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Via Federal Express

February 27, 2009  
In reply refer to SHEA-108338

Regional Water Quality Control Board  
Los Angeles Region  
320 West 4th Street, Suite 200  
Los Angeles, CA 90013

Attention: Information Technology Unit

Reference: Compliance File CI-6027 and NPDES No. CA0001309

Subject: 2008 Annual NPDES Discharge Monitoring Report, The Boeing Company,  
Santa Susana Field Laboratory, Ventura County, California

Dear Sir/Madam,

The Boeing Company (Boeing) hereby submits this annual discharge monitoring report (DMR) for the Santa Susana Field Laboratory (SSFL) for the period of January 1, 2008 through December 31, 2008. This DMR is provided for all outfalls authorized by NPDES Permit No. CA0001309. The Los Angeles Regional Water Quality Control Board (Regional Board) issued a revised permit on November 9, 2007, with an effective date of December 20, 2007.

This annual DMR provides information and data, including summary tables of surface water sample analytical results, rainfall summaries, liquid waste shipment summaries, and analytical laboratory QA/QC procedures and certifications. A compact disc with the report tables, figures and attachments is being submitted along with this DMR. This document will also be made available electronically at:

[www.boeing.com/aboutus/environment/santa\\_susana/programs.html](http://www.boeing.com/aboutus/environment/santa_susana/programs.html).

Additionally, hard copies of this report are available at the following: California State University at Northridge Library; Simi Valley Library; and the Platt Branch, Los Angeles Library.

## REPORT CONTENTS

This annual DMR summarizes analytical data collected from the permitted outfalls during 2008. Data for this report have been summarized in tabular form. Therefore, in addition to the report text, this DMR includes the following:

- SSFL facility map showing the outfall locations (Figure 1)
- Summary of Annual Rainfall (Table 1)
- Summary of Liquid Waste Disposal (Table 2)
- Summary of Permit Limit Exceedances (Table 3)



- Outfall-specific Summary Tables and Charts of Analytical Results (Sections 1 through 15)
- Arroyo Simi (Receiving Water) Summary Tables and Charts of Analytical Results (Section 16)
- Summary of Reasonable Potential Analysis (RPA) (Section 17)
- Storm Water Pollution Prevention Plan Annual Evaluation (Section 18)
- Analytical Laboratory QA/QC Procedures and Certifications (Section 19)

## OVERVIEW OF THE 2008 REPORTING PERIOD AT SSFL

This section presents an overview of the efforts Boeing has made and continues to make to achieve compliance. It provides an overview of best management practices (BMPs) that have been installed to minimize impacts to surface water and the potential for surface water permit limit exceedances.

As reported in previous DMRs and annual reports submitted by Boeing to the Regional Board, Boeing's investigations suggest that most of the constituents detected in storm water result from naturally occurring soil contributions and atmospheric deposition, or were detected at concentrations consistent with regional background concentrations. Additionally, based on SSFL operations and activities, it is Boeing's conclusion that most of the detections of constituents exceeding permit limits are not the direct result of a known discharge or release from an industrial process or historical contamination at the site. In some cases, former industrial activities at the SSFL may have impacted localized areas of on-site soils and sediments that could have potentially affected stormwater quality. However, under regulatory supervision, Boeing has completed numerous mitigation actions to manage surface water impacts potentially resulting from former industrial activities. These actions include extensive soil removal; covering and/or stabilizing areas pending site-wide corrective action implementation; and implementing an extensive system of BMPs. Boeing has implemented and continues to implement and improve BMPs to minimize the transport of soils and/or sediment that may be associated with constituents regulated in the SSFL NPDES permit. Additionally, numerous BMPs are designed to remove dissolved constituents from storm water.

Unlike most industrial facilities regulated through the NPDES Program, the SSFL is a predominantly natural habitat. Greater than ninety percent of the facility is natural and undeveloped, and is covered with natural vegetation (much of which is native), sandstone rock outcrops, and weathered sandstone sediment and soil. Such land use is typically defined as "open space." All discharges from SSFL are storm water with the exception of discharges from the groundwater treatment system, when it is operational. Storm water discharges are not continuous, consistent, or scheduled. Storm water discharge results from rainfall becoming surface flow, and occurs through natural, unlined drainages. Compounds that naturally occur in rocks and sediment (e.g., metals) are present in the surface water that flows through these drainages. Furthermore, as with all areas around the Los Angeles River Basin, there is a contribution of constituents from atmospheric deposition. The contributions from naturally occurring and atmospheric sources have been addressed in the Flow Science Technical Report "Potential Background Constituent Levels in Storm Water at Boeing's Santa Susana Field Laboratory," February 23, 2006 (Flow Science Background Report). Boeing



continues to evaluate this issue, while aggressively striving to achieve our goal of compliance with the permit limits.

Since storm water runoff is sporadic and highly variable in intensity and volume, it is expected that the concentration of these compounds will also vary from sampling event to sampling event. This is discussed in further detail in the following sections.

#### **Best Management Practices (BMPs)**

In 2008 Boeing improved and upgraded multiple BMPs as listed in the Corrective Action section of this report, in order to address previous exceedances, reduce the frequency of bypass or overflow of BMPs, and improve surface water discharge quality. Specific upgrade details are provided by outfall location.

To help to evaluate the effectiveness of BMPs, a monitoring program has been implemented whereby automated influent and effluent sampling units have been installed above and below BMPs at Outfalls 003, 004, 006, 010, 011, and 018 to collect samples to analyze for suspended sediment concentrations during storm events as a means of estimating the constituent removal effectiveness of BMPs. Results are included in the attachment of this report to the Regional Board as required.

Pursuant to Cease and Desist Order No. R4-2007-0056, Boeing is also working with an independent expert panel of stormwater researchers and practitioners on the development of Engineered Natural Treatment Systems (ENTS) in the Outfall 008 and 009 watersheds to meet the NPDES numeric effluent limits at these outfalls. The storm water quality data contained in this annual report will be provided to the expert panel for their review and consideration as part of the ENTS planning effort. Workplans are in development, and construction of the ENTS is scheduled to begin in summer 2009.

As directed by the RWQCB Cleanup and Abatement Order issued December 4, 2008, Boeing is also proceeding with source removal activities in the Outfalls 008 and 009 watersheds to address constituents that have exceeded NPDES permit limits/benchmarks, as directed by the RWQCB Cleanup and Abatement Order issued December 4, 2008.

Pursuant to Clean-up and Abatement Order (CAO) No. R4-2007-0054, issued by the Regional Board on November 6, 2007, under the direction of the DTSC a remedial action was initiated to clean-up and abate wastes observed in the Outfall 009 drainage. Soil and debris removal began in the LOX Debris Area on November 14, 2007, and was completed on December 20, 2007. Further debris removal in the Former Shooting Range Area/Northern Drainage Debris Area and downgradient from LOX to Outfall 009 commenced in July 2008, and was completed in December 2008. Excavation of contaminated soil downgradient from Outfall 009 to the Brandeis-Bardin Institute is scheduled to commence in the spring of 2009. Sediment and erosion control BMPs (including fiber rolls, straw bales, silt fencing, coco matting, and hydromulch) were installed in and downstream of the excavation areas to minimize the potential for excessive erosion and impacts to the drainage.

#### **Bioassessment**

A bioassessment review at SSFL was conducted for the Second Quarter of 2008 as required by the permit. However, all drainages associated with Permit-regulated outfalls at SSFL were dry and there was no suitable habitat to complete the bioassessment sampling.



### **Wildfires**

Wildfires, the effects of which have been widely documented and which have occurred at and near the SSFL site, release significant amounts of metals and dioxins, and storm water runoff following wildfire events has been observed to carry significantly higher concentrations and loads of these constituents. Atmospheric deposition rates of metals have been observed to rise several-fold during fires. Atmospheric deposition rate of dioxin concentrations are also elevated during fires. Fires leave behind ash and destroy vegetation, resulting in significant changes in the hydrologic response of watersheds, including higher runoff volumes, higher runoff flow rates, and higher concentrations of total suspended solids (TSS), all of which may contribute to the downstream conveyance of regulated constituents (Flow Science Background Report). Post-fire effects can continue to impact the quantity and quality of storm water runoff for several years following a fire.

