

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LOS ANGELES REGION

ORDER NO. R4-2005-0068

WASTE DISCHARGE REQUIREMENTS  
FOR  
THE BOEING COMPANY  
PILOT TESTS TO EVALUATE IN-SITU BIOREMEDIATION OF  
VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER  
FORMER COMPTON SITE

(FILE NO. 96-056 and 96-057)

The California Regional Water Quality Control Board, Los Angeles Region, (hereafter Regional Board) herein finds that:

1. The Boeing Company (hereafter Discharger) has filed a Report of Waste Discharge and applied for Waste Discharge Requirements to use a non-pathogenic (naturally derived, not genetically engineered) chlorinated-ethene degrading microbial consortium containing *Dehalococcoides ethenogenes* culture, referred to as KB-1, to bioremediate chlorinated volatile organic compounds (VOCs) in shallow groundwater through reductive dechlorination to environmentally acceptable, non-toxic ethene in groundwater at the Former Compton Site (Site) identified below.
2. The Site encompasses approximately 10 acres on four adjacent former parcels of land and is located at 233 East Manville Street (former Parcel 1), 157 East Stanley Street (former Parcel 3), and 200 East Stanley Street (former Parcels 2 and 4), Compton, California (Latitude 33°52'00" North, Longitude 118°13'00" West, see Figure 1). The site is located in an industrial area and was formerly used between approximately 1955 and 1969 by North American Aviation (NAA), Rockwell International's (Rockwell) Autonetics Division, and Rockwell's Space Division (collectively: NAA/Rockwell) for aerospace manufacturing operations, production of military electronic components including radar and missile guidance systems, and manufacturing of electronic components for the National Aeronautics and Space Administration (NASA) rocket programs. Since 1969 the site has been occupied by various companies and has been used primarily for industrial manufacturing of airplane parts, electronic components, automobile service, precision tool manufacturing, the roofing industry, distribution of SCUBA gear, and the molding of plastic products. The Discharger sold the property in 2004 but is continuing assessment and remediation activities. The new owner is redeveloping the property.
3. In 1991, other parties began soil and groundwater investigations at the Site and discovered soil and groundwater pollution on the site near former processing pits, clarifiers, associated piping, and chemical use, handling and storage areas. The Discharger submitted soil and groundwater investigation reports to the Los Angeles County Department of Public Works and the Regional Board.
4. Shallow groundwater beneath the Site is first encountered at depths ranging from approximately 60 to 68 feet below ground surface, although perched groundwater conditions have been encountered at depths ranging from 20 to 50 feet in portions of the site. Shallow groundwater is unconfined and occurs within the Bellflower Aquitard. The Exposition and Gage Aquifers are present beneath the Bellflower Aquitard. The Bellflower Aquitard comprises the upper portion of the Lakewood Formation and generally occurs from land surface to depths of approximately 105 to 130 feet beneath the Site and appears to be laterally continuous across the Site. The Bellflower Aquitard is comprised primarily of a heterogeneous mixture of low permeability silts and clays, with lenses and layers of

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sandy or gravelly clay, silty sand, and sand identified in some areas. The Bellflower Aquitard is known to have relatively low hydraulic conductivities and regional groundwater supply wells are not screened in and do not produce from this unit.

