CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

ORDER NO. R4-2003-0051

WASTE DISCHARGE REQUIREMENTS
FOR
BOEING REALTY CORPORATION
PILOT TESTS TO EVALUATE IN-SITU BIOREMEDIATION OF
VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
FORMER C-1 FACILITY

(FILE NO. 95-034)

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

1. Boeing Realty Corporation (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 facility (Facility) identified below.

2. The Facility encompasses approximately 343 acres and is located at 3855 Lakewood Boulevard, Long Beach (Latitude 33°50'00", Longitude 118°09'00", see Figure 1) and was formerly used by the Discharger for Aircraft manufacturing operations, which began in about 1941, producing various aircraft for military and civilian use. The Discharger is in the process of closing about 230 acres of the Facility located west of Lakewood Boulevard but may retain about 13 acres of this area (West Ramp Area) to support remaining aircraft production operations, which will continue at the remaining 100 acres east of Lakewood Boulevard. As part of the closure process, the Discharger will remove all equipment, buildings and all associated above- and below ground facility infrastructure from the portion of the facility it is closing.

3. In 1987, the Discharger began soil and groundwater investigations at the Facility and discovered soil and groundwater pollution at the West Ramp, Building 5 and Building 10 areas. The Discharger submitted soil and groundwater investigation reports to the City of Long Beach, Los Angeles County Department of Public Works and the California Regional Water Quality Control Board, Los Angeles Region (Regional Board).

4. Shallow groundwater beneath the Facility is first encountered at depths ranging from approximately 28 to 42 feet below ground surface. Groundwater is unconfined and occurs within the Bellflower Aquitard. The Artesia 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 140 feet beneath the Site and appears to be laterally continuous across the Facility. The Bellflower Aquitard is comprised primarily of a heterogeneous mixture of low permeability silts and clays, with lenses of sandy or gravelly clays identified in some areas. The Bellflower Aquitard is known to have relatively low hydraulic conductivities and groundwater supply wells within the City of Long Beach are not screened in and do not produce from this unit.

5. In 1995, the Regional Board issued Cleanup and Abatement Order 95-048 directing the Discharger to conduct additional soil and groundwater characterization, groundwater remediation and groundwater monitoring.

6. The Discharger has conducted a comprehensive Facility-wide soil and groundwater investigation. The investigation consisted of drilling more than 2,000 soil borings, collecting and analyzing over 3,700 soil samples, collecting and analyzing 1,100 soil gas samples, installation of 237 groundwater monitoring wells (192 conventional monitor recovery wells and 45 direct-push monitor wells), and collection and analysis of over 1,400 groundwater samples.

7. The Facility-wide investigations show that the primary contaminants detected in soil and groundwater are trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethene (1,1-DCE) tetrachloroethene (PCE), methylene chloride (MC), jet fuel, and hexavalent chromium. Concentrations of volatile organic compound (VOC) range from non-detect up to 130,000,000 microgram per liter (µg/l) TCE, up to 45,000,000 µg/l 1,1,1–TCA, up to 6,000,000 µg/l 1,1-DCE, up to 3,300 µg/l PCE, up to 790,000,000 µg/l MC, up to 20,000 µg/l vinyl chloride, and up to 794,000 µg/l hexavalent chromium. A jet fuel free product (light non-aqueous phase liquid) plume is present beneath a portion of the West Ramp Area.

8. The Discharger has implemented various soil and groundwater remedial programs. From 1989 to 1999, approximately 20,000 gallons of free product has been recovered from the groundwater through the implementation of a product recovery system and manual bailing of wells in the West Ramp Area. In December 2001, a second remedial system was implemented to begin soil remediation and conduct additional groundwater remediation via a dual-phase extraction system constructed to recover vapor-phase hydrocarbons in soil vapor and additional free-phase and dissolved-phase hydrocarbons in groundwater.

9. From 1992 to 1999, the Discharger initiated groundwater remediation at the Building 10 areas by recovering approximately 600 gallons of dense non-aqueous phase liquids (DNAPL) with submersible pumps and by manually bailing wells. Soil remediation was initiated at the Buildings 1D, 5, 6, and 148 and Former Fueling Facility areas by using vapor extraction systems (VES). VES have been operating at the Building 5 and 6 areas since October 2001, at the Building 1D area since January 2002, and at the Building 148 and Former Fueling Facility since February 2002. The Discharger has completed VES pilot tests at Buildings 36 and Western Triangle areas to evaluate the feasibility of soil remediation in these areas.

10. The nearest active water supply wells are located approximately 1,000 feet southeast of the Facility, approximately 1200 feet southwest of the Facility and approximately 600 feet north of the Facility (Figure 2). The nearest active water supply wells to the Facility are the City of Long Beach's municipal water supply wells, 10 of which are located within an approximate 1-mile radius of the Facility (Figure 2). The location of active municipal water supply wells near the Facility and depth to the top of the perforated zone for each well are shown on Figure 2. The municipal water supply wells are screened in the deep aquifer system. There are several aquitards between the groundwater containing VOCs and/or hexavalent chromium above respective drinking water maximum contaminant levels (MCLs) within the Bellflower aquitard and the deep aquifer system from which water is produced for municipal supply (Figure 3).

11. The Discharger proposes to remediate VOCs in shallow groundwater at the Facility using carbon source amendments (i.e. lactate, edible oils, ethanol, etc.) and KB-1. Currently, three pilot test remediation

work plans (identified below) involving the use of carbon source amendments and KB-1 have been submitted by the Discharger and approved by the Executive Officer. The Discharger also anticipates the use of KB-1 at a fourth site as outlined in a remediation work plan (identified below). 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). Dehalococcoides ethenogenes have been detected in several areas at the Facility, but do not appear to be ubiquitous and therefore are being amended as proposed in the respective remediation plans. 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.

