastewater directed to the wastewater treatment plant is nonhazardous, and therefore should not be reported as Category A. Some claim recycling exemptions citing Health and Safety Code 25143.2.

D. Source Reduction Summary

The refinery industry's first document review started with the very first SB 14 reporting year 1990 and continued in the following reporting years: 1994, 1998, and 2002. Although the number of sites varied for each review, all major California refineries were consistently included in the assessment. During the first assessment, DTSC reported that the industry generated 272,900 tons of Category B waste only during 1990. The industry further reported, in their 1995 SB 14 documents, that in calendar year 1994 it generated 17 million tons of combined total Category A and Category B waste. Nearly 170,000 tons (or one percent) of the 17 million tons was reported as Category B waste.

In their 1999 SB 14 documents, the petroleum industry reported its combined total Category A and Category B waste generation of 14.55 million tons during 1998 in comparison to 15.72 million tons in 1994—a decrease of more than one million tons or seven percent.

The discrepancy (17 million tons waste generation for 1994 mentioned in 1995 SB 14 documents vs. 15.72 million tons waste generation for 1994 mentioned in 1999 SB 14 documents) is attributed to two factors: (i) number of sites for the 1994 and 1998

assessment were slightly different and (ii) one refinery corrected its waste generation data in its 1999 SB 14 documents.

The current assessment indicates that the industry continued its hazardous waste reduction trend in the 2002 reporting year. The industry reported in their 2003 SB 14 documents that 15.84 and 12.78 million tons (total Category A and Category B combined) of hazardous waste generated for the reporting year 1998 and 2002 respectively. This is a reduction of more than 17 percent (see Table 3).

The discrepancy (14.55 million tons waste generation for 1998 as reported in 1999 SB 14 documents vs. 15.84 million tons waste generation for 1998 as reported in 2003 SB 14 documents) is also attributed to two factors: (i) number of sites for the 1998 and 2002 assessment was slightly different and (ii) more than one refinery had corrected its waste generation data.

III. REFINERY PROFILES

BP WEST COAST PRODUCTS, LLC (BP) CARSON REFINERY

EPA ID: CAD 077 227 049

A. Site Information

The Pan American Oil Company began petroleum refining operations at this site in 1923. In 1926, the Richfield Oil Company purchased the property and expanded the refining operations. The Atlantic Richfield Company (ARCO) was formed in 1967 when Atlantic and Richfield companies merged. BP AMOCO merged with ARCO in 2000, in 2002 ownership of the refinery was transferred to BP West Coast Products, LLC. The BP Carson refinery is divided into five separate geographical areas and occupies approximately 702 acres bounded by Sepulveda Boulevard to the south, Wilmington Avenue to the west, 23rd street to the north, and Alameda street to the east. The refinery operates as a petroleum refinery with a crude oil processing capacity of 261,000 barrels per day. The refinery produces a variety of petroleum products from crude oil refining operations. The main products produced by the refinery include gasoline, jet fuel, diesel, sulfur, petroleum coke, propane, butane, and fuel oil. This facility employs 976 full-time employees and supervises approximately 195 non-BP contract employees (2003 data).

B. Accomplishments

The refinery indicates in its Summary Progress Report (SPR) that its Category A waste was reduced from a total of 3100 million pounds in 1998 to a total of 273 million pounds in 2002. This is a decrease of approximately 91 percent. Between 1998 and 2002, the refinery successfully implemented the following measures: a) installation of a closed loop sampling system; b) segregation and recycling of high benzene input sources; c) benzene wastewater stripping; and d) the promotion of increased source reduction awareness among employees.

Category B waste was decreased to 5.79 million pounds in 2002 from a total waste generation of 7.13 million pounds in 1998. This was a decrease of approximately 19 percent. The refinery addressed one major Category A and two major Category B waste streams in its SPR.

Category A Wastes

In its 2002 SB 14 “Hazardous Waste Management Performance Report (Report)”, the BP refinery identified one source reduction measure for its single Category A major waste stream of wastewater.

1. Wastewater (CWC 135)

The refinery’s wastewater system consists of an extensive network of sewers, surface drains, an American Petroleum Institute (API) oil separator, four lift stations, four tanks, and three induced gas flotation (IGF) units. This system is designed to accommodate all water from the refinery’s process units as well as a pretreatment unit before discharge to the publicly owned treatment works (POTW) or to the Dominguez Channel.

The refinery’s wastewater is generated from process areas, tank farms, cooling towers, and its groundwater remediation system. The process water comes from a number of sources including tank draws and the desalter units as major producers. These various waste streams are combined at the lift stations where oil first undergoes gravity separation from water. The wastewater from lift stations undergoes: (a) another oil/water separation through an API separator; (b) sulfide reduction unit; (c) oil and grease separation from water; and (d) pH adjustment. Finally, the effluent (non-hazardous wastewater) is discharged to the POTW or the channel.

The ground water remediation system effluent is sent through a hydrocyclone oil/water separator and steam stripping tower to remove benzene and other volatile organic compounds (VOC’s). The removed hydrocarbons are recycled to the refinery.

The stormwater component of the aggregate wastewater from the process sewers and surface drains is dependent upon the amount of rainfall. Valves have been installed to divert the first flush of stormwater from non-process areas to the POTW. BP refinery segregated non-process area storm drains from the process area drains before the last SB 14 reporting cycle. This measure reduced a substantial amount of wastewater passing through the refinery’s wastewater treatment system.

As noted above, the BP refinery decreased this waste stream by 91 percent in 2002 in comparison to 1998. This reduction was achieved primarily by reducing benzene in the wastewater. The following discussion provides how this reduction was achieved.

The reduction of benzene in the wastewater, CWC 135, has been an ongoing measure implemented before 1994. A significant reduction of 85 percent occurred between 1990 and 1994. The refinery’s permitted publicly owned treatment works (POTW) discharge limits do not specify a benzene concentration. The refinery’s discharge of wastewater below the hazardous waste classification limit of 0.5 ppm occurred about 80 percent of the time in 1994. By 2002, the refinery’s discharge of wastewater below the hazardous waste classification limit of 0.5 ppm occurred about 98 percent of the time. The installation of closed loop sampling systems, the segregation of high benzene

concentration wastewater streams, and the stripping of benzene from wastewater are attributed to the initial reduction. Another factor in this reduction has been the regulatory change reducing the amount of allowable benzene in gasoline. Continuous and incremental improvements to the numerous upstream units, with a focus on the use of best management practices, have made this approach successful again in this 1998-2002 reporting cycle. BP refinery formed the Water Strategy Team. The team's job is to address all water issues, whether or not they pertain to hazardous waste.

Additional housekeeping measures have been identified as new approaches for the current (1998-2002) SB 14 reporting cycle. These approaches focus on improved containment of hydrocarbon materials. Similar approaches used for the current reporting cycle involve taking weekly environmental walks to identify violations and obtain direct operators feedback.

BP has isolated a substantial number of wastewater streams containing high levels of benzene and other volatile organic compounds (VOCs) upstream where the various streams come together (such as the lift stations). BP removed a substantial amount of the VOCs where VOC containing wastewater volumes are relatively small and yet are responsible for the concentrations that are high enough to be of concern downstream. These collected VOC containing wastewaters originate from remediation effluent that is sent through a National Emission Standards for Hazardous Air Pollutants (NESHAP) stripper, where VOCs are removed from the wastewater. The resulting wastewater stripping effluent is not classified as hazardous.

BP discovered during the 1998-2002 SB 14 planning cycle that benzene levels in the incoming wastewater stream were far lower than those found during the previous 1994-1998 reporting cycle (1994-1998). This resulted in a marked reduction of this benzene waste stream.

Category B Wastes

In its 2002 SB 14 Report, the BP refinery identified several source reduction measures for its two Category B major waste streams.

1. Other Spent Catalysts (CWC 162)

BP refinery mentioned in its SPR that during the 1998 reporting year it generated nearly 1.4 million pounds of spent catalyst. The refinery reduced nearly 33,000 pounds by implementing a combination of administrative steps and recycling measures. BP opted to recycle most of this waste stream at an off-site facility. The refinery now uses a large amount of recycled nickel/molybdenum catalyst in the normal operation of its process units in the reformer complex. This approach is being considered for implementation on an ongoing basis.

2. Wastewater Sludge (CWC 222)

BP refinery generated close to 5.5 million pounds of wastewater sludge in the 1998 reporting year. It reported a reduction of nearly 66 percent (3.6 million pounds) during 1998-2002 reporting cycle by implementing the following measures over the last several years:

- Use of a centrifuge to cycle hydrocarbons back through the process.
- Sewer sock program (When the storm water enters the sewer system it is handled by gravity. Storm water is temporarily stored in catch basin for settling to happen. These catch basins have a screening system called "sock system." Sewer socks can screen out large solids from entering the storm sewer).
- Pump seal conversion (eliminates the loss of pump shaft packing and wastewater).
- Improved management of fluid catalytic cracker (FCC) fines.

BP mentioned that the following successful measures for reducing wastewater sludges are currently being implemented:

- Coker recycling.
- Improved techniques for temporarily blocking or diking the oily water sewer drains.
- Expansions of sewer sock program.
- Dry sweeping the process areas.
- Further improvements in the FCC fines handling system.

The following waste stream was not considered to be a hazardous waste in the 1998 reporting year; however, BP did consider it to be a major waste stream for the 2002 reporting year. Added detail is provided below and in the following Projections section.

3. Spent FCC Catalyst Fines (CWC 161)

According to BP, in 1998 spent hazardous waste FCC fines were not generated. Therefore, no source reduction measures were considered to reduce this hazardous waste stream in the 1998 reporting year. Due to air emission regulations, BP refinery made several changes to the effluent management portion of the FCC unit in the last several years. Better control of the particulates had been accomplished by using an electrostatic precipitator (ESP), which had the side benefit of reducing the fines contribution to wastewater sludge. Collected fines were transported for off-site disposition and were typically classified as a non-hazardous waste. These non-hazardous waste fines can also be recycled to a cement kiln.

In 2002 this waste stream was classified as a California hazardous waste due to its nickel, vanadium, and arsenic concentrations. The nickel and vanadium sources were from catalysts used to reduce nitrogen oxides and sulfur oxides. The Air Quality regulations required BP to reduce the emissions of nitrogen oxides and the sulfur oxides. The concentration of arsenic is currently unknown. BP Carson refinery environmental staff believes that the arsenic source originates from laboratory analyses. This potential source is under investigation. There was a significant increase in this hazardous waste stream due to the introduction of these contaminants in 1998 in comparison with earlier reporting year.

C. Projections

The refinery's SPR mentioned that it generated 273 million pounds of Category A waste and a total of 5.8 million pounds of Category B waste in the 2002 reporting year.

For the 2002 reporting year, BP refinery had one major waste stream contributing to Category A and three major waste streams contributing to the Category B. The refinery considered a total of 25 potential source reduction measures for these waste streams. After conducting feasibility study, eighteen out of the 25 measures were selected for implementation.

Category A Wastes

In its 2002 SB 14 Source Reduction Evaluation Review and Plan (Plan), BP identified one major industrial waste stream. BP projects implementation of the selected measures by September 2005. This is projected to reduce the hazardous wastewater stream by five percent, which amounts to a reduction of more than 13 million pounds. The evaluation of source reduction measures for this waste stream includes further reducing the benzene concentration, recycled water use and an evaluation of housekeeping procedures, operator and maintenance crew training, and assessing cooling tower alternatives. Figure 1-A shows the types and quantity of Category A wastes that BP refinery reported for 2002.

1. Wastewater (CWC 135)

The BP refinery mentioned in its 2002 Source Reduction Plan that it generated some routine non-exempt wastewater from its processes. Wastewater containing benzene concentrations of more than 0.5 parts per million (ppm) is considered to be a hazardous waste. BP generated more than 273 million pounds of this waste in 2002. The wastewater source reduction measures selected for implementation include:

- (a) Study the use of air cooling towers during construction of new processes: BP is considering a process change which involves the use of air instead of water for certain cooling towers in the refinery. It will conduct a feasibility study to evaluate this option. The refinery anticipates that a large amount of air volume would be required. Substitution of water by air for the cooling would reduce the refinery's

demand for clean water. Solids and corrosion problems associated with the cooling water use would also be reduced.

- (b) Study the possibility of using recycled water: The refinery uses considerable amount of reclaimed water from off-site sources and recycled water from on-site recycling loops. During the 2002-2006 planning cycle, the refinery is planning to evaluate additional processes that could use recycled process water and stormwater.
- (c) Develop environmental awareness training: The refinery plans to implement a new training process to ensure the success of a range of environmental protection measures. The refinery has proposed that during the re-certification of all refinery operators, an environmental procedural instruction will be required. Training offers the best opportunity to raise the environmental awareness of all operators. The operators must pass all aspect of their re-certification to continue their refinery operator employment. A similar training proposal will be implemented for the refinery's maintenance personnel after successful implementation of the revised operators' re-certification program.
- (d) Create Water Strategy team to develop and implement cost beneficial ideas: The refinery established its Water Strategy Team in 2002. This team's function is to address refinery water use issues. The team's goal is to discuss alternatives for reducing water consumption, wastewater generation, and to promote water recycling.
- (e) Reduce benzene sources into process wastewater: The refinery continuously assess the possibility of isolating benzene sources upstream of the wastewater treatment plant and wherever feasible, recycle the stream within the generating process and/or treat the stream to strip the benzene prior to discharge to the treatment plant. To treat a large volume of low benzene concentration water is very expensive. However, opportunities usually present themselves when cost-benefit analyses show a savings during refinery turnarounds. A key factor in this source reduction measure is to re-pipe the process units that generate the least amount of benzene to a simpler pretreatment system or to a process water recycling system tailored to the generating process
- (f) Improve lube oil housekeeping procedures: Under normal pump operations, seal leaks and lubricating oil drippings frequently occur. Collector pans must be kept free of solids to enable waste hydrocarbons to adequately collect. A policy is developed to enforce improved pump housekeeping procedures with weekly inspections.

The refinery considered a total of nine source reduction measures for its pump operations. This was projected to be BP's largest waste stream during the 2002-2006 planning cycle. After a careful evaluation, BP rejected the following three measures:

i) reduce stormwater entering process drain; --In order to reduce storm water from entering process drains, weather protection would need to be constructed around process areas. BP refinery indicated that because of the size and complexity of the refinery, this measure would not be economically justified for the relatively small cost of treating storm water from these storm events. ii) evaluate water streams diverted from POTW to surface discharge; --The emphasis from the previous four-year cycle to increase the permitted diversion of non-hazardous wastewater from POTW to the Dominguez Channel was not a selected measure for further evaluation, and iii) evaluate product reformulation; --Product reformulation is a source reduction measure that is largely not under refinery control. Refinery products are formulated to meet strict air quality standards and reduce air pollution. Specifically, the method for formulating an oxygenated product represents one of the air quality requirements and cannot be realistically altered through product reformulations.

Category B Wastes

Figure 1-B shows the types and quantity of wastes that BP refinery generated in 2002.

1. Other Spent Catalysts (CWC 162)

BP generated more than one million pounds of spent catalyst waste during 2002 and projected an annual reduction of 68,000 pounds or five percent by implementing the following selected measures by 2006:

- (a) Maximize process unit run time. The benefit of this measure includes:
 - more representative four year averages to highlight successes
 - reduce catalyst change out frequency resulting in a lower generation of spent catalyst; and
- (b) Continually seek alternatives for catalyst recycle, regenerating, or disposal with the reclamation of catalyst metal content metal reclaim the spent catalyst.

2. Wastewater Sludge (CWC 222)

The refinery generated 1.8 million pounds of wastewater sludge during calendar year 2002 and projected an annual reduction of more than 745,000 pounds or 40 percent by implementing the following selected measures by the year 2006: (a) coker sludge injection; (b) conduct several studies to eliminate the use of sand bag dikes; (c) expand the sewer sock program; and (d) evaluate washing procedures for process areas.

3. FCC Catalyst (CWC 161)

The refinery generated approximately two million pounds of this waste in 2002 and projected an annual reduction of more than one million pounds or 60 percent by implementing the following selected measures by 2006: (a) Install selective catalytic reduction (SCR) unit instead of using additives for NO_x/SO_x reduction. SCR systems

are highly effective at cutting NOx emissions. SCR catalysts selectively convert NOx into nitrogen and water, thereby reducing NOx emissions by up to 99 percent; (b) improve or correct arsenic test methods and to strive for off site recycling; (c) spent FCC fines can be sent for offsite recycling if false positive results for arsenic can be corrected; and (d) improve change out and collection of fluid catalytic cracker (FCC) fines and other catalysts such as nickel/molybdenum, vanadium-titanium, zeolite, and platinum catalysts.

D. Remarks

Comparison of 2002 and 1998 Business Activity Levels:

BP Carson Refinery tracks its business activity according to average daily crude oil throughput. In 1998 the average daily throughput was 255,000 barrels versus 261,000 barrels in 2002. This was a 2.5 percent increase in average throughput between 1998 and 2002. In comparison, during the same period, all routinely generated major waste streams at BP Carson Refinery decreased by 91 percent, significant source reduction.

BP refinery SB-14 Category A Wastes
2002 Reporting year

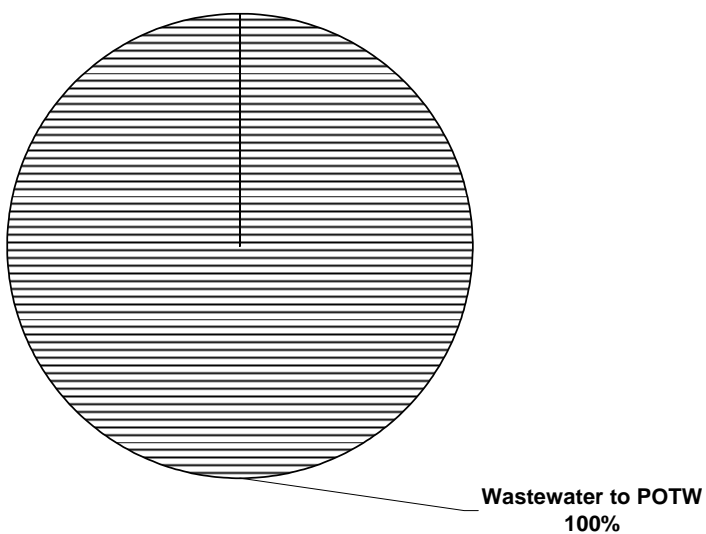


FIGURE 1-A. Category A Wastes for BP West Coast Products, Carson Refinery
2002 Reporting Year.

BP refinery SB-14 Category B Wastes
2002 Reporting year

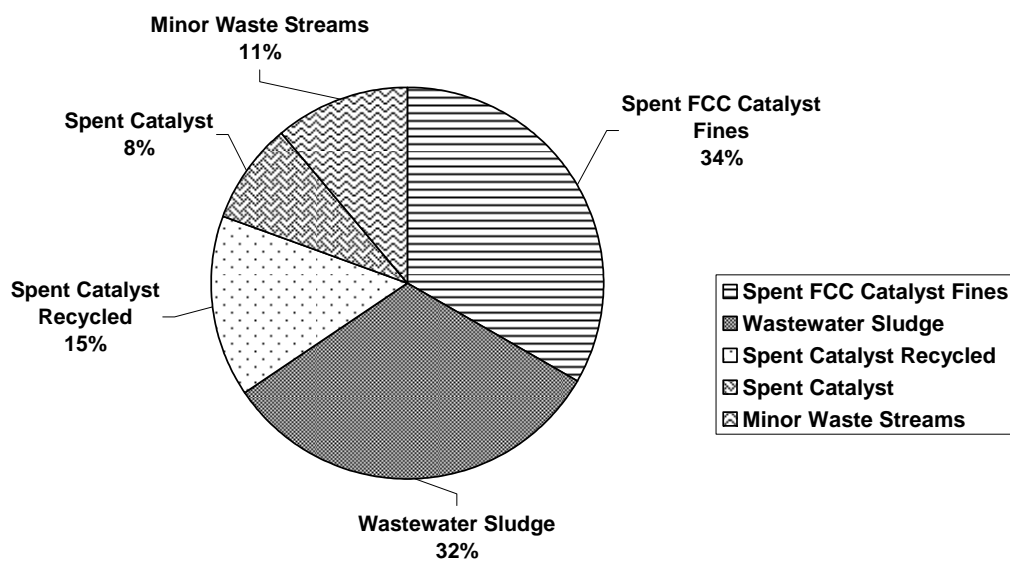


FIGURE 1-B. Category B Wastes for BP West Coast Products, Carson Refinery 2002 Reporting Year.

CHEVRON U.S.A., INCORPORATED
EL SEGUNDO REFINERY
EPA ID: CAD 008 336 901

A. Site Information

The Chevron El Segundo Refinery is located within the city of El Segundo, in Los Angeles County, approximately 15 miles southwest of downtown Los Angeles. The refinery covers approximately 1000 acres and is bordered on the south by Rosecrans Avenue, on the north by El Segundo Boulevard, on the east by Sepulveda Boulevard and on the west by Vista Del Mar and Santa Monica Bay. The refinery employs approximately 1400 full time employees and contractors. The majority of full-time employees work in manufacturing and production, while the remainder perform marketing, warehousing, and finance duties. The refinery was first built in 1911 on undeveloped land. The original facility processed 5,000 barrels of crude oil per day and primarily produced kerosene. Over the next 30 years the product line expanded to include asphalt, fuel oil, gasoline, and aviation fuel. The major units operated during this period were crude distillation units, a cracking plant, a sulfur dioxide plant, and boilers for steam generation. In 1942 the butadiene and alkylation plants were added. Between 1950 to 2002, Chevron modernized and upgraded the refinery by adding several processes and plants. In addition to producing the transportation fuels, the refinery is able to recover sulfur and ammonia compounds and produce elemental sulfur and aqueous ammonia. The refinery has a crude oil processing capacity of 260,000 barrels per day. (California Energy Commission data-2002)

B. Accomplishments

Category A Wastes

Chevron El Segundo Refinery did not report any Category A wastes during 1995-1998 and 1999-2002 SB 14 four year cycles.

Category B Wastes

Total Category B waste increased from 49.376 million pounds in reporting year 1998 to 49.766 million pounds in reporting year 2002. This is an increase of 0.8 percent. Chevron El Segundo Refinery identified Oil Water Separation Sludge (CWC 222) as its only major hazardous waste stream during 1998 reporting year and it achieved a substantial reduction (approximately 13 percent). Chevron also discussed the status of two minor waste streams, Spent Catalyst (CWC 162) and Sandblasting Material (CWC 181).

1. Oil Water Separation Sludge (CWC 222)

Chevron reported that during 1998 oil water separation sludge was its single Category B major waste stream. The majority of this waste is generated by the refinery's on-site wastewater treatment processes. The major sources for this stream are the effluent treatment plant, segregated drains, American Petroleum Institute (API) separators, and effluent treatment feed tanks.

According to Chevron's 2002 SB 14 "Hazardous Waste Management Performance Report (Report)", the most effective means for reducing this sludge is to recycle it. Chevron called this recycling approach miscellaneous oily sludge coking (MOSC). The refinery continues to use its on-site MOSC. In this process, oil is recovered and returned to the refining process, while solids become part of the refinery's coke product.

2. Spent Catalyst (CWC 162)

Although a minor (<5 percent) waste stream, during the 1998 reporting year, spent catalyst was identified as the refinery's second largest waste stream. It has been identified as a major waste stream in the current 2002 SB 14 source reduction plan. Chevron compared the waste generation quantities for 1998 and 2002 and noted a difference of 93 tons--an increase of approximately 13 percent. Chevron reported a four year average of 825 tons that were generated during the years 1999 through 2002. In its 1999 Source Reduction Evaluation Review and Plan (Plan), Chevron mentioned that the source reduction options are limited for spent catalyst and much effort has been dedicated to come up with the current optimal catalyst types used at present. It further mentioned that potential waste reduction opportunities cannot compete with the economic benefits of current catalyst use. The only measure implemented from the 1999 Plan was off-site recycling to reclaim heavy and/or precious catalyst metals. The refinery recycled an average of 30 percent of its spent catalyst at the end of 1998. Over the last four years ending 2002 the refinery increased their average annual catalyst recycling to 57 percent. In 2001 and 2002 the recycling average was greater than 80 percent. According to Chevron, off-site recycling of spent catalyst is the most prevalent and cost-effective means to manage this waste stream.

3. Sandblast Material (CWC 181)

Sandblast material was also identified as a minor 1998 waste stream. Like spent catalyst, Chevron compared sandblast waste generation for 1998 and 2002 and noted an annual increase of 57 tons. This was an increase of 19 percent between 1998 and 2002. Chevron reported a four year average of 356 tons generated during the years of 1999-2002. The refinery mentioned that the best source reduction approach for this waste stream is to use an alternative blasting material that does not contain metal slag. Chevron began using a blasting material comprised primarily of iron calcium silicate. Chevron found that this material was not effective for all applications. A significant volume of silica sandblast media was used in the refinery which was disposed of as non-hazardous waste. Despite making progress in reducing hazardous waste, there

was an increase in the volume of sandblast waste overall during the 1999-2002 reporting cycle. This was attributed to these three factors: new construction/plant upgrades, repainting of major equipment, and tank inspections/cleanings.

C. Projections

In its Summary Progress Report (SPR), Chevron mentioned that it did not generate any Category A waste but generated close to 50 million pounds of Category B waste in the 2002 reporting year. The refinery reported two major waste streams and selected one source reduction measure for implementation for one of the two major waste streams during the 2003-2006 projection period. Figure 2 shows the types and quantity of Category B wastes that Chevron El Segundo reported for 2002.

Category A Wastes

None

Category B Wastes

The following are the two major Category B waste streams identified during the 2002 reporting year.

1. Oil/Water Separator Sludge (CWC 222)

Chevron reported that more than 39 million pounds of this waste was generated during the 2002 reporting year and it projected to reduce this amount approximately two million pounds annually by implementing the following measures:

- (a) On-site recycling via MOSC.
- (b) Augment the MOSC process with a crusher/grinder: "Non-pumpable" sludge cannot be sent to the "MOSC" process. This type of sludge has historically been sent off-site for disposal. Adding a "collider" type crusher/grinder would enable the refinery to send this type of sludge to the coker in lieu of off-site disposal.
- (c) Continue the drain inspection and maintenance program: This measure was originally mentioned in the 1999 Plan. This program removes sand sources entering the drain system thus reducing wastewater sludge formation. The refinery plans to continue with this program during 2003-2006 period until the second half of the unsegregated system is complete.
- (d) Repair landscaping and berms: The repair of refinery berms and stabilization of refinery landscaping will help reduce the amount of solids entering the wastewater drainage system and therefore reduce generation of oil/water separation sludge.

2. Other Spent Catalyst (CWC 162)

Chevron reported 1.65 million pounds of this waste generated in the 2002 reporting year. The refinery plans to continue recycling spent catalyst to reclaim the heavy and precious metals as a means to effectively manage this waste stream. No projection was made for this waste.

Chevron El Segundo Refinery Category B Wastes 2002 Reporting Year

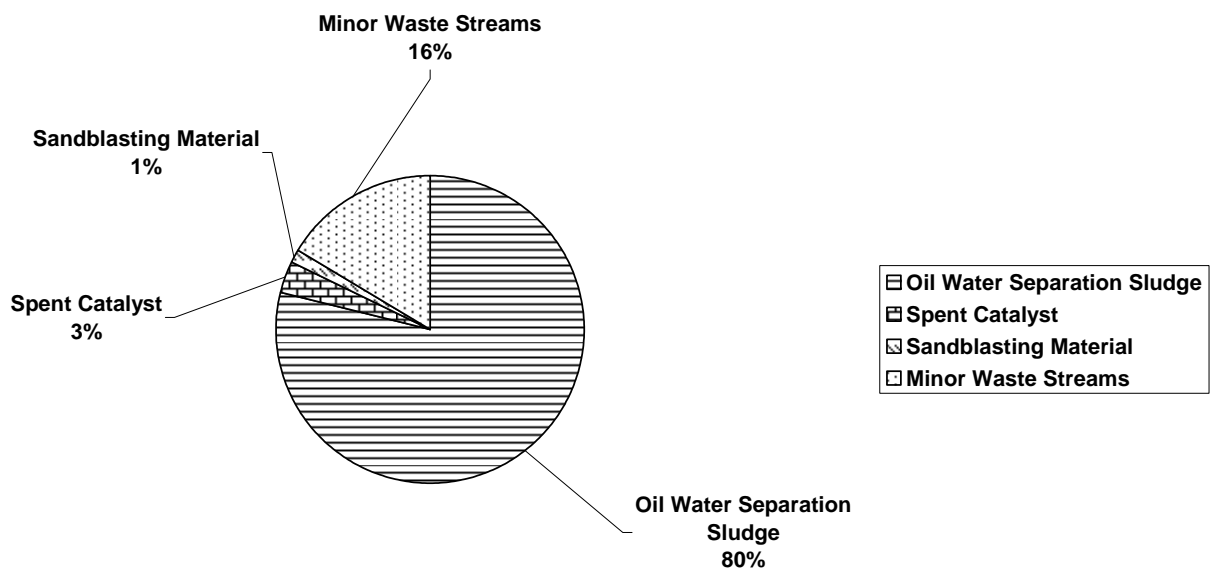


FIGURE 2. Category B Wastes for Chevron El Segundo Refinery 2002 Reporting Year.

CHEVRON RICHMOND REFINERY

EPA ID: CAD 009 114 919

A. Site Information

Chevron Richmond Refinery is located in Richmond, California. This facility distills crude oil and produces motor gasoline, jet/aviation fuel, diesel fuel, sulfur, fuel oil, lube oil, and liquefied petroleum gas. The refinery is in business at the present location for the last 101 years. During 2002, it employed 1200 people.

B. Accomplishments

Chevron Richmond marked several pages as “Confidential Business Information” in its 2002 SB 14 documents. These pages contain key information such as: waste generation quantities, source reduction and other waste management related activities on their past major waste streams. It is surprising and disappointing that this refinery wants to withhold such important information of their waste generation and source reduction activities while the same type of information was shared very willingly by the rest of the 16 refineries through their SB 14 documents. The Department of Toxic Substances Control (DTSC) chose not to use those pages marked as “confidential” using instead its Summary Progress Report (SPR). It is DTSC’s recommendation that Chevron (and other refineries) should not mark pages containing above mentioned information as “Confidential Business Information” in their future SB 14 documents. Rather publishing this information enables a refinery to assume a leadership role to encourage others to do likewise to reduce waste. This is the founding spirit of SB 14. The following source of information is gathered from Chevron’s SPR:

Category A Wastes

Chevron Richmond Refinery did not report any Category A wastes during 1995-1998 and 1998-2002 SB 14 four year cycles.

Category B Wastes

Chevron Richmond Refinery reported their total Category B wastes as more than 10 million pounds for 1998 and 8.6 million pounds for the year 2002. The refinery discussed the following four waste streams in its performance report and SPR: 1) API separator sludge and primary/secondary sludge (CWC 222); 2) Spent hydroprocessing catalyst (CWC 162); 3) Spent FCC (Fluid Catalytic Cracking) catalyst (CWC 161); and 4) Process equipment solids (CWC 352).

1. API Separator Sludge and Primary/Secondary Sludges (CWC 222)

Chevron Richmond Refinery generated more than 5.85 million pounds of this waste in 1998. The refinery reduced close to 1.35 million pounds of the sludges. This reduction was achieved by implementing the following two measures:

- (a) Chevron Richmond Refinery sent oily sludge to its sister refinery in El Segundo, California as feed for their coker. However, this measure was discontinued in 2002 due to lack of coker capacity. During the years 2000 and 2001, more than million pounds were recycled in the coker.
- (b) Chevron segregated calcium bearing wastewaters from phosphate bearing wastewater to prevent the formation and deposition of calcium phosphate solids in the wastewater treatment system. Each segregated stream was treated separately. Total anticipated waste deposition reduction was 42,000 pounds per year.

2. Spent FCC (Fluid Catalytic Cracking) Catalyst (CWC 161)

Chevron generated close to 235,000 pounds of this waste in 1998. Since this was not one of their major waste streams during 1998, Chevron did not conduct source reduction evaluation for this waste stream in 1998.

3. Arsenic-Contaminated Process Equipment Solids (CWC 352)

Chevron reported that this was not one of their major waste streams in 1998; therefore they did not conduct source reduction evaluation of this waste.

4. Spent Hydroprocessing Catalyst (CWC 162)

The refinery generated more than 2.5 million pounds of this waste during 1998. It successfully reduced close to 1.1million pounds during 1998-2002. This reduction was achieved by implementing the following two measures:

- (a) Chevron Richmond regenerated spent hydrotreating catalyst for reuse. Although recycling is not source reduction, 14 percent was regenerated for reuse.
- (b) The refinery eliminated the cement processing of self-heating catalyst and reduced 30 percent of this waste.