As reported in past quarterly and annual reports, the Topanga Wildfire began on September 28, 2005, and burned approximately 70% of the SSFL site. On-site restoration activities were immediately implemented following the Topanga Wildfire and have continued to date to reduce the impact of the ash and charred material on surface water quality. In 2008, additional activities were implemented in order to help restore the natural, engineered and/or institutional controls that aid in minimizing the erosion of surface materials and the migration of sediment in surface water. Hydromulch and/or hydroseed was placed over approximately 20 acres of areas observed to have erodible soils and/or ash. Hydromulch is a semi-liquid organic binder blended with hydromulch paper or wood fiber/pulp that is dispersed onto and adheres to the ground surface and soil surface to protect from further soil erosion, to aid in minimizing sediment transport, and to decrease the potential for mudslides and debris flows. Hydroseed is hydromulch that incorporates a native seed mixture. Hydromulch/hydroseed application occurred upstream of and near Outfalls 001, 002, 003, 008, 009, 010, 011 and 018 during 2007, and upstream of and near Outfalls 001, 002, 003, 004, 005, 008, and 010 during 2008 where additional erosion control measures were needed.

Other significant fires in the vicinity of the site included the Marek and the Sesnon Wildfires. The Marek Wildfire began on October 12, 2008, burning east (upwind) of the SSFL site and approaching as close as 10 miles, and the Sesnon Wildfire burned approximately 1 mile from Black Canyon, north of the SSFL site, on October 13, 2008. The Sesnon fire burned 14,703 acres upwind of the SSFL. The fire was in such proximity that fire officials ordered evacuation of the SSFL. Smoke and ash from the fire impacted the SSFL and, like previous fires, are likely to have contributed to increases in concentrations of regulated constituents in SSFL soils and stormwater runoff. Following the fire, SSFL continued upgrading its BMPs throughout the facility to attempt to stay within permit limits for stormwater runoff.

### **Natural Occurrences of Regulated Constituents Affecting Surface Water Quality**

It is Boeing's conclusion that most of the constituents detected in storm water monitoring data collected over the past several years can not be attributed to the presence of any specific on-site current or historic industrial or operational source(s). Our analysis suggests that many, if not most, of the permit limit exceedances may be due to naturally occurring or regional background concentrations – from naturally occurring constituents in soils, impacts from on-site wildfires and ash deposition from wildfires occurring upwind, or due to regional atmospheric deposition. Attempts to find patterns in the exceedances or magnitudes of constituent concentrations have been generally unsuccessful to date. In most cases exceedances are not repeated with regularity or consistency, and most concentrations of



constituents greater than permit limits have not been shown to be related to any potential on-site source area or site activity.

In cases where historical site operations appeared to impact or have the potential to impact surface water, extensive measures have been taken, generally by way of removing impacted soils and backfilling with clean material to mitigate such impacts. In some instances, tarping and/or other protective measures were installed to isolate impacted soils from stormwater runoff. Following such interim measures, constituents in surface waters were generally within the ranges expected due to natural background conditions.

An outfall by outfall description of the BMPs implemented in 2008 is described in the Corrective Action Section of this document.



## **DISCHARGE STATUS**

Precipitation during 2008 at SSFL is provided for each month of the year in Table 1. Surface water samples were collected when flow was observed at the designated outfall locations during storm events of greater than 0.1 inches. For all qualifying events between January 1 to December 31, 2008, surface water samples were collected from Outfalls 001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, and 018, in accordance with the NPDES Permit No. R4-2007-0055. Figure 1 illustrates the SSFL facility and the locations of the outfalls.

All sanitary wastes from the domestic sewage treatment plants (STPs I, II, and III) were shipped off-site to a permitted treatment and disposal facility. Details of the waste shipments are summarized in Table 2.

## **SURFACE WATER DISCHARGE ANALYTICAL RESULTS REPORTING**

All analyses of surface water discharge samples were conducted at laboratories certified for such analyses by the California Department of Public Health or approved by the Regional Board's Executive Officer and in accordance with current United States Environmental Protection Agency (EPA) guidelines, procedures, or as specified in the monitoring program. As indicated on Page T-3 in the NPDES permit, analytical results were designated "Detected but not Quantified (DNQ)" (similar to organic analyses being J-flagged by the laboratory or data validator) if the analytical result was greater than or equal to the laboratory's method detection limit (MDL), and less than the State Board's Minimum Level (ML) or laboratory reporting limit (RL). For the purposes of determining compliance with permit limits, data that were designated DNQ or that were J-flagged (estimated values), were reported as such, but were not used to establish compliance because the estimated value was less than the laboratories' RL.

Attachment T-A of the NPDES permit presents the State Board's MLs for use in reporting and determining compliance with NPDES permit limits. The analytical laboratory achieved these MLs for 2008. However, some constituents' daily maximum and/or monthly average discharge limits in the NPDES permit are less than their respective MLs and less than the laboratory RL. In cases where the permit limit is less than the RL and ML, the RL was used to determine compliance. As required in the NPDES permit, Section 11 of this report provides a summary table of constituents listed in the permit, their analytical laboratory

methods, MDLs, and RLs, and copies of laboratory quality assurance and quality control procedures. California Department of Public Health Environmental Laboratory Accreditation Program (ELAP) certifications are also included in Section 11, as required in the NPDES permit.

During 2008, specific constituents that had permit limits that were less than the RLs and MLs were mercury, bis(2-ethylhexyl)phthalate, cyanide, polychlorinated biphenyls (PCBs), (Aroclor congeners), chlordane, 4,4-DDD, 4,4-DDE, 4,4-DDT, dieldrin, toxaphene, and chlorpyrifos. None of these compounds were detected at concentrations equal to or greater than their RL with the exception of bis(2-ethylhexyl)phthalate at outfall 002 during the first quarter 2008.



### SUMMARY OF NON-COMPLIANCE AND CORRECTIVE ACTIONS

Analytical results for all surface water samples are summarized in Table 3 and in the Attachment -- Sections 1 through 16. Consistent with prior annual report submittals and in accordance with the NPDES permit, graphical presentation of the data collected has also been included for specific analytes and parameters that could be effectively graphed. Analytes that had a permit limit were graphed. Analytes that do not have permit limits were not graphed. Graphing consisted of charting an analyte's analytical result(s) with the sample date(s). The graphs are included in each section of the attachment as described below.

The tabular and graphic data for all outfall locations, including the Arroyo Simi receiving water location, where data were collected (i.e., where outfalls flowed) are provided in the attachment as follows:

Attachment:

Section 1	Outfall 001	South Slope below Perimeter Pond
Section 2	Outfall 002	South Slope below R-2 Pond
Section 3	Outfall 003	RMHF
Section 4	Outfall 004	SRE
Section 5	Outfall 005	FSDf-1
Section 6	Outfall 006	FSDf-2
Section 7	Outfall 007	Building 100
Section 8	Outfall 008	Happy Valley
Section 9	Outfall 009	WS-13 Drainage
Section 10	Outfall 010	Building 203
Section 11	Outfall 011	Perimeter Pond
Section 12	Outfall 012	Alfa Test Stand
Section 13	Outfall 013	Bravo Test Stand
Section 14	Outfall 014	APTF
Section 15	Outfall 018	R-2A Pond
Section 16	Receiving Water and Sediment Sampling Location – Arroyo Simi (Frontier Park)	

Included after Table 3 and at the beginning of the sections in the Attachment are the Annual Reporting Summary Notes. The Annual Reporting Summary Notes are a compilation of notes, abbreviations, and data validation codes that are found in the analytical data summary tables contained in the attachment.

As indicated in the Attachments, and as summarized in Table 3, a 2008 Summary of Daily Max, Monthly Average, and Daily Mass Permit Limit or Benchmark Limit Exceedances includes:

- Bis (2-ethylhexyl) Phthalate at Outfall 002
- Cadmium at Outfall 013
- Chronic Toxicity at Outfall 004
- Total Residual Chlorine at Outfalls 001, 002, 011 and 018
- Chloride at Outfall 012
- Fluoride at Outfall 012
- Iron at Outfalls 001, 002, 011 and 018
- Lead at Outfall 001, 002, 008, and 009
- Manganese at Outfalls 001 and 002
- Nitrate + Nitrite as Nitrogen (N) at Outfall 014
- Nitrate as Nitrogen (N) at Outfall 014
- pH at Outfalls 004, 006, and 013 (pH compliance is based on a range of pH values, therefore, non-compliance could be less than or greater than the permitted range)
- TCDD TEQ at Outfalls 001, 002, 004, 009, 011, 012, 014, and 018
- Zinc at Outfall 013

#### **Discussion of the Most Prevalent Permit Exceedance**

A discussion regarding TCDD TEQ (dioxin) is included below, considering that it was reported to exceed daily maximum permit limits at seven compliance outfall locations, and TCDD TEQ has been a consistent source of exceedances at SSFL since the limit was established as TCDD TEQ. A short discussion regarding monthly average exceedances is also included.