5. The Discharger has conducted a comprehensive Site-wide soil and groundwater investigation. The investigation consisted of drilling more than 600 soil borings, collecting and analyzing over 2,000 soil samples, collecting and analyzing 59 soil gas samples, installation of over 64 groundwater monitoring wells, 16 hydropunch groundwater sampling points, and collection and analysis of approximately 800 groundwater samples.
6. The Site-wide investigations show that the primary contaminants detected in soil and groundwater are trichloroethene (TCE), tetrachloroethene (PCE), and cis-1,2-dichloroethene (cis-1,2-DCE), trichlorofluoromethane (Freon 11), 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113), and toluene. Concentrations of volatile organic compounds (VOCs) range from non-detect up to 34,000 micrograms per liter ( $\mu\text{g/l}$ ) TCE, up to 503  $\mu\text{g/l}$  PCE, up to 1,210  $\mu\text{g/l}$  cis-1,2-DCE, up to 1,700  $\mu\text{g/l}$  Freon 11, up to 33  $\mu\text{g/l}$  Freon 113, and up to 66  $\mu\text{g/l}$  toluene. Three relatively discrete plumes have been identified on site; a plume is present beneath each of the former Parcels 1, 2, and 3 (see Figure 2).
7. The Discharger has implemented various soil and groundwater remedial programs. In 2003, a detailed and comprehensive Regional Board-approved review and evaluation program was performed by Haley & Aldrich, Inc. to identify historical Environmental Features (EFs) at the Site. A total of 85 identified potential EFs were assessed through an extensive soil assessment and delineation investigation. The assessment program identified 32 locations with elevated concentrations of VOCs and metals in the shallow soil. Soil from these 32 locations were excavated and removed. In addition, a post-demolition assessment confirmation and monitoring program identified eight EFs that were investigated and removed. Following excavation, post-remediation sampling confirmed that the impacts were removed and remediation of the shallow soil was complete. Upon completion of the remediation program, a total of 11,800 cubic yards of soil was excavated and disposed of off-site to the following locations; Lancaster Landfill in San Bernadino County, California, Apple Valley Landfill in Palmdale, California and McKittrick Landfill in McKittrick, California. The Regional Board issued an unrestricted no further action for the shallow soil (0 to 12 feet below ground surface) at the Site on December 12, 2003.
8. The Discharger installed a soil vapor extraction remediation system (VES) at 157 E. Stanley (former Parcel 3) to reduce the concentration and mass of VOCs in the deep soil (greater than 12 feet bgs). The Discharger submitted a "Soil Vapor Extraction Extended Pilot Test Work Plan" (Extended VES Work Plan) prepared by Haley & Aldrich. The Regional Board approved the Extended VES Work Plan in a letter dated December 20, 2002. Operation of the VES removed approximately 71 pounds of VOCs from deep soils and VOC concentrations decreased significantly during VES operation (as reported in confirmation soil samples). The Regional Board issued a no further action for the deep soil (12 to 65 feet below ground surface) at 157 E. Stanley (former Parcel 3) on January 24, 2005.
9. There are thirteen water supply wells located within an approximate 1 mile radius of the Site (Figure 3). Three of the wells were identified as City of Compton wells, seven are Dominguez Water Corporation wells, two are Southern California Edison wells, and one is a Dominguez Memorial Seminary well. Available well construction information indicates that the depths to the tops of the screened intervals for these wells range from approximately 256 to 554 feet and are located in the

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deep aquifer system. The water supply well closest to the site is Compton Well No. 14 with the top of the screened interval at a depth of 436 feet, but this well is not currently an active water supply well. VOCs have not been detected in this well.

10. The Discharger proposes to remediate VOCs in shallow groundwater (Bellflower Aquitard) at the Site using carbon source amendments (i.e. lactate, edible oils, ethanol, etc.) and KB-1. A pilot test remediation work plan (identified below) involving the use of carbon source amendments and KB-1 has been submitted by the Discharger and approved by the Executive Officer on February 26, 2003. The carbon sources are all approved for use under Regional Board Order No. R4-2002-0030 "General Waste Discharge Requirements for Groundwater Remediation at Petroleum Hydrocarbon Fuel and/or Volatile Organic Compound Impacted Sites" (General WDR). This Site-Specific WDR will also cover the use of carbon sources, therefore, once this permit is adopted a letter rescinding the General WDR will be issued. KB-1 requires a carbon source amendment (food), VOCs, and anaerobic conditions to survive. Given these growth requirements, KB-1 will not survive indefinitely after the residual carbon sources have been consumed or the VOCs have been depleted following the last delivery of carbon source amendment.
11. The Discharger submitted a "Former Compton Site In-Situ Reactive Zone Pilot Test Workplan" (Arcadis Workplan) prepared by Arcadis dated February 3, 2003. The Arcadis Work Plan was approved by the Executive Officer on February 26, 2003. The Arcadis Work Plan presents the rationale and procedures for pilot-scale implementation of enhanced in-situ bioremediation at the subject treatment area at the Site. The Discharger proposes to conduct a pilot study in order to evaluate the effectiveness of in-situ remediation of dissolved chlorinated volatile organic compounds, primarily TCE, in the groundwater beneath the site. The pilot study is proposed to be conducted by introducing a solution of selected amendments, including sodium lactate, soybean oil, ethanol, and acetate, (amendments specified in the General WDR Permit package) and KB-1. The combination of amendments and KB-1 will henceforth be referred to as the Solution. The Solution will be injected through permanently installed wells to evaluate the effectiveness of delivery and biologic reduction of chlorinated VOCs. The composition of the Solution was chosen to reduce dissolved TCE to ethene. The results of the pilot study will be evaluated in accordance with the monitoring and reporting schedule presented in the approved Arcadis Work Plan.
12. The Arcadis Work Plan presents the procedures for monitoring the remediation program, evaluating the injection volume and concentrations, and the frequency of injection will be adjusted based on the results of field monitoring. Groundwater conditions will be monitored during the operation to evaluate the efficiency of the injection.
13. The Discharger submitted a "General Waste Discharge Requirements (WDR) Permit Application, Enhanced In-Situ Bioremediation, The Boeing Company, Former Compton Site, Compton, CA" on 1 April 2003 and "Addendum No. 1 to the Application" on June 5, 2003 to inject a carbohydrate solution into groundwater at the Site for use in in-situ bioremediation pilot tests to address the VOCs in the groundwater. It was determined on July 22, 2003 by the Regional Board staff and the Executive Officer that the proposed discharge meets the conditions specified in Regional Board Order No. R4-2002-0030.
14. The Discharger submitted a "Former Boeing Compton Site, General Waste Discharge Requirements Schedule Update and New Property Owner Notification" letter prepared by Haley & Aldrich, Inc. dated March 1, 2004. In this document, the Discharger requested an extension of the WDR schedule