C. Projections

Chevron Richmond marked several pages as “Confidential Business Information” in its SB 14 2002 Source Reduction Evaluation Review and Plan (Plan). These pages contain key information such as waste generation quantities, source reduction and other waste management related activities on their current major waste streams. It is

surprising that this refinery wants to withhold such important information of their waste generation and source reduction activities while the same type of information was shared very willingly by the balance of the 16 participating refineries. DTSC is therefore not using those pages marked as “Confidential Business Information” instead using Chevron’s SPR. It is DTSC’s recommendation that Chevron (and other refineries) should not mark pages containing above mentioned information as “Confidential Business Information” in future SB 14 documents. The following source of information is gathered from Chevron’s SPR:

Category A Wastes

Chevron Richmond Refinery did not report any Category A wastes during 2002.

Category B Wastes

Chevron Richmond Refinery reported that it generated more than 8.6 million pounds of Category B waste during 2002. Chevron Richmond Refinery discussed the following four waste streams in its Plan and SPR: 1) API separator sludge and primary/secondary sludge (CWC 222); 2) Spent hydroprocessing catalyst (CWC 162); 3) Spent FCC catalyst (Fluid Catalytic Cracking) (CWC 161); and 4) Process equipment solids CWC 352. Figure 3 shows the types and quantity of Category B wastes that Chevron Richmond reported for 2002.

1. API Separator Sludge and Primary/Secondary Sludge (CWC 222)

Chevron Richmond generated 1.73 million pounds of this waste during 2002. The refinery projected a reduction of approximately 130,000 pounds by implementing the following three measures by December 2003:

- (a) Chevron planned to send this waste to an off-site facility for biological treatment to reduce hazardous organic constituents.
- (b) Increase street sweeping to prevent clean soil entering into process sewers where it can mix forming oily sludge hazardous waste.
- (c) Direct clean storm water directly to the bay, avoiding the refinery’s effluent treatment system.

2. Spent FCC (Fluid Catalytic Cracking) Catalyst (CWC 161)

Chevron Richmond generated 2.3 million pounds of this waste during 2002. The refinery is planning to send the entire quantity to an off-site Portland cement kiln. The spent catalyst will be used for its alumina and silica content as substitute feedstock in the kiln. Chevron reported that this option will reclassify the spent catalyst as a feedstock, thus exempting it as a waste.

3. Spent Hydroprocessing Catalyst (CWC 162)

The refinery generated over two million pounds of this waste. While not source reduction, the refinery reported that approximately ten percent of this quantity will be reduced by sending it off-site for regeneration and reuse.

Extremely Hazardous Waste

4. Arsenic-Contaminated Process Equipment Solids (CWC 352)

Chevron Richmond generated 205 pounds of this extremely hazardous waste during 2002. Chevron reported that this waste stream is generated only once every eight to ten years during maintenance operations.

D. Remarks

Chevron reported that from 1986 to 1998, the refinery reduced the off-site disposal of their routinely generated hazardous waste by more than seventy five percent. This success is attributed to several factors including decreasing waste sources, recycling, treatment and using less hazardous materials. Chevron further reported that between 2002 and 1998 the total amount of routinely generated waste was reduced by twenty percent. According to Chevron, this success is attributed to yearly variations, recycling and classification of spent carbon as non hazardous waste.

In July 2005 Chevron Richmond refinery voluntarily retracted its designation of all pages as noted as "Confidential Business Information" from its 2002 SB 14 documents as mentioned on pages 34 and 35 of this chapter.

Chevron Richmond Refinery Category B Wastes 2002 Reporting Year

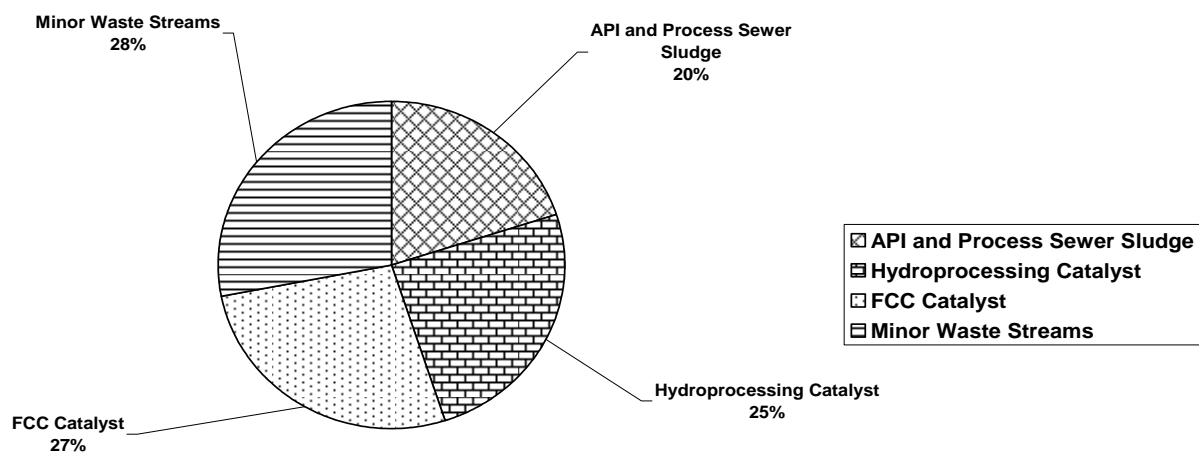


FIGURE 3. Category B Wastes for Chevron Richmond Refinery 2002 Reporting Year.

CONOCOPHILLIPS LOS ANGELES REFINERY (LAR)

**EPA ID: CAD 980 881 676
CAD 008 237 679
CAT 000 611 228**

A. Site Information

The ConocoPhillips Los Angeles Refinery (LAR) consists of the Carson Plant (LARC), Wilmington Plant (LARW), and Marine Terminal (LARMT). ConocoPhillips has operated LAR since January 2003 after a name change resulting from the merger with Phillips in August 2002. Before becoming ConocoPhillips, Tosco Corporation operated LAR from September 2001 to August 2002 as a wholly owned subsidiary of Phillips after the acquisition in September 2001. Tosco operated LAR from April 1997 to September 2001.

LARC consists of 224 acres and is located in Los Angeles County. The facility is located in a heavily industrialized area. The Carson plant was originally constructed by Shell Oil in 1923. Shell Oil operated the Carson plant from 1923 to December 1991 when it was sold to Unocal. Unocal operated the plant from December 1991 through March 1997.

At the year-end 2002, the Carson Plant (LARC) employed approximately 125 full time employees. The number of LARC employees does not vary with the season, although a variable number of contractor employees are present on site at any one time.

The crude charge rate increased from an average of 131,000 barrels per stream day (bpsd) in 1998 to 135,000 bpsd in 2002.

The Wilmington Plant (LARW) consists of 400 acres and is located in Los Angeles County. Unocal operated the LARW from 1919-1997. This Wilmington site was originally was purchased by the Union Oil Company in 1916.

At year-end 2002, the Wilmington Plant employed approximately 400 full time employees.

The Marine Terminal (LARMT) consists of 13.5 acres and is located in Los Angeles County. Unocal operated the plant from 1929 to 1997. The LARW employee total presented above includes the number of LARMT employees.

B. Accomplishments

ConocoPhillips, in its 1998 SB 14 documents identified four major waste streams and proposed ten different source reduction measures. The refinery summarized in detail all

the waste management approaches for all four major waste streams, including treatment, recycling, and landfilling.

Category A Wastes

1. Aqueous Streams with Selenium (CWC 132)

The quantity of selenium-contaminated sour water generated, increased from 3.00 billion pounds in 1998 to 3.62 billion pounds in 2002-an increase of approximately 21 percent. This flow increase is attributed to both the increase in refinery production during the reporting period and more accurate sour water flow monitoring. LAR applied the following two source reduction measures during 1998-2002 period:

- (a) In 2002, LARC installed a vacuum pump to replace the third stage ejectors on the vacuum unit flasher. This enhancement reduced sour water makeup and waste by approximately 240,000 pounds/day (88 million pounds/year).
- (b) A feasibility study was completed in 2002 at the LARC hydrotreaters that has prompted the plant to begin engineering designs for routing stripped sour water to water wash in these units. Using stripped sour water for water wash reduces the amount of water taken from the reverse osmosis (RO) treatment facility, thereby reducing RO treatment costs and backing out clean make-up water from use as wash water. The estimated sour water re-use for this project is 1.26 million pounds/day (460 million pounds/year).

The facility started a steam optimization/minimization study in the LARC crude unit. By reducing the live steam production, the facility minimizes make-up water and sour water generation. This feasibility study will continue into the 2003-2006 reporting period.

Category B Wastes

1. Spent Catalysts (CWC 162)

Spent catalyst generation decreased from 1.6 million pounds in 1998 to 1.3 million pounds in 2002. This estimate may have been impacted by the spent catalyst generation estimating technique; estimates were derived by averaging catalyst disposal weights over the four year period from 1999 to 2002.

At LARC, one of the primary job functions of the process and operations engineers is to ensure that the longest run lengths are obtained between catalyst change-outs. Due to the significant expense involved in catalyst change-outs, including production loss, fresh catalyst purchase, catalyst unloading maintenance, and catalyst disposal, it is in the refinery's interest to generate the minimum amount of spent catalyst.

During the 1999 to 2002 period, the following engineering activities took place to increase catalyst run times, thereby reducing catalyst waste generation.

- LAR replaced pneumatic instrumentation with digital control systems (DCS) for the fluid catalytic cracker (FCC), alkylation, hydrocracking, jet hydrotreating, and diesel hydrotreating units. The DCS interface has allowed the process engineers to use their desktop personal computers to analyze real time unit data such as particulate in feed, sulfur content in product, jet fuel haze, aromatic content, recycle gas purity, pressure, temperature, and other important parameters. Additionally, a refinery data management system has been established electronically. This data management system allows the process engineers to access historical one-minute snapshot data for critical trend analyses.
- LAR instituted graded bed technology (GBT) for several of its catalyst systems. GBT incorporates a sacrificial catalyst bed that minimizes particulates and other poisons/impurities to the remaining bulk of the catalyst bed. The physical and chemical composition of the sacrificial bed is selective for catalyst impurities thereby minimizing the impurities from entering the remaining catalyst mass and increasing overall catalyst life.

2. Stretford/Sulfur Waste (CWC 181)

The quantity of Stretford waste that was generated increased from 3.15 million pounds in 1998 to 4.12 million pounds in 2002. An increase of 30 percent. All of the Stretford waste was land disposed.

The increase in the Stretford waste was attributed to the following two factors:

- (a) LAR changed the operation of their tail gas unit (TGU). LAR decided to use plate and frame filter press system in lieu of its in-process Stretford/sulfur separation tank (or autoclave). The autoclave is the limiting factor in LARW's sulfur recovery operations. In order to extend run time of the sulfur processing units, the autoclave was bypassed via the filter press operations, which creates more waste than autoclave operations.
- (b) The sulfur loading to the TGU was increased due to maintenance activity at the sulfuric acid regeneration plant (Unit 141) in 2002. During that year Unit 141 experienced maintenance activities that created 106 down days, an unusually long period. In the absence of sulfuric acid regeneration, more sulfur was sent to the TGU and hence rejected as Stretford/sulfur waste.

LAR implemented the following two source reduction measures during 1998-2002 period:

- (a) Increased Unit Run Lengths: Although bypassing the autoclave has resulted in a net increase in Stretford waste, the consequential increased unit run time has

also benefited waste reduction by minimizing the amount of Stretford/sulfur solids generated. Many process and mechanical variables were also improved or repaired during the reporting period. Currently, the sulfur and tail gas units' run time has exceeded 20 months, thereby minimizing the amount of residual waste that has coated the process vessels, which must be removed during planned or unplanned maintenance events.

- (b) On Site Recycling: As part of the tail gas unit design, Stretford solution is continuously recycled. Stretford recycling occurs via a Stretford/sulfur separation tank followed by a plate and frame filter press.

3. Blasting Grit (CWC 181)

The quantity of blasting grit waste decreased from 135,000 pounds in 1998 to close to 90,000 pounds in 2002, a reduction of 33 percent. All of this blasting grit waste was landfilled.

LAR implemented the following two source reduction measures during the 1998-2002 period:

- (a) Tank blasting contract procedures: LAR revised its tank blasting procurement procedures to include provisions for waste minimization by providing recyclable blasting grit for certain projects. Large tank blasting jobs now contain provisions for waste limits per job. In some cases contractor compensation is actually reduced if excess waste is generated during a tank blasting project. These strict contract provisions are reserved for larger projects, and non-recyclable grit is still used for routine small jobs.
- (b) Additives to reduce lead leachability: In 2002, ConocoPhillips began investigating the viability of mixing additives with blasting grit that would reduce the leachability of lead wastes, thereby rendering the grit non-hazardous. At the time of SB 14 document preparation, the project was in pilot stage. LAR is planning to review this measure during the 2003-2006 reporting period.

4. High Specific Gravity Organic Sludges (CWC 352)

The quantity of organic sludges decreased from 237,000 pounds in 1998 to 233,000 pounds in 2002, a decrease of 1.7 percent. All of this waste was disposed by incineration.

The following source reduction measures were implemented during the 1998-2002 period:

- (a) Tank farm modifications: LAR continued to implement tank farm modifications whereby gravel is placed in the vicinity of drain openings in order to minimize the amount of solids that can enter the sewer system. Additionally, small areas

surrounding the sewer openings have been asphalt paved and provided with a lip berm to further impede solids. These modifications have minimized the amount of tank farm dirt that could otherwise add to the volume of oily sewer sludges generated during rain events.

- (b) Optimizing use of coker sludge injection system (SIS): LAR transfers organic sludges from the wastewater system components and tank bottoms to the coker sludge injection system (SIS). LARW sludge processed at the LARC coker decreased from 8.5 million pounds in 1998 to 4.5 million pounds in 2002. This is a decrease of 47 percent.

During 2000, LAR completed several projects that facilitate high specific gravity sludge processing in the coker. In the past, LAR had to dispose significant volumes of high specific gravity sludges. During the 1998-2002 period, LAR enhanced its sludge processing system with the following improvements.

- Sludge transfer from vacuum trucks to the SIS was facilitated by installing electric grinders for use as unloading shredders. In the past, sludges vacuumed from tanks/vessels would sometimes be difficult to pump from vacuum trucks into the SIS. The shredding mechanisms eliminated most of the problems associated with such transfers.
- New pumps were installed at the LARC sludge storage tank 2518. Tank 2518 is the final holding tank prior to injection into the SIS. These new pumps were designed to transfer high specific gravity sludges that had previously been impossible to process because of pump limitations.

C. Projections

LAR generated 3.7 billion pounds of SB 14 applicable Category A (aqueous) waste and 6.7 million pounds of SB 14 applicable category B (non aqueous) waste during 2002. LAR's major waste streams during 2002 were as follows: (1) Aqueous Solution with Metals (CWC 132); (2) Spent Catalyst (CWC 162); and (3) Inorganic Solid Waste (CWC 181). LAR conducted a very careful screening of ten source reduction measures for the above listed major waste streams and one minor waste stream. The detail discussion of these ten source reduction measures follows. Figure 4-A shows the types and quantity of category A wastes that LAR reported for 2002.

Category A Wastes

1. Aqueous Solution with Metals (CWC 132)

This waste contains selenium and has been estimated from direct measurement of the inlet flow meters to the sour water strippers at both LARC and LARW. Selenium occurs naturally in crude oil. Some selenium is removed by refinery processes and eventually flows to the sour water handling systems.

The refinery evaluated the following four source reduction measures and selected two:

- (a) Use of stripped sour water for wash water in the diesel hydrotreater (DHT): Stripped sour water will replace approximately 105 gallons per minute of water that would otherwise originate from the reverse osmosis unit and condensate. Use of stripped sour water as wash water in diesel hydrotreaters is a common practice in fully integrated refineries such as LAR. However, stripped sour water must not create undue corrosion in the DHT. The refinery estimated annual waste management savings of \$379,000. The pre-tax payback period is estimated as less than 0.5 year.
- (b) Return the LARC sour water stripper reboiler back to service: The existing LARC sour water stripper reboiler is out of service. If bought back on-line, the reboiler may be able to minimize live 50 psi steam use (300 million pounds annually), which is now being used in the stripping tower without condensate recovery. LAR would minimize the amount of live steam contaminated with sour water. The reboiler was taken off-line in the late 1980s due to fouling problems that would curtail stripper operations numerous times per year. LAR is planning to investigate a new reboiler or the use of an enhanced anti-fouling treatment program. If successfully implemented, this measure can save annually \$355,000 with a pre-tax payback period of less than 0.5 year.
- (c) Review sour water handling system to identify potential flow reduction: LAR has rigorous programs to optimize the use of stripping steam in product towers and other applications that generate sour water. These programs include preparation of standard operating procedures and product analytical testing. LAR has allocated numerous resources such as process engineering, mechanical engineering, and maintenance to minimize sour water generation.
- (d) Compare stripped sour water use with other ConcoPhillips refineries: LAR has created best practices manuals for numerous refinery operations, including minimizing live steam use and sources of sour water.

LAR projects reduction of approximately 660 million pounds of this waste during 2003-2006 period.

Category B Wastes

Figure 4-B shows the types and quantity of category B wastes that LAR generated in 2002.

1. Spent Catalysts (CWC 162)

LAR generated 1.3 million pounds of this waste during 2002. The following measures were selected for implementation during 2003-2006 period.

- (a) Optimize unit process parameters to maximize catalyst run lengths: LAR employs process engineers for all process units. One of the primary functions of the process engineers is to ensure the longest run length is obtained between catalyst changeouts. The engineers review feed conditions, process operating variables including recycle hydrogen concentration, reactor pressure, reactor temperature to ensure that the reactor is operating under optimum conditions. Due to the significant expense involved in catalyst changeouts, it is in LAR's best interest to generate a minimum amount of spent catalyst. LAR will continue to identify any significant changes to the operations or types of catalysts that could reduce the quantity or toxicity of the spent catalyst generated.
- (b) Replace pneumatic catalyst instrumentation with digital control systems: During the 2003-2006 period, LAR is planning to replace pneumatic instrumentation with digital control systems (DCS) at its four catalyst units. This project is a major capital expenditure for LAR that has implications well beyond waste minimization. The DCS interface allows the process engineers to use their desktop personal computers to analyze real time catalyst data such as particulate in feed, product sulfur content, jet fuel haze, aromatic content, recycle gas purity and several other important parameters. Additionally, the DCS system allows the refinery to access an electronic data management system. This data management system allows the process engineers to access historical one-minute snapshot data for critical trend analyses. The overall benefit of these new systems is to minimize the impact on catalyst life due to abnormal unit operations thereby increasing catalyst runs and minimize hazardous waste generation.

By implementing the above listed measures, ConocoPhillips estimates a reduction of 260,000 pounds (20 percent) during the 2003-2006 period.

2. Inorganic Solid Wastes (CWC 181)

- (a) Sulfur plant replacement feasibility study: At LAR, 86 percent of CWC 181 waste stream is composed of sulfur solids and Stretford sulfur wastes that originate from Beavon Stretford tail gas unit (BSTGU), which is located at the Wilmington plant. LAR is conducting a feasibility study to replace the BSTGU with a selective amine based technology, thereby eliminating Stretford and sulfur solid waste generation. Amine based TGUs generate a nominal amount of waste annually. The operational cost estimation for the amine based technology is only three percent of the existing BSTGU process. One of the most common amine based TGU is the Shell Claus off-gas treatment (SCOT) unit. The SCOT unit typically uses methyldiethanolamine (MDEA) and its salts as the sour gas absorbent. The MDEA is regenerated on site, approximately ten percent of which must be replaced annually. LAR operates a SCOT unit at the Carson Plant. Replacing the two existing BSTGU facilities with selective amine technology would result in a capital expenditure exceeding \$20 million. Due to the complex nature of this project, LAR predicts that it would require at least three years to analyze this option in detail.

- (b) Install instrumentation that effectively monitors and controls H₂S:SO₂ ratios: Increased SO₂ concentrations results in decreased sulfur production to the sulfur pits. SO₂ contaminates Stretford solution and results in higher thiosulfate concentrations. Proper H₂S/SO₂ ratios prevent sooting of catalysts in the Clause beds. Currently approximately ten percent of the potential sulfur generation is entrained in the Stretford. Instrumentation that monitors/controls H₂S/SO₂ ratios could reduce this loss to eight percent, thereby reducing Stretford/sulfur waste by 20 percent. Stretford waste generation in 2002 was 4.12 million pounds. Therefore potential annual waste reduction would be 824,000 pounds. LAR estimates annual waste management savings of \$106,000 and pre-tax payback period of one year.
- (c) Re-route sulfur pit off-gases to location other than cooling towers: This option proposes the redirection of sulfur pit off-gas from the evaporative coolant system to a stand-alone degassing and vapor treatment device. Although the expected change in hazardous waste generation is difficult to measure, the process engineers at ConocoPhillips estimate that 30,000 pounds of incremental Stretford waste is generated due to the existing configuration. Total waste management savings due to this measure is estimated conservatively at \$103,000. Pre-tax payback period is estimated more than seven years. Product quality will improve as greater sulfur production efficiency is realized.

3. Selenium Reduction Unit Sludges (CWC 491)

Conduct a statistical process control assessment of the selenium reduction unit: During the 2003-2006 period, LAR plans to establish procedures that will significantly optimize chemical use at the selenium reduction unit (SRU). This will help to minimize flocculants used to create the filter press cake. This will result in reduction of waste mass. LAR will use Six Sigma training method to optimize the SRU. Six Sigma uses measurement and analysis tools to minimize process variation. ConocoPhillips estimated a ten percent reduction of SRU sludges once this measure is successfully implemented.

D. Remarks

ConocoPhillips indicated that hazardous waste generation increased during 2002 due to increased crude throughput and refinery maintenance activities at the sulfuric acid regeneration plant. The crude charge rate was increased from an average of 131,000 barrels per stream day (bpsd) in 1998 to 135,000 bpsd in 2002; an increase of three percent. The crude sulfur concentration average weight percent in 1998 was 2.1 percent. During the years of 1999, 2000, and 2001 the sulfur concentration weight percent rose and dropped and rose again to 2.2, 1.9, and 2.0 respectively. In 2002 the weight percent was 2.1 as in 1998.

LAR estimated its numerical waste reduction goal as 18 percent and 17 percent for Category A and Category B wastes respectively for the 2003-2006 SB 14 cycle. LAR mentioned that these goals are based on their best estimate of waste reduction efficiency and general feasibility.

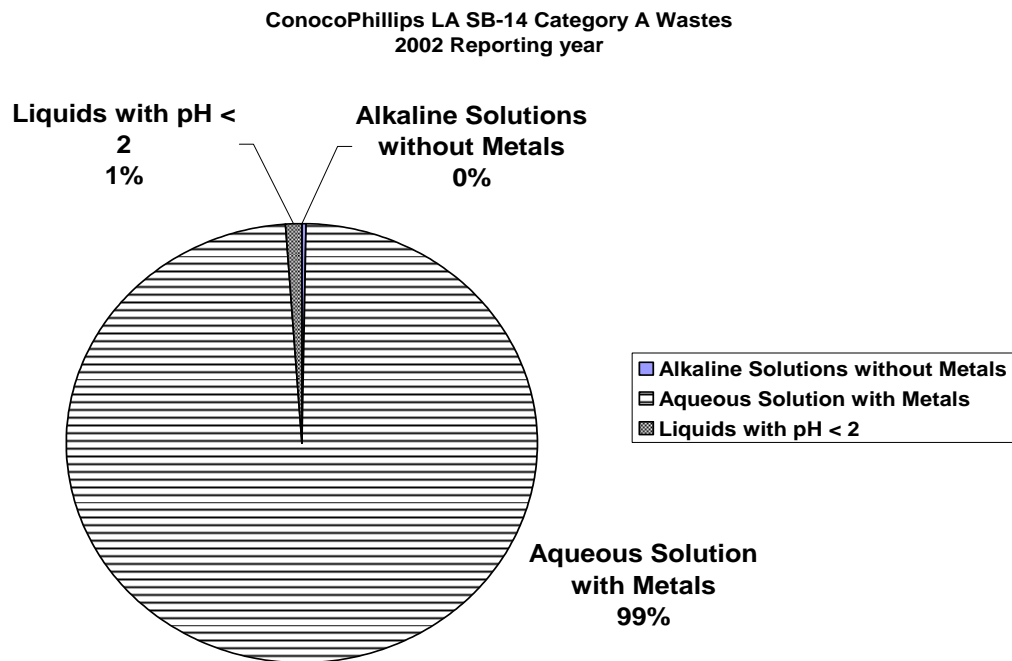


FIGURE 4-A. Category A Wastes for ConocoPhillips Los Angeles Refinery (LAR) 2002 Reporting Year.

ConocoPhillips LA SB-14 Category B Wastes
2002 Reporting year

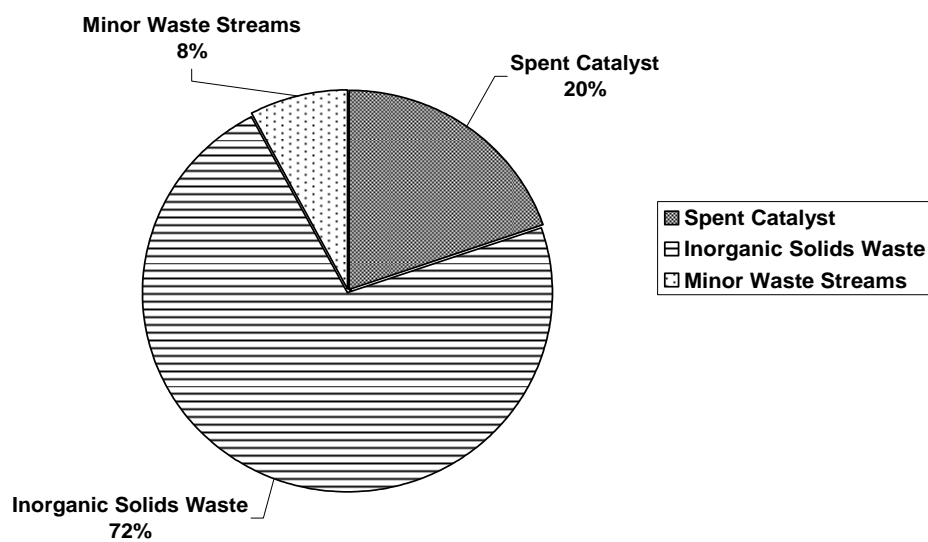


FIGURE 4-B. Category B Wastes for ConocoPhillips Los Angeles Refinery (LAR) 2002 Reporting Year.

CONOCOPHILLIPS COMPANY
SAN FRANCISCO REFINERY (SFR)
EPA ID: CAD 009 108 705

A. Site Information

The ConocoPhillips Company San Francisco Refinery (SFR) has operated in Rodeo, California for 107 years. It processes San Joaquin Valley Heavy crude oil and several low sulfur crudes, as well as several intermediate streams from ConocoPhillips Santa Maria Refinery into a variety of products including butane, various grades of gasoline, diesel fuel, jet fuel, fuel oils, sulfur, and petroleum coke. The SFR currently employs 420 full-time employees.

B. Accomplishments

The refinery reported 1.2 billion pounds of Category A waste in 2002, versus 700 million pounds in 1998, an increase of 550 million pounds. However, the Category B waste generation was reported about 11 million pounds in 2002, versus about 12 million pounds in 1998, a decrease of one million pounds.

Category A Wastes

In 1998, there were two hazardous Category A waste streams: steam power plant regeneration water (CWC 122/791) and stripped sour water (132). The San Francisco refinery generated about 250 million pounds of steam power plant regeneration water and 460 million pounds of stripped sour water in 1998.

1. Steam Power Plant Regeneration Water (CWC 122/791)

Cation and anion exchange columns are used to demineralize feed water prior to its use in the steam power plant. These columns can take hours to be regenerated and the regeneration results in a large amount of wastewater being discharged to elementary neutralization. During the regeneration cycle, the pH can range from a low of 1 to a high of 13.5. Thus, the steam power plant regeneration wastewater is classified as hazardous based on corrosivity. The low and high pH water generated from this process is used to neutralize each other. No source reduction measures have been implemented for this waste stream since 1998.

2. Stripped Sour Water (CWC 132)

The San Joaquin crude processed at the refinery contains naturally high concentrations of sulfur compounds and the metal selenium. Sour process water is treated by two sour water stripping columns. These columns strip hydrogen sulfide and other volatile compounds from the sour water. The resultant aqueous effluents, collectively known as

stripped sour water, are then conveyed for treatment. The refinery has installed a Selenium Removal Plant (SRP). In the feed tanks for this plant, the effluents converge, and the selenium is chemically precipitated and removed in the SRP. This unit renders the treated water non-hazardous prior to discharge. No feasible source reduction measures have been identified for this waste stream.

Category B Wastes

Five Category B waste streams were determined to be major streams in 1998: Stretford solution (CWC 132), spent catalyst (CWC 162), off-grade sulfur cake (CWC 181), oily trash (CWC 181), and oil/water separator sludge (CWC 222).

1. Stretford Solution (CWC132)

ConocoPhillips SFR did not report any Stretford solution in 2002, versus 1.6 million pounds in 1998. Before 1998, Stretford solution was continuously purged from the sulfur recovery process trains in order to maintain thiosulfate levels below the level where Stretford solution loses its catalytic effectiveness. The Stretford solution is no longer purged on a continuous basis. Before the thiosulfate concentration increases beyond usable levels, the Global Modified System (GLOBAL) was implemented. The Global process is a portable treatment system that regenerates Stretford solution by converting sodium thiosulfate to sodium sulfate and then removing the sodium sulfate from solution. A new evaporative cooler was installed in 2002. The Claus reaction and the verti-press operations add water during normal operation. If more water is added that can be evaporated by the coolers, then it is necessary to purge Stretford solution from the system for inventory control. By increasing evaporative capacity, less Stretford solution will need to be purged for inventory control. Consequently, Stretford solution is no longer a major waste stream in 2002.

2. Spent Catalyst (CWC 162)

SFR generated 3.6 million pounds of spent catalyst in 2002, compared to 191,000 pounds in 1998. This is an increase of nearly 20 times. In 2000 and 2002 major turnarounds were performed, resulting in significantly higher spent catalyst generation rates, as spent catalysts were replaced. Numerous refinery process units use catalyst. Spent catalysts are periodically removed from those process units during the unit turnarounds and replaced with new or regenerated catalysts. Several measures were implemented to reduce the amount of catalyst waste, these source reduction measures include:

- (a) Lengthening unit runtimes prior to catalyst change out: The uncracker uses 700,000 pounds of a new Nickel-based catalyst. The substitution of new catalyst enables a catalyst service life, doubling from 2.5 to 5 years. SFR recently implemented a catalyst service life monitoring system, which will determine specifically when the catalyst is spent and needs to be changed. In addition,

SFR estimates that the zinc-oxide catalyst will now be changed out every 4-5 years, rather than the previous 2.5 to 3 years.

- (b) Catalyst regeneration in favor of disposal: In some units, the spent catalyst is no longer disposed. Rather it is regenerated off-site and reused.
- (c) Use of low density catalysts: The use of low density catalysts will reduce the total generation of catalyst waste, without negatively affecting the process. Units that originally had used 88,000 pounds of catalyst will now require only 66,000 pounds of the new density catalyst.

3. Off-Grade Sulfur Cake (CWC 181)

ConocoPhillips SFR generated 5 million pounds of off-grade sulfur cake in 2002, versus 2.4 million pounds in 1998. This is a reduction of 52 percent. Sulfur is generated at the verti-press filters in the Stretford plant. When the filters work properly, Stretford solution is effectively separated from the sulfur cake. An “on-grade” sulfur cake is produced as the product. However, when the filters do not work efficiently, the Stretford solution is inadequately removed. The resulting off-grade sulfur cake contains vanadium at concentrations exceeding the hazardous waste criteria. SFR reduced water wash cycles at the verti-press operation, which contributed to increases in off-grade sulfur. The source reduction measures implemented since 1998 were:

- (a) Optimization of the verti-press filters operation: Certain problems such as bypassing the seals have been noted for the two verti-press filters. SFR continuously strives to optimize the operation of the filters. The goal is to schedule a planned maintenance to include change-out of the filter belts and total filter overhaul. Optimization of the verti-press filters through improved reliability will reduce the amount of off-grade sulfur cake produced.
- (b) The installation of a new evaporative cooler: The new cooler allows for better evaporation rates, allowing more wash water to be processed in the system. Adding more wash water cycles at the verti-press will rinse out and reduce vanadium levels in the sulfur cake.