#### **TCDD (Dioxin): Discussion of Occurrence and Potential Sources**

Due to the unique process by which TCDD concentrations are determined, a brief discussion of TCDD reporting is included. To enable a single total concentration (commonly called a Toxicity Equivalence (TEQ)) to be calculated from the sum of the 17 dioxin and furan congeners, 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (2,3,7,8-TCDD) 'equivalent' concentrations are calculated for each congener by multiplying that individual congener's concentration by its toxic equivalency factor (TEF). The TEF is based on the toxicity of the congener compared to the toxicity of 2,3,7,8-TCDD. The TEFs published by the World Health Organization (WHO) in 1998 are used. The dioxin summary tables in the attachments show the TEFs for the various congeners. The common term for the sum of the factored concentration is TEQ. When used in this report, the term TCDD refers to the total equivalence of the seventeen 2,3,7,8-substituted dioxin and furan congeners (commonly called the TCDD TEQ).

For the purposes of evaluating compliance with permit limits (as stated in the 2007 NPDES permit on Page 54, Section II, C. 3), TCDD TEQ is based on detected congeners and does not include those congeners reported as ND (not detected) or detected, but not quantifiable



(DNQ). A DNQ is a value less than the laboratory RL, but greater than the method detection limit (MDL). Therefore, when evaluating whether a permit limit exceedance occurred, ND or DNQ data (the resulting estimated values) were considered zero in the calculation.

During 2008, TCDD TEQ exceeded daily permit or benchmark limits at Outfalls 002, 004, 009, 011, 012, 014, and 018, and exceeded monthly average permit limits at Outfalls 001 and 011. TCDD has been frequently detected in DTSC-approved non-impacted background soil sample locations (MWH, 2005). In some areas, on-site operations have utilized combustion processes. However, the TCDD TEQ values in soils collected from these potentially impacted areas have been found either not to be elevated above background levels, or if elevated, they have been shown to decrease to near background levels within a short distance from the suspected source area.

Also, as documented in the Flow Science Background Report (Flow Science, 2006), TCDD TEQ concentrations in storm water runoff from off-site surface water sampling locations in undeveloped areas and in receiving waters throughout the region during storm conditions are comparable to concentrations in storm water runoff from the SSFL.

#### **Monthly Average Exceedance Discussion**

Monthly average permit limits are not appropriate for inconsistent, sporadic, and infrequent storm water-dominated discharges such as those at SSFL. Based on the data collected from the SSFL, monthly average permit limit exceedances are typically the result of a single sample where there are no additional rainfall events or monitoring data during the month.

A monthly average based only on one or two data points is not representative of actual monthly average concentrations or constituent mass traveling to receiving waters over a one-month period. In addition, monthly average permit limits are calculated based on the State of California's Policy for the Implementation of Toxics Standards for Inland Waters, Enclosed Bays, and Estuaries (State Implementation Policy), and the EPA's Technical Support Document for Water Quality-based Toxics Control methodology developed for continuous, end of pipe discharges, such as Publicly Owned Treatment Works or industrial wastewater discharges. This methodology often uses California Toxics Rule chronic criteria as the basis for average monthly permit limits. SSFL storm flows are often shorter in duration than chronic exposure timeframes (i.e., shorter than 4 days (for metals) or 30 days (for ammonia)). Therefore, the average monthly permit compliance criteria and the calculated average monthly concentration may not be representative of appropriate permit criteria or actual monthly site conditions throughout the SSFL.

#### **Discussion of Permit Limit or Benchmark Exceedances**

The following paragraphs present a summary of permit limit exceedances by outfall. Following these summaries, a discussion of corrective measures is included.

#### **Storm Water Outfall 001**

##### **Exceedance Summary**

During the 2008 monitoring period, samples collected at Outfall 001 had nine exceedances for five constituents with benchmark limits, as summarized in Table 3:





- On January 25 and February 3, manganese was detected at concentrations of 71  $\mu\text{g/L}$  and 220  $\mu\text{g/L}$ , respectively, which are above the daily maximum benchmark limit of 50  $\mu\text{g/L}$ .
- On January 25, February 3, and February 24, iron was detected at concentrations of 5.7 mg/L, 17 mg/L, and 3.5 mg/L, respectively, which are above the daily max benchmark limit of 0.3 mg/L.
- On February 3, lead was detected at a concentration of 6.4  $\mu\text{g/L}$ , which is above the daily max benchmark limit of 5.2  $\mu\text{g/L}$ .
- On February 3, total residual chlorine was detected at a concentration of 0.17 mg/L, which is above the daily max benchmark limit of 0.1 mg/L.
- The February monthly average for lead was 4.0  $\mu\text{g/L}$ , which is above the monthly average benchmark limit of 2.6  $\mu\text{g/L}$ .
- The January monthly average for TCDD-TEQ was  $2.25 \times 10^{-8}$   $\mu\text{g/L}$ , which is above the monthly average benchmark limit of  $1.40 \times 10^{-8}$   $\mu\text{g/L}$ .

#### Exceedance Discussion

##### Iron, Lead, and Manganese

Boeing benchmark limit exceedances for iron, lead, and manganese occurred at Outfall 001 in 2008. Background soils may have contributed to these exceedances, and of the reduction of TSS in storm water runoff is likely to be the most effective approach for reducing the number of metals exceedances in the future. Outfall 001 is located in the undeveloped portion of the property where no industrial activities have occurred. Boeing continues to investigate erosion sources and erosion control measures at the site, and will improve BMPs as appropriate, to better control sediment and associated metals transport into the surface water.

##### Total Residual Chlorine

On February 3, 2008, the total residual chlorine concentration was in excess of the benchmark limit at Outfall 001. Because there are no identified sources of chlorine that may have contributed to the presence of total residual chlorine in the stormwater samples taken at this outfall, it is Boeing's conclusion that the reported exceedance is the result of errors in the method by which the sample was analyzed. The outfall where this exceedance occurred contained some level of turbidity, which may have led to the reported concentration of residual chlorine. Turbidity, even low levels indistinguishable to the human eye, can lead to false readings with the residual chlorine analysis. An investigation into the data by the laboratory indicates that a background correction for turbidity was not performed on this sample. Boeing is continuing an investigation of the analytical measures used by its contracted laboratory to ensure the highest quality of data is provided. Laboratory analysts have been instructed to perform background verifications for all Boeing NPDES sampling for total residual chlorine analyses, and are receiving additional training in the laboratory's procedures. The laboratory will be revising their procedures to ensure this type of error does not occur in the future.

##### TCDD TEQ

The monthly average benchmark limit for TCDD TEQ was exceeded at Outfall 001 in January 2008. At this time, Boeing is uncertain where the TCDD in this sample originated,



but Boeing will continue to investigate sources of TCDD onsite. The presence of TCDD in both background soils and fire-related materials is well documented in the scientific literature (USEPA, 2000; Gullett and Touati, 2003). These findings are further substantiated by previously completed onsite and offsite studies (MWH, 2005) as presented in the Flow Science Background Report (Flow Science, 2006) and reported in the first, second and fourth quarter 2006 Discharge Monitoring Reports. These reports suggest that the levels of TCDD TEQ measured in surface water samples at the SSFL may result primarily from wildfire combustion processes, regional atmospheric deposition, and other off-site sources over which Boeing has no reasonable control. Continued monitoring of surface water at the outfall locations during storm events will provide a more thorough dataset with which to further evaluate the occurrence of TCDD.

Boeing is committed to attempting to achieve the water quality based effluent limit, if possible.

## Storm Water Outfall 002

### Exceedance Summary

During the 2008 monitoring period, samples collected at Outfall 002 had nine exceedances for six constituents with benchmark limits, as summarized in Table 3:

- On January 25, bis (2-ethylhexyl) phthalate was detected at a concentration of 5.7ug/L, which is above the daily max benchmark limit of 4.0 ug/L.
- On January 25, lead was detected at a concentration of 7.1 ug/L which is above the daily max benchmark limit of 5.2 ug/L.
- On January 25, manganese was detected at a concentration of 120 ug/L, which is above the daily max benchmark limit of 50 ug/L.
- On January 25, TCDD TEQ was detected at a concentration of  $9.69 \times 10^{-7}$  ug/L, which is above the daily max benchmark limit of  $2.80 \times 10^{-8}$  ug/L.
- On January 25 and February 3, iron was detected at concentrations of 4.3 mg/L and 0.62 mg/L, respectively, which are above the daily max benchmark limit of 0.3 mg/L. The February 3, 2008 detection was equivalent to a daily mass result of 827 lbs/day, which is above the daily mass benchmark limit of 400 lbs/day.
- On February 3, total residual chlorine was detected at a concentration of 0.14 mg/L, above the daily max benchmark limit of 0.1 mg/L. This detection was equivalent to a daily mass result of 187 lbs/day, which is above the daily mass benchmark limit of 133 lbs/day.