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due to redevelopment of the Site. The Discharger proposed to submit a revised sampling and reporting schedule to the Regional Board by October 31, 2004. The Regional Board granted an extension to the schedule in a letter dated March 9, 2004.

15. The Discharger submitted a "Proposed Modifications to General Waste Discharge Requirements Permit Order No. R4-2002-0030 (Series No. 24) and Monitoring and Reporting Program No. CI-8586" (Workplan Modification) prepared by Geosyntec Consultants dated September 29, 2004. In this document, the Discharger proposed to use emulsified soybean oil (in addition to the molasses that was previously approved), request modification of the existing monitoring and reporting program, conduct a pre-injection biofoul test at four injection wells prior to full scale operation, and test biofouling control agents. The proposal was approved by the Executive Officer in a letter dated December 24, 2004.
16. Groundwater will be treated using enhanced in-situ bioremediation as presented in the Arcadis Workplan and the Workplan Modification. An amendment solution will be injected into three areas within the Site presented in the remediation work plan where it will promote biological reduction of TCE to ethene as groundwater flows through the amendment area. The Discharger proposes to include control measures for source area remediation. The control measures related to amendment solution without the addition of KB-1 were presented as part of the General WDR permit application package and will continue to be used throughout this project. The control measures related to KB-1 would be implemented if carbon source amendment and *Dehalococcoides ethenogenes* (DHE) associated with the KB-1 culture were detected in monitoring points outside the treatment zone. This control measure would involve stopping further addition of amendments to the groundwater. After this control measure has been implemented the remaining amendments in the groundwater will naturally break down, effectively removing food source and allowing the groundwater system to return to more aerobic conditions. The KB-1 will not survive due to the loss of the food source and anaerobic conditions. The contingency plan, should indications of offsite migration occur, is the installation of a hydraulic containment system. The slow rate of groundwater flow within and down gradient of the pilot test areas allows for sufficient time to complete design, installation, and implementation of a hydraulic containment system if necessary.
17. Any injection of a solution into the groundwater is a discharge of waste as defined by the California Water Code. However, the discharge of carbohydrate solution with chlorinated-ethene degrading consortium KB-1 is intended to provide more effective remediation of chlorinated VOC-impacted groundwater and is expected to significantly reduce the anticipated site cleanup time as compared to pump-and-treat technology or enhanced in-situ bioremediation without addition of KB-1.
18. The application of carbon source amendments independent of the addition of KB-1 to groundwater may result in temporary adverse impacts to groundwater quality, but impacts that may result will be localized, and of short-term duration, and will not impact any existing or prospective uses of groundwater. The addition of a carbohydrate solution with KB-1 will improve groundwater conditions by ensuring complete degradation of TCE to ethene.
19. On January 24, 2002, this Regional Board adopted General Waste Discharge Requirements for Groundwater Remediation at Petroleum Hydrocarbon Fuel and/or Volatile Organic Compound Impacted Sites (Order No. R4-2002-0030). This Order permits the injection of selected carbon source amendments (i.e. lactate, edible oils, ethanol, etc.) proposed for use at this Site. On July 22, 2003, the Discharger was granted coverage under the General WDR and issued Monitoring and