4. Oily Trash (CWC 181)

ConocoPhillips SFR reported 561,000 pounds of oily trash waste in 2002, versus 1.5 million pounds in 1998, a reduction of 63 percent. Examples of oily trash include oily dirt, debris, oily rugs, booms, sludge, sweepings and small quantities of sandblast grit. The source reduction measure implemented since 1998 was the training of ConocoPhillips personnel. All refinery employees are required to complete annual training, which includes a section on waste minimization. The training focused on promoting good housekeeping reactions that have effectively resulted in significant reduction of this waste since 1998.

5. Oil/Water Separator Sludge (CWC 222)

ConocoPhillips SFR generated about 6,000 pounds of this waste in 2002, as compared to 4.8 million pounds in 1998. The higher than normal amount produced in 1998 was due to cleaning operations at Unit 100. The reductions in 2002 reflect the increased recycling of oil/water solids to the coker. Maximizing solids recycling to the coker has significantly reduced off-site waste disposal while producing petroleum cake product.

C. Projections

The refinery projected a five to ten percent waste reduction for all major waste streams. For the 2002 reporting year, ConocoPhillips SFR had two major streams contributing to its Category A waste generation and four major waste streams contributing to Category B generation.

Category A Wastes

Two Category A waste streams are considered major for the reporting year: steam power plant regeneration water and stripped sour water. Figure 6-A shows the types and quantity of ConocoPhillips SFR Category A wastes reported for 2002.

1. Steam Power Plant Regeneration Water (CWC 122/791)

ConocoPhillips SFR generated 320 million pounds of steam power plant regeneration water in 2002. The refinery projects an annual source reduction of 32 million pounds for this waste stream. The following source reduction alternatives were considered:

- (a) The installation of a reverse osmosis unit (RO) upstream of the ion exchange columns: An RO unit will decrease the frequency of ion exchange bed regeneration. This could substantially decrease the quantity of hazardous waste at this plant.
- (b) Increase condensate recovery at the steam power plant: Increasing the amount of clean steam condensate returned to the steam power plant will reduce the amount of regeneration water since fewer regeneration cycles would be required. This alternative must be further evaluated for both technical and economic feasibility.
- (c) Maintain pH at Non-Hazardous Levels: If the regeneration process can be accomplished without having the pH of the regeneration water attain hazardous status (pH <2 or pH >12), this waste would be eliminated.

2. Stripped Sour Water (CWC 132)

ConocoPhillips SFR generated 960 million pounds of stripped sour water in 2002. The refinery identified no operational or administrative alternatives that would reduce sour water generation at the facility in 2002.

Category B Wastes

The refinery documented a total of 43 hazardous waste streams in its 2002 source reduction plan. Eleven out of these 43 wastes were identified as exempt from SB 14. Four out of the remaining 32 Category B waste streams were determined to be major streams in 2002: spent catalyst (CWC 162), off-grade sulfur cake (CWC 181), oily trash (CWC 181), and catacarb solution (CWC 342). Figure 6-B shows the types and quantity of ConocoPhillips SFR Category B wastes reported for 2002.

3. Spent Catalyst (CWC 162)

The refinery generated 3.5 million pounds of spent catalyst waste in 2002. The refinery projects an annual source reduction of 60,000 pounds for this waste stream. The following alternatives are continuously evaluated:

- Production process changes:
 - Use new and improved catalysts to lengthen unit runtimes between catalyst changeouts.
 - Maximize unit runtimes.
 - Regenerate and/or reuse catalysts.
 - Substitute lower density catalysts.

4. Off-Grade Sulfur Cake (CWC 181)

The refinery generated five million pounds of this waste in 2002. The refinery reported that they project an annual reduction of 500,000 pounds of this waste. The source reduction measures selected to be implemented by 2006 include the following operational improvements:

- (a) The installation of a new evaporative cooler: In March 2002 a new more efficient evaporative cooler was installed in the sulfur process unit. This new cooler has increased the ability to remove water from the circulating Stretford solution. This reduces the total Stretford inventory and allows for an increase in the verti-press wash water cycles. This increased wash water cycles reduces the amount of vanadium left in produced sulfur cake, thus enabling its safe as a commercial product.
- (b) Scheduled maintenance on the verti-press filter belts: The refinery's maintenance reliability group reviewed historical data of the verti-press filters and have made recommendations to change the filter belts every five months.

Additionally, the group recommended the performance of a total filter overhaul once per year.

5. Oily Trash (CWC 181)

The refinery generated 561,000 pounds of oily trash waste in 2002. The refinery projects an annual source reduction of 30,000 pounds for this waste stream and proposes this reduction by implementing the following administrative measure by 2006: Institute a training program to educate employees on methods to segregate and properly manage industrial trash. In this way, wastes once allowed to commingle with hazardous materials will be segregated for disposal as nonhazardous waste.

6. Spent Catacarb Solution (CWC 342)

The refinery generated 753,000 pounds of spent catacarb solution in 2002. The refinery projects a source reduction of 220,000 pounds annually. The catacarb process is used to remove CO₂ from the hydrogen production stream using a hot potassium carbonate solution. The CO₂ in the hydrogen production gas stream is removed in the absorber by a circulating catacarb solution. The catacarb solution is reactivated in the regenerator. As the catacarb solution continuously circulates back-and-forth between the absorber and the regenerator, small amounts of reaction by-products accumulate in the solution and must be removed. A slip stream of the catacarb solution is continuously filtered to remove these contaminants. The on-line filter is monitored and switched to the spare filter when sufficient solids have collected. The spent filter is flushed with captured solids, washed to a collection sump. The washed filter cartridges are replaced. The wash water is removed from the sump and ultimately disposed of as hazardous waste due to an elevated vanadium concentration.

The source reduction measure to be implemented is to increase the filtration capacity and extend the time between filter changeouts. Installing new, larger, and more efficient filters will extend the time between changeouts. Installing an additional filter on the spent solution sump will allow for sending the filtered-spent solution to a storage tank, for reuse, thus significantly reducing the generation of spent catacarb solution.

D. Remarks

Decreases or increases in the hazardous waste generation rates at a facility can be better interpreted if the production environment at the facility over the same time period is known. Between 1998 and 2002, total annual yields increased from 17 million barrels to 24 million barrels. The total amount of waste generated in 1998 was 743 million pounds and increased to 1.3 billion pounds in 2002.

Category A SB 14 wastes
ConocoPhillips San Francisco Refinery 2002 Reporting Year

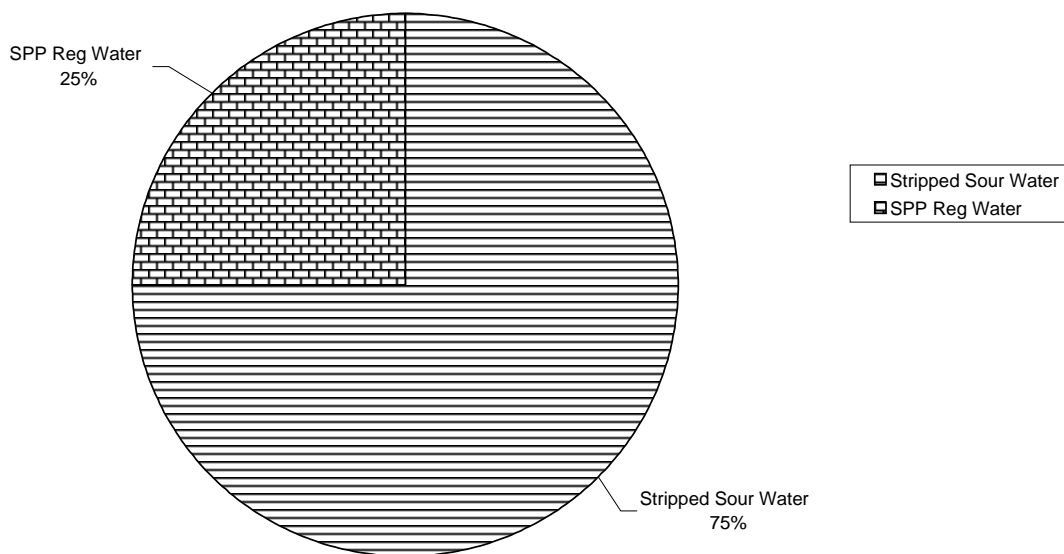


FIGURE 6-A. Category A Wastes for ConocoPhillips San Francisco Refinery 2002 Reporting Year.

ConocoPhillips-San Francisco Refinery 2002 Reporting Year
Category B SB-14 wastes

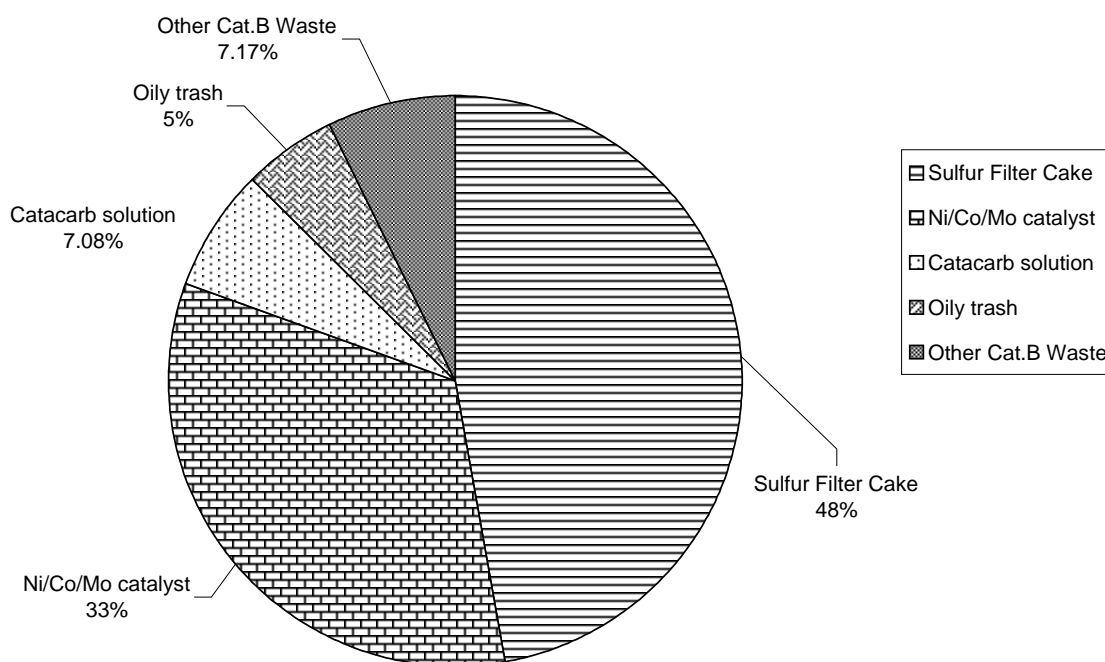


FIGURE 6-B. Category B Wastes for ConocoPhillips San Francisco Refinery 2002 Reporting Year.

CONOCOPHILLIPS COMPANY
SAN FRANCISCO CARBON PLANT
EPA ID: CAD983577537

A. Site Information

The ConocoPhillips Carbon Plant has operated in Rodeo, California since 1962. The plant produces 900 tons per day of calcined petroleum coke for sale to manufacturers of aluminum, steel, other metals, as well as metal oxides. ConocoPhillips also produces and sells excess electricity from its cogeneration plant. The San Francisco Carbon Plant currently employs 38 full-time employees.

B. Accomplishments

The refinery did not report any Category A wastes during 1998 and 2002. However, Category B was reported as 2.1 million pounds in 2002 and 891,000 pounds in 1998.

Category A Wastes

The refinery did not report any wastes during 1998 and 2002.

Category B Wastes

A total of seven Category B hazardous waste streams were generated at the Carbon Plant. Two out of seven waste streams were determined to be major waste streams in 1998: slag, brick and loose refractory (CWC 181) and baghouse fines (CWC 591).

1. Slag, Brick and Loose Refractory (CWC 181)

The carbon plant generated 359,000 pounds in 2002, compared to 560,000 pounds in 1998, a 36 percent reduction. Brick and refractory material line the two rotary kilns, pyro-scrubbers, coolers, and hot stacks at the plant. During the roasting of raw petroleum coke into calcined product, some trace heavy metals such as nickel and vanadium are deposited as slag in an aluminum silicate matrix on the cooler exposed faces of the brick and refractory linings. Periodic replacement of these linings is necessary to maintain optimal operating conditions for coke calcinations. The two source reduction measures implemented since 1998 were:

- The use of spent refractory elsewhere in the process equipment, and
- A refractory material replacement.

2. Baghouse Fines (CWC 591)

The Carbon Plant generated 1.8 million pounds of this waste in 2002, versus 293,000 pounds in 1998. This is an increase of 508 percent. The off-gases from the boiler enter a baghouse where fine suspended solids are filtered from the flue gases and bag filters which periodically dump accumulated fines to hoppers beneath the filter bags. These fines are primarily carbon with low concentrations of cadmium, nickel, vanadium, and zinc. The addition of sodium bicarbonate was started in 2000 due to regulatory requirements to control sulfur dioxide emissions. The sodium bicarbonate is now an additional component of this solid stream, creating a larger volume of the fines requiring disposal. The source reduction measures implemented since 1998 were: adding/mixing fines with the plant petroleum coke feedstock prior to calcining.

C. Projections

Category A Wastes

The refinery did not report any Category A wastes during 1998 and 2002.

Category B Wastes

During 2002, the plant generated two million pounds of Category B wastes. The two major streams generated are slag, brick and loose refractory (CWC 181) and baghouse fines (CWC 591). Figure 6-C shows the types and quantity of Category B wastes that ConocoPhillips San Francisco Carbon Plant reported for 2002.

1. Slag, Brick and Loose Refractory (CWC 181)

The Carbon Plant generated 359,000 pounds of this waste in 2002. No new source reductions plans have been made for this waste stream. The refractory currently used in the kilns, cooler, and pyroscrubber offers the longest service life. Calcining is a strictly controlled, high temperature process inevitably resulting in refractory break down. The facility plans to continue with its refractory material replacement plan. Technological advancements in the manufacture of refractory brick may provide future source reduction opportunities. The facility projects an annual source reduction of 18,000 pounds for this stream by 2003.

2. Baghouse Fines (CWC 591)

The Carbon Plant generated 1.8 million pounds of baghouse fines in 2002. No new source reduction options were identified for 2002-2006 cycle.

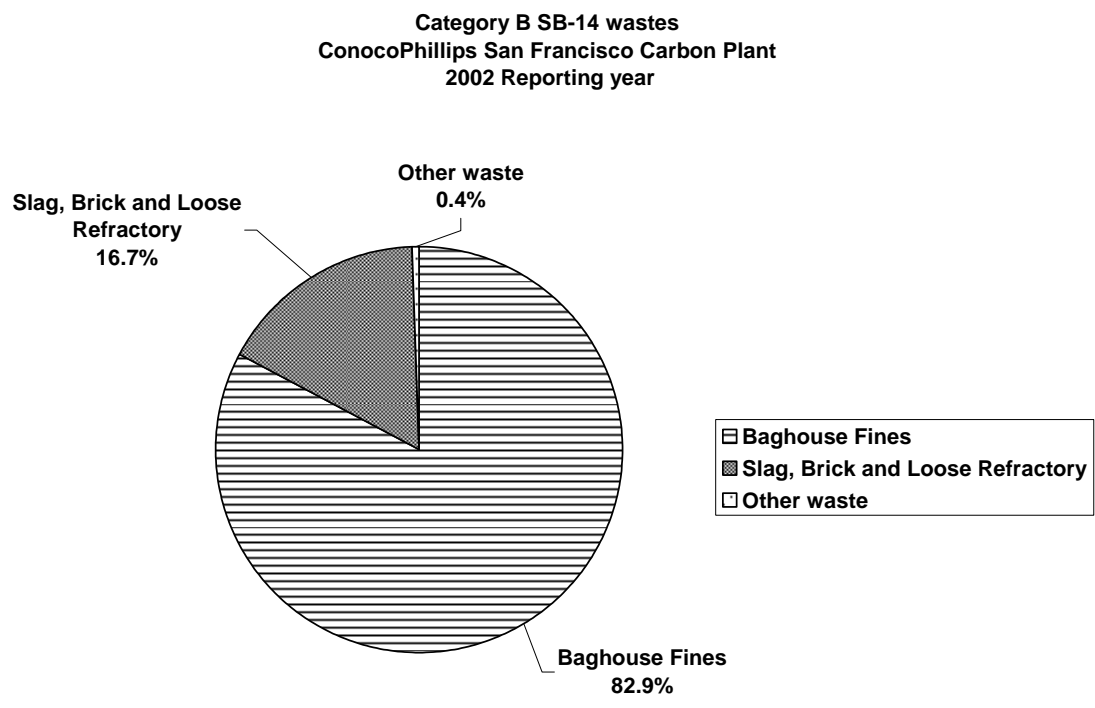


FIGURE 6-C. Category B Wastes for ConocoPhillips San Francisco Carbon Plant 2002 Reporting Year.

CONOCOPHILLIPS COMPANY

SANTA MARIA FACILITY

EPA ID: CAD 990 846 701
CAT 080 010 796

A. Site Information

ConocoPhillips Company, Santa Maria Facility consists of a refinery and carbon plant located at Arroyo Grande in San Luis Obispo County. This facility is in business at the present location for 48 years. In 2002 it had 140 employees and 46 contractors. The refinery processes crude oil from the San Joaquin Valley, the Santa Maria Valley and offshore Central California into semi-refined products for use as feedstock for other refineries in the San Francisco area. The refinery has a capacity to process 41,800 barrels per day (bpd) of crude oil (source: California Energy Commission Fuels Office staff). Petroleum coke and elemental sulfur are products of the refining process that are transported to the adjacent carbon plant for further processing. The carbon plant processes raw petroleum coke supplied from the adjacent refinery and converts it into calcined coke which is sold to various buyers for a variety of applications. Semi-refined products produced at the refinery include naphtha, gas oil, sulfur, and petroleum coke. The gas oil and naphtha are transported by pipeline to other facilities in the San Francisco area for further refining. The majority of the calcined coke is sold to a phosphorous manufacturer. The sulfur is sold for use in the agriculture industry.

B. Accomplishments

The refinery in its Summary Progress Report (SPR) identified no Category A waste generated during 1998 and 2002. However, Category B waste was reported as 1.3 million pounds in 1998 vs. 1.15 million pounds in year 2002 - a significant reduction of 12 percent. The refinery discussed three major waste streams in its SPR.

Category A Wastes

Not Applicable. The refinery did not report any waste during 1998 and 2002.

Category B Wastes

In their SPR, the ConocoPhillips, Santa Maria Refinery discussed three major waste streams.

- Stretford Solutions (CWC 132)
- Baghouse Ash Liquid (CWC 132)
- Refinery Waste Cleanup including Refractory (CWC 352)

1. Stretford Solutions (CWC 132)

The list of current hazardous waste minimization approaches implemented during 1998-2002 period is as follows:

A permanent crystallizer was installed to minimize the generation of spent Stretford solution. Stretford solution is used to remove the remaining sulfur in the tail gas from the sulfur recovery unit. The tail gas is scrubbed using Stretford Solution thus removing hydrogen sulfide. Prior to 1998, onsite regeneration of the Stretford solution was implemented at the Santa Maria Facility to reduce the rate of spent solution generation. Onsite regeneration consisted of using a portable crystallizer to remove salts, primarily sodium sulfate from the solution thus extending its life. Subsequent to 1998, a permanent crystallizer was installed at the tail gas unit to remove sodium sulfate from solution on a continuous basis. This measure has been successful in extending the life of the Stretford solution. No spent Stretford solution was produced between 1999 and 2002.

2. Baghouse Ash Liquid (CWC 132)

More than 235,000 pounds of this waste was generated during the 1998 SB 14 reporting year. The refinery mentioned that there were no feasible source reduction measures available.

3. Refinery Waste Cleanup Including Refractory (CWC 352)

The ConocoPhillips, Santa Maria Facility refinery reported that it generated more than 585,000 pounds of this waste during calendar year 1998. The refinery implemented several expanded and refined operational improvements that were developed previously, and administrative measures to reduce hazardous waste generation. However, the refinery was unable to quantify specific source reduction quantities.

Operational improvements and administrative measures have been implemented to minimize the generation of hazardous waste. These include measures implemented before and after the 1998 calendar year. Examples of these measures include:

- Ongoing procedures, including hazardous waste management procedures and a formal environmental policy that, in part, focuses on waste minimization measures.
- Ongoing incentive programs to promote good housekeeping programs.
- Making employees aware of source reduction achievements, such as the recent significant reduction in the generation of spent Stretford solution using the permanent crystallizer.
- Regular training is held to keep personnel apprised of hazardous materials management policies and procedures.
- Ongoing procedures for receiving hazardous materials shipment, including inspecting shipments received at the facility.

- Hazardous raw reagent materials (e.g. Stretford solution) must meet specifications.
- Hazardous reagents are routinely inventoried and are purchased on an as-needed basis to minimize inventory to the extent practical.
- Hazardous materials are stored separately from nonhazardous materials.
- Where practical, hazardous reagents are stored in reusable containers (e.g. tote bins).
- Hazardous waste and hazardous materials are stored in secured areas.
- Appropriate tools and equipment are used to move hazardous waste and hazardous material containers.
- Plans are in place and updated as necessary, and drills are conducted periodically, to ensure preparedness for prompt response to hazardous material spills.
- Hazardous waste storage tanks, drums, and containers are routinely inspected to ensure proper containment and storage.
- Equipment is routinely inspected and maintained to prevent leaks and spills of hazardous materials.
- Used oil, antifreeze, parts cleaning solvent and other hazardous wastes are recycled offsite where practical.
- High pressure/low flow systems are used for cleaning where practical to reduce rinsate volume and reduce the need for chemical cleaning agents.
- Automated feeding systems are used in the refinery processes where practical, reducing the potential for spillage.

C. Projections

Category A Wastes

Not Applicable. The refinery did not report any waste generation during the 1998 and 2002 calendar years.

Category B Wastes

ConocoPhillips, Santa Maria Facility documented 22 hazardous waste streams in its 2002 Source Reduction Evaluation Review and Plan (Plan). Seven out of these 22 wastes were identified as exempt from SB 14. The total quantity of the fifteen SB 14 applicable wastes amounted to more than 1.15 million pounds. Two of the fifteen hazardous wastes were declared as major waste streams:

Refinery Waste Cleanup (CWC 352) Baghouse Ash liquid (CWC 132)

Figure 5 shows the types and quantity of Category B wastes that ConocoPhillips Santa Maria facility reported for 2002.

1. Refinery Waste Cleanup including Refractory (CWC 352)

ConocoPhillips, Santa Maria Facility, in its 2002 SPR, reported generating 861,000 pounds of this waste. It further mentioned that the refinery was not able to select any feasible source reduction source reduction measure for the 2002-2006 SB 14 cycle. The refinery mentioned that it has applied operational improvements approach including a loss and spill prevention program previously. Administrative steps have also been implemented in past years. Although the refinery was not able to select any feasible operational improvements measures for the 2002 reporting year, the refinery evaluated the following measures:

Elimination of amine reclaim filters: Elimination of cloth filters currently used to reclaim amine (sulfinol) solution was identified as a potential viable refinery waste cleanup reduction measure. The disposable cloth filters could be eliminated by replacing the filters with an onsite reclaim skid that allows filters to be regenerated by backwashing. This measure was not proposed because it would not result in any reduction in operating costs. It would transfer the filtrate from one media to another.

Replacement of the amine reclaim filters could eliminate the production of spent filters: Current spent filter generation is approximately 40 filters per week, with each filter weighing approximately two pounds. If the filters can be eliminated, there would be a reduction of approximately 4,000 pounds annually, which is approximately 0.4 percent of the refinery waste cleanup waste generated in 2002.

Replacing the current filters with regenerated filters would result in a small increase in cost. Technical feasibility has not been fully explored because other evaluations indicate that there is no significant environmental benefit. A key technical issue would be whether the onsite wastewater treatment plant could accommodate the chemistry of the inflow resulting from filter regeneration.

2. Baghouse Ash Liquid (CWC 132)

The refinery generated nearly 231,000 pounds of this waste and it was not able to identify any feasible source reduction measure for the 2002-2006 period.

3. Stretford Solution (CWC 132)

ConocoPhillips reported in their SPR that it did not generate any of this waste during 2002 calendar year.

ConocoPhillips Santa Maria Facility Category B Wastes 2002 Reporting Year

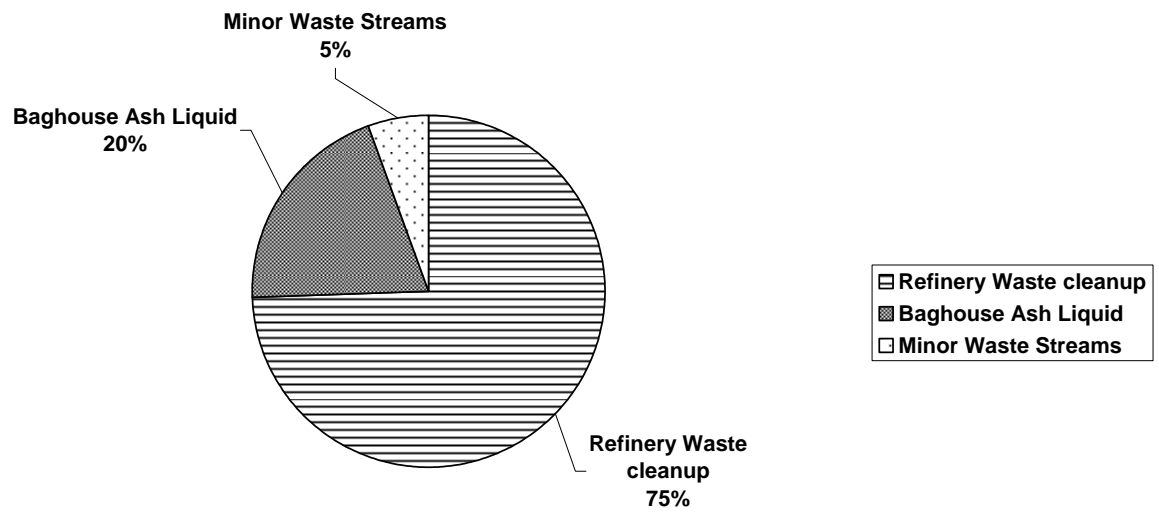


FIGURE 5. Category B Wastes for ConocoPhillips Santa Maria Refinery 2002 Reporting Year.

EXXONMOBIL TORRANCE REFINERY

EPA ID: 008 354 052

A. Site Information

ExxonMobil refinery is located on 723 acres in the city of Torrance, California. This refinery began its operation in 1929. In 2002, this refinery employed 750 full-time employees. ExxonMobil produces gasoline, diesel fuel, petroleum coke, liquefied coke, liquefied petroleum gas (LPG), propane, and elemental sulfur. Storage tanks that hold the refinery's inventory of feed stocks, intermediate products, and finished products take up the majority of the site's area. Various process units convert crude oil into products. The various types of process operations include distillation, fluid catalytic cracking, catalytic reforming, delayed coking, hydrogen production, hydrocracking, hydrotreating, alkylation, sulfur recovery, and water treatment. The facility is designed to process 155,000 barrels of crude oil per day into various consumer products.

B. Accomplishments

The refinery's Summary Progress Report (SPR) mentioned that in Category A waste, it reduced from 1998 a total quantity of 11.18 billion pounds of waste to 11.13 billion pounds in 2002 - a decrease of approximately 55 million pounds or 0.4 percent. Category B waste increased to 3.07 million pounds in 2002 from 2.2 million pounds in 1998 - an increase of 39 percent. The refinery addressed three major Category A wastes and four major Category B wastes in its SPR.

ExxonMobil mentioned in its Hazardous Waste Management Performance Report (Report) that there are notable differences in the way waste streams were reported for the two reporting years 1998 and 2002. The refinery further mentioned that these differences are due to changes in management practices and changes in the business activities. The detail discussion is offered in the Remarks section at the end of this chapter.

Category A Wastes

In their SPR and Report, ExxonMobil discussed the following three Category A major waste streams. 1) Aqueous Solution with Metals (CWC 132), 2) Aqueous Solution with Total Organic Residues less than 10 percent (CWC 134), and 3) Oil/Water Separation Sludge (CWC 222).

1. Aqueous Solution with Metals (CWC 132)

This waste stream was not considered in the facility's 1998 SB 14 document for reduction. The refinery mentioned in their SPR that this waste was determined to be hazardous in 2003 due to its selenium content. For the 2002 reporting year, the refinery

has selected a source reduction measure which will be discussed later in the Projection section.

2. Aqueous Solution with Total Organic Residues Less than 10 Percent (CWC 134)

The refinery generated more than 11 billion pounds of this waste during the 1998 reporting year. The refinery reported that nearly 5 billion pounds (approximately 45 percent) of this waste was reduced by developing standard operating procedures for sampling, draining process equipment, and drawing water from tanks. These procedures were designed to limit the amount of organic residue (e.g. benzene) entering the water collection system.

Aqueous Solution with Organic Residue (< 10 percent) is process wastewater that is discharged to a Publicly Owned Treatment Works (POTW). The POTW requires routine sampling for the wastewater benzene content. The data for calendar year 2002 indicated that the benzene concentration for the third and fourth quarters was less than the 0.5 mg/l RCRA toxicity limit for determining it to be a hazardous waste. Therefore, the 2002 calendar year generation rate reported by ExxonMobil was equivalent to the first and second quarters of 2002.

3. Oil/Water Separation Sludge (CWC 222)

In the 1998 reporting year ExxonMobil generated approximately 82 million pounds of oil/water separation sludge. This material is generated through processing oily sewer wastewater and sent through the Coker Mobil Oil Sludge Coking (MOSC) process where petroleum hydrocarbons in the sludge are recovered. The refinery was able to implement one source reduction measure: They took the vacuum truck washout pit out of service. By doing this, the refinery reduced particulates into the vacuum sump pump which ultimately reduced sludge generation.

The refinery claimed that this material no longer classified as an SB 14 waste. The refinery mentioned in their Report: that "Material is recycled back to the process under exemption provided in Health and Safety Code 25144; therefore, it is exempt from being classified as an SB 14 waste for 2002. This material was handled in the same manner in 1998 but was not listed as exempt from being classified as a waste." The 82 million pounds difference between 1998 and 2002 is not due to source reduction but it was because the refinery's interpretation of Health and Safety Code 25144 for this waste stream.

Category B Wastes

In their SPR and the Report, ExxonMobil discussed the following four Category B major waste streams: 1) Other Inorganic Solid Waste (CWC 181), 2) Unspecified oil-containing waste (CWC 223), 3) Unspecified Organic Liquid Mixture (CWC 343), and 4) Other Organic Solids (CWC 352).

1. Other Inorganic Solid Waste (CWC 181)

ExxonMobil mentioned in their SPR that this waste did not meet the criteria for a major SB 14 hazardous waste stream in 1998. Hydrotreater guard reactor and PRTR/Reformer catalyst were not changed out in 1998. Mercury and sulfur waste were likely included under another California waste code in 1998. Therefore the refinery in their 1998 reporting year indicated as no waste generation for this category.

2. Unspecified Oil-Containing Waste (CWC 223)

During 1998, the refinery generated 66,000 pounds of this waste. No source reduction measures were identified.

3. Unspecified Organic Liquid Mixture (CWC 343)

During 1998, the refinery generated approximately 327,000 pounds of this waste. During 2002, the generation was more than 891,000 pounds - an increase of 172 percent. This increase was attributed to the degradation of MEA (Monoethanolamine) quality due to oxygen entering the process vapor recovery system. The refinery made attempts to optimize the process unit generating MEA waste; however, quality issues resulted in a net increase in waste quantity.

4. Other Organic Solids (CWC 352)

During 1998, approximately 1.8 million pounds of this waste was generated. The refinery reduced more than 100,000 pounds of this waste. This reduction is due to better waste segregation practices and reclassification of hazardous waste. Coker gaskets are now managed as scrap metal as opposed to non-RCRA debris. Used hoses not contaminated with oil are now segregated as nonhazardous waste.

C. Projections

ExxonMobil generated more than 11 billion pounds of SB 14 Category A (aqueous) waste and more than 3 million pounds of SB 14 Category B (non aqueous) wastes during 2002 reporting year. ExxonMobil identified a total of five waste streams as its major waste streams during 2002. The refinery selected five source reduction measures for both the Category A and B major waste streams and projected a reduction of more than 6.22 billion pounds of waste in the next four years. The refinery has an overall goal to reduce its hazardous waste in the 2002-2006 cycle by 50 percent. The detail discussion of the five selected source reduction measures follows:

Category A Wastes

Figure 7-A shows the types and quantity of Category A wastes that ExxonMobil Torrance Refinery reported for 2002.