### Exceedance Discussion

#### *Bis (2-ethylhexyl) phthalate*

Bis (2-ethylhexyl) phthalate was detected at Outfall 002 on January 25, 2008, at a concentration of 5.7 ug/L, above its benchmark limit of 4.0 ug/L. As this was the first exceedance of bis(2-ethylhexyl) phthalate, and no other phthalates were observed at elevated concentrations, it is Boeing's conclusion that this isolated exceedance is a result of a common



laboratory contaminant. Bis (2-ethylhexyl) phthalate is a common laboratory contaminant and the level detected in Outfall 002 on January 25 was within the range seen in laboratory blanks used during analysis of the samples collected from this storm event. Since phthalates are common within the laboratory because of their use in products used in the laboratory such as tissues, paper products, and plastics, they can come into contact with site samples without necessarily contacting the method blank. The analytical laboratory has been advised to monitor low level detects of phthalates in samples collected at the SSFL site and notify the project chemist in the event a phthalate detect occurs again without an associated method blank detect. This will allow an immediate reanalysis to be performed to confirm the presence or absence of this common laboratory contaminant.

#### Iron, Lead, and Manganese

Boeing benchmark limit exceedances for iron, lead, and manganese occurred at Outfall 002 in 2008. Background soils may have contributed to these exceedances, and additional removal of TSS is likely to be the best approach for reducing the number of metals exceedances in the future. Outfall 002 is located in the undeveloped portion of the property where no industrial activities have occurred. Boeing continues to investigate erosion sources and erosion control measures at the site, and will improve BMPs as appropriate, to better control sediment and associated metals transport into the surface water.

#### Total Residual Chlorine

On February 3, 2008, the total residual chlorine concentration was in excess of the benchmark limit at Outfall 002. The result at Outfall 002 was DNQ at an estimated value (J) of 0.14 mg/L, between the laboratory detection limit and the laboratory reporting limit. As discussed above, because there are no identified sources of chlorine that may have contributed to the presence of total residual chlorine in the stormwater samples taken at this outfall, It is Boeing's conclusion that the reported exceedance is the result of errors in the method by which the sample was analyzed, specifically the failure of the laboratory to perform a background correction for turbidity during the sample analysis. The laboratory will be revising their procedures to ensure this type of error does not occur in the future.

#### TCDD TEQ

The reported concentration of TCDD TEQ in the sample collected on January 25, 2008, from Outfall 002 exceeded the daily max benchmark limit of  $2.80 \times 10^{-8}$  ug/L. At this time, Boeing is uncertain where the TCDD in this sample originated, but Boeing will continue to investigate sources of TCDD onsite. As discussed above, the levels of TCDD TEQ measured in surface water samples at the SSFL may result primarily from wildfire combustion processes, regional atmospheric deposition, and other off-site sources over which Boeing has no reasonable control. Continued monitoring of surface water at the outfall locations during storm events will provide a more thorough dataset with which to further evaluate the occurrence of TCDD.

Boeing is committed to attempting to achieve the water quality based effluent limit, if possible.

### **Storm Water Outfall 003**

There were no permit limit exceedances in discharge from Outfall 003 during 2008.



## Storm Water Outfall 004

### Exceedance Summary

Outfall 004 had five exceedances for three constituents with permit limits collected at this outfall during the 2008 monitoring period, as summarized in Table 3:

- On January 5, January 24, and February 24, TCDD TEQ was detected at  $6.53 \times 10^{-7}$ ,  $3.26 \times 10^{-7}$ , and  $3.80 \times 10^{-7}$  ug/L, respectively, which are above the daily max permit limit of  $2.80 \times 10^{-8}$  ug/L.
- On December 15, pH was measured at 9.1, outside the daily max permit limit range of 6.5-8.5.
- On December 15, tests for chronic toxicity exceeded the daily max permit limit of 1.0 TUc.

### Exceedance Discussion

#### TCDD TEQ

Concentrations of TCDD TEQ in samples collected from Outfall 004 during 2008 exceeded the daily max permit limit of  $2.80 \times 10^{-8}$  ug/L. At this time, Boeing is uncertain where the TCDD in these samples originated, but Boeing will continue to investigate sources of TCDD onsite. As discussed above, the levels of TCDD TEQ measured in surface water samples at the SSFL may result primarily from wildfire combustion processes, regional atmospheric deposition, and other off-site sources over which Boeing has no reasonable control. Continued monitoring of surface water at the outfall locations during storm events will provide a more thorough dataset with which to further evaluate the occurrence of TCDD.

Boeing is in the process of increasing the capacity of its BMPs across the site to meet the proposed Design storm criteria of 2.5 inches in a 24-hour period. At outfall locations with structural BMPs where TCDD TEQ exceeded its applicable limits (Outfalls 004, 011, and 018), additional dioxin removal can be facilitated by increasing the retention time of the water within activated carbon media contained in the BMPs installed. However, it is unclear exactly what retention time would be necessary to achieve the water-quality based effluent limit of  $2.8 \times 10^{-8}$  ug/L for TCDD TEQ. Dioxin congeners are hydrophobic molecules that partition readily into the organic fraction of sediments and solid materials. Activated carbon is believed by the United States Environmental Protection Agency (EPA) to be best available technology for the removal of dioxins from water (<http://www.epa.gov/OGWDW/dwh/t-soc/dioxin.html>). However, studies have not been conducted to support the development of technology-based effluent limits for dioxin when activated carbon is used, and Boeing is unaware of any studies documenting what retention time, if any, in activated carbon can achieve this effluent limit. In fact, specific studies of activated carbon do not show effluent concentrations as low as the water quality based permit effluent limit of  $2.8 \times 10^{-8}$  ug/L. One of the few studies identified while researching the literature reported an effluent concentration just below  $8.1 \times 10^{-5}$  ug/L (Torrens, 2000). Nevertheless, Boeing is committed to attempting to achieve the water quality based effluent limit, if possible. Specifically, bagged carbon and zeolite at Outfall 004 will be replaced with bulk media, such as granular activated carbon and zeolite. The bulk placement will reduce hydraulic short-circuiting and increase average retention time.

pH



Measurements on storm water collected on December 15, 2008 at Outfall 004 indicated a pH of 9.1 which is outside the NPDES permit limit range of 6.5 to 8.5. The elevated pH condition at this location is believed to have been caused by inadequate rinsing of the extensive granular activated carbon (GAC) bed, which is used as part of the multimedia treatment system at this location, during pre-storm-season rinsing operations. All rinse water is collected and analyzed for proper disposal at an offsite facility. Boeing is conducting more extensive rinsing of the GAC bed with pH neutralization, which is a typical practice necessary for GAC to avoid high pH in GAC effluent. Boeing will continue to monitor pH data at Outfall 004 and, if necessary, continue to implement BMP measures to prevent elevated pH measurements in the future.

#### Chronic Toxicity

Measurements on storm water collected on December 15, 2008 at Outfall 004 indicated a chronic toxicity result of >1.0 TUc, which is above the NPDES permit daily limit of 1.0 TUc.

Sampling for toxicity consists of both acute and chronic toxicity for SSFL samples. The acute toxicity test is performed on the fathead minnow (*pimephales promelas*) and the chronic toxicity test is performed on the water flea (*ceriodaphnia dubia*). The survival results showed 100 percent survival for the acute and chronic toxicity test and No Observable Effect Concentration (NOEC) of 100 percent sample for chronic toxic units (TUc) value of 1.0, which complies with the permit. However, there are two components to the chronic toxicity test: survival and reproduction. Typically, young organisms are more sensitive to chemicals than older organisms. Since reproduction is generally a sensitive endpoint, tests are continued until reproduction begins. The reproduction component of the test showed low reproduction counts at a sample concentration less than 100 percent (the NOEC). This resulted in a TUc >1.0, which exceeds the permit limit for this test.

As previously described, measured pH of the December 15, 2008, Outfall 004 sample showed levels in excess of the NPDES permit limit, which may have contributed to the elevated chronic toxicity. The measured pH (9.1) is outside the range and, therefore, as described in the bioassay test method (EPA 2002), pH alone may be a cause of the observed impaired reproduction. Other constituents were within permit limits at this outfall and there is no indication that they would have contributed to the exceedance of the chronic toxicity reproductive criteria. The most likely explanation is the elevated pH, which is being corrected through more extensive BMP rinsing and pH neutralization. Boeing will continue to monitor for chronic toxicity at Outfall 004 and, if necessary, additional testing will be conducted per the NPDES Permit requirements.

#### **Storm Water Outfall 005**

There were permit limit exceedances in discharges from Outfall 005 during 2008.

#### **Storm Water Outfall 006**

##### Exceedance Summary

Outfall 006 had one exceedance of constituents with permit limits collected at this outfall during the 2008 monitoring period, as summarized in Table 3:

- On November 26, pH was measured at 6.0, outside the daily max permit limit range of 6.5-8.5.