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Reporting Program No. CI-8586 for the injection of carbon source amendments. The General WDR does not cover the use of KB-1, therefore, these site-specific waste discharge requirements have been developed for the addition of KB-1 at this Site and will also cover the injection of the carbohydrate solution currently covered under the existing General WDR, which will be rescinded once the Individual permit has been issued. Currently, the addition of KB-1 is proposed at three locations within the Site, and the Regional Board has already approved the remedial action work plans that describe this work. The Discharger shall submit remedial action work plans for the use of enhanced in-situ bioremediation with KB-1 at any other areas within the Site. Once work plans are reviewed and approved by the Regional Board's Executive Officer, the expanded use of enhanced in-situ bioremediation with KB-1 will be included under the coverage of these site-specific waste discharge requirements and the monitoring and reporting program will be modified as appropriate.

20. The Regional Board adopted a revised Water Quality Control Plan for the Los Angeles Region on June 13, 1994. The Plan contains beneficial uses and water quality objectives for the Central Groundwater Basin. The requirements contained in this Order, as they are met, will be in conformance with the goals of the Plan.
21. The beneficial uses for the Central Groundwater Basin are municipal and domestic water supply, industrial service and process supply, and agricultural supply.
22. The permitted discharge is consistent with the anti-degradation provisions of State Water Resources Control Board Resolution No. 68-16 (Anti-degradation Policy). The discharge may result in some localized temporary exceedances of background concentrations of total organic carbon, iron, manganese, arsenic, TDS, and certain microorganisms. However, after the injection of amendments, these parameters are not anticipated to exceed the primary or secondary standards to the extent that these parameters do not already exceed the respective standard. Moreover, any parameter change resulting from the discharge:
  - a. Will be consistent with maximum benefit to the people of the State.
  - b. Will not unreasonably affect present and anticipated beneficial uses of such water, and
  - c. Will not result in water quality less than that prescribed in the Water Quality Control Plan for Central Groundwater Basin.
23. The Regional Board has assumed lead agency role for this project under the California Environmental Quality Act (Public Resources Code section 21000 et seq.) and has conducted an Initial Study in accordance with section 15063 of the "State CEQA Guidelines" at California Code of Regulations, title 14, section 15000 et seq. Based upon the Initial Study, the Regional Board prepared a Mitigated Negative Declaration that the project, as mitigated, will not have a significant adverse effect on the environment.
24. The Regional Board has notified the Discharger and interested agencies and persons of its intent to prescribe Waste Discharge Requirements for this discharge and has provided them with an opportunity for a public hearing and an opportunity to submit their written comments and recommendations. The Regional Board, in a public meeting, heard and considered all comments pertaining to the discharge and to the tentative requirements.

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**IT IS HEREBY ORDERED** that The Boeing Company, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted there under, shall comply with the following:

**A. Discharge Limits**

1. The Discharger shall not cause the groundwater outside of the remediation area to exceed background concentrations of chloride and TDS established prior to start of remediation.
2. The discharge of carbohydrate solution with chlorinated-ethene degrading consortium, referred to as KB-1, into the groundwater shall be only performed while this Order is in force.
3. During this remediation, the injection volume carbohydrate solution shall not exceed 1.9 million gallons and the injection volume of KB-1 shall not exceed 150 gallons at the Site, unless approved by the Executive Officer.
4. Discharge duration shall not exceed more than two years, unless approved by the Executive Officer.
5. The amendment solution shall be limited to potable water, extracted groundwater, amendments specified in the approved remediation work plans as approved under the General WDR permit, and KB-1. The amendments will consist of a mixture of food-grade vegetable/soybean-lactate and water at a maximum concentration of up to 2% or molasses and water at a concentration of up to 20%. The maximum concentration of KB-1 shall not exceed 0.1% (by pore water volume of the treatment area).