1. Aqueous Solution with Metals (CWC 132)

This waste stream consists of wastewater that has not been in contact with hydrocarbons or is not expected to have residual hydrocarbons such as cooling tower blowdown, stripped sour water, or demineralizer regeneration wastewater. This waste stream has been determined to contain selenium above the hazardous waste threshold. The source of the selenium is the stripped sour water stream. This stream is discharged to a POTW (Los Angeles County Sanitation District - Carson Treatment Plant) via the refinery's Del Amo discharge.

Demineralizer wastewater originates from the mixing of acidic and caustic streams that originate from the regeneration of the cation and anion beds that are used to remove minerals/solids from boiler feedwater. The resulting wastewater after mixing is typically nonhazardous. According to ExxonMobil, this process is exempt from hazardous waste permitting per Health and Safety Code (H&SC) 25201.13 (deals with demineralize water, permit-by-rule, and exemption). Because it is not feasible to determine the volume of wastewater generated during regeneration that is hazardous and non-hazardous prior to the mixing of acid and caustic containing streams, these waste streams were not evaluated separately in the refinery's Plan. For simplicity, the entire quantity of water discharged to the POTW (Los Angeles County Sanitation District) at this discharge was included in the Plan.

ExxonMobil generated nearly five billion pounds of this waste in 2002. The refinery was not able to select any feasible source reduction measure and therefore the refinery did not project reduction of this waste stream. However, a study has been planned to examine selenium concentration and speciation data along with potential technologies for reducing selenium concentrations in the stripped sour water stream. This study would identify treatment technologies and management options along with the feasibility of implementing the options identified.

2. Aqueous Solution with Total Organic Residues Less than 10 Percent (CWC 134)

ExxonMobil refinery generated over six billion pounds of this waste in 2002. This waste stream consists of process wastewater exiting the industrial wastewater treatment plant (IWW). Process water is collected from various areas within the refinery via a gravity feed sewer system. This sewer system is commonly referred to as the "oily water sewer" or the "process sewer". Hydrocarbon and oily sludges are removed from the wastewater in the IWW and recycled back to refinery processes. The wastewater stream after treatment in the IWW is discharged to a POTW via the refinery's Van Ness discharge. This waste stream contains benzene greater than the hazardous waste threshold for the first two quarters of 2002. Benzene concentration data for the third and fourth quarters of 2002 show levels below the hazardous waste threshold of 0.5mg/l.

Material enters the process sewer at many locations through process drains and direct connections. The following are key process sewer sources:

- Drains in the process units.
- Drains on pump pads and compressor pads.
- Drains at sample points.
- Heat exchanger bundle cleaning pad.
- Drain inside of tank dikes.
- Oil water separation vessels.
- Boiler blowdown.
- Water draws from storage tanks.

The refinery selected the following measure:

Reduce benzene concentration in the wastewater:

ExxonMobil continued to utilize standard operating procedures for sampling, draining process equipment, and drawing water off tanks (for closed and non-closed loop sampling and draining of process equipment), and drawing water off tanks. These procedures were designed to limit the amount of organic residues entering the water collection system. Ongoing compliance efforts for the Benzene Waste NESHAPS regulation have facilitated reducing benzene levels below hazardous waste threshold concentrations.

Category B Wastes

Figure 7-B shows the types and quantity of Category B wastes that ExxonMobil Torrance Refinery generated in 2002.

1. Oil/Water Separation Sludge (CWC 222)

ExxonMobil reported no generation of this waste during 2002. As mentioned previously in the Accomplishments section of this chapter, the refinery generated more than 82 million pounds of this waste in 1998; however, it decided to claim an exemption for this waste stream, based on H&SC 25144 for the year 2002. H&SC 25144 deals with exemption of units, including associated piping that are part of system used for the recovery of oil from oil-bearing material.

2. Other Inorganic Solid Waste (CWC 181)

ExxonMobil outlined the following four SB 14 applicable wastes for the reporting year 2002: 1) spent hydrotreater guard Rx catalyst, 2) spent Pretreater (RRTR)/Reformer catalyst, 3) mercury debris waste, and 4) sulfur waste. A total of 383,000 pounds of this waste was generated during calendar year 2002. The refinery was able to select the following source reduction measure for sulfur waste.

Classify as Nonhazardous Waste:

ExxonMobil generated 17,150 pounds of sulfur waste in 2002. The refinery intends to classify this waste as non-hazardous. If successful, ExxonMobil will be able to declare the entire quantity (17,150 pounds) of this waste as nonhazardous.

3. Unspecified Organic Liquid Mixture (CWC 343)

Under the CWC 343 waste stream, ExxonMobil outlined the following two wastes for 2002: 1) spent antifreeze (Ethylene Glycol), and 2) MEA (monoethanolamine) reclaimer. Only MEA reclaimer is an SB 14 applicable waste. ExxonMobil generated nearly 892,000 pounds of this waste during calendar year 2002.

MEA is used to treat refinery fuel gas to remove hydrogen sulfide (H₂S). MEA is continuously regenerated and reused in the H₂S removal process. A potential source of MEA degradation is oxygen in the fuel gas stream being treated. When MEA degrades, reclamation is performed to maintain MEA quality. The waste stream from this process consists of residue and sludge. Additionally, fresh MEA is continuously added to the system and used MEA is bled from the system as another step in maintaining MEA quality. The MEA bled from the system is also included in the process waste stream. ExxonMobil managed to select the following measure using Operational Improvements approach.

Manage fuel gas oxygen content to reduce MEA degradation rate:

The refinery is planning to monitor and control factors affecting MEA quality. Their goal is based on limiting waste generation rates to 1998 levels adjusted for changes in production. The refinery is projecting to reduce generated waste by 500,000 pounds by implementing this single measure.

4. Other Organic Solids (CWC 352)

ExxonMobil outlined 14 wastes in 2002 contributing to the CWC 352 waste code. Thirteen of these fourteen wastes are SB 14 applicable wastes. ExxonMobil selected nine source reduction measures (see Table 1). The refinery generated nearly 1.8 million pounds of this waste during calendar year 2002, and expects to reduce 858,000 (48 percent) pounds during the 2002-2006 cycle by implementing most of the nine selected measures.

D. Remarks

ExxonMobil mentioned that some of the noted increases were due to the fact that there were notable differences in the way waste streams were reported for 1998 and 2002 years. The refinery further mentioned that the differences were also due to changes in management practices, and changes in business activity.

ExxonMobil Torrance Facility Category A Wastes 2002 Reporting Year

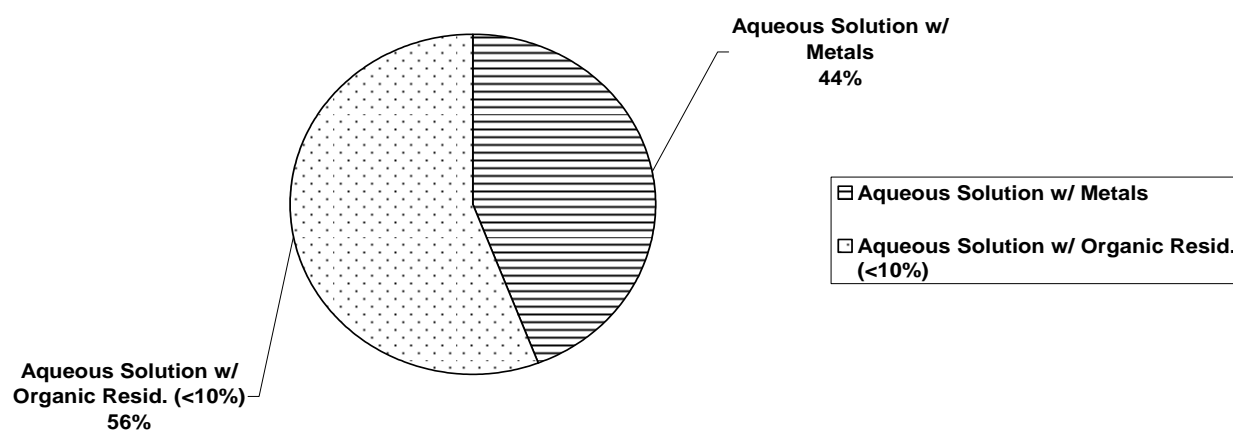


FIGURE 7-A. Category A Wastes for ExxonMobil Torrance Facility for 2002 Reporting Year.

ExxonMobil Torrance Facility Category B Wastes 2002 Reporting Year

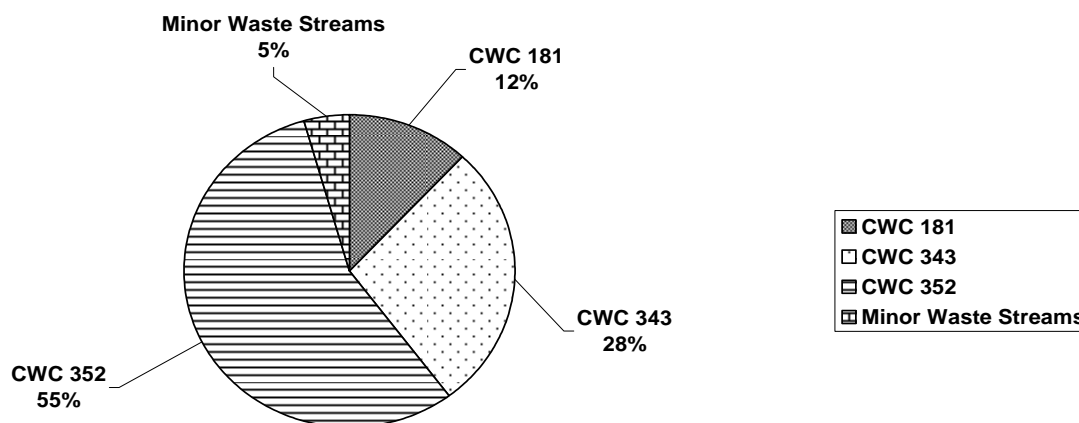


FIGURE 7-B. Category B Wastes for ExxonMobil Torrance Facility for 2002 Reporting Year.

TABLE 1 Other Organic Solids (CWC 352)

REFINERY WASTE DESCRIPTION	MEASURES TO BE IMPLEMENTED	IMPLEMENTATION DATE	NUMERICAL GOALS
Clay Treater Sand	Optimize characteristics of jet fuel product units to reduce clay treater sand waste generation.	Ongoing	50 percent reduction. Target to achieve previous waste generation levels, even with current higher refinery production levels. Goal – approximately 93,000 pounds waste reduction annually.
Coke from Coker	Reclassify as a non-hazardous waste.	First half of 2004	100 percent reduction. Target is to reclassify as non-hazardous which would result in 5800 pounds annually of hazardous waste reduction based on 2002 figures.
DEA/MEA Filters	See measure proposed for unspecified organic liquid mixture (CWC 343).	Ongoing	No specific goal possible but expected to decrease as MEA Reclaimer waste is reduced.
Non-RCRA Debris, Mixed	Apply exemption in Health and Safety Code 25143.12.	First half of 2004	70 percent reduction. Target eliminating 70 percent of stream as hazardous waste under Health and Safety Code exemption which would result in approximately 700,000 pounds annually of hazardous waste reduction based on 2002 figures.
Refractory (Specify)	Additional analysis of refractory may enable some quantities to be classified as non-hazardous.	First half of 2004	Hazardous waste reduction will not be known until analyses of specific refractory is performed.
Resid/Tar	Perform necessary analyses to reclassify as non-hazardous waste.	First half of 2004	100 percent reduction. Target is to reclassify as non-hazardous which would result in 50,000 pounds annually of hazardous waste reduction based on 2002 figures.
Resin – Demin/Anion	Perform necessary analyses to reclassify as non-hazardous waste.	Perform analyses next time used resin is generated.	100 percent reduction. Target to manage waste stream to eliminate average of 9820 pounds annually of hazardous waste based on 2002 figures.
Sand Blasting Sand	Perform necessary analyses to reclassify as non-hazardous waste.	First half of 2004	Hazardous waste reduction will not be known until analyses of specific sand blasting sands are performed.
Spent Carbon – Vapor Phase (Non-RCRA)	Perform necessary analyses to determine if more spent carbon can be reclassified as non-hazardous waste.	First half of 2004	Hazardous waste reduction will not be known until analyses of specific vapor phase carbon streams are performed and results interpreted.

KERN OIL AND REFINING COMPANY

EPA ID: CAD 990 724 916

A. Site Information

The Kern Oil and Refining Company refinery has a process capacity of approximately 25,000 barrels of crude oil per day. The major products manufactured at the refinery are reformulated gasoline, aviation fuel, solvent stock, diesel and fuel oil. Kern is located in Bakersfield, California and has been operating since 1934. This facility employed 105 employees in 2002.

B. Accomplishments

Category A Wastes

Kern Oil did not report any Category A wastes in 1998.

Category B Wastes

The major wastes generated in 1998 were: other spent catalyst (CWC 162), oil/water separation sludge (CWC 222), tank bottom waste (CWC 241), and other organic solids (CWC 352).

1. Other Spent Catalyst (CWC 162)

Kern reported 17,600 pounds of this waste in 2002, versus 20,000 pounds in 1998. This decrease can be attributed to the different accounting methods used in the baseline and reporting years. It is therefore not possible to compare the waste generated in the different years. Spent catalysts are generated from the diesel hydrotreater (DHT), and unifier unit processes. Catalyst service life varies but typically ranges from approximately two years (DHT) to approximately six years (Unifier). Kern has implemented the following source reduction measures since 1998 for this waste:

- (a) Optimized various unit process parameters to maximize catalyst service life.
- (b) Regenerated and reused spent hydrotreating catalyst: The hydrotreating catalyst can be regenerated and reused in the unifier.
- (c) Implemented graded bed technology (GBT) in the hydrotreating unit (DHT): A larger, sacrificial catalyst is placed at the inlet of the DHT. The catalyst promotes the combination of hydrogen gas with the oil entering the DHT forming new hydrocarbons. Some of these hydrocarbons "crack" forming "coke", which forms a layer over the hydrotreating catalyst, reducing catalyst effectiveness. The coke that coats the sacrificial catalyst can easily be removed from the DHT unit by

vacuuming. The coke is then disposed offsite in sealed bins, while the downstream catalyst remains active. This process prevents the formation of coke on the hydrotreating catalyst, extending its life.

2. Oil/Water Separation Sludge (CWC 222)

Wastewater sludge is generated when the water plant process tanks are drained or cleaned, the Wemco air flotation unit is drained, or the multimedia filters are backwashed. Kern generated 19,000 pounds of this waste in 2002, versus 40,000 pounds in 1998, a 52 percent reduction. A source reduction measure that contributed to this reduction was that Kern paved various refinery unit areas and traffic ways served by the oil/water separator system. The refinery also implemented street sweeping programs which contributed to the decrease in the amount of solids entering the drains serving the oil/water separator system.

3. Tank Bottom Waste (CWC 241)

Kern generated 16,000 pounds of tank bottom waste in 1998. There were no measures implemented for this waste stream in the refinery's 2002 SB 14 documents.

4. Other Organic Solids (CWC 352)

This waste consists of heat-exchanger bundle cleaning sludge, paint waste and maintenance fluids. Maintenance fluids include waste from compressor oil change-outs and other rotating equipment oils. Heat-exchanger bundle cleaning sludge is generated when tubing bundles from the process units are cleaned. Kern generated 7,800 pounds of this waste in 2002, versus 10,000 pounds in 1998, a 22 percent reduction. The facility reported that two major source reduction measures have contributed to this reduction:

- Kern researched improved operations for sludge dewatering.
- An aqueous parts washer was installed to replace the solvent cleaner. This reduced the quantity of solvent based cleaning fluid waste generated.

C. Projections

Category A Wastes

The refinery did not report any Category A wastes during 2002.

Category B Wastes

The major wastes generated in 2002 were: other spent catalysts (CWC 162), oil/water separation sludge (CWC 222), unspecified oil-containing waste (CWC 223) and other

organic solids (CWC 352). Figure 8 shows the types and quantity of Kern Category B wastes reported for 2002.

1. Other Spent Catalyst (CWC 162)

Kern generated 17,600 pounds of spent catalyst in 2002. There were no new measures chosen for implementation.

2. Oil/Water Separation Sludge (CWC 222)

Kern generated more than 19,000 pounds of this waste in 2002. Kern intends to install an oil/water sludge separation tank that will serve as a dewatering unit from which the segregated sludge will be removed and disposed.

3. Unspecified Oil-Containing Waste (CWC 223)

This waste category includes all oil contaminated wastes, including oily rags, gloves, and other used personal protective equipment, sample containers, hoses, pallets, filters, and other items generated in the operation and maintenance of the process units. Kern generated 49,000 pounds of this waste in 2002. Kern has implemented a practice of segregating hazardous waste from non-hazardous refinery clean-up waste to reduce hazardous waste volumes. Employees also undergo annual hazardous waste compliance training. In addition, maintenance “tool box” training sessions are conducted regularly to ensure employees are trained and up to date with maintenance procedures.

4. Other Organic Solids (CWC 352)

Kern generated nearly 8,000 pounds of this waste in 2002. The measures projected for implementation include those discussed for CWC 223 above. Kern intends to install an oil/water sludge separation tank that will serve as a dewatering unit from which the segregated sludge will be removed and disposed.

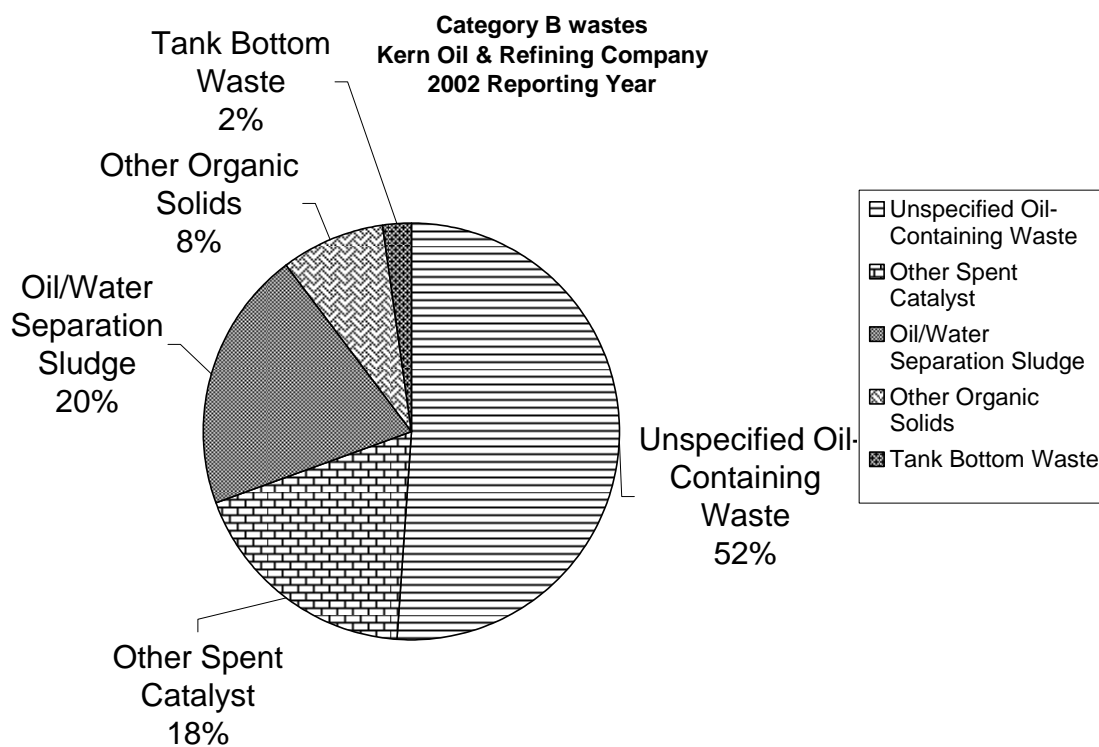


FIGURE 8. Category B Wastes for Kern Oil and Refining Company 2002 Reporting Year.

LUNDAY-THAGARD COMPANY (LTR)

EPA ID: CAD 008 345 464

A. Site Information

The Lunday-Thagard Company (LTR) is located in the city of South Gate, in Los Angeles County. This facility has been in operation since the 1930s. The primary business activity at LTR is the production of roofing and paving asphalt. Crude received at LTR is fed to an LTR crude distillation unit and vacuum flasher (distillation unit). This material is separated into specific boiling range materials. These intermediate streams produced at LTR are pumped to tanks for storage of such products as light ends, naphta, diesel distillate, gas oil. The light-end material is sold to other refineries for further conversion; heavy-end stock is used for production of roofing and paving asphalt. In 2003, LTR employed 88 full-time employees and between 5-10 contract employees.

B. Accomplishments

Category A Wastes

Lunday-Thagard did not report any Category A wastes in 1998 and 2002.

Category B Wastes

LTR reported more than 333,000 pounds of Category B wastes in 2002 and nearly 355,000 pounds in 1998. This is a decrease of approximately six percent. The major waste stream generated in 1998 includes other organic solids (CWC 352). Organic solid waste is comprised of solid granular absorbent socks/pigs that are used to absorb spills and leaks. Asphalt waste is generated as a result of sampling of the asphalt and spills during sampling. The absorbent waste is comprised of the absorbent material combined with asphalt waste and is disposed of as hazardous waste. The source reduction measure implemented since 1998 was: that concrete and asphalt has been placed throughout the facility in order to allow spills/leaks to be recovered with the wastewater system which routes collected wastewater to an on-site wastewater treatment and recovery system.

C. Projections

The facility reported its SB 14 numerical goal for waste reduction between 2002 and 2006 as 30 percent for Category B waste stream.

Category A Wastes

Lunday-Thagard did not report any Category A wastes in 2002.

Category B Wastes

The refinery reported other organic solids (CWC 352) as the major hazardous waste stream generated in 2002, although unspecified oil containing waste (CWC 223) and tank bottom wastes (CWC 241) were also generated. Figure 9 shows the type and quantity of Category B wastes that Lunday-Thagard Company reported for 2002. Several measures are selected for implementation by 2006:

- (a) Utilize steam gun to hose down leaks and spills: Because the retrofit of piping systems is cost prohibitive, the possibility of using a steam gun to hose down leaks and spills will be evaluated. The steam gun would be used to wash off leaks/spills; the produced wastewater would then be pumped to the facility treatment unit for oil recovery and subsequent discharge of water to the commercial sewer. This measure is expected to result in a five percent decrease of this waste stream.
- (b) Implement employee training to maximize the use of steam gun and to reduce the use of granular absorbent to clean up spills and leaks: The use of the new steam gun will require employee training to ensure that employees understand its value in waste minimization in lieu of using granular absorbent. Granular absorbent would still be used to clean up spills and leaks that cannot be safely removed using the steam gun.
- (c) Segregate the non-hazardous asphalt waste from the hazardous absorbent waste: This segregation would be done by installing two separate waste bins to accommodate each waste stream, respectively, instead of combining the hazardous solid asphalt waste stream and the non-hazardous absorbent waste.
- (d) Devise a tracking system for oily rags and gloves in order to minimize the amount of solid, nonhazardous waste: This measure would require that maintenance/operators track their oily rags and gloves by putting individual operators names on the rags/gloves. This measure is expected to reduce the unnecessary discard of rags and gloves thereby reducing the contribution to the generation of CWC 352 by two percent as well as generally decreasing maintenance costs.
- (e) Segregate hazardous liquid asphalt waste from solid non-hazardous asphalt waste: This segregation would be done by installing two separate drums to accommodate each waste stream separately, instead of combining nonhazardous solid asphalt waste stream and the hazardous liquid asphalt waste.

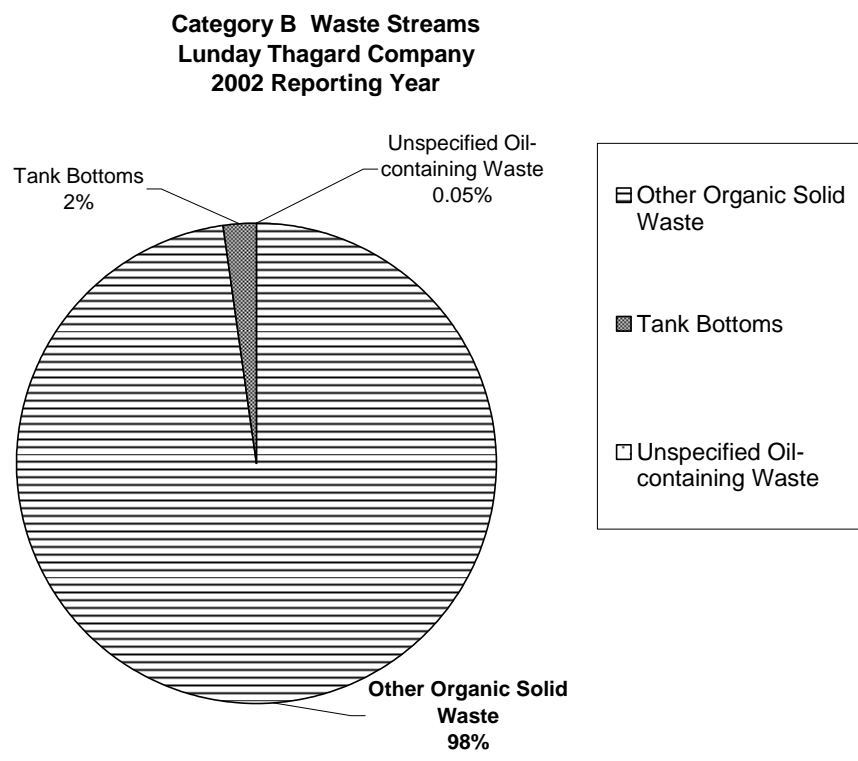


FIGURE 9. Category B Wastes for Lunday-Thagard Company 2002 Reporting Year.

PARAMOUNT PETROLEUM CORPORATION

EPA ID: CAD 008 371 098

A. Site Information

Paramount Petroleum Corporation operates a small, independent refinery. Its major products are gasoline components, diesel, jet fuel, gas oil, fuel oil, and asphalt. The Paramount refinery is located in the city of Paramount, California. Paramount has been in business since early 20's. The current owners have operated the plant since 1993. In 2002, the company employed approximately 200 full time employees and 30 to 45 contract workers.

B. Accomplishments

Category A Wastes

The refinery did not report any Category A wastes for 1998 and 2002.

Category B Wastes

A total of about 150,000 pounds of Category B waste was reported for the 1998 baseline year. The major wastes reported were: other inorganic solid waste (CWC 181), oil/water separation sludge (CWC 222), tank bottom waste (CWC 241), off-specification, aged or surplus Organics (CWC 331), and other organic solids (CWC 352).

1. Other Inorganic Solid Waste (CWC 181)

The refinery generated about 11,000 pounds of this waste in 1998. No source reduction measures were implemented for this stream in 1998.

2. Oil/Water Separation Sludge (CWC 222)

The American Petroleum Institute (API) separator is part of the oily process water system, and this particular piece of equipment involves the gravity separation of oil, water and solids. Oil, rising to the top, is skimmed off and recovered for production. Water continues on in the wastewater system and is finally discharged to the local sanitation district. Solids form sludge at the bottom of the separator. This waste is collected in drums and sent to an offsite disposal facility where it is consolidated and ultimately incinerated. The refinery generated 16,600 pounds of this waste in 2002 and nearly 32,000 pounds in 1998, a 48 percent reduction. The measures implemented since 1998 included:

- (a) Paramount researched ways of diverting clean water from the API separator System.
- (b) Paramount installed solid filters at the API Separator inlet in order to minimize the contact of non-hazardous particles with hazardous API Separator solids, that is, storm water and refinery wastewater remained segregated.

When a vacuum dump truck dumps a load of water or oily process water to the API, the filter (screen) keeps any solids picked up by the vacuum truck from becoming listed hazardous waste. The filtered solids are then tested for hazardous waste characteristics. If the truck is carrying hazardous waste, the solids will be drummed and labeled as the listed hazardous waste. This method avoids the plugging up of the API and the need to perform a costly dewatering process.

3. Tank Bottom Waste (CWC 241)

Tank bottoms are generated when a crude oil or refined product tank is taken out of service for cleaning or maintenance. The tank solids originate from accumulated product sediment or from tank scale. Tank sediment is hazardous waste if this waste contains regulatory levels of benzene or heavy metals, both of which are inherent to crude oil. The refinery reported 13,420 pounds of this waste in 2002, versus more than 2,000 pounds in 1998. No source reduction measures were implemented for this stream in 1998.

4. Off-Specification, Aged or Surplus Organics (CWC 331)

Paramount generated about 13,000 pounds in 2002, versus nearly 22,000 pounds of this waste in 1998, a 41 percent reduction. The majority of this waste stream was drums of ethylene dichloride that were injected into the hydroprocessing units while they were running. When the units are shutdown, the drums of ethylene dichloride are no longer needed. The measures implemented since 1998 included encouraging employees to minimize waste volume by managing smaller quantities of chemicals. In this way, less waste is generated by more promptly consuming age dependent chemical reserves.

5. Other Organic Solids (CWC 352)

This waste category includes all oil contaminated wastes, including oily rags, gloves, and other used personal protective equipment, sample containers, hoses, pallets, filters, and other items generated in the operation and maintenance of the process units.

The refinery generated 170,000 pounds of this waste in 2002 and more than 81,000 pounds in 1998. This increase in waste generation is due to the addition of heat exchanger sludge and spent carbon in 2002 to this waste stream. The measures implemented since 1998 included encouraging employees to minimize waste volume by managing smaller quantities of chemicals. Paramount continued to practice improved

housekeeping, improved segregation of hazardous and non-hazardous waste, and encouraged more complete use of chemicals, so that residual chemical disposal is reduced. All of Paramount's oily debris that was transported off-site is now sent to a recycler, where, through a series of mills and centrifuges, liquids, metals and other solids were reclaimed for reuse.

In 2001, Paramount began using vapor phase carbon canisters for vapor control of tank and wastewater system vents to comply with local air quality management district regulations. The refinery considered methods to reduce the amount of spent carbon waste generated at the facility by implementing a vapor balancing system among three groups of storage tanks. This system includes three knock out pots that serve to divert the liquid and vapor from entering the carbon drums. This approach permits only vapor to enter. This reduces the flow of organic mass to the carbon drums. The system can then evenly distribute the load to each of the carbon drums. The resulting waste reduction for spent carbon was approximately 44,000 pounds annually.

C. Projections

Category A Wastes

The refinery did not report any Category A waste for the 2002 reporting year.

Category B Wastes

The refinery projected 36.5 percent Category B waste reduction for the 2002-2006 cycle.

A total of 200,000 pounds of Category B waste was reported generated in the 2002 reporting year. The major wastes reported were: Oil/water separation sludge (CWC 222), tank bottom waste (CWC 241), off-specification, aged or surplus organics (CWC 331), other organic solids, oily process waste (CWC 352) and other organic solids, spent carbon (CWC 352). Figure 10 shows the types and quantity of Category B wastes reported by Paramount for 2002.

1. Oil/Water Separation Sludge (CWC 222)

The refinery generated nearly 17,000 pounds of this waste in 2002. Paramount is in the process of diverting non-wastewater solids from the API Separator System. Source reduction measures that will continue to be implemented to achieve this goal include:

- Pave roads and work areas.
- Street sweeping.
- Place berms along road ways to prevent storm water from entering the process waters.
- Maintain and clean drains in order to prevent large particles from entering the storm drains.

- Retain the storm water in a retention pond which serves as means to allow settling of suspended solids.
- Place large rocks along the entry of the retention pond. The rocks prevent dirt from being picked up by the rainwater and dumped into the retention pond.
- Place gravel around the collection points in process areas or place berms to allow solids settling.

All of these measures will reduce non-hazardous particle entrainment and hence, minimize the contact of non-hazardous particles with hazardous API separator solids.

2. Other Organic Solids, Oily Process Waste (CWC 352) and Off-Specification, Aged or Surplus Organics (CWC 331)

The refinery generated around 180,000 pounds of other organic solids and 13,000 pounds of off-specification, aged or surplus organics waste in 2002. The refinery's SB 14 documents reported source reduction measures that appeared feasible for these two types of wastes but would require further investigation:

- (a) Encourage employees to minimize waste volume: Paramount employees are encouraged to minimize waste volume by using methods such as washing and reusing sample containers, using completely rags and gloves before discarding, and also emptying completely a container before throwing it away. Paramount uses its training sessions to promote a general switch to non-hazardous cleaners and degreasers.
- (b) Manage smaller quantities of chemicals: Whenever possible, chemicals will be purchased only in quantities necessary for the intended use. Excess materials will be returned, or resold through the company's waste exchange. Also, weather sensitive materials will be properly stored until needed.

3. Other Organic Solids, Spent Carbon (CWC 352)

Paramount began using vapor phase carbon canisters for vapor control of its tank and wastewater system vents to comply with local air quality management district regulations. This entire waste stream is contained and treated. Spent carbon is sent to the vendor for reactivation. One measure considered for implementing is to reduce spent carbon attributed to the API separator system by incinerating collected vapor in a process heater or incinerator.