### Exceedance Discussion

#### pH

Measurements on storm water collected at Outfall 006 on November 26, 2008, indicated a pH of 6.0 which is outside the NPDES benchmark range of 6.5 to 8.5. The reason for the decreased pH condition at this location could be associated with either byproducts of biological activity or leaching of ashes from the media. Ashes are a product typically associated with carbon manufacturing. Boeing implemented measures to alleviate pH issues at this location that included air blowing to dry the media in addition to adding broken concrete to raise the pH to neutrality.

Boeing will continue to monitor pH at Outfall 006 and, if necessary, continue to implement BMP measures to prevent decreased pH measurements in the future.

#### **Storm Water Outfall 007**

There were no permit limit exceedances in discharges from Outfall 007 during 2008.

#### **Storm Water Outfall 008**

Outfall 008 had one exceedance of constituents with benchmark limits collected at this outfall during the 2008 monitoring period, as summarized in Table 3:

- On January 25, lead was detected at a concentration of 6.3 ug/L, which is above the daily max benchmark limit of 5.2 ug/L.

### Exceedance Discussion

#### Lead

A Boeing benchmark limit exceedance for lead occurred at Outfall 008 in 2008. Background soils may have contributed to the lead exceedance at Outfall 008. The reduction of TSS in storm water is likely to be the best approach for reducing lead exceedances, since lead typically has low solubility and is associated with sediments. Additionally, Boeing has investigated and continues to investigate potential sources of constituents believed to come from areas of historical Site industrial activity, in coordination with the DTSC. Boeing continues to upgrade its BMPs across SSFL to mitigate the movement of these trace metals into the watershed from historical Site industrial areas. Boeing continues to investigate erosion sources and erosion control measures at the site, and will improve BMPs as appropriate, to better control sediment and associated metals transport into the surface water.

Consistent with the requirements of the Cease and Desist Order No. R4-2007-0056, Boeing is also working with an independent expert panel of stormwater researchers and practitioners on the development of Engineered Natural Treatment Systems (ENTS) in the Outfalls 008 and 009 watersheds to meet its the NPDES effluent numeric limits. Workplans are in development with ENTS construction scheduled to begin in summer 2009.

In addition, Boeing is also proceeding with source removal activities in the Outfall 008 and 009 watersheds to address constituents, including lead, that have exceeded NPDES permit



limits /benchmarks, as stated in the RWQCB Cleanup and Abatement Order issued December 3, 2008.

### **Storm Water Outfall 009**

#### Exceedance Summary

Outfall 009 had five permit limit exceedances for two constituents with benchmark limits collected at this outfall during the 2008 monitoring period, as summarized in Table 3:

- On February 3, November 26, and December 15, TCDD TEQ was detected at  $3.58 \times 10^{-7}$  ug/L,  $3.99 \times 10^{-7}$  ug/L, and  $1.83 \times 10^{-6}$  ug/L, respectively, which are above the daily max benchmark limit of  $2.8 \times 10^{-8}$  ug/L. The December 15 detection was equivalent to a daily mass result of  $6.23 \times 10^{-9}$  lbs/day, above the daily mass benchmark limit of  $4.20 \times 10^{-9}$  lbs/day.
- On February 3 and December 15, lead was detected at 6.0 ug/L and 19 ug/L, respectively, which are above the daily max benchmark limit of 5.2 ug/L.

#### Exceedance Discussion

##### TCDD TEQ

Concentrations of TCDD TEQ in samples collected from Outfall 009 during 2008 exceeded the daily max and daily mass benchmark limit for TCDD. At this time, Boeing is uncertain where the TCDD in this sample originated, but Boeing will continue to investigate sources of TCDD onsite. The presence of TCDD in both background soils and fire-related materials is well documented in the scientific literature (USEPA, 2000; Gullett and Touati, 2003). These findings are further substantiated by previously completed onsite and offsite studies (MWH, 2005) as presented in the Flow Science Background Report (Flow Science, 2006) and reported in the first, second and fourth quarter 2006 DMRs. These reports suggest that the levels of TCDD TEQ measured in surface water samples at the SSFL may result primarily from wildfire combustion processes, regional atmospheric deposition, and other off-site sources over which Boeing has no control. Continued monitoring of surface water at the outfall locations during storm events will provide a more thorough dataset with which to further evaluate the occurrence of TCDD.

Consistent with the requirements of the Cease and Desist Order No. R4-2007-0056, Boeing is also working with an independent expert panel of stormwater researchers and practitioners on the development of Engineered Natural Treatment Systems (ENTS) in the Outfalls 008 and 009 watersheds to meet its the NPDES effluent numeric limits. Workplans are in development with construction scheduled to begin in Summer 2009

In addition, Boeing is also proceeding with source removal activities in the Outfall 008 and 009 watersheds to address constituents, including TCDD, that have exceeded NPDES permit limits /benchmarks, as stated in the RWQCB Cleanup and Abatement Order issued December 3, 2008..



Lead

Lead was detected at Outfall 009 on December 15, 2008 in concentrations above its benchmark limit, as indicated in Appendix E. A lead concentration of 19 ug/L was recorded, which is in excess of the 5.2 ug/L NPDES benchmark limit.

During 2008, cleanup activities occurred and are ongoing in the Northern Drainage area to remove residual lead shot and clay pigeon debris under California Department of Toxic Substance Control (DTSC) oversight. Additionally, since the concentration of the exceedance was fairly low, background soils could have contributed to this exceedance. The reduction of TSS in stormwater runoff is likely to be the most effective approach for reducing lead exceedances since lead typically has low solubility and is associated with sediments. Additionally, Boeing has investigated and continues to investigate potential sources of constituents, including lead, believed to come from areas of historical Site industrial activity in coordination with DTSC. Boeing continues to upgrade its BMPs across SSFL (Table 2) to mitigate the transport of these trace metals from historical Site industrial areas into downstream areas of the watershed. Boeing continues to investigate erosion sources and erosion control measures at the site, and will improve BMPs as appropriate to better control sediment and associated metals transport into the surface water.

Consistent with the requirements of the Cease and Desist Order No. R4-2007-0056, Boeing is also working with an independent expert panel of stormwater researchers and practitioners on the development of Engineered Natural Treatment Systems (ENTS) in the Outfall 008 and 009 watersheds to meet its the NPDES effluent numeric limits. In addition, Boeing is also proceeding with source removal activities in the Outfalls 008 and 009 watersheds to address constituents, including lead, that have exceeded NPDES permit limits/benchmarks, as directed by the RWQCB Cleanup and Abatement Order issued December 4, 2008. Workplans are in development with construction scheduled to begin in Summer 2009.

**Storm Water Outfall 010**

There were no permit limit exceedances in discharges from Outfall 010 during 2008.

**Storm Water Outfall 011**

Exceedance Summary

During the 2008 monitoring period, samples collected at Outfall 011 had six exceedances for three constituents with permit limits, as summarized in Table 3:

- On January 27, TCDD TEQ was detected at a concentration of  $7.04 \times 10^{-7}$  ug/L, which is above the daily max permit limit of  $2.80 \times 10^{-8}$  ug/L. Since this was the sole detection of TCDD TEQ at Outfall 011 in 2008, it led to an exceedance of the monthly average permit limit of  $1.40 \times 10^{-8}$  ug/L for January 2008.
- On February 3, iron was detected at a concentration of 0.72 mg/L, which is above the daily max permit limit of 0.3 mg/L. This was equivalent to a daily mass result of 961 lbs/day, above the daily mass permit limit of 400 lbs/day.





- On February 3, total residual chlorine was detected at a concentration of 0.15 mg/L, respectively, which is above the daily max permit limit of 0.1 mg/L. This was equivalent to a daily mass result of 187 lbs/day, above the daily mass permit limit of 133 lbs/day.

#### Exceedance Discussion

##### TCDD TEQ

Concentrations of TCDD TEQ in samples collected from Outfall 011 during 2008 exceeded the daily max permit limit of  $2.80 \times 10^{-8}$  ug/L. At this time, Boeing is uncertain where the TCDD in these samples originated, but Boeing will continue to investigate sources of TCDD onsite. As discussed above, the levels of TCDD TEQ measured in surface water samples at the SSFL may result primarily from wildfire combustion processes, regional atmospheric deposition, and other off-site sources over which Boeing has no reasonable control. Continued monitoring of surface water at the outfall locations during storm events will provide a more thorough dataset with which to further evaluate the occurrence of TCDD.

Investigations of pond sediments are under way within the RFI program under DTSC oversight. To mitigate against the potential for accumulation of TCDD TEQ in pond sediments, a stormwater pump and treat strategy has been employed. Boeing initiated installation of a stormwater treatment system consisting of 3 stages of filtration, two stages of ion exchange, and activated carbon to facilitate removal of constituents of concern. This stormwater treatment system, when fully operational, should prevent pond overflow under most storms and provide a significantly higher degree of treatment. Boeing is committed to attempting to achieve the water quality based effluent limit, if possible.