**B. Discharge Specifications**

1. The Discharger shall stop further addition of amendments to the groundwater if carbon source amendment and *Dehalococcoides* associated with KB-1 are observed to be migrating off-site. After this control measure has been implemented the remaining amendments in the groundwater will naturally break down, effectively removing food source and allowing the groundwater system to return to more aerobic conditions. The KB-1 will not survive due to the loss of the food source. Furthermore, KB-1 is sensitive to oxygenated water.
2. The Discharger shall not cause KB-1, the amendment, and the by-products of the bioremediation process to migrate outside of the treatment area established by the Discharger and approved by the Executive Officer.
3. The discharge of carbohydrate solution with KB-1 or any by-products into any surface water or surface water drainage course is prohibited.
4. The Discharger shall not cause the groundwater to contain taste or odor producing substances in concentrations that cause nuisance or adversely affect beneficial uses outside the treatment area.
5. The Discharger shall not cause the groundwater to contain concentrations of chemical substances or its by-products, including KB-1 solution in amounts that adversely affect any designated beneficial use as a result of the injection of solution.

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6. The Discharger shall implement hydraulic control to prevent off-site migration if necessary.

**C. Provisions:**

1. This Order includes the attached "Standard Provisions Applicable to Waste Discharge Requirements," which are incorporated herein by reference. If there is any conflict between provisions stated herein before and the attached "Standard Provisions," those provisions stated herein shall prevail.
2. Discharge of wastes to any point other than specifically described in this Order is prohibited and constitutes a violation thereof.
3. In the event of any change in name, ownership, or control of the Site, the Discharger shall notify this Regional Board in writing and shall notify any succeeding owner or operator of the existence of this Order by a letter, a copy of which shall be forwarded to this Regional Board.
4. A copy of these requirements shall be maintained at an on-site office and be available at all times to operating personnel.
5. In accordance with section 13260 of the Water Code, the Discharger shall file a report of any material change or proposed change in the character, location or volume of discharge.
6. The Discharger shall notify Regional Board immediately by telephone of any adverse condition resulting from this discharge or from operations producing this waste discharge, such notifications to be affirmed in writing within one week from the date of such occurrence.
7. This Regional Board considers the property operator and owner to have continuing responsibility of correcting any problem that may arise in the future as a result of this discharge.
8. All work must be performed by or under the direction of a registered civil engineer, registered geologist, or certified engineering geologist. A statement is required in all technical reports that the registered professional in direct responsible charge actually supervised or personally conducted all the work associated with the project.
9. The use of a carbohydrate solution with KB-1 solution shall not cause a condition of pollution or nuisance as defined by California Water Code, section 13050.
10. The Discharger shall comply with all conditions of this Order, including timely submittal of technical and monitoring reports as specified in the attached Monitoring and Reporting Program No. CI-8974. Violations of any conditions may result in enforcement action, including Regional Board or Court Order requiring corrective action or imposition of civil monetary liability, or revision, or rescission of the Order.
11. This Order does not exempt the Discharger from compliance with any other laws, regulations, or ordinances, which may be applicable. This Order does not legalize the waste treatment Site, and leaves unaffected any further restraints on the Site that may be contained in other statutes or required by other agencies.

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12. The Discharger shall cleanup and abate the effects of injecting amendment solution as specified in the General WDR permit, including extraction of any by-products which adversely affect beneficial uses, and shall provide an alternate water supply source for municipal, domestic or other water use wells that become contaminated in exceedance of water quality objectives as a result of using the solution.
13. In accordance with section 13263 of the California Water Code, these requirements are subject to periodic review and revision by this Regional Board.
14. After notice and opportunity for a hearing, this Order may be terminated or modified for cause including, but not limited to:
  - a. Violation of any term or condition contained in this Order.
  - b. Obtaining this Order by misrepresentation, or failure to disclose all relevant facts.
  - c. A change in any condition that requires either a temporary or permanent reduction or elimination of authorized discharge.
15. The Regional Board, through its Executive Officer, will modify the Monitoring and Reporting Program, as necessary. The California Environmental Quality Act (CEQA) initial study and associated public comment were conducted once as part of the Waste Discharge Requirement (WDR) permit application process and will not be required for the expansion or modification of this remediation program.

**D. Expiration Date**

This Order expires on October 6, 2010.

The Discharger must file a Report of Waste Discharge in accordance with title 27, California Code of Regulations, not later than 180 days in advance of such date as application for issuance of new waste discharge requirements.

I, Jonathan Bishop, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Los Angeles Region on October 6, 2005.

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Jonathan Bishop  
Executive Officer