Paramount is considering methods to reduce the amount of carbon used in the API separator system for adsorption of the API vapor. Currently Paramount generates approximately six drums/week of carbon waste for disposal. Paramount's goal is to attain 100 percent waste reduction and get pay back within two years by routing collected API vapors to a refinery incinerator. Reducing the generation of spent carbon

will result in a decrease of approximately two thirds in the total facility spent carbon generated.

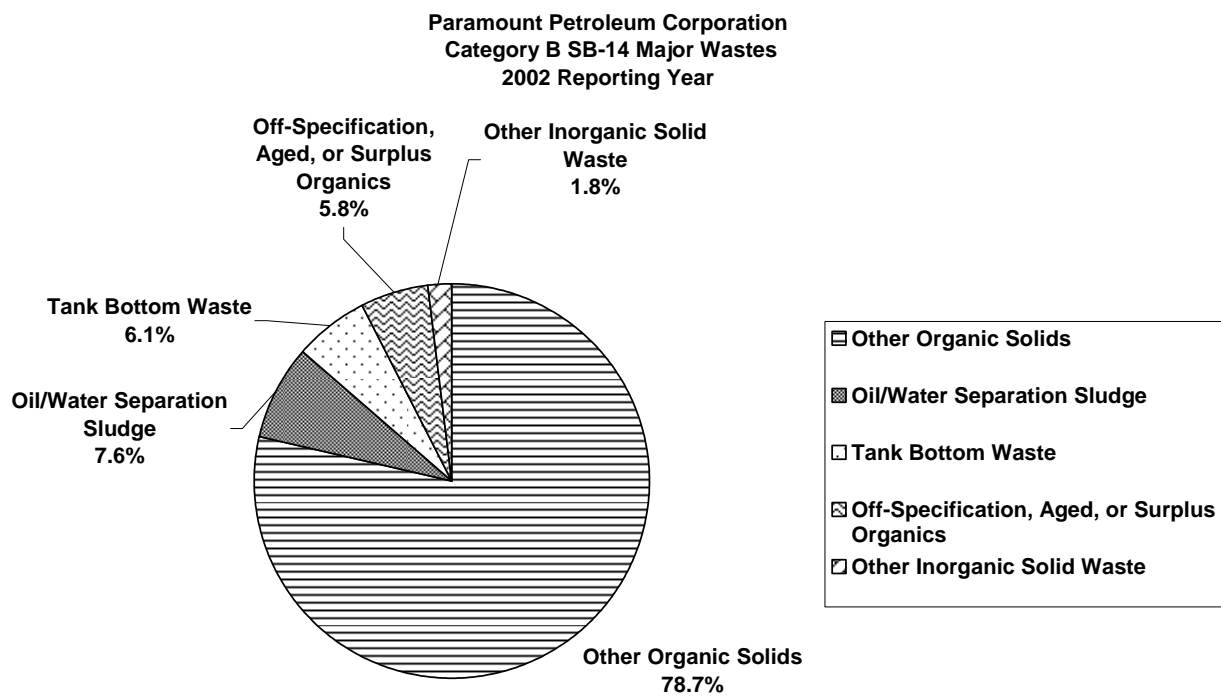


FIGURE 10. Category B Wastes for Paramount Petroleum Corporation 2002 Reporting Year.

SHELL OIL PRODUCTS US
MARTINEZ REFINERY
EPA ID: CAD 009 164 021

A. Site Information

The Shell Martinez Refinery (SMR) has been in operation since 1915. The refinery converts approximately 140,000 barrels of crude oil per day into many finished products, including liquefied petroleum gas, automotive gasoline, jet fuel, diesel, industrial fuel oils, asphalt, and petroleum coke. The lubricant department also processes crude oil—approximately 15,000 barrels per day - into finished lubricating oils, sodium sulfonates, and asphalt.

Several major expansions occurred since the opening of the refinery in 1915. The light oil processing (LOP) units were added in the 1960's and the flexicoker and associated units were added in the mid 1980's. Most recently, the "clean fuels" units, including a delayed coking unit began operation in 1996.

As of January 1, 2003, there were 837 full time and 4 part-time employees at the SMR facility.

B. Accomplishments

The refinery in its Summary Progress Report (SPR) mentioned that it reduced its Category A waste generation from a 1998 total quantity of 7.89 billion pounds generated to 5.05 billion pounds in 2002—a decrease of 36 percent. Category B waste increased to 42.7 million pounds in 2002 from 40.43 million pounds in 1998—an increase of 5.6 percent. The refinery addressed 1 major Category A waste and 2 major Category B wastes in its SPR.

Category A Wastes

According to SMR's 2002 SB 14 Hazardous Waste Management Performance Report (Report) and SPR, the refinery had one major waste stream in this category: Process Water to Biotreater (CWC 134).

1. Process Water to Biotreater (CWC 134)

Process water that enters the SMR effluent treatment plant contains varying degrees of oil and solids as well as other organic and inorganic contaminants. Wastewater treatment units in use at SMR include an American Petroleum Institute (API) oil/water separator and dissolved nitrogen flotation (DNF) units are designed to separate oil, water and solids fractions resulting in significant oil recovery. Recovered oil is combined with normal refinery process streams to produce refined products. Shell

refinery mentioned in their Report that wastewater and the units that are part of the system used for the recovery of oil from oil-bearing materials are exempt from hazardous waste and SB 14 regulation. The specific waste stream addressed in here is wastewater downstream of the DNF unit i.e. following recovery of oil that is hazardous due to benzene concentrations exceeding 0.5 mg/l TCLP.

Under DTSC's permit-by-rule, approximately two million gallons per day of process water that may at times contain greater than 0.5 mg/l benzene is biologically treated in the biotreater and subsequently discharged under the facility's NPDES permit following further treatment.

SMR implemented two measures during the 1998-2002 period to reduce the quantity of process water directed to the biotreater. During 1998, the refinery generated close to 8 billion pounds of wastewater. By implementing the following two measures, the refinery was able to reduce more than one billion pounds (15 percent) of waste.

- (a) Implemented water reuse practice relating to hydrotesting: SMR has implemented a source reduction effort for hydrotesting tanks and other pieces of equipment by returning the hydrotest water back to the source water system instead of draining it into process sewers wherever practical.
- (b) Generally, the source of water used for hydrotesting equipment and tanks came from refinery's fresh raw water supply. In certain circumstances, treated refinery wastewater can be substituted for fresh water as a source of hydrotest water. In a typical situation, the volume of water reused by implementing this measure for one hydrotest can be as much as 700,000 gallons. This measure, not only reduces hazardous waste generation, it also reduces fresh water consumption.

SMR reduced not only the volume of waste streams discharged to process sewers through water reuse activities, it also made considerable efforts to reduce the discharge of oil and other process streams to the process sewers. This had the effect of both reducing hazardous sludge generation and decreasing wastewater toxicity due to contaminants such as benzene and metals.

SMR has focused on reducing oil discharges by installing sampling stations with sample recycle loops. When flushing sample lines to obtain representative samples, closed (fast) loop sampling systems eliminate sewer discharges by returning the fluid directly to the process line instead of draining to the process sewers.

SMR had taken the following administrative steps to reduce this waste:

- They posted signs at fast-loop sample stations providing information to operators regarding the use of this improved sampling procedure.
- Established internal procedures explaining to operators and supervisors the notification and response requirements for spills, leaks, or any unusual discharges. The notification and form completion includes information on the

quantity and characteristics of the material that was spilled or otherwise discharged to the process sewers.

2. Oil/Water Separator Sludge (CWC 222)

SMR generated nearly 23 million pounds of sludge in the baseline year 1998. During the 1999-2002 cycle, the refinery successfully implemented the following four source reduction measures. As a result, the refinery reduced more than two million pounds of this waste.

- (a) Coating/guniting/and curbing: SMR spent approximately one million dollars on coating, guniting and curbing certain areas in the refinery to minimize oil and solids from the process sewer.
- (b) Street sweeping program: This measure was successfully implemented and it will be an ongoing program as part of SMR's waste minimization efforts.
- (c) Reduce oil discharge: SMR continued installing sample stations with recycle loops that effectively keep oil and other lighter hydrocarbons from entering the sewer.
- (d) Diverting high hardness low BOD wastewater: SMR conducted studies indicating that precipitation of "hardness" solids, specifically calcium carbonate and magnesium hydroxide occurs when cooling tower blowdown and other high hardness water is present in refinery wastewater and subject to high pH in the DNF unit. In the presence of oily wastewater, these solids contribute significantly to the formation of DNF float.

3. Selenium Precipitation Unit (SPU) Filter Cake (CWC 181)

SMR generated more than 12 million pounds of this waste during the 1998 baseline year. During the 1999-2002 cycle, the refinery reduced more than 25 percent (3,000,000 pounds) of this waste by implementing the following three measures: Optimized chemical treatment performance; Developed monitoring program; and Reduced the water volume needing treatment.

Management Approaches for 2002 Non-Major Waste Streams

- Spent Catalyst (CWC 161): SMR managed nearly 1600 tons of this waste by a) regeneration, b) metals reclamation, c) recycling, and d) land disposal. The refinery landfilled only two percent of the total spent catalyst generated in 2002.
- Spent Abrasives (Sandblast Grit): In 1998, SMR began working with a sandblast grit recycling company. Historically this waste was disposed off-site at a Class 1 hazardous waste landfill. In 2002, over 580 tons of sandblast grit was recycled

within the facility instead of disposing to the landfill. SMR started recycling abrasive additive (nonhazardous) as a raw material in the cement kiln industry.

- **Recycling Program:** While not a source reduction process, SMR increased their recycling program substantially since 1998. SMR recycled thirteen different waste streams including used paints, plastics, spent catalytic cracker catalyst, batteries, etc. More than 90 percent of these wastes were recycled.

C. Projections

SMR generated a total of 21 waste streams in 2002. Fifteen out of these 21 waste streams were SB 14 applicable; and a total of three waste streams were major, one in Category A and two in Category B. The refinery projected a five percent reduction in Category A and more than a 75 percent reduction in Category B waste during the 2002-2006 cycle.

Category A Wastes

In the 2002 reporting year, SMR identified one major waste stream: process wastewater to the (Effluent Treatment Plant-2) ETP-2 Biotreater (CWC 134). SMR uses approximately nine million gallons per day (mgd) of raw water in the process of refining crude oil into the various final products. Approximately 50 percent or 5.5 mgd is discharged as final effluent under their NPDES permit. The balance is lost primarily through the evaporative cooling towers.

1. Process Wastewater to ETP-2 Biotreater (CWC 134)

SMR generated more than five billion pounds of this waste in 2002. This is the only major waste stream in the Category A. The following sources/processes contribute to generating this waste stream. 1) process wastewater containing oil from SMR's light oil processing (LOP) facility, 2) clean fuel units, 3) crude desalter, and 4) brine deoiler. All these waste streams are treated in the SMR's effluent treatment plant-2 treatment system. A pair of dissolved nitrogen flotation (DNF) units provides oil/water/solids separation. After DNF treatment, the process wastewater is treated by the ETP-2 activated sludge unit. After activated sludge treatment, the wastewater undergoes further treatment including clarification, selenium removal, and carbon adsorption prior to final discharge to the Carquinez Strait under the NPDES permit.

SMR successfully reduced 50 percent of this waste during the 1998-2002 cycle. This was achieved by segregating benzene-containing wastewater streams entering into ETP-2 waste treatment train. For the 2002-2006 cycle, SMR is further planning to reduce five percent more waste amounting to 253 million pounds by selecting the following two source reduction measures.

Reduce oil discharges: Over the last few years, SMR implemented this measure and experienced good results. SMR is continuing to implement this measure via installing

42 more closed (fast) loop sample stations. Over 65 fast loop sample stations have been installed, since 1993, and approximately 42 more stations have been identified for fast loop sample conversions to be completed by the end of 2004. This will complete conversion of all routine sample stations in VOC service in the refinery. It is estimated that each sample event requires one to five gallons of flush prior to taking a representative sample. With over 100 fast-loop stations in the refinery and approximately 350 samples taken per day, it is estimated that implementation of this source reduction measure results in avoidance of 500 to 2500 tons of oil and other hydrocarbon material to the sewer each year.

SMR is also planning to continue the use of vacuum trucks to transport oil to oil recovery facilities rather than using the sewers; and improved employee awareness of methods for reducing oil discharges to the sewer.

Reduce overall water volume to sewer: SMR plans to evaluate the potential for reducing the overall water volume to the sewer. Opportunities such as using recycled process water for sprays at SMR equalization ponds and continuing to segregate wastewater streams between ETP-1 and ETP-2 will also be evaluated.

Category B Wastes

Under Category B waste, SMR generated fourteen SB 14 applicable waste streams totaling more than 49 million pounds of wastes in the 2002 reporting year. Two out of these fourteen were major waste streams. They are: 1) Oil/Water Separator Sludge-DNF Float (CWC 222) and 2) Filter Cake with Selenium (CWC 181). Figure 11 shows the types and quantity of Category B wastes that Shell Martinez reported for 2002.

1. Oil/Water Separator Sludge-DNF Float (CWC 222)

SMR treats its process wastewater comprised primarily of stormwater and oily wastewater in its effluent treatment plant (ETP). The ETP plant consists of parallel wastewater treatment systems ETP-1 and ETP-2. Both of these systems contain two dissolved nitrogen flotation (DNF) units. The DNF units are designed to remove oil and solids from the process wastewater. The oily solids from this process are removed from the DNF units and pumped to the on-site boilers for incineration.

SMR generated approximately 12,800 tons of DNF float in 2002. The refinery is projecting a reduction of about five percent of this waste by continuing with the two measures that they started implementing in the previous SB 14 cycle. They are: 1) erosion control and 2) street sweeping. They will implement two new source reduction measures during the 2002-2006 cycle. They are: 1) divert high hardness wastewater around DNF and 2) reduce oil discharge to sewer. The detail of these two measures is discussed in previous sections.

2. Filter Cake with Selenium (CWC 181)

SMR pumps treated wastewater from ETP-1 and ETP-2 to the selenium precipitation unit (SPU). The SPU removes soluble selenium from the wastewater using a ferric chloride precipitation process. The ferric chloride precipitate sludge generated from this process is dewatered using belt press filter and is disposed of off-site in a hazardous waste landfill.

The removal of selenium from the treated wastewater is required by SMR's NPDES permit to meet 50 ug/l final effluent discharge concentration and a 2.13 lb. daily mass limit discharge. For each pound of selenium removed from the wastewater, approximately 2.5 tons of hazardous waste sludge is generated. SMR generated 8575 tons of SPU filter cake in the reporting year 2002. This cake was disposed in a Class 1 hazardous waste landfill. SMR is planning to take the following measures to completely reduce this waste stream: a) continue optimize chemical treatment performance, and b) pursue recycle option.

- (a) Continue optimizing chemical treatment performance: As discussed in the previous section, SMR wastewater contains soluble selenium that must be reduced to comply with NPDES permit prior to discharge the effluent to the Carquinez Strait. The SPU reduces SMR's treated wastewater selenium levels using ferric chloride precipitation process. The removal of selenium is dependent on several chemical injections. The optimization of ferric chloride dosage, the control of pH using sodium hydroxide and sulfuric acid, and the role that phosphate has in selenium removal will each be evaluated. This evaluation will aim to improve selenium removal while reducing sludge formation. The removal of selenium using the precipitation process is also dependent upon the total water volume treated as well. Evaluations are underway to determine the best combination of selenium-containing wastewater streams to achieve optimum removal efficiency. If successful, this measure will reduce up to 1,600 tons of filter cake generation.
- (b) Pursue recycle option: The refinery is currently evaluating the SPU filter cake as a suitable substitute as an ingredient in an industrial process, specifically, as a raw material in the production of roadbase. SMR discussed transporting this material for recycling in Arizona with the Arizona Department of Environmental Quality. SMR is also working with a contractor and the DTSC to reclassify this material as an "excluded recyclable material". If successful, up to 8000 tons of waste will be classified as non-hazardous.

D. Remarks

Waste Elimination: SMR has done remarkable job in eliminating the following waste streams from their facility. Although these waste streams are exempt from SB 14 requirements, SMR's efforts are noteworthy in terms of environmental benefit.

- Usage of the ozone depleting chemical Freon. This was used in the testing laboratory. SMR eliminated use of Freon as a solvent for wastewater oil and grease analysis by eliminating the on-site testing of wastewater for oil and grease.
- As of 2003, SMR became a PCB-free facility.
- Nearly all asbestos containing equipment has been removed from SMR. Additionally, a phased approach has begun in September 2003, to eliminate all remaining asbestos gaskets throughout the refinery complex.

As of late 2003, Shell shut down its Lubricant Department.

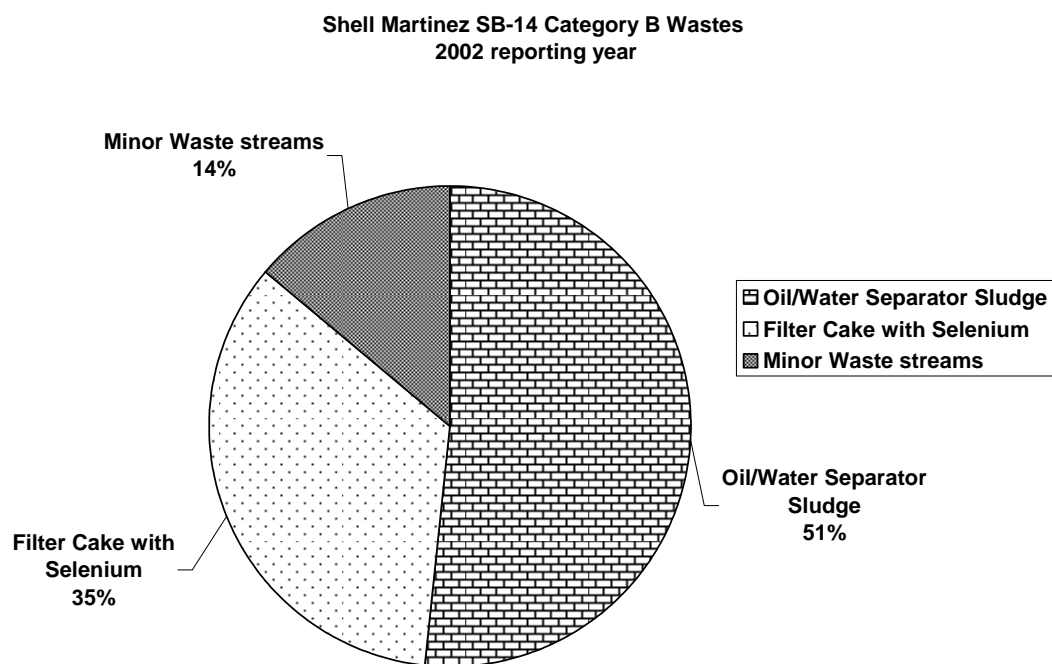


FIGURE 11. Category B Wastes for Shell Martinez Refinery 2002 Reporting Year.

SHELL OIL PRODUCTS U.S. SHELL BAKERSFIELD REFINERY (SBR)

**EPA ID: CAD 099 457 087
CAD 982 052 094**

A. Site Information

The Shell Oil Products U.S. Bakersfield Refinery (SBR) consists of three operating areas designated as Area 1, Area 2, and Area 3. Area 1 and Area 2 are contiguous, while Area 3 is located 1.5 miles northeast of Area 1. Since they are geographically separate and have different EPA numbers, they are reported as separate sites in their SB 14 multi-site Source Reduction Evaluation Review and Plan (Plan). SBR currently has a rated crude oil processing capacity of 70,000 barrels per day. This facility has been in operation since 1984 in Area 1, 1986 in Area 2, and 1987 in Area 3. In 2003, it employed 223 employees in Areas 1 and Area 2 and 25 in Area 3. The majority of the crude oil feedstock enters the refinery in Areas 1 and Area 2 via pipeline, with the remainder delivered by tanker truck. The hydrocracking units produce gasoline and diesel blend stocks along with desulfurized gas oil (DGO) for further processing at the Shell Martinez Refinery, as well as for direct sales. Lighter and naphta products from the crude unit and other units are further processed by catalytic reformers to produce reformate, a gasoline blend stock. The overhead vapors from some units are directed to the gas treating plant to produce liquefied petroleum gas (LPG), butane and isobutane. As byproducts of the refining process, both ammonia and sulfur are produced and sold. The final products of the Bakersfield Refinery are diesel, LPG, unleaded regular gasoline (87 octane), unleaded intermediate gasoline (89 octane), unleaded premium gasoline (92 octane), vacuum tower residuum (asphalt), sulfur, ammonia, fuel oil cutter, desulfurized gas oil, propane, butane, coke, isobutene, refinery fuel gas (internal use only) and raw gas oil (RGO).

B. Accomplishments

SBR did not report any Category A wastes for 1998 and 2002. However, in 2002, SBR reported Category B wastes as 1.5 million pounds for Area 1 and Area 2 a reduction of 22 percent from 1998 and 78,000 pounds for Area 3, a reduction of more than 75 percent from 1998.

Area 1 and Area 2

Category A Wastes

The refinery did not report any Category A wastes for 1998 and 2002, for Area 1 and Area 2.

Category B Wastes

SBR reported the following major hazardous waste streams for 1998, for Area 1 and Area 2: spent catalyst (CWC 162), other inorganic solid wastes (CWC 181), tank bottoms waste (CWC 241) and other organic solids (CWC 352).

1. Spent Catalyst (CWC 162)

The facility generated 195,000 pounds of this waste stream in 2002, versus 496,000 pounds in 1998. This is a reduction of 61 percent. Catalysts are used to initiate or promote reactions in petroleum refining operations. Specific catalysts are used to promote chemical reactions inside reactors vessels under specified operating conditions. Spent catalyst is generated when the catalyst loses efficiency or becomes inactive due to physical fouling or chemical poisoning and must be replaced. Once removed from the reactor, the spent catalyst is properly disposed, regenerated, reclaimed or recycled off-site. The facility reported a list of source reduction approaches implemented since 1998 as follows:

- (a) Procurement of longer life-cycle catalysts: There was a 61 percent reduction in the quantity of the spent catalyst generated between 1998 and 2002. Part of this reduction may be due to improvements in catalyst design that resulted in an increase in catalyst life.
- (b) Improved catalyst handling: SBR evaluated catalyst handling procedures to identify best practices for reducing the amount of catalyst that must be disposed to a landfill rather than recycled or reclaimed. The refinery worked with catalyst suppliers to replace the unlined drums used to ship catalyst with lined drums, reusable catalyst bins, or bulk bags. Most catalyst is now shipped in these containers.
- (c) Efficient operation of the process unit to avoid upsets, catalysts poisoning, etc.

2. Other Inorganic Solids (CWC 181)

This category includes RCRA sandblast grit, cooling tower sludge, crushed empty drums, selenium centrifuge solids and sulfuric acid sludge. The facility generated 955,000 pounds of this stream during 1998. Between the baseline year, 1998 and the reporting year, 2002, the inorganic solid wastes increased. However, several individual streams, for example, empty containers and cooling tower sludge, did decrease between those years. The following is a description of each of the CWC 181 waste streams.

- RCRA sandblast grit: Sandblasting is used to clean a variety of materials within the refinery. On occasion this sandblast media becomes contaminated with organic material. In other cases spent sandblast grit itself may be a hazardous waste. The sandblast waste increased from 1,200 pounds in 1998 to

2,300 pounds in 2002. This increase of 92 percent was due to an increase in tank maintenance activities.

- **Cooling tower sludge:** The induced draft cooling towers operated by the refinery use large water storage basins. These basins require cleaning to remove solid materials on an infrequent basis, thereby generating a cooling tower sludge. The cooling tower sludge contains metals from the cooling water treatment chemicals and the corrosion of heat exchangers, piping, and other equipment that use cooling water. During cleaning the cooling tower sludge is removed and dewatered prior to off-site disposal at a permitted hazardous waste facility. SBR did not generate any cooling tower sludge in 2002, versus 86,000 pounds of this waste generated in 1998.
- **Crushed empty drums:** The refinery purchases many products, such as solvents, alkalis and acids in drums for the refinery operation and maintenance. Drums are also used to collect hazardous waste materials prior to disposal. Empty metallic drums are crushed prior to disposal to reduce volume. All crushed drums are sent to permitted hazardous waste facilities for disposal. In 2002, about 10,000 pounds of this waste were generated, versus 48,000 pounds in 1998, an 80 percent reduction.
- **Selenium centrifuge solids:** The refinery generated 950,000 pounds of this waste stream in 2002, versus 816,000 pounds in 1998, an increase of 16 percent. The facility installed a processing unit in 1997 to remove selenium from stripped sour water. This process removes selenium by a patented precipitation process. Solids are dewatered using a centrifuge and disposed of at a permitted off-site facility. This process routinely generates the largest volume of hazardous waste at the refinery. There were no source reduction measures reported for this waste.
- **Sulfuric acid sludge:** Sulfuric acid is used to adjust the pH of cooling water and refinery wastewater. Periodically, the process tank used for storage of sulfuric acid must be cleaned to remove sludge generated by material storage. SBR did not generate any sulfuric acid sludge in 2002, versus 3,500 pounds generated in 1998.

The refinery implemented the following source reduction measures since 1998:

- Increased use of bulk chemicals to minimize empty containers.
- Replaced sight glass on acid tank to aid in gauging and reducing frequency of cleaning.

3. Tank Bottoms Waste (CWC 241)

SBR did not generate any of this waste in 2002, versus 151,000 pounds generated in 1998. This is due to the implemented process change that allowed a small stream of

these tank solids to be processed at the delayed coker. Tank cleaning involves the removal of solids that settle in the tank over several years of operation. Tank cleaning is performed for recovery of lost tank capacity, for periodic inspection, for changes in service, and for repair.

4. Other Organic Solid Waste (CWC 352)

This waste stream includes bundle sludge, primary treatment sludge, and wastewater treatment unit (WWTU) filters. There was a 55 percent waste reduction between 1998 and 2002.

- **Bundle sludge:** Heat exchangers are used throughout the refinery to heat and cool process streams. These heat exchangers become fouled and lose efficiency. To recover the heat exchanger efficiency, the heat exchanger bundles are cleaned by hydroblasting to remove the scale and hydrocarbon solids. Hydroblasting the heat exchanger bundles takes place on a concrete pad from where the scale and hydrocarbon solids are placed in drums for disposal.
- **Primary treatment sludge:** The wastewater collection and treatment system is the source of primary treatment sludge and oil emulsions. Oily solids settle out of the wastewater stream in various sumps located within the refinery. The sludge is sent to off-site hazardous waste facilities for disposal or is burned as a supplemental fuel at approved off-site facilities.
- **Wastewater treatment filters:** The wastewater is filtered using disposable cartridges to prevent sub-surface plugging of the receiving aquifer. Wastewater filters are classified as contaminated debris and are shipped off-site to a permitted hazardous waste facility for incineration.

The facility generated 93,000 pounds of the organic solids waste stream in 2002, versus 206,000 pounds in 1998, a 55 percent reduction. This waste reduction is primarily associated with the reduced generation of WWTU filters. Two changes in operation of the wastewater treatment unit contributed to this reduction:

- Multi-media filters were replaced during the fourth quarter of 1997 with walnut shell filters. Walnut shell filters exceed multi-media filters in oil removal effectiveness, thereby reducing the plugging of WWTU cartridge filters and extending the life of the filter.
- Improvements in chemical treatment at the wastewater treatment plant have reduced the formation of particulate, thus resulting in a decrease in the generation of WWTU filters.

Source reduction measures implemented for CWC 352 waste streams were as follows:

- (a) Improvements to solids removal upstream of the wastewater treatment unit.

- (b) Improvements to hydrocarbon recovery system: by identifying oil-bearing streams that would normally have otherwise gone off site as a waste stream and identifying ways to maximize what could be processed at the delayed coking unit to produce additional coke product. Oily-water emulsion from wastewater tanks was generally the only stream going into the quench cycle. By altering other oily streams to meet the limitations of the DCU, the amount of oil-bearing materials to the coker increased.

5. Soil and Debris from Refinery Operations (CWC 611)

The facility generated 74,000 pounds of this waste stream in 1998, versus 117,000 pounds in 2002, an increase of 58 percent. This waste is generated as part of the improvements made to the facility's spill containment and surface drains, routine cleanup of facilities, and materials collected during maintenance activities. Since it was not a major waste stream in 1998, no source reduction measures were implemented since 1998.

Area 3

Category A Wastes

SBR did not report any Category A waste during 1998 and 2002 for Area 3.

Category B Wastes

SBR discussed three major hazardous waste streams generated during the 1998 baseline year for Area 3: Tank bottoms waste (CWC 241), other organic solids (CWC 352) and soil and debris from refinery operations (CWC 611).

1. Tank Bottoms Waste (CWC 241)

SBR did not generate any tank bottoms waste in 2002, versus 216,000 pounds in 1998. This is due to the increased utilization of coker for recovery of hydrocarbons from tank cleaning solids.

2. Other Organic Solid Waste (CWC 352)

The Area 3 facility generated 52,000 pounds in 1998, versus 58,000 pounds in 2002. This category includes primary treatment solids and spent wastewater filters. While the refinery preferred disposition for primary treatment solids is injection into the delayed coker, operational limitations exist which may prohibit using the total volume generated. Further improvements are being considered to increase the amount of organic solids that can be processed in the coker.

- Primary treatment solids: The Area 3 facility generated about 48,000 pounds during 2002, versus about 44,000 pounds in 1998. The wastewater collection

and treatment system is the source of primary treatment sludge and oil emulsions. Oily solids settle out of the wastewater stream in various sumps around the refinery. Because of the similar physical and chemical composition, refinery bundle cleaning sludge is combined with this waste stream. Two measures were taken since 1998: Improved hydrocarbon recovery system and minimization of solids to the process sewer system.

- Spent wastewater filters: The Area 3 facility generated 11,000 pounds of this waste in 2002, versus about 8,600 pounds in 1998. The wastewater is filtered using disposable filter cartridges to prevent sub-surface plugging of the wastewater disposal wells. The facility improved chemical treatment to refinery wastewaters, resulting in a reduction of solids and particulate matter.

3. Soil and Debris from Refinery Operations (CWC 611)

The Area 3 facility generated 14,000 pounds in 2002, versus 43,000 pounds in 1998, a 67 percent reduction. This waste was generated as part of the improvements made to the facility's spill containment and surface drains, routine cleanup of facilities, and materials collected during maintenance activities. The decrease in this waste generation during the baseline year, 1998 and reporting year, 2002, was due to refinery improvements in operations, maintenance and reliability that are directly related to the reduced number of spills and resultant wastes. A source reduction measure implemented was the construction of an additional spill containment in 2000.

C. Projections

Area 1 and Area 2

Category A Wastes

SBR did not report generating Category A waste during 2002 for Area 1 and Area 2.

Category B Wastes

Category B wastes were reported as 1.5 million pounds for Area 1 and Area 2 during 2002. The facility discussed three major hazardous waste streams generated during the 2002 reporting year for Area 1 and Area 2: spent catalyst (CWC 162), selenium centrifuge solids (CWC 181), and soil and debris from refinery operations (CWC 181/611). These wastes are generated as described in section II above. Figure 12-A shows the types and quantity of Shell Bakersfield Refinery Category B wastes reported for Areas 1 and 2 in 2002.

1. Spent Catalyst (CWC 162)

The facility generated 195,000 pounds of this waste stream during 2002. The source reduction measures selected to be implemented by 2006 are as follows:

- Evaluation of vendors and quantities necessary to avoid surplus.
- Review of handling procedures to minimize spills and other losses.

2. Selenium Centrifuge Solids (CWC 181)

The refinery generated 950,000 pounds of this waste during 2002. The source reduction measure selected to be implemented by 2006 is additional training for unit operators to ensure consistent operation of selenium removal unit.

3. Soil and Debris from Refinery Operations (CWC 181/611)

The facility generated about 117,000 pounds of the waste stream during 2002. The source reduction measures selected to be implemented by 2006 are as follows:

- Continue initiatives in place to minimize leaks and spills. An employee reward program for reducing the number of spills below identified targets is an example of this measure. This program has been effective at reducing spills and waste generated by spill cleanup.
- A program to report “environmental observations” has been incorporated into a system originally developed for safety/near-miss reporting. Although still new, this program has shown success in early identification and communication of an environmental near miss, such as potential spill conditions.

Area 3

Category A Wastes

SBR did not report any Category A waste during 2002 for Area 3.

Category B Wastes

The Category B wastes were reported as 78,000 pounds for Area 3, a reduction of over 75 percent from 1998. SBR discussed three major hazardous waste streams generated during the 2002 reporting year for Area 3: primary treatment solids (CWC 352), spent wastewater filters (CWC 352) and soil and debris from refinery operations (CWC 611). Figure 12-B shows the types and quantity of Shell Bakersfield Refinery Category B wastes reported for Area 3 in 2002.