##### Iron

A Boeing permit limit exceedance for iron occurred at Outfall 011 in 2008. Background soils may have contributed to this exceedance, and of the reduction of TSS in storm water is likely to be the best approach for reducing the number of metals exceedances in the future. Additionally, Boeing has investigated and continues to investigate potential sources of constituents believed to come from areas of historical Site industrial activity, in coordination with the DTSC. Boeing continues to upgrade its BMPs across SSFL to mitigate the movement of these trace metals into the watershed from historical Site industrial areas. Boeing continues to investigate erosion sources and erosion control measures at the site, and will improve BMPs as appropriate, to better control sediment and associated metals transport into the surface water.

##### Total Residual Chlorine

On February 3, 2008, the total residual chlorine concentration was in excess of the permit limit at Outfall 011. As discussed above, because there are no identified sources of chlorine that may have contributed to the presence of total residual chlorine in the stormwater samples taken at this outfall, it is Boeing's conclusion that the reported exceedance is the result of errors in the method by which the sample was analyzed, specifically the failure of the laboratory to perform a background correction for turbidity during the sample analysis. The laboratory has revised their procedures to ensure this type of error does not occur in the future.

#### **Storm Water Outfall 012**

On December 20, 2007, NPDES Permit No. R4-2007-0055 became effective, and discharges from Outfall 012 were included in the monitoring and reporting program at SSFL. Prior to



December 20, 2007, NPDES Permit No. R4-2006-0036 had been in effect, and only discharges occurring during testing operations were monitored and reported at this outfall. All testing operations have ceased at Outfall 012.

During the 2008 monitoring period, samples collected at Outfall 012 had three exceedances for three constituents with benchmark limits, as summarized in Table 3:

- On January 5, chloride was detected at a concentration of 320 mg/L, which is above the daily max benchmark limit of 150 mg/L.
- On January 5, fluoride was detected at a concentration of 2.0 mg/L, which is above the daily max benchmark limit of 1.6 mg/L.
- On February 25, TCDD TEQ was detected at a concentration of  $6.11 \times 10^{-7}$  g/L, which is above the daily max benchmark limit of  $2.80 \times 10^{-8}$  g/L.

#### Exceedance Discussion

##### Chloride

Chloride was detected at Outfall 012 on January 5, 2008, above its benchmark limit. Prior to December 20, 2007, storm water was not monitored under the NPDES permit at Outfall 012 – only engine test cooling water was required to be monitored. Three storm water samples were collected at Outfall 012 during 2008. A NPDES benchmark limit exceedance of chloride occurred only during the January 5 storm event.

Chloride is a naturally occurring compound (Hunter and Davis, 2001). BMP materials installed at the site include zeolite and activated carbon. Zeolite may contain chloride salts that could be flushed or rinsed from filter media. No activities other than BMP installation occurred at the site that could have introduced chloride at levels that would be expected to cause an exceedance.

Rinsing of the media was performed after the January 5 storm event and was expected to remove chloride salts and reduce the likelihood of further exceedances. Subsequent storm water samples collected from Outfall 012 on January 25 and February 25, 2008, did not contain chloride at concentrations that exceeded the NPDES benchmark limit. This suggests that the chloride may have been residual in the media and should not recur.

Boeing will continue to monitor chloride concentrations at this outfall to try to identify sources. Measures to reduce chloride will be implemented to the extent possible. Additionally, where new BMP materials are added, Boeing will flush the materials and collect the rinse water to eliminate the potential for benchmark limit exceedances in the future.

##### Fluoride

Fluoride was detected at Outfall 012 on January 5, 2008, above its benchmark limit. Prior to December 20, 2007, storm water samples were not monitored under the NPDES permit at Outfall 012. Three storm water samples were collected at Outfall 012 during 2008. A NPDES benchmark limit exceedance of fluoride occurred only during the January 5 storm event.



There are no known sources of fluoride at this location. Fluoride is known to occur at low concentrations in potable water, zeolite, and other mineral materials. The low concentration observed in runoff from this site could be residual from potable water used for rocket engine testing, from the zeolite in the BMP material placed in the drainage, or from other natural mineral sources near the test stand. In response to the fluoride concentration observed, Boeing will implement housekeeping measures at the test stand to attempt to remove residual fluoride that may be present at the test stand, as well as flush any new BMP materials and collect the rinse water.

#### TCDD TEQ

The concentration of TCDD TEQ in one sample collected from Outfall 012 during 2008 exceeded the daily max benchmark limit of  $2.80 \times 10^{-8}$  µg/L. At this time, Boeing is uncertain where the TCDD in this sample originated, but Boeing will continue to investigate sources of TCDD onsite. As discussed above, the levels of TCDD TEQ measured in surface water samples at the SSFL may result primarily from wildfire combustion processes, regional atmospheric deposition, and other off-site sources over which Boeing has no reasonable control. Continued monitoring of surface water at the outfall locations during storm events will provide a more thorough dataset with which to further evaluate the occurrence of TCDD.

#### **Storm Water Outfall 013**

On December 20, 2007, the NPDES Permit No. R4-2007-0055 became effective, and stormwater discharges from Outfall 013 were included in the monitoring and reporting program at SSFL.

During the 2008 monitoring period, samples collected at Outfall 013 had three benchmark exceedances for three constituents with benchmark limits, as summarized in Table 3:

- On January 5, cadmium was detected at a concentration of 5.2 µg/L, which is above the daily max benchmark limit of 3.1 µg/L.
- On January 5, zinc was detected at a concentration of 160 µg/L, which is above the daily max benchmark limit of 159 µg/L.
- Also on January 5, pH was measured at 8.7, outside the daily max benchmark limit range of 6.5-8.5.

#### Exceedance Discussion

##### Cadmium and Zinc

Boeing benchmark limit exceedances for cadmium and zinc occurred at Outfall 013 in 2008. Stormwater runoff sampled at Outfall 013 is primarily from rain falling on the test stand and the concrete apron of the test stand itself. Elevated levels of zinc could be due to a galvanic coating or anti corrosion paint used on the test stand or pavement runoff. Elevated levels of cadmium could be due to an anti fouling paint used on the test stand or pavement runoff. The make-up of the paints used is not known since records of the paints' purchase are not available. Note, the magnitudes of the exceedances are not unlike urban runoff from parking or paved areas. To mitigate further potential exceedances of metals that might be associated



with paint coatings, Boeing is working with NASA, who owns the test stand, to complete an extensive housekeeping of the facility.

#### pH

pH measurements at Outfall 013 indicated a pH of 8.7 on January 5, 2008, which is slightly in excess of the NPDES benchmark limit of 8.5. The reason for the slightly elevated pH condition at this location has not been identified. The elevated pH value at Outfall 013 in January may have resulted from BMP filter media recently placed at the outfall. Prior to December 20, 2007, storm water samples were not monitored under the NPDES permit at Outfall 013. The January 5 rainfall event was the media's first contact with storm water, and the pH of the runoff may have been slightly elevated due to contact with activated carbon. Activated carbon when not pre-washed can be high in pH. Subsequent storm water samples collected from Outfall 013 on January 24 and February 24, 2008, did not have pH values that exceeded the NPDES benchmark limit. In future instances where new BMP media are installed, Boeing will flush the new media and capture the water to minimize the potential for benchmark limit exceedances of pH. Boeing will continue to monitor pH data at Outfall 013 and, if necessary, further rinse the BMP media as part of its efforts to prevent elevated pH measurements.

#### **Storm Water Outfall 014**

##### Benchmark Summary

On December 20, 2007, NPDES Permit No. R4-2007-0055 became effective, and discharges from Outfall 014 were included in the monitoring and reporting program at SSFL. Prior to December 20, 2007, NPDES Permit No. R4-2006-0036 had been in effect, and only discharges occurring during testing operations were monitored and reported at this outfall. All testing operations have ceased at Outfall 014.

During the 2008 monitoring period, samples collected at Outfall 014 had five exceedances for three constituents with benchmark limits, as summarized in Table 3:

- On January 5, January 22, and February 3, TCDD TEQ was detected at concentrations of  $4.64 \times 10^{-7}$  ug/L,  $4.11 \times 10^{-7}$  ug/L, and  $1.12 \times 10^{-6}$  ug/L, respectively, which are above the daily max benchmark limit of  $2.80 \times 10^{-8}$  ug/L.
- On November 4, Nitrate + Nitrite as Nitrogen (N) was detected at 9.3 mg/L, which is above the daily max benchmark limit of 8.0 mg/L.
- On November 4, Nitrate as Nitrogen (N) was detected at 9.3 mg/L, which is above the daily max benchmark limit of 8.0 mg/L.

##### Exceedance Discussion

##### TCDD TEQ

Concentrations of TCDD TEQ in samples collected from Outfall 014 during 2008 exceeded the daily max benchmark limit of  $2.80 \times 10^{-8}$  ug/L. At this time, Boeing is uncertain where the TCDD in these samples originated, but Boeing will continue to investigate sources of TCDD onsite. As discussed above, the levels of TCDD TEQ measured in surface water samples at the SSFL may result primarily from wildfire combustion processes, regional atmospheric



deposition, and other off-site sources over which Boeing has no reasonable control. Continued monitoring of surface water at the outfall locations during storm events will provide a more thorough dataset with which to further evaluate the occurrence of TCDD.

Nitrate + Nitrite as Nitrogen, and Nitrate as Nitrogen

Nitrate and nitrite as nitrogen (N), and nitrate as nitrogen (N) were both detected at a concentration of 9.3 mg/L in storm water collected on November 4, 2008 from Outfall 014. These concentrations exceed the NPDES benchmark limits of 8.0 mg/L for both constituents.

The reason for the elevated nitrate/nitrite condition at this location has not been identified. All forms of nitrogen, including organic nitrogen, that are released to surface waters may be transformed to nitrate by soil bacteria under aerobic conditions. Primary sources of organic nitrogen include organic material such as leaf litter, animal excrement, atmospheric deposition, and fertilizers. Though there is no fertilizer application occurring at SSFL, it is possible that nitrification and/or some other bacterial metabolic activities are occurring in the GAC of the filter BMPs, or accumulated decaying debris and organics may be causing an increase in nitrates. Since the outfall drainage area is relatively small, a 20,000-gallon Baker tank was installed at the outfall to collect and hold stormwater. The collected stormwater is then sampled to ensure its proper disposal. Demolition activities at this location are ongoing and scheduled to be completed in 2009.

**Storm Water Outfall 018**

During the 2008 monitoring period, samples collected at Outfall 018 had five exceedances for three constituents with permit limits, as summarized in Table 3:

- On January 23, February 3, and February 24, TCDD TEQ was detected at concentrations of  $5.15 \times 10^{-7}$  ug/L,  $3.41 \times 10^{-7}$  ug/L, and  $4.41 \times 10^{-7}$  ug/L, respectively, which are above the daily max permit limit of  $2.80 \times 10^{-8}$  ug/L.
- On February 3, iron was detected at 0.66 mg/L, which is above the daily max permit limit of 0.3 mg/L.
- On February 3, total residual chlorine was detected at 0.14 mg/L, which is above the daily max permit limit of 0.1 mg/L.

Exceedance Discussion

TCDD TEQ

Concentrations of TCDD TEQ in samples collected from Outfall 018 during 2008 exceeded the daily max permit limit of  $2.80 \times 10^{-8}$  ug/L. At this time, Boeing is uncertain where the TCDD in these samples originated, but Boeing will continue to investigate sources of TCDD onsite. As discussed above, the levels of TCDD TEQ measured in surface water samples at the SSFL may result primarily from wildfire combustion processes, regional atmospheric deposition, and other off-site sources over which Boeing has no reasonable control. Continued monitoring of surface water at the outfall locations during storm events will provide a more thorough dataset with which to further evaluate the occurrence of TCDD.



Investigations of pond sediments are under way within the RFI program under DTSC oversight. To mitigate against the potential for accumulation of TCDD TEQ in pond sediments, a stormwater pump and treat strategy has been employed. Boeing initiated installation of a stormwater treatment system consisting of 3 stages of filtration, two stages of ion exchange, and activated carbon to facilitate removal of constituents of concern. This stormwater treatment system, when fully operational, should prevent pond overflow under most storms and provide a significantly higher degree of treatment. Boeing is committed to attempting to achieve the water quality based effluent limit, if possible.

#### Iron

A Boeing permit limit exceedance for iron occurred at Outfall 018 in 2008. Background soils may have contributed to this exceedance, and the reduction of TSS in storm water is likely to be the best approach for reducing the number of metals exceedances in the future. Additionally, Boeing has investigated and continues to investigate potential sources of constituents believed to come from areas of historical Site industrial activity, in coordination with the DTSC. Boeing continues to upgrade its BMPs across SSFL to mitigate the movement of these trace metals into the watershed from historical Site industrial areas. Boeing continues to investigate erosion sources and erosion control measures at the site, and will improve BMPs as appropriate, to better control sediment and associated metals transport into the surface water.

#### Total Residual Chlorine

On February 3, 2008, the total residual chlorine concentration was in excess of the permit limit at Outfalls 011 and 018 and the benchmark limit at Outfalls 001 and 002. The result at Outfall 018 was DNQ at an estimated value (J) of 0.14 mg/L, between the laboratory detection limit and the laboratory reporting limit. As discussed above, because there are no identified sources of chlorine that may have contributed to the presence of total residual chlorine in the stormwater samples taken at this outfall, it is Boeing's conclusion that the reported exceedance is the result of errors in the method by which the sample was analyzed, specifically the failure of the laboratory to perform a background correction for turbidity during the sample analysis. The laboratory will be revising their procedures to ensure this type of error does not occur in the future.

#### **Treated Groundwater Outfall 019**

NPDES Permit No. R4-2007-0055 became effective on December 20, 2007, and added Outfall 019 to the monitoring and reporting program at SSFL. In 2007, Boeing continued to explore the feasibility of the treatment of certain waste streams and is currently moving forward with a fixed groundwater treatment unit operating under the DTSC Permit-by-Rule. Treated effluent discharges from the Groundwater Extraction Treatment System (GETS) will be released at a separate outfall (Outfall 019) that is co-located with Outfall 011. The GETS is currently under construction. In 2008, treated groundwater was hauled off-site. Therefore, no discharges were associated with Outfall 019.

#### **Arroyo Simi (Frontier Park, Receiving Water and Sediment Sampling Location)**

There were no exceedances in the receiving water for the Arroyo Simi during 2008.



**CORRECTIVE ACTIONS**

Throughout 2008, Boeing took actions to improve the quality of surface water discharges. These actions included the installation and rinsing of BMP materials at various outfalls and the continued implementation of the site-wide Storm water Pollution Prevention Plan (SWPPP). SWPPP Activities throughout the SSFL site included site-wide inspections and metal and debris removal, and hydromulch at various areas throughout SSFL. The 2008 SWPPP annual evaluation is included as Section 18 of this report.

The following table lists the Outfall location and respective BMP activities completed during the 2008 calendar year:

OUTFALL	BMP ACTIVITIES DURING 2008
001 (South Slope below Perimeter Pond)	Inspected erosion control BMPs. Cleaned up debris in drainage system. Calibrated flow meters. Performed maintenance on flume and conducted housekeeping activities at the sample location. Applied hydroseed to two acres of hill slopes to control erosion. Performed calibration check maintenance service of flow meter.
002 (South Slope below R-2 Pond)	Inspected and performed maintenance on erosion control BMPs. Removed hay bales from drainage. Cleaned up debris in drainage system. Calibrated flow meters. Performed maintenance on flume and conducted housekeeping activities at the sample location. Removed concrete footing to allow for flow distribution through the flume. Applied hydroseed to 2.5 acres of eroding and poorly-vegetated areas. Performed calibration check maintenance service of flow meter.
003 (RMHF)	Conducted structural BMP and storm water filtration system inspections. Cleaned up debris in drainage system. Calibrated flow meters. Performed maintenance on flume and conducted housekeeping activities at the sample location. Increased height of Gabion Dam to hold the 2.5-inch 24-hour storm. Added flow control valves on dam and filtration beds to increase retention time in the system substantially. Applied hydroseed to upland areas and 0.5 acres of hill slopes to control erosion. Rinsed filtration bed media. Performed calibration check maintenance service of flow meter.
004 (SRE)	Conducted structural BMP and storm water filtration system inspections. Cleaned up debris in drainage system. Changed bag GAC/Zeolite media to bulk GAC/Zeolite media. Completed rinse of filter media. Calibrated flow meters. Installed new fiber rolls and straw bales. Performed maintenance on flume and conducted housekeeping activities at the sample location. Installed sand bag berm on upstream area with flow control valve and perforated piping system to