1. Primary Treatment Solids (CWC 352)

The Area 3 facility generated about 48,000 pounds of this waste during 2002. The source reduction measure selected to be implemented by 2006 is to review and improve coker injection process to increase amount of solids recycled on-site.

2. Spent Wastewater Filters (CWC 352)

The Area 3 facility generated about 11,000 pounds of this waste during 2002. The source reduction measure selected to be implemented by 2006 is to continue to identify ways to improve wastewater treatment and minimize solids. The refinery is continuously evaluating the water treatment chemicals it uses to reduce the formation of particulates, which will result in a decrease in the generation of spent wastewater filters. The refinery is working closely with its vendors to identify new products to help achieve this goal.

3. Soil and Debris from Refinery Operations (CWC 611)

The facility generated about 14,000 pounds of the waste stream during 2002. The source reduction measure selected to be implemented by 2006 are as follows:

- Continue initiatives in place to minimize leaks and spills. An employee reward program for reducing the number of spills below identified targets is an example of this measure. This program has been effective at reducing spills and waste generated by spill cleanup.
- A program to report “environmental observations” has been incorporated into a system originally developed for safety/near-miss reporting. Although still new, this program has shown success in early identification and communication of an environmental near miss, such as potential spill conditions.

D. Remarks

This section describes factors that affected hazardous waste generation rates during the reporting year and management practices since the baseline year, 1998 at the refinery. Since the baseline year, SBR has implemented major upgrades to produce government mandated reformulated fuels. The effect of these modifications have been changes in the types and amounts of catalyst used in processing units, changes in wastewater quality and additional process chemical treatment requirements. As noted in the 1994 and 1998 reports, the refinery underwent changes to allow for increased throughput of heavy crude oil. San Joaquin Valley heavy crude oils contain elevated concentrations of selenium as compared to light crude oil. Increased processing of heavy crude led to an increase in the selenium concentration in wastewater. On March 15, 2005, Shell Bakersfield Refinery was sold to Big West of California, LLC. Due to this transition period, some of the sections in this refinery chapter are not more descriptive since the refinery was not able to provide details.

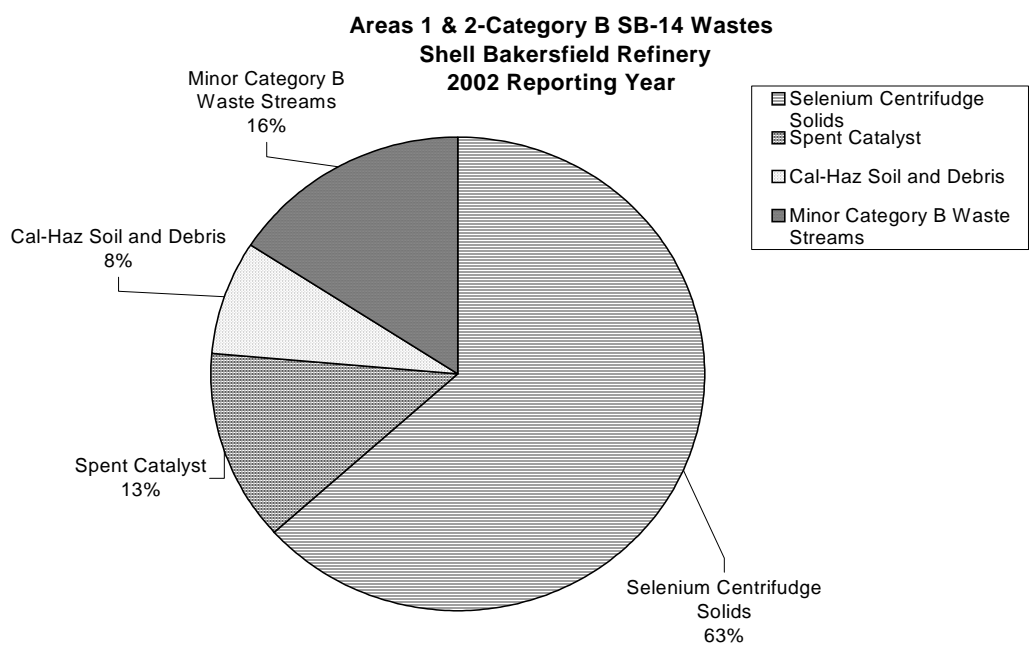


FIGURE 12-A. Category B Wastes of Areas 1 & Areas 2 for Shell Bakersfield Refinery 2002 Reporting Year.

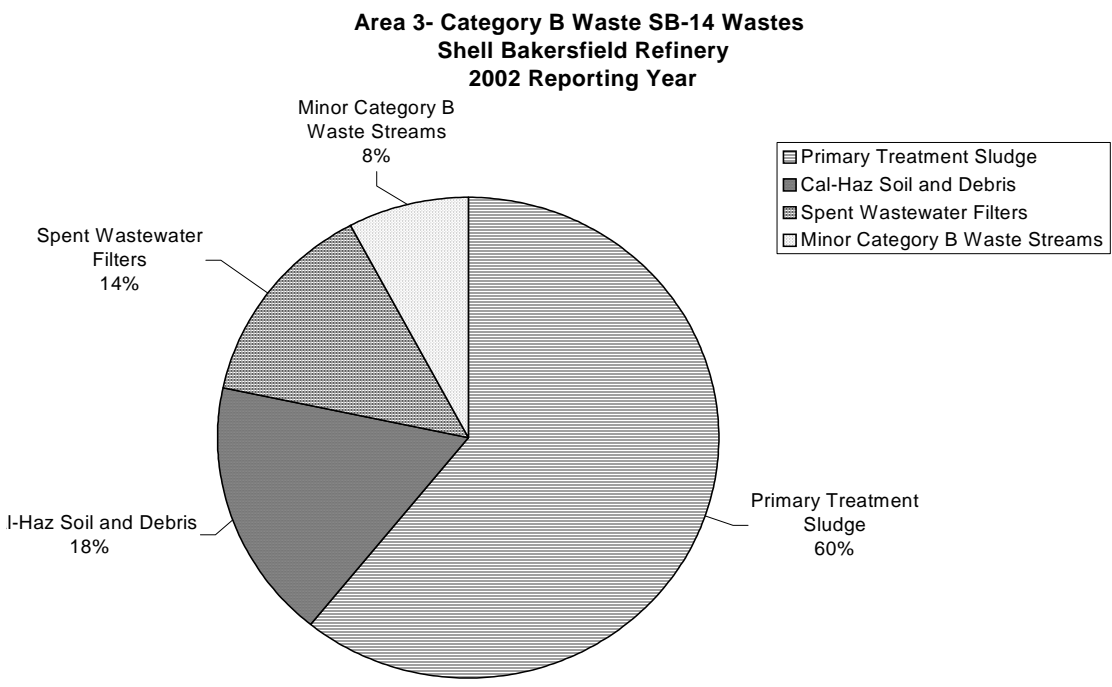


FIGURE 12-B. Category B Wastes of Area 3 for Shell Bakersfield Refinery 2002 Reporting Year.

SHELL OIL PRODUCTS U.S.
EQUILON ENTERPRISES LOS ANGELES REFINERY (LAR)
EPA ID: CAD 041 520 644

A. Site Information

This facility has been in operation since 1924. The refinery is designed and operated to process up to 100,000 barrels per day of mostly heavy California crude oils into marketable products such as gasoline, jet fuels, diesel fuels, liquefied petroleum gases, petroleum coke, and refinery gases. In 2003, LAR employed 438 full-time employees and 80 contract employees.

B. Accomplishments

The refinery reported generating 2.2 billion pounds of Category A waste in 2002 and 3.2 billion pounds in 1998. Category B waste generation was reported as 770,000 pounds in 2002 and 78 million pounds in 1998.

Shell implemented the following measures to reduce the amount of waste generated at this facility between 1998 and 2002:

- Decommissioning of the lime softening unit and installation of a reverse osmosis (RO) system to pretreat boiler feed water.
- Installation of a RO system to treat Cooling Tower #7 make-up water.
- Installation of sewage traps at several locations.
- Dewatering of recyclable material prior to coker injection.

Additionally, refinery operational personal are continuously trained in maintaining process operational parameters in a range which enables maximization of product output, while minimizing the amount of generated waste.

Category A Wastes

No source reduction measures were implemented for this waste stream.

Category B Wastes

The refinery reported the following major waste streams: fluid cracking catalyst unit (FCC) waste (CWC 161), combined inorganic solid waste (CWC 181), tank bottoms (CWC 241), sewer sludge (CWC 321) and heat exchanger bundle cleaning sludge (CWC 352).

There were several general approaches to reduce the amount of waste generated:

- (a) DCU Input Change: The input change to the Delayed Coker Unit (DCU) has been aggressively pursued since 1987. In 2002, 60 million pounds of tank bottom, brine water treatment sludges, and other sludges were recycled to the DCU.
- (b) Operational Improvements: Several measures were implemented to reduce the amount of waste generated at the facility between 1998 and 2002:
 - Decommissioning of lime softening unit and installation of reverse osmosis (RO) system to pretreat boiler feed water.
 - Installation of a RO system to treat cooling tower #7 make-up water.
 - Installation of sewage traps at several locations.
 - Successful installation of dewatering recyclable material prior to coker injection. An increase from 2-3 percent solids to 20-25 percent solids was realized from the dewatering of sludge.

1. FCC Waste (CWC 161)

The facility generated 1.84 million pounds of this waste in 2002. 1.78 million pounds of which were recycled in Portland cement kilns and 62,000 pounds were disposed offsite, compared to 550,000 pounds that were disposed offsite in 1998. This waste stream is due to attrition fines that are routinely removed from the FCC regenerator.

The facility reported the following list of approaches implemented since 1998:

- Operator training
- Increase recycling to cement kiln.

2. Combined Other Inorganic Solid Waste Stream (CWC 181)

This waste stream includes sand blast, lead contaminated blast grit, and heater bricks and other refractory. The refinery generated about 230,000 pounds in 1998 and 229,000 in 2002. No source reduction measures have been implemented for this waste stream since 1998.

3. Heat Exchanger Bundle Cleaning Sludge (CWC 352)

The refinery generated 74,000 pounds of this waste in 2002, versus 128,000 pounds in 1998, a 42 percent reduction. The source reduction measure implemented since 1998 was recycling this material to the delayed coker unit (DCU). Heat exchangers are used throughout the refinery to heat and cool process streams. With use, these heat exchangers become fouled and lose efficiency. To recover heat exchanger efficiency, the heat exchanger bundles are cleaned by hydroblasting to remove the scale and hydrocarbon solids. Hydroblasting the heat exchanger bundles takes place on a

concrete pad from where the scale and hydrocarbon solids are placed in drums for disposal.

4. Tank Bottoms (CWC 241)

The refinery generated 10 million pounds of this waste in 1998. A waste management measure implemented since 1998 was to increase the quantity of this stream sent to the DCU. This reduced the amount sent offsite to 178,000 pounds in 2002.

5. Sewer Sludge (CWC 321)

This waste is defined as sludge generated routinely by washing down the dust from pads surrounding refinery equipment. The generation rate depends on maintenance and construction activities at the site and on remediation of impacted soil by excavation. The refinery reported that about 224,000 pounds of this waste was shipped offsite for disposal in 2002, versus about 11.6 million pounds in 1998. Refinery management has implemented several measures to reduce the amount of generated sewer sludges including installation of sewer traps in several units.

C. Projections

Shell selected the following measures for implementation in the 2002-2006 SB 14 planning cycle:

- Evaluate waste generation rate after completion of the MTBE phase-out project.
- Continue evaluation of increasing the quantities of solid waste which can be recycled to the DCU.
- Continue operator training to maintain process operational parameters within an optimal range ensuring maximum product and minimal waste.
- Continue to improve refinery housekeeping practices.
- Evaluate additional steps for reducing the frequency of generating sewer slugs;
- Negotiate with paint suppliers for recycling residual paint and empty cans at their facilities.

Category A Wastes

There were 2.2 billion pounds of this waste generated in the 2002 reporting year and no source reduction opportunities were identified. Figure 13-A shows the types and quantity of Category A wastes that LAR reported for 2002.

Category B Wastes

The refinery reported the major hazardous waste streams for the 2002 reporting year as follows: FCC catalyst (CWC 161), combined inorganic solid waste (CWC 181), tank bottoms (CWC 241), sewer sludge (CWC 321/352) and heat exchanger bundle cleaning

sludge (CWC 352). Figure 13-B shows the types and quantity of Category B wastes that LAR reported for 2002.

1. FCC Catalysts (CWC 161)

The refinery generated a total of about 2 million pounds of FCC catalysts in 2002, 97 percent of which were recycled in Portland cement kilns and 3 percent of this waste were disposed offsite. No source reduction measures have been identified for this reporting year.

2. Combined Inorganic Solid Waste Stream (CWC 181)

The refinery generated 229,000 pounds of this waste in 2002. No additional source reduction opportunities were identified.

3. Tank Bottoms (CWC 241)

The refinery generated about 178,000 pounds of this waste in 2002. The source reduction measure selected to be implemented by 2006 is to increase recycling to the DCU. The refinery projects an annual source reduction of this waste stream of 1,000 pounds.

4. Sewer Sludge (CWC 321)

The refinery generated 224,000 pounds of this waste in 2002. LAR projects an annual source reduction of 1,000 pounds. The source reduction measures selected to be implemented by 2006 are:

- Housekeeping and administrative steps and
- Increase recycling to the DCU.

5. Heat Exchanger Bundle Cleaning Sludge (CWC 352)

The refinery generated 74,000 pounds of this waste in 2002. The source reduction measure selected to be implemented by 2006 is to increase recycling of this waste stream to the DCU. The refinery projects an annual source reduction of this waste stream of 2,000 pounds.

D. Remarks

This section describes factors that affected hazardous waste generation rates and management practices since 1998 at LAR. Since 1998, there have been some new constructions. A new crude desalting unit and C4 - isomerizations unit were installed in 2001 and 2002, respectively. During the reporting period, a major construction effort was completed to implement LAR's MTBE phase-out project.

Shell LA SB-14 Category A Wastes
2002 Reporting year

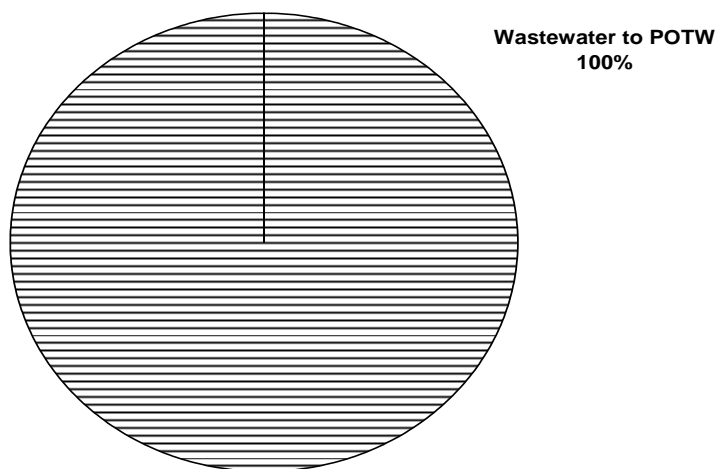


FIGURE 13-A. Category A Wastes for Shell-LA 2002 Reporting Year.

Category B SB-14 Waste Streams
Shell-Equilon Los Angeles Refinery
2002 Reporting Year

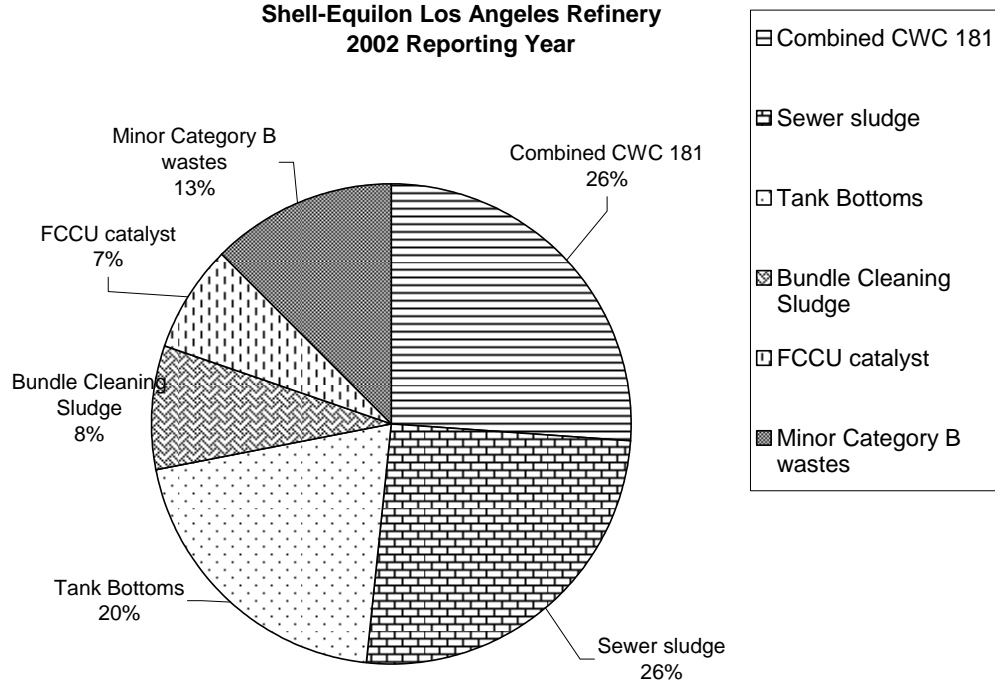


FIGURE 13-B. Category B Wastes for Shell-LA 2002 Reporting Year.

SHELL OIL PRODUCTS U.S.
EQUILON ENTERPRISES SULFUR RECOVERY PLANT
EPA ID: CAD 041 520 644

A. Site Information

Equilon Enterprises Sulfur Recovery Plant is located in Carson, California and it has been in operation for 53 years. This facility is designed and operated to remove sulfur and nitrogen compounds from wastewater and amine streams to produce molten sulfur. In 2003, it employed 46 full-time employees and 6 contract employees.

B. Accomplishments

The refinery did not report Category A waste during 1998 and 2002. Category B waste production was reported as about 23,000 pounds in 2002 and more than 85,000 pounds in 1998, a 73 percent reduction. Most of the 1998 waste stream is due to cleaning of heat exchanger bundles (CWC 352).

Category A Wastes

Equilon Enterprises Sulfur Recovery plant did not report any Category A wastes in 1998 and 2002.

Category B Wastes

The sulfur recovery plant reported only combined inorganic solid waste (CWC 181) as its major hazardous waste stream, although other streams were generated such as empty paint cans, waste sulfuric acid, solid waste, waste aerosol and contaminated metal trays. The combined inorganic solid wastes (CWC 181) include sand blast and lead contaminated blast grit, solid lead waste and oily filters and TGTU filters. The facility generated nearly 23,000 pounds of Category B waste in 2002, compared to nearly 86,000 pounds in 1998, a 73 percent reduction. The source reduction measure implemented since 1998 were administrative steps.

C. Projections

In 2002, the Sulfur Recovery Plant did not report any Category A wastes and reported nearly 23,000 pounds of Category B waste. There were no projections reported for the CWC 181 waste stream. Figure 13-C shows the quantity and types of the Sulfur Recovery Plant Category B wastes reported in 2002.

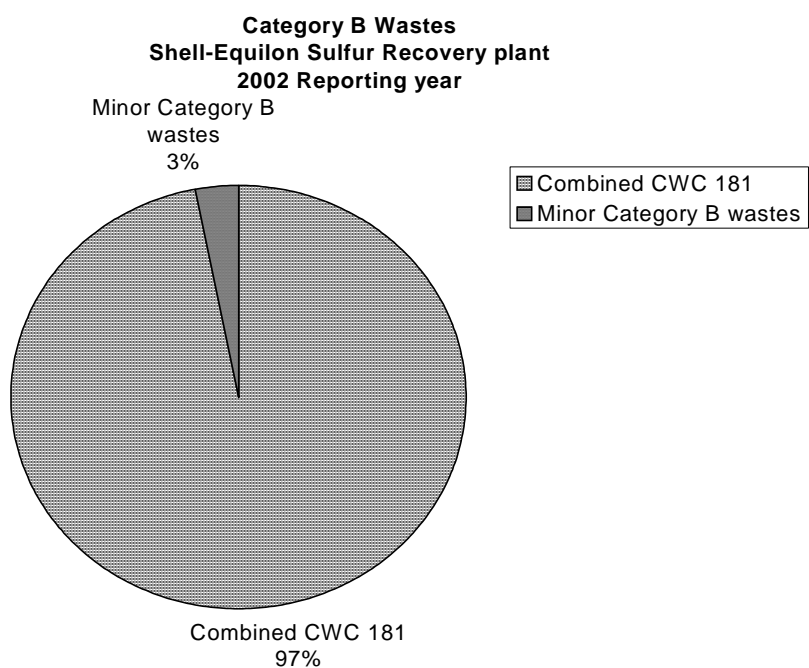


FIGURE 13-C. Category B Wastes for Shell-LA Sulfur Recovery Plant 2002 Reporting Year.

TESORO REFINING AND MARKETING COMPANY
GOLDEN EAGLE REFINERY
EPA ID: CAR 000 091 488

A. Site Information

Tesoro Refining and Marketing Company consists of the Golden Eagle Refinery and the Amoco Terminal, both located at Martinez, in Contra Costa County. This facility has been in operation for 91 years and has been operated by Tesoro since 2002. In 2003 it employed approximately 670 full time and seasonal employees. Crude oil arrives at the refinery via pipelines and ships and is stored at the Amoco Terminal. The refinery distills crude oil into separate petroleum fractions, including gas oils, diesel, unfinished gasolines, and residual oil. Residual oils go to the fluid coker, where the oil is thermally cracked into gasolines, gas oils, gases, and petroleum coke. Heavy oils are directed to the Catalytic Feed Hydrotreater Unit, where sulfur and other impurities are removed. Purified gas oils are directed to the Fluid Catalytic Cracking Unit (FCCU), to produce gasolines, gas oils, and fuel gases. Finished stocks are then sent offsite by pipeline and distributed to West Coast markets. Sulfur compounds are processed into elemental sulfur and sulfuric acid, while ammonia is processed into anhydrous ammonia. The refinery went through ownership changes. During the period of 1994-1998, the refinery was owned by Tosco Refining Company and operated as the San Francisco Area Refinery at Avon. Since 1999, the ownership of this refinery has changed twice. Ultramar, Incorporated purchased the refinery and assets in 2000 and the name was changed to Golden Eagle Refinery. Ultramar merged with Valero Energy Corporation in 2002. The refinery was then sold to Tesoro, who currently operates the refinery.

B. Accomplishments

Category A Wastes

Tesoro generated two Category A waste streams: the demineralizer regeneration effluent (CWC 122) and acid plant effluent (CWC 791).

1. Demineralizer Regeneration Effluent (CWC 122)

The facility generated nearly 500 million pounds of this waste in 2002 and nearly 400 million pounds in 1998. This waste is produced during the regeneration of the resin beds that demineralize steam production feed water. Sulfuric acid solution is run through the cation bed exchanger to regenerate the hydrogen ions used for cation removal, and sodium hydroxide is run through the anion bed exchanger to regenerate the hydrogen ions used for anion removal. To date, the refinery was not able to select any implementable source reduction measures for this waste stream.

2. Acid Plant Effluent (CWC 791)

The facility generated 1.3 billion pounds of acid plant effluent in 2002 and 1.4 billion pounds of this waste in 1998. This waste is generated during the production of fresh sulfuric acid and the reprocessing of sulfuric acid used as a catalyst in the alkylation unit. The acid plant effluent is combined with other Chemical Plant wastewater streams, such as steam condensate, boiler blowdown, and stormwater to form the Acid Plant Effluent waste stream. To date, the refinery was not able to select any implementable source reduction measures for this waste stream.

Category B Wastes

Two Category B wastes were determined to be major streams for 1998: spent catalyst (CWC 162) and biological sludge (CWC 352).

1. Spent Catalyst (CWC 162)

Tesoro generated 2.3 million pounds of this waste in 2002, compared to 1.3 million pounds in 1998. This is a 77 percent increase from 1998. The primary reason for this increase was due to several plant maintenance shut downs (turnarounds) in 2002. Spent catalyst change outs can only be conducted during turnarounds.

Catalysts are used at the refinery to reduce sulfur and nitrogen content of certain hydrocarbon streams (hydrotreating), to promote hydrocarbon conversion reactions (hydrocracking and fluid catalytic cracking) and to convert sulfur compounds recovered from the refinery wastewater and off-gases into elemental sulfur and sulfuric acid. They are also used to convert steam and natural gas to hydrogen for use in the hydrotreating and hydrocracking reactions. Absorbents that are used in the refinery process for the recovery of sulfur or sulfuric acid are also included in this stream.

Refinery catalysts are composed of various metallic compounds including nickel-molibdenum, iron-chromium, copper, nickel, zinc oxide, platinum, cobalt-molybdenum or vanadium pentoxide. In service, they lose effectiveness over time and must be replaced between two to eight years, depending upon catalyst application. Some catalysts can not be regenerated offsite and reused, and must be landfilled. These include vanadium pentoxide, and copper-based absorbent. This is primarily because these materials are not economically feasible to reclaim or a reclaimer has not been found for the given material. A little more than 200,000 pounds of spent catalyst was recycled as a raw material feedstock at a primary smelting facility during 2002. While this is a valid waste management approach, recycling is not considered a source reduction measure.

2. Biological Sludge (CWC 352)

Tesoro generated nearly 15 million pounds of this waste stream in the 2002 and more than 22 million pounds of this waste stream in 1998. This was more than 31 percent

decrease from 1998. Better management of the dredging program is the primary reason for the decrease of biological solids through 2002. Also, this decrease may be attributed to an increase in solids content by weight achieved by centrifugation.

The two primary components of this waste stream are biosolids formed during the biological breakdown of organic compounds in the wastewater and ferric hydroxide sludge formed by adding ferric hydroxide as a coagulant to facilitate settling of solids in the clarifiers. The biological solids become a hazardous waste stream during the centrifuging process. This process concentrates the hazardous metals in the biological solids. Since 1998, the refinery has implemented an aggressive dredging program, to keep up with the production of solids in the ponds and to increase the capacity and retention time, of the two surge ponds.

C. Projections

Category A Wastes

1. Demineralizer Regeneration Effluent (CWC 122)

During 2002, the facility generated nearly 500 million pounds of this waste stream. Tesoro continues to evaluate the economic feasibility of augmenting or replacing the demineralizer system with a reverse osmosis system. Installation of a reverse osmosis unit would decrease the rate at which the ion exchange units require regeneration, thereby reducing generated waste. A reduction of 95 percent of this waste is expected if the reverse osmosis unit is used. This alternative needs further economic evaluation before it is implemented. Figure 14-A shows the types and quantity of Category A wastes reported for 2002.

2. Acid Plant Effluent (CWC 791)

During 2002, the facility generated 1.2 billion pounds of acid plant effluent. No source reduction measures were proposed for this waste stream in the plan.

Category B Wastes

A total of 38 Category B waste streams were generated according to the facility's plan for the reporting year, 2002. Twenty out of these 38 hazardous waste streams were either exempted or non-routinely generated. Three out of the 18 remaining waste streams were determined to be the major waste streams: Spent Catalyst (CWC 162), Electrostatic Precipitator (ESP), Fines (CWC 352), and Biological Sludge (CWC 352/491). Figure 14-B shows the types and quantity of Category B wastes reported for 2002.

3. Spent Catalyst (CWC 162)

Tesoro generated nearly 2.3 million pounds of this waste in the 2002 reporting year. Options to substitute current catalysts for ones that will reduce the waste generation rates, or decrease the hazardous waste characteristics should be evaluated. If the following options are shown to be technically and economically feasible, they should be implemented:

- (a) Investigate appropriate catalyst substitutes.
- (b) Investigate potential for additional segregation of catalyst support materials from spent catalyst: Since catalyst support material is non-hazardous, additional separation from the spent catalyst at the refinery would reduce the total quantity of the spent catalyst hazardous waste stream. The advantages of separating the raw material must be weighed against the health and safety problems and the economic impact caused by the separation.
- (c) Investigate opportunities for reclaiming spent catalysts currently landfilled including opportunities to reuse certain catalysts as ores at primary smelting facilities: The refinery staff continually reviews opportunities for reusing and reclaiming catalysts and will take advantage of any new opportunities as they develop and become economically feasible.

4. Electrostatic Precipitator (ESP) Fines (CWC 352)

Tesoro generated nearly 2.5 million pounds of ESP fines in 2002, versus more than 10,000 pounds in 1998. Under previous ownership, the ESP fines were recycled, either to the fluid Coker feed or to the petroleum coke product stream. Succeeding refinery owners determined this stream should not be recycled, and therefore disposed of it as a hazardous waste. This management practice is undergoing additional evaluation and an internal recycle may be developed, as explained below. The source reduction measures to be evaluated for implementation are:

- (a) Improve the efficiency of the cyclone separator process: ESP fines result from the operation of the Fluid Coker unit. The cyclone separators remove petroleum coke dust from fuel gas phase prior to treatment in the boiler. An increase in the efficiency of the cyclone separator process could reduce the amount of ESP fines produced. This may require an additional cyclone separator. The capital cost versus economic savings would need to be evaluated.
- (b) Recycle ESP fines to the coker: Some analytical results suggest that sending ESP fines to the fluid coker could potentially recover petroleum coke. If the ESP fines contain a relatively large percentage of petroleum coke, Tesoro plans to begin discussions with DTSC regarding recycling ESP fines through the fluid coker. This production process change could eliminate the ESP fines waste stream, while increasing coke production.

5. Biological Sludge (CWC 352)

Tesoro generated nearly 15 million pounds of this waste stream in the 2002 reporting year. Source reduction measures to be evaluated for implementation:

- (a) Sulfuric acid as an alternative to ferric chloride for pH control: Tesoro is in the process of planning a pilot study to evaluate the effects of using sulfuric acid instead of ferric chloride for pH control. The facility is currently waiting for equipment acquisition to commence the pilot plant studies.
- (b) Evaluate whether it is possible to discontinue conveying the clarifier solids back to the surge ponds: Clarifier solids are currently conveyed back to the surge ponds. Originally, the solids were conveyed to sludge ponds for treatment and/or disposal. However odors emanating from the sludge ponds became an issue, and the solids were redirected to the surge ponds. The clarifier solids generated contain selenium, which creates a hazardous waste stream. The combination of these solids with previously settled biosolids could essentially contribute to the hazardous characteristics of the entire wastewater solids waste stream that is removed from the surge ponds. If clarifier solids segregation is feasible, a reduction in the amount of hazardous waste generated could be achieved. Tesoro has plans to perform a pilot test to separate and dewater clarifier sludge.
- (c) Enhanced biological solids drying: Wastewater solids removed from the surge ponds consist of up to ten percent solids by weight. Methods to further dewater the waste stream (e.g., thermal dryer, filter press) would reduce the total weight of hazardous wastewater solids manifested offsite for disposal. The refinery has plans to improve the efficiency of the solids dewatering process and has increased the percent solids obtained by centrifugation from approximately 25 percent to 30 percent.

D. Remarks

This section describes factors that affected hazardous waste generation rates and management practices at the refinery. Between 1998 and 2002, the refinery throughput decreased from about 52 million barrels (bbls) to about 49 million barrels (bbls). This is primarily due to the changes in ownership and the shutdown of the #3 Crude Unit from December 10, 1998 through February 25, 2001. Nineteen ninety-eight was a wet year: rainfall decreased from 42.93 inches in 1998 to 19.61 inches in 2002 (Western Regional Climate Center, 2003). Although it is difficult to quantify how an increase in rainfall affects the amount of total hazardous waste generated, it was found that heavy rainfall in 1998 contributed to a higher biological solids waste stream. This refinery has changed ownership two times since 1999 (described in site information). These changes can affect waste production due to different management practices, particularly with respect to handling of ESP fines.

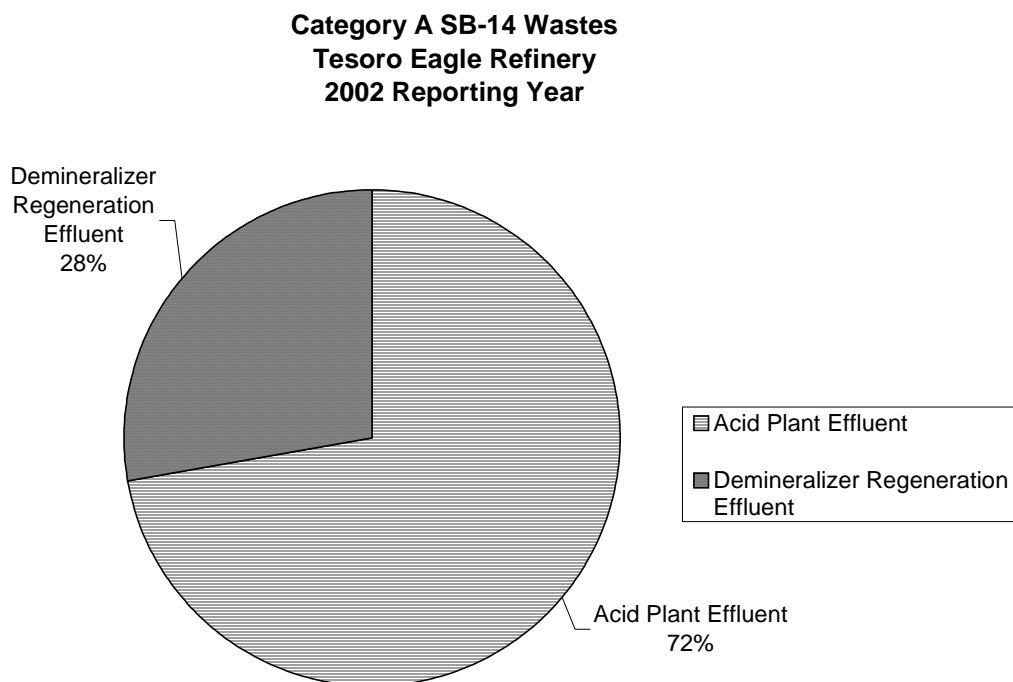


FIGURE 14-A. Category A Wastes for Tesoro Eagle Refinery 2002 Reporting Year.

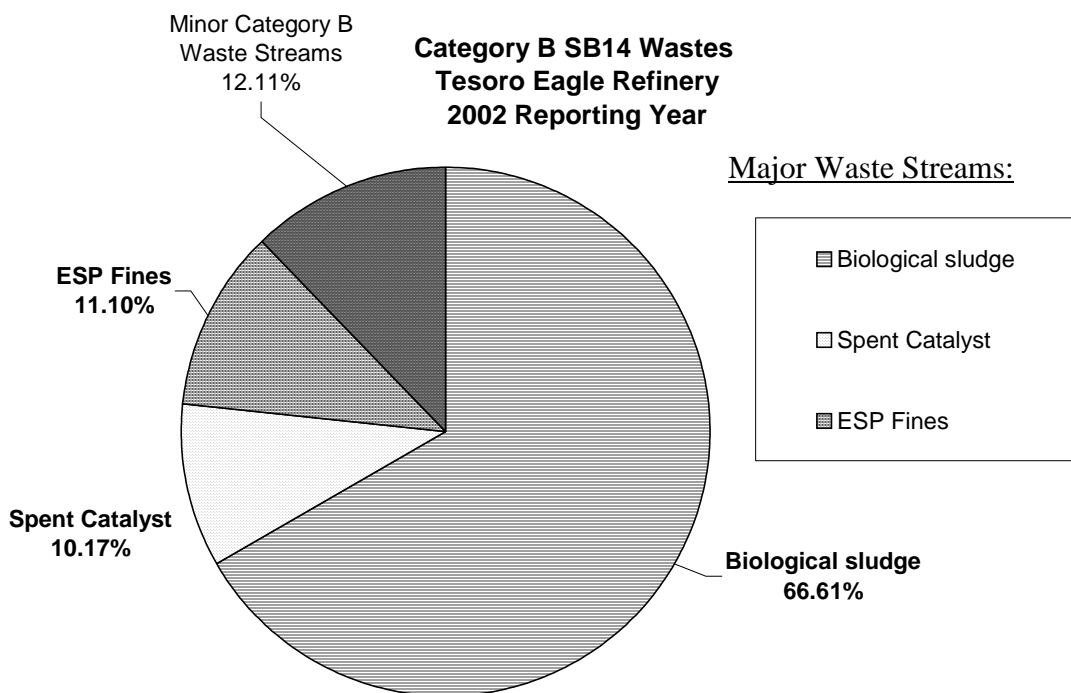


FIGURE 14-B. Category B Wastes for Tesoro Eagle Refinery 2002 Reporting Year.

VALERO REFINING COMPANY, BENICIA (VALERO)

EPA ID: CAD 063 001 770

A. Site Information

The Valero Refining Company, Benicia (Valero, Benicia) was built by Humble in 1968 and has been in operation since January 1969. The refinery is located in Solano County. Valero purchased the facility from ExxonMobil in May 2000. In June 2001 Valero purchased an asphalt plant located on adjacent property from Huntway Refining Company and that facility has been merged with the Valero Benicia operation. The refinery currently (2003) has approximately 470 employees. A variable number of contract employees averages about 600, but was as high as 2000 during a major refinery shutdown and maintenance operation in early 1999.

In 1998 the Valero Benicia refinery processed an average of 129,500 barrels per day (bpd) of crude oil. This amount increased to nearly 132,000 bpd in 2002. The 2002 quantity includes crude oil processed at the Valero Asphalt Plant (formerly Huntway) which was purchased by Valero in June 2001.

B. Accomplishments

Category A Wastes

No Category A waste was reported in calendar year 2002. In 1998, the refinery reported generation of Category A amounting to more than 456 million pounds.

Category B Wastes

The refinery discussed the following six Category B waste streams in their Hazardous Waste Management Performance Report (Report).

1. Wastewater Treatment Plant Selenium Sludge (CWC 181)

Valero began an additional wastewater treatment process at its onsite wastewater treatment plant in July 1998. It is called the Benicia Effluent Quality Improvement Project (EQIP). The EQIP process employs iron co-precipitation to precipitate and settle out selenium from the wastewater. The selenium occurs naturally in the crude oil processed at the refinery and enters the wastewater with discharged oily wastes. The unit was installed to meet a mandate required by Regional Water Quality Control Board (RWQCB) to reduce selenium levels in wastewater discharge to below 50 micrograms per liter. The EQIP process generates a sludge, which has selenium concentration levels exceeding DTSC's soluble threshold limit concentration (STLC) of 1 mg/l. Therefore the sludge is considered hazardous waste under state law.

The EQIP process includes a reactor/clarifier into which ferric chloride is added. The ferric chloride converts to iron hydroxide precipitate and hydrochloric acid. The positively charged iron hydroxide floc adsorbs negatively charged selenium ions from the wastewater and settles the resultant floc in the clarifier. The water and sludge are formed in the reactor. The sludge is dewatered. The thickened sludge is ultimately transported for off-site disposal as a non-RCRA hazardous waste. Valero generated 4.5 million pounds in 1998 and 3.1 million pounds in 2002. The decrease of 1.4 million pounds (31 percent) could be attributed to any or all of the three factors: The EQIP process start-up; change quantity of crude processed between the two reporting years; and less consumption of water.

2. VLE Spent Caustic (CWC 122)

Spent caustic is generated in Valero's Virgin Light Ends (VLE) propane treater. The purpose of the propane treater is to remove hydrogen sulfide and water. Valero reported in its SPR that it did not generate this waste in 1998. However, in 2002, approximately two million pounds of spent VLE caustic was treated and landfilled. This was attributed to the loss of the recycle outlet in April 2001 resulting in the generation and reporting of the waste stream in the 2002 SB 14 reporting year. Valero reported in their SB 14 Report that a new recycle option was identified and implemented in October 2002. This will result in eliminating the future waste classification of this material.

3. Dimersol Caustic (CWC 121)

In comparison to 1998 dimersol waste caustic quantity was increased by approximately 80 percent to 1,342,000 pounds in 2002. Valero noted in its 2002 SPR that their dimersol unit was not decommissioned as projected in the 1998 SPR. Currently, Valero rail shipped the dimersol caustic to an out-of state wastewater treatment facility where it is used as a substitute for virgin caustic for pH adjustment. The pH adjusted wastewater is then discharged to receiving waters under that facility's NPDES permit. As with most raw materials and chemicals used in the manufacture of petroleum products, economics is a significant driver in Valero's efforts to optimize caustic use and minimize the generation of spent caustic.

4. Wastewater Treatment Plant (WWTP) Sewer Sludge (CWC 222)

WWTP sewer sludge volume increased approximately 50 percent from 1998 to 895,000 pounds in 2002. Periods of unit shutdown, maintenance activities and operational problems at times limit the amount of sewer sludge that can be fed to the coker and during such times this material was land disposed of off-site. Such was the case in 2002 as indicated by the increase in waste generated and disposed in comparison with 1998 quantities. Valero continues aggressively to keep solids from entering its sewer system, hence, reducing the generation of sewer sludge.

5. Spent Catalyst (CWC 162)

Refining catalysts typically are composed of an inert substrate impregnated with metallic compounds including nickel, platinum, zinc, copper, and molybdenum. Spent catalysts may contain other contaminants that also render them hazardous such as arsenic, benzene, and chromium. Spent catalysts are generated from various unit processes units such as the hydrogen unit, hydrocracker unit and the alkylation hydrogenation process. Various spent catalysts at the Valero refinery have been classified as non hazardous, non-RCRA hazardous, RCRA listed hazardous or RCRA characteristic hazardous wastes. Spent catalysts are ultimately landfilled, reclaimed to recover precious metals, or regenerated for reuse. The quantity of spent catalyst generated at the Valero refinery increased by approximately 15 percent from 1998 to 2002 (1.26 million vs. 1.45 million pounds). Catalyst technology developments have significant effects on petroleum refining efficiency and production costs. Valero is paying close attention to maximize catalyst life while minimizing spent catalyst generation.

6. Spent Activated Carbon (CWC 352)

Spent activated carbon volume increased by 430 percent from 154, 000 pounds in 1998 to 816,000 pounds in 2002. During the 1998-2002 cycle the refinery reduced spent activated carbon by 20,000 pounds by applying Huntway's WORT system.

C. Projections

Category A Wastes

No waste was reported in calendar year 2002.

Category B Wastes

Figure 15 shows the types and quantity of Category B wastes that Valero-Benicia Refinery reported for 2002. The Valero Benicia refinery documented 31 hazardous wastes in its 2002 Source Reduction Evaluation Review and Plan (Plan). Twelve out of the 31 wastes were identified as exempt from SB 14 and seven wastes were declared as non-routinely generated wastes. The total quantity of the nineteen SB 14 applicable wastes amounted to more than 9.8 million pounds. Six out of nineteen SB 14 applicable wastes were determined to be major wastes during 2002:

- (a) Selenium sludge (CWC181)
- (b) VLE [virgin light end] spent caustic—(CWC 122)
- (c) Spent catalysts (CWC 162)
- (d) Dimersol caustic (CWC 121)
- (e) Sewer sludge (CWC 222)
- (f) Spent activated carbon (CWC 352)

Valero selected the following measure for **Spent Activated Carbon (CWC 352)**:

Substitute Thermal Oxidizer for Activated Carbon: Valero Benicia selected only this measure for implementation during 2004. The refinery is planning to reduce spent activated carbon by implementing a production process change. In 1999 the refinery installed a flameless thermal oxidizer to reduce the use of activated carbon in their wastewater treatment facilities. The project did not have much success at the time in mid-2000. The refinery is now planning to install field mounted instrumentation for troubleshooting the thermal oxidizer. The availability of improved monitoring may allow the refinery to conduct the evaluation and possibly determine necessary solutions to effectively operate the thermal oxidizer as a carbon replacement. The refinery reported the spent carbon generation as 816,000 pounds in 2002. Projected source reduction quantity of spent carbon is 327,000 pounds if the thermal oxidizer is successful.

D. Remarks

- (a) In their SB 14 Report Valero mentioned that in 2002, the refinery recycled, reused, or reclaimed over 8,000 tons of waste or about 25 percent of all the waste generated at the facility. The refinery further claimed that secondary oil-bearing materials, if not recycled in the refinery would be hazardous waste, contributing an additional 28,000 tons of material prevented from not disposing to landfill. Valero mentioned the following waste reduction approaches addressing their non-major waste streams:
- Lime Sludge: Approximately 5,300 tons was recycled.
 - Spent Sulfidic Caustic: More than 1,600 tons of spent caustic was recycled at a geothermal plant to control hydrogen sulfide emissions and odor from active wells at the facility.
 - Secondary Oil-Bearing Materials: On an average, Valero processes approximately 500 barrels per day of oily sewer sludge and other secondary oil-bearing materials in the coker unit. This translates to approximately 28,000 tons of this material would otherwise be disposed of as hazardous waste.
 - Electrostatic Precipitator Fines: Approximately 800 tons of precipitator fines were recycled as raw material for the production of Portland cement.
- (b) Valero recycled the following during the 1999-2002 period: scrap metal, batteries, fluorescent lights, aerosol cans, computer equipment, antifreeze, and some catalysts.
- (c) The refinery's goal for the 2003-2006 SB 14 cycle is to reduce overall five percent of their hazardous waste.

Valero Refining Co., Benicia
Category B SB-14 Wastes 2002 Reporting Year

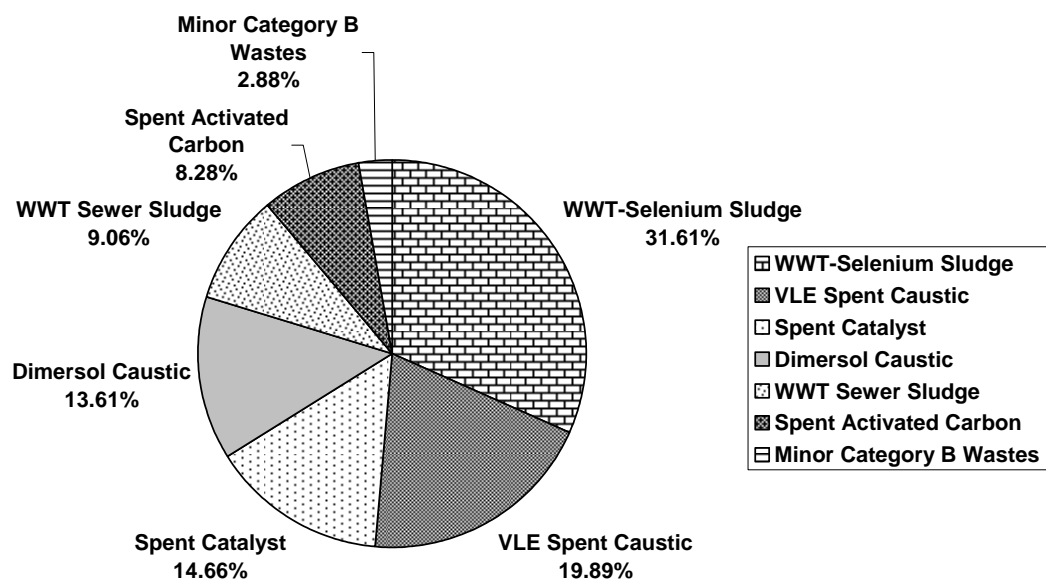


FIGURE 15. Category B Wastes for Valero-Benicia Refinery 2002 Reporting Year.

VALERO WILMINGTON ASPHALT PLANT

EPA ID: CAD 981 373 053

A. Site Information

The Valero Wilmington Asphalt Plant is located in Los Angeles County in the city of Wilmington. This facility is an asphalt refinery. The company refines various crude oils into a variety of heavy petroleum products, its principle product being liquid asphalt. The light distillates, naphtha, kerosene, as gas oil are secondary products and are shipped via pipeline to the Valero Wilmington refinery for further processing. Valero Wilmington was constructed in 1979 and began operations as Huntway Refining Company. In 2001, the Valero Energy Corporation purchased the Huntway assets including this facility, and since that time, the facility operated as the Valero Wilmington Asphalt Plant. The refinery's operations staff consists of three operators per shift. In addition, there are three maintenance personnel, four quality control personnel, a refinery manager and an Operations Superintendent.

B. Accomplishments

Category A Wastes

Valero Asphalt plant did not report any Category A wastes in 1998 and 2002.

Category B Wastes

The facility reported oil/water sludge (CWC 222) as the major stream for Category B waste. It generated more than 96,000 pounds of waste oil/water sludge in 1998. Oil/separator sludge solids are generated as the result of recycling oily process water and storm waters in the refinery's water/oil recycling treatment system (WORT). These solids are generated from the separation of naturally occurring sand particles in the incoming crude oil, wind blown dust that is captured in the WORT system drains and from the re-precipitation of "removed hardness" discharged from the water softening process. These small particles combine with oil and deposit in the bottom of the WORT system process tanks.

1. Oil/water Sludge (CWC 222)

Valero Asphalt plant reported the following source reduction approaches for this waste:

- (a) Contracted for a powered sweeper to clean the refinery's access roads: prior to implementing this measure, a significant amount of solids would reach the water oil recovery treatment (WORT) conveyance system during washdowns and during storm water runoff during the rainy season. Entrained solids would accumulate in the oil/water separator as sludge. As a result of sweeping the

access roads, the amount of solids washed from the refinery's driveways has been reduced.

- (b) Incorporated a closed loop sampling system, which allows for a sample line to purge from high pressure points to low pressure points. This measure was designed to prevent excessive discharges of crude oil and products to the WORT system. This measure is intended to reduce the toxicity of the material entering the WORT system. Therefore reducing the toxicity of the waste generated.
- (c) Paved the previously unpaved areas of the WORT system: Solids can reach the WORT conveyance system through refinery wash downs and storm water run-offs during the raining seasons. By paving the unpaved areas of the refinery, Valero has reduced the quantity of solids entering the WORT system. Therefore, reducing the weight of waste generated.
- (d) Isolated the WORT conveyance system from storm water run-ons: Valero recently completed the berming of its process area.
- (e) Reduced the sludge volumes by using a centrifuge to extract free oil/water prior to sending the concentrated cake off-site for further recycling: The liquid extract by the centrifuge is then dewatered by a gravity separator. The separated oil is recycled back to the crude oil tank and the water to the wastewater system. This method results in approximate 30 to 50 percent sludge volume reduction.

C. Projections

Category A Wastes

Valero mentioned that it did not generate any Category A wastes in 2002.

Category B Wastes

The facility reported oil/water sludge as its only major stream for Category B waste in 2002. Figure 16 shows the types and quantity of Valero Wilmington Asphalt plant Category B wastes reported for 2002.

1. Oil/Water Separation Sludge (CWC 222)

Valero generated approximately 120,000 pounds of oil/water separation sludge during the 2002 reporting year.

A number of source reduction measures have been developed to reduce this waste and are discussed below.

- (a) Provide WORT system drain covers/plugs: As previously noted, solids can reach the WORT conveyance system through refinery wash-downs and from surface

water run-off during storm events. Covering on needed WORT conveyance system openings will reduce debris entering the WORT system.

- (b) Provide employee training: Valero provides employee training on waste regulations and waste minimization approaches. With improved training, the employees will have the opportunity to take a more personal and active role in the refinery's waste minimization.
- (c) Recycle sludge within the Valero refinery coker unit: The recycle sludge waste stream is completely eliminated from offsite by injecting it into the coker unit. The coker unit incorporates all of the recycled waste stream into its petroleum coke product.
- (d) Segregate the boiler blowdown from the refinery's wastewater stream: By segregating the boiler blowdown from the refinery's wastewater stream and discharging the "clean" hard water directly to the city sewer, the portion of sludge generated by precipitation of hard water residue can be eliminated. At the time the report was submitted, Valero did not have any data indicating the percentage of the sludge originating from the discharge of blowdown to the refinery wastewater collection system. Additional data is needed to fully evaluate this alternative.

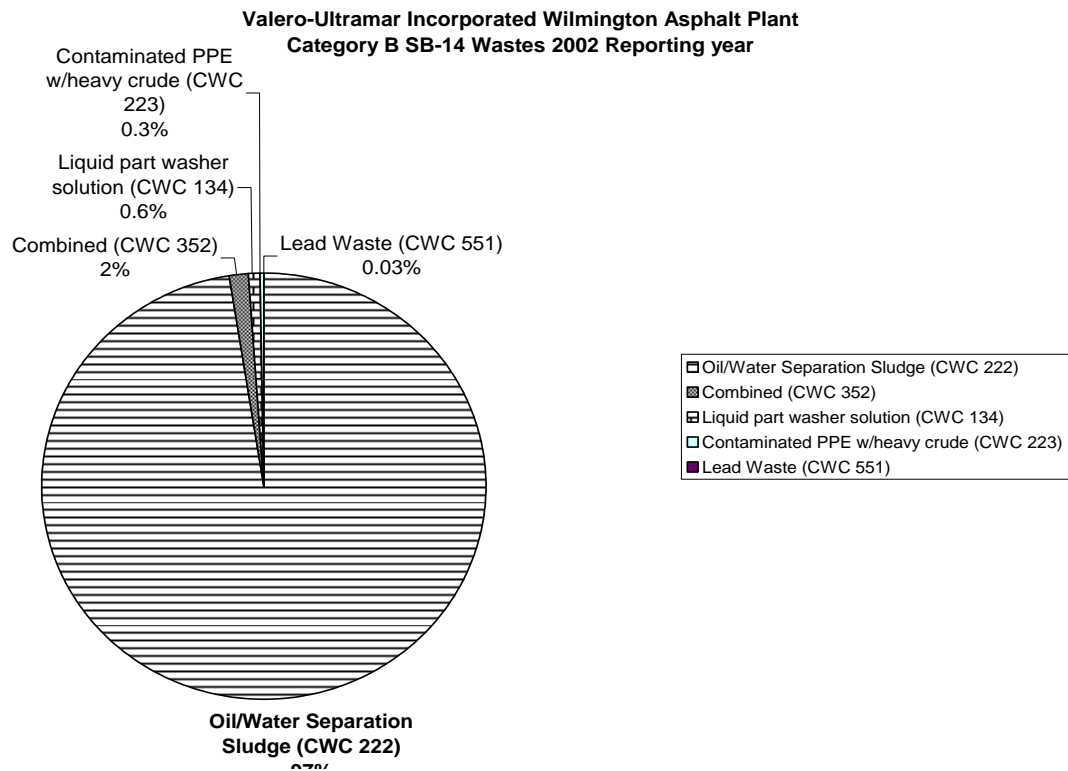


FIGURE 16. Category B Wastes for Valero Wilmington Asphalt Plant 2002 Reporting Year.

VALERO-ULTRAMAR, INCORPORATED
WILMINGTON REFINERY
EPA ID: CAD 066 647 066

A. Site Information

The Ultramar Wilmington Refinery is located in Los Angeles County in the city of Wilmington. The Wilmington refinery has a crude processing capacity of approximately 100,000 barrels per stream day. Ultramar employs approximately 440 full-time employees. It was originally constructed in 1969. The refinery produces gasoline, low sulfur diesel and jet fuel, fuel-oil blending components, coke, sulfur, propane, and fuel gas to fire furnaces.

B. Accomplishments

Category A Wastes

The refinery did not report any Category A wastes during 1998.

Category B Wastes

Ultramar generated more than 19 million pounds of Category B waste in 1998. The refinery reported for its major category waste streams: FCC fines (CWC 161), other spent catalyst (CWC 162), other inorganic solid waste (CWC 181), oil/water separation sludge (CWC 222) and sewage sludge (CWC 321).

1. FCC Fines (CWC 161)

The Ultramar Wilmington refinery generated nearly 1.6 million pounds of FCC fines in 1998. Catalytic cracking is widely used in the refinery process for converting heavy oils into more valuable gasoline and lighter products. The fluid catalytic cracking (FCC) process employs a catalyst in the form of very fine particles, which behave as a fluid when, aerated with vapor. The cracking process produces carbon (coke) which remains on the catalyst particles and rapidly lowers its catalytic activity. To maintain the catalyst activity at a useful level, it is necessary to regenerate the catalyst by burning off this coke with hot air. As a result, the catalyst is continuously moved from the reactor to regenerator and back to reactor. The measure implemented since 1994: recycled the FCC fines to a cement kiln. This recycling effort has been a successful alternative to the landfill disposal of FCC fines. Ultramar Wilmington reported that this stream is non-hazardous and should not have been reported as a SB 14 waste stream in 1998. They estimated that 1.6 million pounds of this waste has been reduced annually since the recycling measure was implemented.

2. Other Spent Catalyst (CWC 162)

The refinery generated about 700,000 pounds of this waste in 2002 and more than 1.1 million pounds in 1998. This difference is due to spent alumina not being reported in 2002. No new source reduction measures have been selected for implementation. This waste stream, which is composed of Cobalt molybdenum catalyst and nickel molybdenum catalyst are being generated at the same approximate rates for 1998 and 2002.

3. Other Inorganic Solid Waste (CWC 181)

The refinery generated 1.1 million pounds of this waste in 2002 and 700,000 pounds of this waste in 1998. This waste principally includes alkylation sludge. The Ultramar refinery operates a hydrofluoric acid (HF) alkylation unit to produce high-octane gasoline blending stock. Byproducts of the process are two highly acidic streams: long-chain hydrocarbons (polymer); and a mixture of spent acid and water. Each of the byproducts must be neutralized before further processing. This is done using potassium hydroxide (KOH). The KOH is converted to potassium fluoride (KF). The resultant KF is then reconverted to KOH using lime (calcium hydroxide). The resultant KOH is then reintroduced at the process beginning to neutralize the HF acid byproducts. The residual (alkyl sludge) is hazardous because it is a corrosive solid contaminated with polymer. Since late 1988, all the alkylation sludge generated by the refinery has been processed through a vacuum filter to capture and recycle the entrained KOH. This process has resulted in a decrease in calcium fluoride disposal volumes. No new source reduction measures were selected for implementation.

4. Oil/Water Separation Sludge (CWC 222)

The refinery did not report any oil/water separation sludge in 2002 and reported nearly 16 million pounds of this waste in 1998. There are a number of oil-bearing sludges produced by the wastewater treatment plant, process sewers and the cleaning of tanks. Ultramar recycles such sludges back into its delayed coking operations under license using the patented Mobil Oily Sludge Coking (MOSC) process and under a recycling exemption provided in Section 25143.2 of the Health and Safety Code. The MOSC process uses process water mixed with oily sludges as a partial substitute for quenching water in the final stage of the coking cycle. The hydrocarbons are flashed off and converted to petroleum coke. The refinery reported in their SPR that this waste stream should not have been listed as a SB 14 hazardous waste stream since it was recycled to the Coker unit to recover oil in sludges under the recycling exemption provided in health and safety code Section 25143.2.

5. Sewage Sludge (CWC 321)

This waste stream was not reported in 1998 in the refinery's 1999 SB 14 documents. However, the refinery reported in their 2002 SPR that facility records indicate about

360,000 pounds were sent for offsite treatment/disposal in 1998, versus 100,000 pounds in 2002.

C. Projections

Valero-Ultramar Wilmington considered a few source reduction approaches, including production process changes, administrative steps and operational improvements for all their hazardous waste streams. However, they were not able to identify viable measures, due to economics, time requirement and health and safety concerns. No new source reduction measures were identified for implementation in their 2002 plan.

Category A Wastes

The refinery did not report any Category A wastes in 2002.

Category B Wastes

The major hazardous waste streams for the 2002 reporting year are: spent catalyst (CWC 162), other inorganic solids (CWC 181) and sewage sludge (CWC 321). Figure 17 shows the types and quantity of Category B wastes that Valero Wilmington Refinery reported for 2002.

1. Spent Catalysts (CWC 162)

The refinery generated about 29,000 pounds of spent cobalt molybdenum catalyst and more than 650,000 pounds of spent nickel molybdenum hydrotreating catalyst wastes in 2002. Cobalt molybdenum catalyst is used in the sulfur unit and nickel molybdenum hydrotreating catalyst is used in the naphta, gas oil, and union hydrotreater units. When the catalyst is determined to be no longer effective, it is replaced. The refinery plans a minimum number of catalyst change outs to minimize process unit down time and to save the expense of having to replace and dispose of catalyst. Options to offsite reclaim metals in the spent catalyst in place of land disposal are always selected if economically viable. However, the economics have been previously evaluated and due to transportation costs this is not an economically viable option. No new source reduction measures were identified for implementation on this plan.

2. Other Inorganic Solids (CWC 181)

This waste stream consists of alkylation sludge, spent butamer catalyst, and refractory and contaminated debris.

Alkylation sludge

In 2002, the refinery generated approximately 980,000 pounds of alkylation sludge. There are no viable options identified in the refinery SB 14 documents, but the refinery has plans to make significant changes to the alkylation unit within the next several

years. The impact that these changes will have on waste generation was not known at the time that SB 14 documents were submitted.

Spent butamer catalyst

The refinery generated 6,000 pounds of this waste in 2002. Butamer catalyst is used in the butamer unit to facilitate the reaction of normal butane to isobutene. When the catalyst is determined to be no longer effective, it is replaced. The used catalyst is sent to an offsite facility where the metals are recovered for future beneficial use. Changeout of this catalyst occurs at a frequency of approximately once every three years. The refinery intends to minimize process unit down time and to minimize the expense of replacement and disposal of catalyst.

Refractory and contaminated debris

The refinery generated 153,000 pounds of this waste in 2002. Refractory is used in heaters and in piping to protect surfaces from heat and/or corrosion. The refractory is replaced as part of normal refinery maintenance, when it is damaged or is no longer protecting equipment as designed. Refractory is typically not hazardous when first installed but can become hazardous depending on process service. The contaminated debris portion of this waste stream typically consists of alkylation trash, contaminated metal, catalyst supersacks, contaminated wood and general construction debris that is contaminated by inorganic compounds and/or hydrocarbons. Additional analyses may result in the reclassification of a portion of this waste stream as non-hazardous. One measure considered was the segregation of waste to minimize the quantity of waste classified as hazardous. This measure was not feasible because it would be time intensive to manage and would require additional laboratory analyses without a significant economic return. Health and safety concerns arising from the additional management and sampling of wastes eliminate this as a viable option.

3. Sewage Sludge (CWC 321)

This waste stream consists of exchanger solids and separation sludges.

Exchanger solids

The refinery generated 41,000 pounds of exchanger solids in 2002. This material is generated from the cleaning of heat exchangers. Corrosion products and other solids in process streams contribute to the source of this waste. The heat exchangers are cleaned to improve the heat transfer efficiency. This waste is sent offsite for appropriate treatment/disposal. A portion of this waste could potentially be sent to the coker unit via the MOSC (Mobil Oily Sludge Coking) process. Recoverable oil would need to be present in the material to be a viable candidate for this option. Concerns with odors resulting from the addition of this stream to the coker unit and the cost to install facilities to prepare the material for coker unit delivery eliminates this option from being considered further at this time.

Separation sludge

The refinery generated more than 100,000 pounds of separation sludge in 2002. A portion of this waste could potentially be sent to the coker unit via the MOSC (Mobil Oily Sludge Coking) process. Concerns with odors resulting from the addition of this stream to the coker unit and the cost to install facilities to prepare the material for insertion into the coker unit eliminates this option from being considered further at this time.

**Valero-Ultramar Incorporated Wilmington Refinery
Category B SB-14 Wastes 2002 Reporting year**

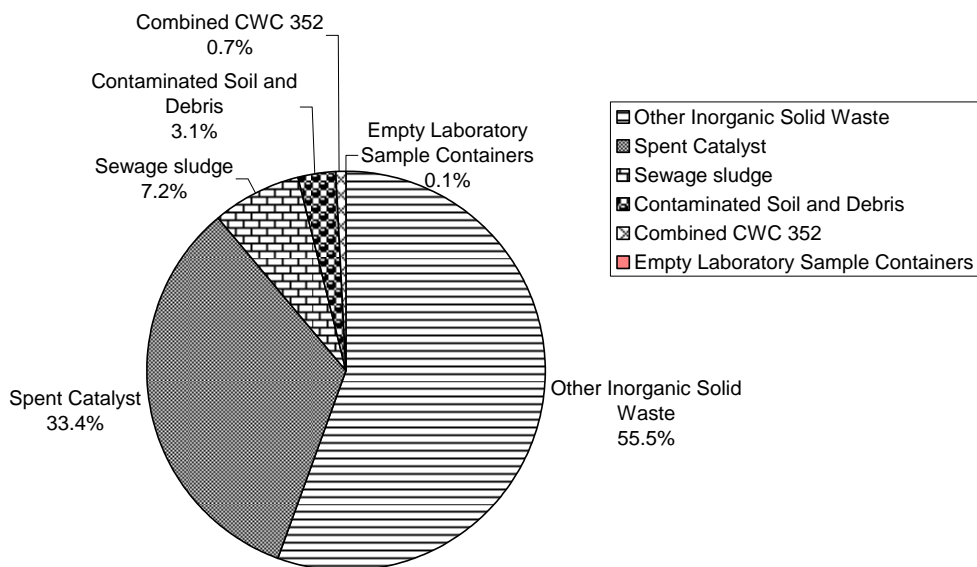


FIGURE 17. Category B Wastes for Valero Wilmington Refinery 2002 Reporting Year.