OUTFALL	BMP ACTIVITIES DURING 2008
	retain water, increase retention time in the filtration media, and spread flow more evenly over filtration system. Applied hydroseed over 0.5 acres. Installed sand bag berm, HDPE liner, and piping system to direct stormwater from SRE to Outfall 004. Performed calibration check maintenance service of flow meter.
005 (FSDF-1)	Conducted BMP and sedimentation basin inspections. Performed portable Baker tank and media filtration system inspections. Cleaned up debris in drainage system. Performed maintenance on drainage system. Removed tanks/treatment systems. Installed new fiber rolls. Performed maintenance on flume, and conducted housekeeping activities at the sample location. Increased height of Gabion Dam to hold 2.5 inch 24 hour storm. Replaced fiber rolls, applied hydroseed, and replaced liner. Initiated installation of a stormwater treatment system consisting of 3 stages of filtration, two stages of ion exchange, and activated carbon. Note this treatment system will treat water collected at impoundment at Outfalls 005 and 007. Conducted filtration system inspections.
006 (FSDF-2)	Conducted structural BMP, sedimentation basin and storm water filtration system inspections. Cleaned up debris in drainage system. Calibrated flow meters. Replaced fiber rolls and repaired gravel road. Performed maintenance on flume, and conducted housekeeping activities at the sample location. Performed media rinse. Performed calibration check maintenance service of flow meter.
007 (Building 100)	Conducted BMP and sedimentation basin inspections. Performed portable Baker tank and media filtration system inspections. Cleaned up debris in drainage system. Performed maintenance on drainage system. Removed tanks/treatment systems. Performed maintenance on flume and conducted housekeeping activities at the sample location. Increased height of Gabion Dam to hold 2.5 inch 24 hour storm.. Replaced liner and fiber rolls. Initiated installation of a stormwater treatment system consisting of 3 stages of filtration, two stages of ion exchange, and activated carbon. Note this treatment system will treat water collected at impoundment at Outfalls 005 and 007. Conducted filtration system inspections.
008 (Happy Valley)	Conducted drainage system and erosion control BMP inspections. Installed new fiber rolls. Completed weed abatement in upper drainage. Cleaned up debris in drainage system. Conducted BMP inspections and performed maintenance on drainage system. Calibrated flow meters. Performed maintenance on flume and conducted housekeeping activities at the sample location. Applied hydroseeding to watershed area. Continued progress with





OUTFALL	BMP ACTIVITIES DURING 2008
	permitting and design of Engineered Natural Treatment System (ENTS). Performed calibration check maintenance service of flow meter.
009 (WS-13 Drainage)	Conducted BMP inspections and performed maintenance on drainage system. Installed flow meter instrumentation. Cleaned up debris in drainage system. Calibrated flow meters. Performed maintenance on flume and conducted housekeeping activities at the sample location. Continued with design of Engineered Natural Treatment System (ENTS). Initiated installation of culvert maintenance within the Outfall 009 watershed. Performed calibration check maintenance service of flow meter. Removed approximately 9,425 yards of debris and soil under Northern Drainage Removal Action.
010 (Building 203)	Conducted structural BMP, sedimentation basin and filtration system inspections. Cleaned up debris in drainage system. Installed new fiber rolls. Calibrated flow meters. Performed hydroseeding and media rinse. Performed maintenance on flume and conducted housekeeping activities at the sample location. Performed calibration check maintenance service of flow meter.
011 (Perimeter Pond Flume)	Conducted BMP and drainage system inspections. Installed temporary storm water filtration system. Repaired flow meter. Cleaned up debris. Calibrated flow meters. Removed media filter for installation of GETS piping and inclusion of Outfall 019. Performed maintenance on flume and conducted housekeeping activities at the sample location. Initiated installation of a stormwater treatment system consisting of 3 stages of filtration, two stages of ion exchange, and activated carbon. Performed media rinse. Performed calibration check maintenance service of flow meter.
012 (Alfa Test Stand)	Conducted BMP inspections. Cleaned up debris and performed maintenance on drainage system. Performed housekeeping activities at the sample location. Performed media rinse.
013 (Bravo Test Stand)	Conducted BMP inspections. Rinsed filter media. Cleaned up debris and performed maintenance on drainage system. Performed housekeeping activities at the sample location. Performed media rinse.
014 (APTF Test Stand)	Conducted inspection of filtration systems. Cleaned up debris and performed maintenance on drainage system. Performed media rinse. Demolition activities are currently ongoing at APTF and are scheduled to be completed in 2009. Performed housekeeping activities at the sample location.
018 (R-2 Spillway)	Conducted structural BMP and stormwater filtration system inspections. Installed fiber rolls on hillside. Developed structural BMP upgrade design. Cleaned up debris and

OUTFALL	BMP ACTIVITIES DURING 2008
	performed maintenance on drainage system. Calibrated flow meters. Removed bulk media from filter cells. Performed maintenance on flume and conducted housekeeping activities at the sample location. Initiated installation of new filter media in BMP and anchoring system to hold filter media in place during overflows. Initiated installation of stormwater treatment system consisting of 3 stages of filtration, two stages of ion exchange, and activated carbon. Performed media rinse. Performed calibration check maintenance service of flow meter.
019 (GETS)	Groundwater Extraction Treatment System (GETS) under construction. Pipeline being installed around CTL III. Modified media cell at Outfall 011 for the inclusion of Outfall 019. Treated groundwater hauled off-site. No discharges.

**REASONABLE POTENTIAL ANALYSIS (RPA)**

Outfall monitoring data were collected during the First (Outfalls 001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, and 018) and Fourth (Outfalls 004, 006, 009, 010, 013 and 014) Quarters of 2008. Data from these quarters were added to the RPA data set, as per the MWH and Flow Science RPA procedures, for the following outfall monitoring groups: Outfalls 001, 002, 011, 018; Outfalls 003-010; and Outfalls 012-014 (MWH and Flow Science, 2006). The analytical results for these sampling periods did not trigger reasonable potential for any constituents not already regulated under the current NPDES permit. Complete RPA tables for the outfall monitoring groups are provided in Section 17.

As summarized in the RPA Technical Memo (MWH and Flow Science, 2006), Boeing does not believe the currently used RPA procedures are appropriate for storm water and storm water-dominated discharges from the SSFL.

**CONCLUSIONS**

Based on the reported data in 2008 and in previous years, and consistent with published studies referenced in this report, Boeing’s belief is that a majority of the constituents that exceeded permit limits result from naturally occurring contributions (e.g., wildfires, native soil discharges into channels), or were detected at concentrations consistent with regional background concentrations and, therefore, were not the direct result of a known discharge or release from an industrial process or historical contamination on the site.

However, former industrial activities at the SSFL may have impacted localized areas of on-site soils and sediments that could have potentially affected surface water quality at some outfalls. Under DTSC supervision, mitigation actions were taken in 2008 and in previous years to manage surface water impacts potentially resulting from former industrial activities. These mitigation actions consisted of implementing an extensive system of BMPs. Boeing has installed and continues to install BMPs to minimize the potential for surface water to



contact contaminated on-site soils, sediment, or bedrock, and to minimize transport of soils and/or sediment that may be impacted with constituents regulated in the SSFL NPDES permit.

Boeing will continue to evaluate patterns of compliance and non-compliance, potential source areas, and effectiveness of BMPs to minimize the potential for pollutants, whether naturally occurring or not, to impact surface water at the SSFL.

### FACILITY CONTACT

If there are any questions regarding this report or its enclosures, you may contact Ms. Lori Blair of Boeing at (818) 466-8778.

### CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted.

Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for a knowing violation.

Executed on the 27th day of February 2009 at the Boeing Company, Santa Susana Field Laboratory.

Sincerely,



Thomas D. Gallacher  
Director, Santa Susana Field Laboratory  
Environment, Health and Safety

TDG:bjc

Figure 1 Storm Water Drainage System and Outfall Locations

Table 1 2008 Rainfall Summary

Table 2 2008 Liquid Waste Shipments

Table 3 2008 Summary of Permit Limit and Benchmark Limit Exceedances

Attachments:

Section 1 Outfall 001	South Slope below Perimeter Pond
Section 2 Outfall 002	South Slope below R-2 Pond

Section 3	Outfall 003	RMHF
Section 4	Outfall 004	SRE
Section 5	Outfall 005	FSDF-1
Section 6	Outfall 006	FSDF-2
Section 7	Outfall 007	Building 100
Section 8	Outfall 008	Happy Valley
Section 9	Outfall 009	WS-13 Drainage
Section 10	Outfall 010	Building 203
Section 11	Outfall 011	Perimeter Pond
Section 12	Outfall 012	Alfa Test Stand
Section 13	Outfall 013	Bravo Test Stand
Section 14	Outfall 014	APTF
Section 15	Outfall 018	R-2A Pond
Section 16	Receiving Water and Sediment Sample Location – Arroyo Simi (Frontier Park)	
Section 17	Reasonable Potential Analysis (RPA) Summary Tables	
Section 18	Storm Water Pollution Prevention Plan Annual Evaluation	
Section 19	Analytical Laboratory Methods, Method Detection Limits, Reporting Limits, QA/QC Procedures, and ELAP Certifications	



cc: Jim Pappas, Department of Toxic Substances Control  
William Jeffers, Department of Toxic Substances Control  
Robert Marshall, California State University – Northridge, Library  
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Lynn Light, Platt Branch, Los Angeles Library

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