IV. CONCLUSIONS

The following are the major findings based on the SB 14 documents review of 23 sites of California's 17 major refineries. Some of this review included discussion with some facility environmental managers.

- 1) Figure 18 represents the total SB 14 waste generated for all the refineries in years 1998 and 2002. The largest amount of waste generation (99 percent) is from Category A for both years.
- 2) Figure 18 also depicts that there was a substantial amount of waste generation decrease for both categories A and B between 1998 and 2002. In Category A (Figure 18-A), the refinery's waste generation was decreased about 5.5 billion pounds (more than 17.72 percent) from the baseline year 1998 to the reporting year 2002. During the same cycle, Category B (Figure 18-B) waste was reduced by approximately 95 million pounds (36.07 percent). Overall, the refining industry reduced their total waste (Category A and Category B) by 5.7 billion pounds (2.8 million tons or 17.87 percent) during the 1998-2002 SB 14 cycle.
- 3) It is our observation that sometimes the reduction of major hazardous waste stream(s) could be due to other factors then, simply implementation of hazardous waste source reduction measure(s). Some of these factors are: (a) a facility might have changed method of calculation of hazardous waste in 2002 versus that used in 1998; (b) a facility might have claimed exemption for a particular waste stream in 2002 and not in 1998; and (c) a facility may have reduced its waste by using recycling instead of using source reduction.
- 4) Sixteen out of the 23 sites did not report any Category A wastes during 2002. Some claimed that the wastewater directed to the wastewater treatment plant is nonhazardous, and therefore should not be reported as Category A. Some claim recycling exemptions. Figure 19 shows only refineries that reported Category A wastes for 1998 and 2002.
- 5) Eight out of 23 sites reported an increase in their Category B waste generation during 2002. For two refineries there was a large decrease in Category B waste generated. (Figures 20-A and 20-B)
- 6) Most of the Category B wastes reported by the refineries were spent catalyst (CWC 162), other organic solids (CWC 352) and other inorganic solid waste (CWC 181).
- 7) Most of the source reduction measures implemented by the refinery industry included administrative steps, operational improvements and product process changes.

- 8) The refining industry projected that it would reduce more than 7 billion pounds (3.5 million tons) of waste during the 2002-2006 cycle. This is normally a 25 percent reduction over the 1998-2002 period.
- 9) The petroleum refining industry reported the following barriers to some of the suggested general source reduction measures:
- Input Changes
Some refineries recognized the need to purchase lower selenium crude oils but they claimed this option is not feasible in the current market.
 - Product reformulation
Some refineries claimed that changing catalysts would adversely affect product quality and it would make little difference in waste reduction.
- 10) In 1998 the refineries projected a reduction of 15.8 million pounds/year of Category B waste by 2002 due to implementation of source reduction measures. The actual annual reduction achieved by 2002 was 68.4 million pounds of Category B waste. This information is based on data in Table 2 from the 2002 SPR provided by the refineries.
- 11) Table 5 shows a normalization of the total SB 14 Category B (principally manifested hazardous waste) generated by the California refinery industry to the refinery crude oil processed by the industry for 1998 and 2002. It can be seen that although the refinery crude oil input has not changed much from 1998 to 2002, the Category B waste generated in 2002 was decreased by more than 36 percent from that generated in 1998.

This normalization is based on Category B waste generation only. Inclusion of Category A (principally wastewater) negates normalization significance due consideration of the large volumes of wastewater generated. Note that only industry wide normalization is presented. Individual refinery input crude quantities are not consistently available.

V. RECOMMENDATIONS

The following are recommendations based on a review of the 2002 SB 14 documents for the 17 refineries:

- 1) Refineries must be consistent with the amount of waste reported in the SPR and the waste reported in their Plan and Report.
- 2) Refineries must be consistent applying their accounting method for the baseline and reporting years, in order to allow for a meaningful comparison.
- 3) Several refineries did not report Category A wastes in their 2002 SB 14 Plan. We recommend that for the future SB 14 cycles, these refineries briefly explain why the wastewater was not considered to be an SB 14 Category A waste.
- 4) Unless the waste was exempted or nonhazardous by definition under Title 22, if any aqueous hazardous waste was sent to the wastewater treatment plant and discharged to a POTW, the influent quantities to the wastewater treatment plant totals should be reported as Category A waste.
- 5) Two refineries, in their 2002 SB 14 documents mentioned that they have “updated” their documents from 1998. As a matter of fact, all the generators should start their source reduction evaluation from a scratch for every new cycle and prepare their current documents based on new assessment information. SB-14 requires that for 2007 SB 14 documents, that all facilities collect their hazardous waste generation data for calendar year 2006; calculate the major waste streams; search for and select new feasible source reduction measures; prepare a new implementation schedule; and if possible, project implementable source reduction quantities for all of their major waste streams during the 2007-2010 planning period.
- 6) We noticed that two sites did not calculate their major waste streams correctly when they had two or more different wastes under the same California Waste Code (CWC). The following discussion explains how to calculate major waste in this situation:

Section 67100.5 (h) of the California Code of Regulations states:

"Identification of all routinely generated hazardous waste streams in the current reporting year which result from ongoing processes or operations that have a yearly volume, or comparable weight exceeding five percent of the total yearly volume, or comparable weight of hazardous waste generated at the site, or, for extremely waste, five percent of the total yearly volume, or comparable weight generated at the site. **Similar industrial processes or institutional activities generating similar wastes (with the same California Waste Codes) shall be**

considered a single waste stream for purposes of this subsection." (bold face added)

The Source Reduction Unit discussed the highlighted portion above concluding that individual major waste streams shall each share the same CWC classification, but that each CWC major waste stream grouping shall be comprised only of individual waste streams originating from similar ongoing processes or operations. Individual waste streams sharing the same CWC but not originating from similar processes shall be considered separately for qualifying as a major waste stream. Thus it is conceivable that a generator could identify two major waste streams, having the same CWC but comprised of individual waste streams in each CWC group originating from common processes or operations but not sharing the same process origins as those in the other group sharing the same CWC. The forgoing example assumes that for both groupings sharing the same CWC, in order for each to be major waste streams, the total of the individual waste stream quantities making up each CWC group must be greater than five percent of the facility total and be greater than 600 KG. (see Section 25244.19 (b) (3) HSC). Extremely hazardous waste major waste streams shall be greater than five percent of the extremely hazardous waste total for the facility and be greater than 0.6 KG.

Total SB14 Category A Waste Generation

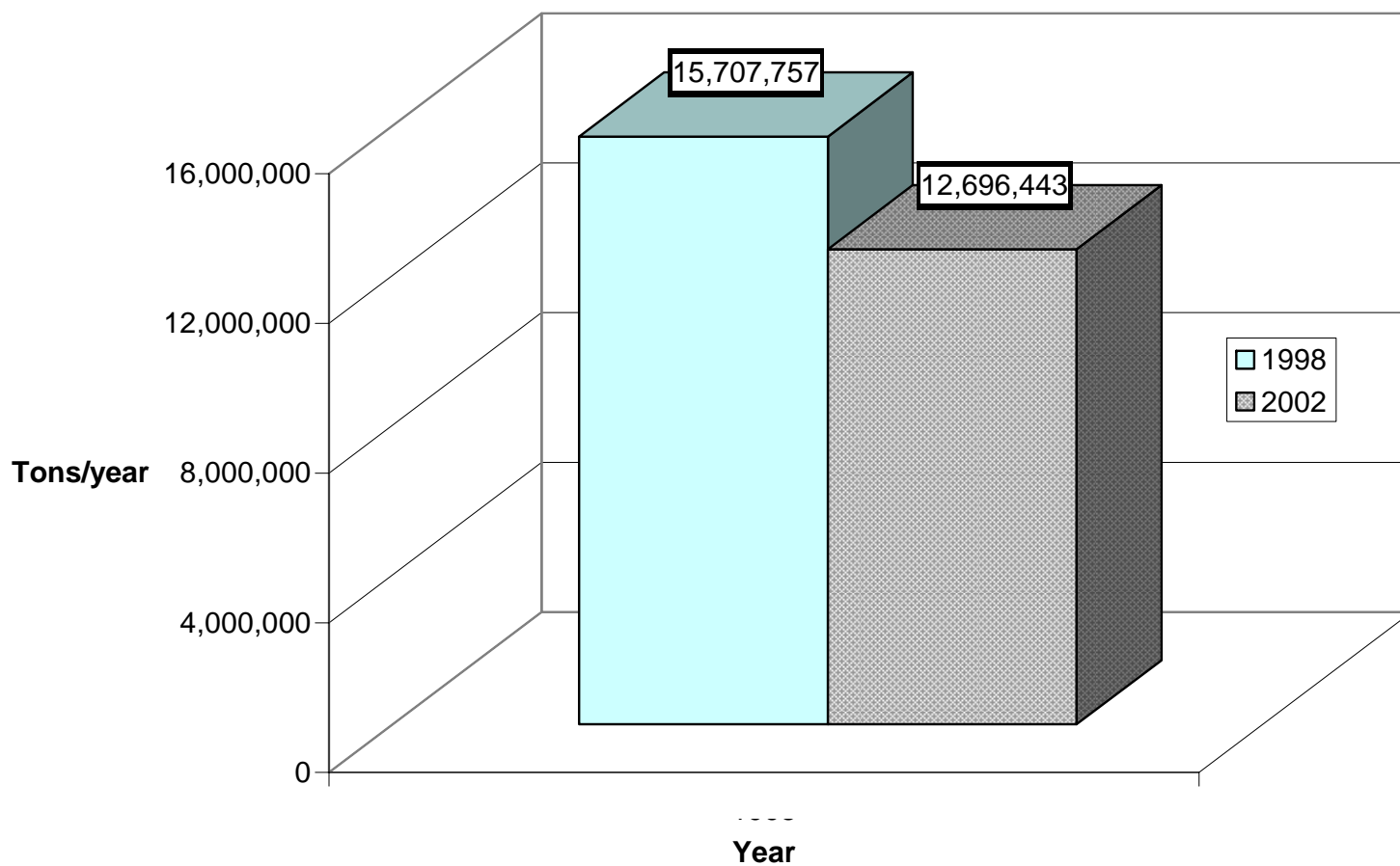


FIGURE 18-A. Total Petroleum Refining SB 14 Waste Generated for Category A in 1998 and 2002.

Total SB-14 Category B Waste Generation

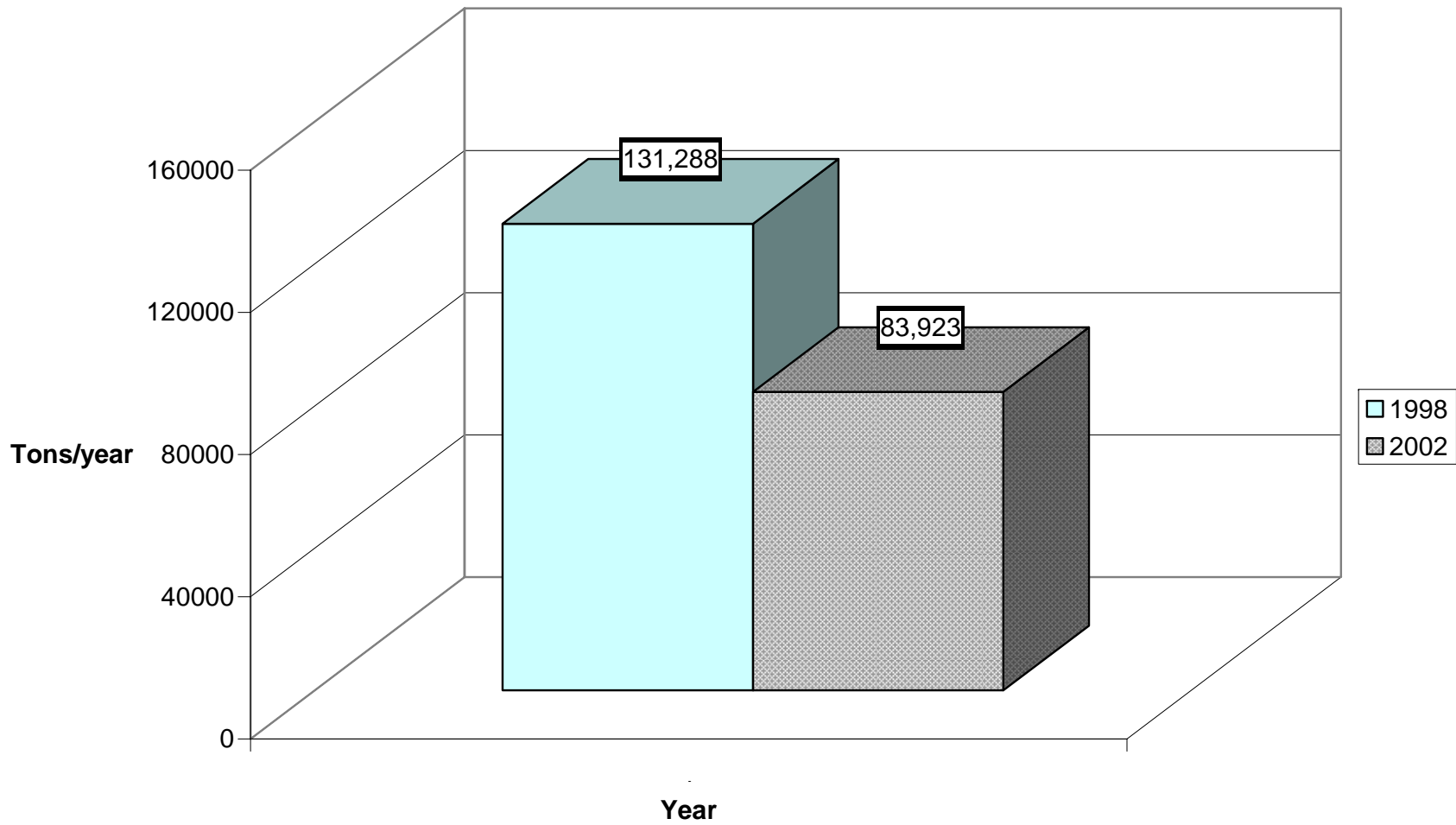


FIGURE 18-B. Total Petroleum Refining SB 14 Waste Generated for Category B in 1998 and 2002.

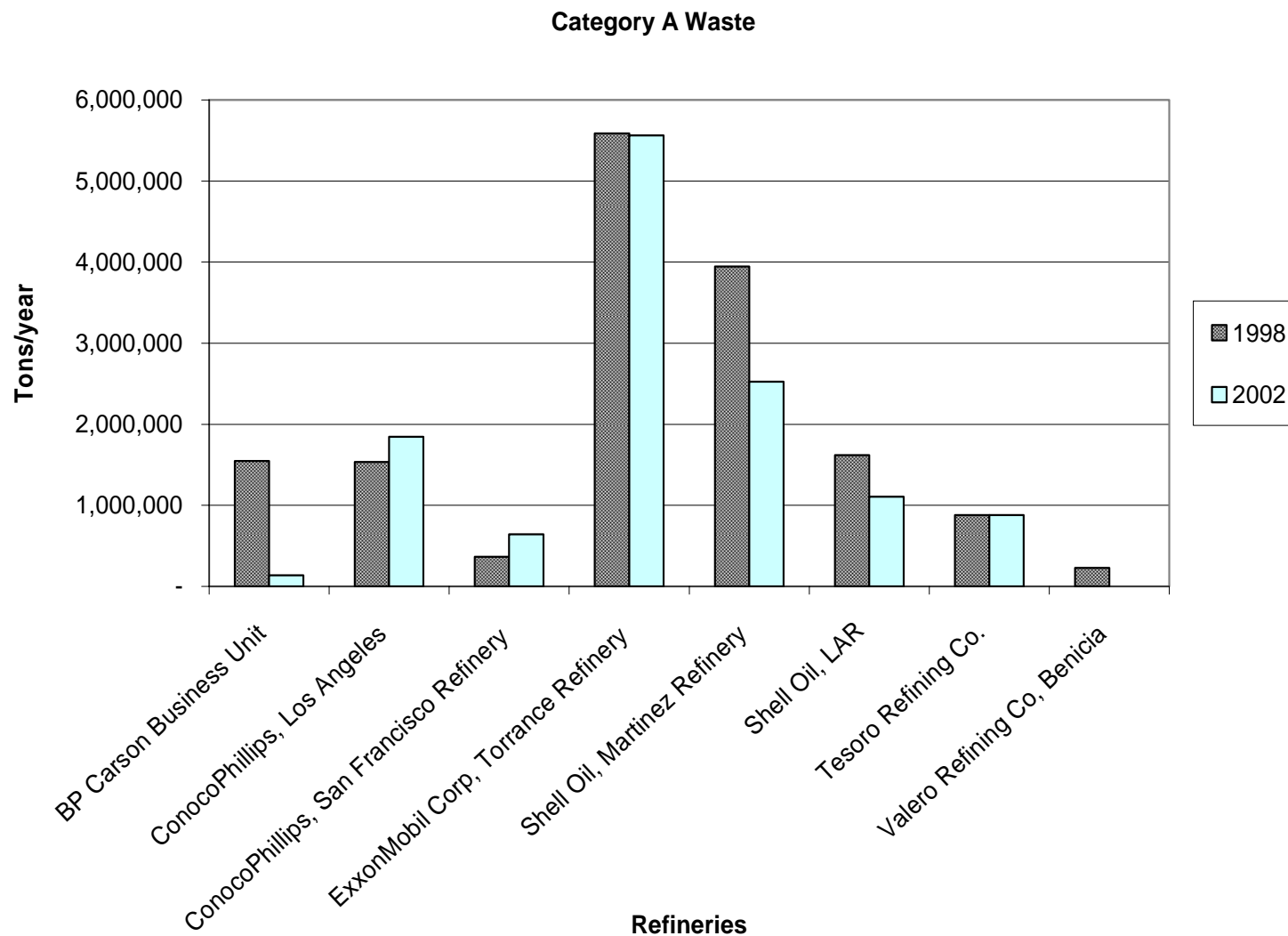


FIGURE 19. Category A Wastes for Sites Reporting Generation in 1998 and 2002.

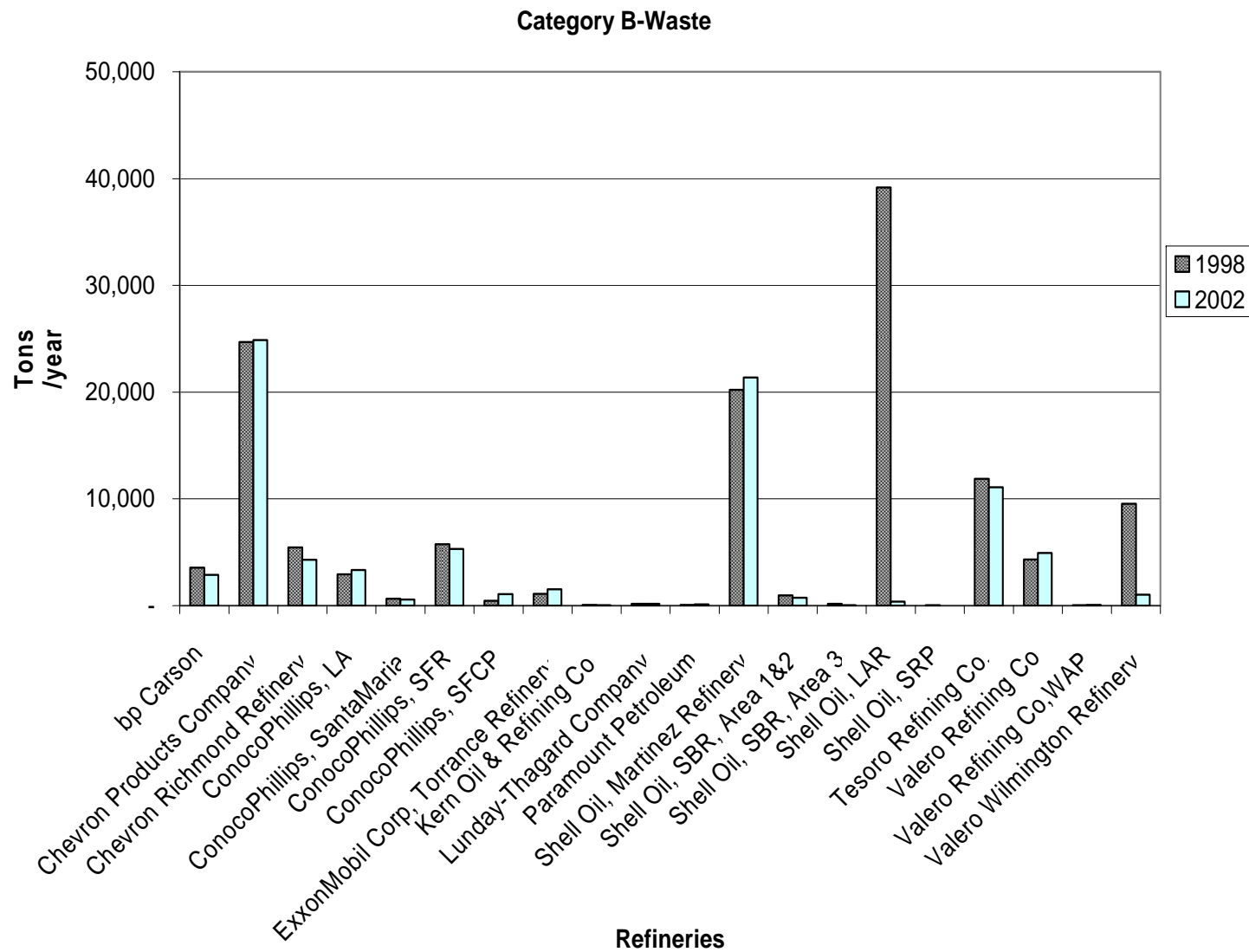


FIGURE 20-A. Category B Wastes for Sites Reporting Generation in 1998 and 2002.

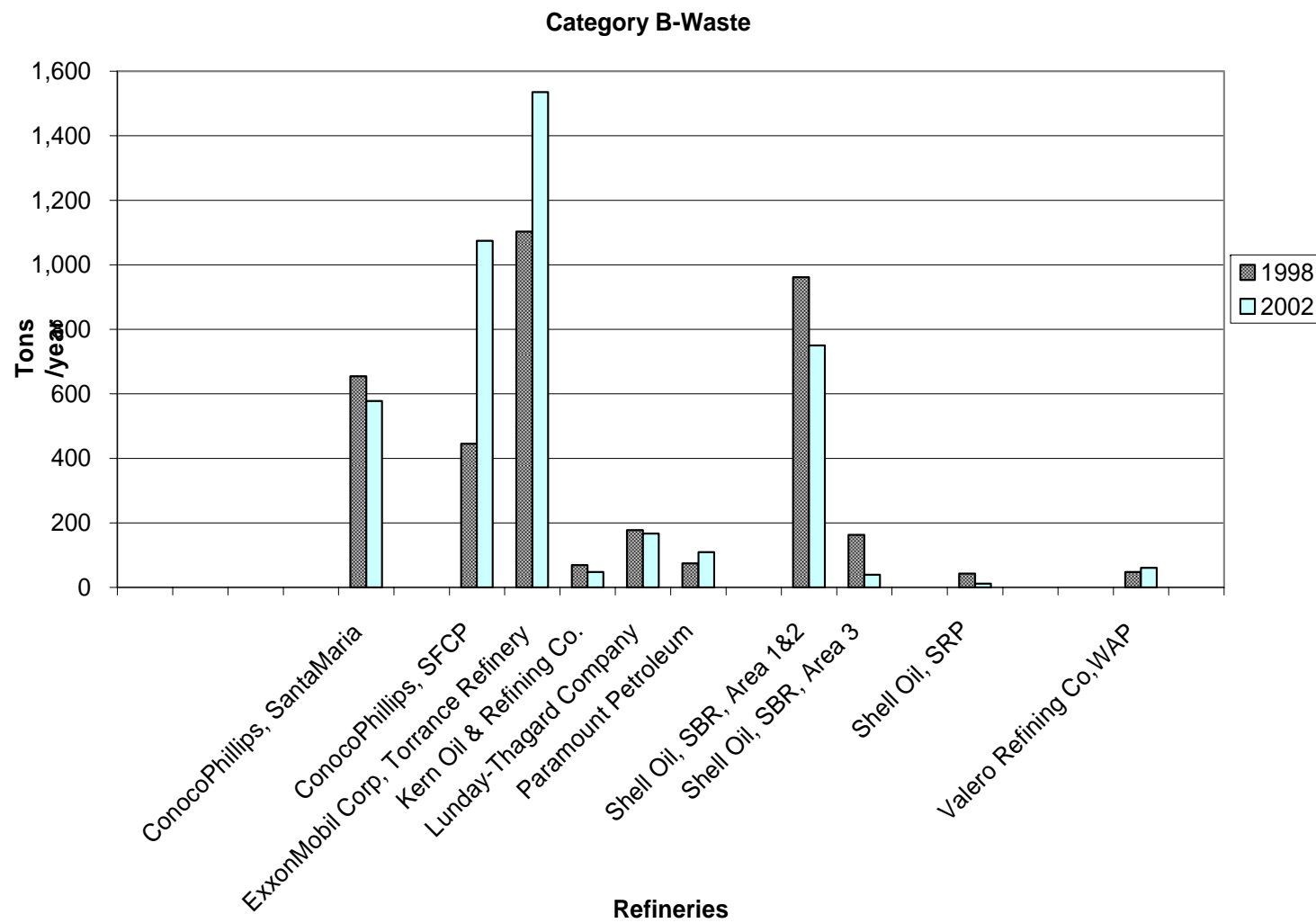


FIGURE 20-B. Zoom in Figure 20-A for Refineries that Generated up to 1,600 tons/year of Category B wastes in 1998 and 2002.

TABLE 2*									
REFINERY INDUSTRY HAZARDOUS WASTE GENERATION DATA 1998 VS. 2002									
	EPA ID	Refinery Name (2003)	City	1998 (Category A) (pounds)	2002 (Category A) (pounds)	Category A (1998-2002) (#) (pounds)	1998 (Category B) (pounds)	2002 (Category B) (pounds)	Category B (1998-2002) (#) (pounds)
1	CAD 077227049	Bp Carson Business Unit Atlantic Richfield Company, a subsidiary of BP America	Carson	3,094,326,000	273,502,883	2,820,823,117	7,134,400	5,793,667	1,340,733
12	CAD 008336901	Chevron Products Company	El Segundo	0	0	-	49,375,896	49,766,293	(390,397)
3	CAD 009114919	Chevron Products Company, Richmond Refinery	Richmond	0	0	-	10,912,000	8,637,523	2,274,477
4-A	CAD 980881676	ConocoPhillips, Los Angeles Refinery-LARC(*)	Carson	3,070,000,000	3,690,000,000	(620,000,000)	5,870,000	6,680,000	(810,000)
4-B	CAD 008237679	ConocoPhillips, LARW(*)	Wilmington			-			-
4-C	CAT 000611228	ConocoPhillips, LARMT(*)	Los Angeles			-			-
5-A	CAD 990846701	ConocoPhillips, Santa Maria Facility (Refinery)(**)	Arroyo Grande			-			-
5-B	CAT 080010796	ConocoPhillips, Santa Maria Facility (Carbon Plant) (**)	Arroyo Grande	0	0	-	1,309,160	1,155,615	153,545
6-A	CAD009108705	ConocoPhillips, San Francisco Refinery	Rodeo	731,057,521	1,283,000,000	(551,942,479)	11,515,700	10,623,000	892,700
6-B	CAD 983577537	ConocoPhillips, San Francisco Carbon Plant	Rodeo			-	890,964	2,149,000	(1,258,036)
7	CAD 008354052	ExxonMobil Corporation, Torrance Refinery	Torrance	11,179,307,440	11,125,378,100	53,929,340	2,206,588	3,070,820	(864,232)
8	CAD 990724916	Kern Oil and Refining Company	Bakersfield			-	138,000	95,783	42,217
9	CAD 008345464	Lunday-Thagard Company	South Gate	N/A	N/A	-	354,995	333,156	21,839
10	CAD 008371098	Paramount Petroleum Corporation	Paramount	N/A	N/A		148,640	218,731	(70,091)
11	CAD 009164021	Shell Oil, Martinez Refinery	Martinez	7,890,000,000	5,050,000,000	2,840,000,000	40,717,000	42,717,000	(2,284,941)
12-A	CAD 099457087	Shell Oil, Bakersfield Refinery, Area 1 and Area 2	Bakersfield	0	0	-	1,923,107	1,500,342	422,765
12-B	CAD 982052094	Shell Oil, Bakersfield Refinery, Area 3	Bakersfield	0	0	-	325,864	78,260	247,604
13-A	CAD 041520644	Shell Oil, Equilon enterprises, Los Angeles Refinery	Wilmington	3,235,779,837	2,215,283,286	1,020,496,551	78,339,800	766,670	77,573,130
13-B	CAT 000646331	Shell Oil, Equilon enterprises, Sulfur Recovery Plant	Carson	0	0	-	85,490	22,730	62,760
14	CAR 000091488	Tesoro Refining Company, Golden Eagle Refinery	Martinez	1,759,009,700	1,755,722,000	3,287,700	23,780,054	22,190,664	1,589,390
15	CAD 063001770	Valero Refining Company, Benicia	Benicia	456,034,000	N/R	None (***)	8,650,100	9,866,250	(1,216,150)
16	CAD 981373053	Valero Refining Company, Wilmington Asphalt Plant	Wilmington	0	0	-	96,100	121,040	(24,940)
17	CAD 066647066	Valero-Ultramar, Wilmington refinery	Wilmington	0	0	-	19,087,000	2,059,884	17,027,116
				31,415,514,498	25,392,886,269	5,566,594,229	262,575,917	167,846,428	94,729,489
* Waste generation data based on Table 1 of SPR									
	(*) Consolidated data for three facilities.			N/R – None Reported					
	(**) Consolidated data for two facilities.								
	(***) No Source Reduction. Refinery claim exemption on the Category A Waste(s).								
	#) The hazardous waste reduction between 1998 and 2002 may be attributed to combinations of the following factors: (a) measures implemented during 1998-2002; (b) different method of calculating hazardous waste in 1998 and 2002; and (c) claiming some waste stream exemption in 2002.								
	NOTES:								
	17 Refineries – 23 Sites								
	7 out of 23 reported Category A Waste in 2002								
	All except one out of 23 facilities reported Category B Waste. This one facility generated less than threshold amount.								
	8 out of 23 reported that their Category B Waste increased in 2002 compared to 1998.								

TABLE 3								
REFINERY INDUSTRY'S OVERALL HAZARDOUS WASTE GENERATION COMPARISON								
				1998 (pounds)	2002 (pounds)	1998-2002 (pounds)	1998-2002 Percent Reduction (*)	
	Category A			31,415,514,498	25,392,886,269	5,566,594,229	17.72 percent	
	Category B			262,575,917	167,846,428	94,729,489	36.07 percent	
	TOTAL			31,678,090,415	25,560,732,697	5,661,323,718	17.87 percent	
(*) the percent reduction may be attributed to combinations of the following factors: (a) measures implemented during 1998-2002; (b) different methods of calculating hazardous waste in 19998 and 2002; and (c) claiming some waste stream exemption in 2002.								

TABLE 4					
REFINERY INDUSTRY'S HAZARDOUS WASTE REDUCTION PROJECTION BY WASTE STREAM FOR 2002-2006					
	CWC	Waste Description	Projection (pounds) 2002 to 2006		
		Category A:			
	134	Aqueous solution with total organic residues less than 10 percent	6,473,327,100		
	791	Liquids with pH ≤ 2	692,000,000		
	135	Unspecified aqueous solution	13,675,144		
	132	Aqueous solution with metals	none		
		Category B:			
	122	Alkaline solution without metals pH>12.5	115,496,725		
	181	Other inorganic solid waste	21,474,412		
	222	Oil/Water separation sludge	4,218,406		
	161	Fluid Catalytic Cracker waste	3,168,628		
	352	Other Organic Solids	1,647,723		
	162	Other Spent catalyst	696,485		
	343	Unspecified organic liquid mixture	500,000		
	342	Organic liquids with metals (see 121)	220,000		
	591	Baghouse waste	90,000		
	241	Tank bottom waste	2,000		
	441	Sulfur sludge	---		
	223	Unspecified oil-containing waste	---		
	121	Alkaline solution (pH>12.5) with metals (antimony, arsenic, beryllium chromium etc.)	---		
			7,326,516,623		

TABLE 5			
REFINERY INPUT OIL AND WASTE GENERATION			
	Refinery Input Crude Oil (thousand tons/year)*	SB-14 Category B Waste Generation (thousand tons/year)	NORMALIZATION SB 14 Category B Waste Generation/Refinery Input Crude Oil (percent)
1998	106,139	131	0.12
2002	104,708	84	0.08

*California Energy Commission Weekly Fuels Watch Report