12. The Discharger submitted a "Pilot Test Work Plan for Enhanced In-Situ Bioremediation, Building 1D Treatment Area" and "Response to Los Angeles Regional Water Quality Board Comments for Building 3, Building 36, Building 14, and Building 1D" prepared by Geosyntec Consultants dated June 2002 and September 23, 2002, respectively (collectively referred to as Building 1D Work Plan). The Building 1D Work Plan was approved by the Executive Officer on October 3, 2002. The Building 1D Work Plan presents the rationale and procedures for pilot-scale implementation of enhanced in-situ bioremediation at the subject treatment area at the Facility. The Discharger proposes to conduct a pilot study to evaluate the effectiveness of in-situ remediation of dissolved chlorinated volatile organic compounds, primarily TCE, in the groundwater beneath Building 1D. The pilot study is proposed to be conducted in two areas, 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 a direct-push technology or temporary well 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 Building 1D Work Plan.

13. The Discharger submitted a "Pilot Test Work Plan for Enhanced In-Situ Bioremediation, Building 3 Treatment Area" and "Response to Los Angeles Regional Water Quality Board Comments for Building 3, Building 36, Building 14, and Building 1D" prepared by Geosyntec Consultants dated May 17, 2002 and September 23, 2002, respectively (collectively referred to as Building 3 Work Plan). The Building 3 Work Plan was approved by the Executive Officer on October 7, 2002. The Building 3 Work Plan presents the rationale and procedures for pilot-scale implementation of enhanced in-situ bioremediation at the subject treatment area at the Facility. The Discharger proposes to conduct a pilot study to evaluate the effectiveness of in-situ remediation of dissolved chlorinated VOCs, primarily TCE, in the groundwater beneath Building 3. The pilot study is proposed to be conducted in two phases. The first phase will involve introduction of a solution of selected amendments. The second phase will involve introduction of a solution of selected amendments and KB-1. The solution will be mixed using groundwater extracted from three extraction wells, and injected back to the contaminated groundwater through three injection wells to promote in-situ treatment. The pilot test will evaluate the effectiveness of delivery and biologic reduction of chlorinated VOCs. The compositions of the solutions were 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 Building 3 Work Plan.

14. The Discharger submitted a "Pilot Test Work Plan for Enhanced In-Situ Bioremediation, Building 36 Treatment Area" and "Response to Los Angeles Regional Water Quality Board Comments for Building 3, Building 36, Building 14, and Building 1D" prepared by Geosyntec Consultants dated May 1, 2002

and September 23, 2002, respectively (collectively referred to as Building 36 Work Plan). The Building 36 Work Plan was approved by the Executive Officer on October 3, 2002. The Building 36 Work Plan presents the rationale and procedures for pilot-scale implementation of enhanced in-situ bioremediation at the subject treatment area at the Facility. The Discharger proposes to conduct a pilot study to evaluate the effectiveness of in-situ remediation of dissolved chlorinated volatile organic compounds, primarily TCE, in the groundwater to the south of Building 36. The pilot study involves introducing a solution of selected amendments and KB-1. The Solution will be injected through a direct-push technology or temporary well(s) 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 Building 36 Work Plan.

15. The Discharger submitted a "Pilot Test Work Plan for Enhanced In-Situ Bioremediation, Building 14 Treatment Area" and "Response to Los Angeles Regional Water Quality Board Comments for Building 3, Building 36, Building 14, and Building 1D" prepared by Geosyntec Consultants dated July 1, 2002 and September 23, 2002, respectively (collectively referred to as Building 14 Work Plan). The Building 14 Work Plan was approved by the Executive Officer on October 16, 2002. The Building 14 Work Plan presents the rationale and procedures for pilot-scale implementation of enhanced in-situ bioremediation at the subject treatment area at the Facility. The Discharger proposes to conduct a pilot study to evaluate the effectiveness of in-situ remediation of dissolved chlorinated volatile organic compounds, primarily TCE, in the groundwater near Building 14. The pilot study is proposed to be conducted in phases. The first phase will involve introducing a solution of selected amendments through a temporary well to evaluate the effectiveness of amendment delivery in the subsurface. The second phase will involve introducing a solution of selected amendments through direct-push technology and temporary wells at four additional areas to evaluate the effectiveness of amendment delivery in the subsurface. The third phase involves monitoring biologic reduction of chlorinated VOCs to determine the effectiveness and completeness of reduction of TCE to ethene. If during the third phase it is determined that reduction of TCE is incomplete (TCE converted to cis-1,2-Dichloroethene with no further degradation) then an addendum to the Building 14 Work Plan would be submitted to the Regional Board for a fourth phase. The fourth phase would involve injection of KB-1. The results of the pilot study will be evaluated in accordance with the monitoring and reporting schedule presented in the approved Building 14 Work Plan.

16. The Building 1D, 3, 36, and 14 Work Plans also present the procedures for monitoring the remediation program evaluating the injection volume and concentrations, and the frequency of injection will be adjusted based on the result of field monitoring. Groundwater conditions will be monitored during the operation to determine the efficiency of the injection.

17. Groundwater will be treated using enhanced in-situ bioremediation as presented in the four remediation work plans. At the Building 3 area, groundwater will be extracted from three extraction wells, amendments will be added to the extracted groundwater and the amended groundwater will be injected into three injection wells located upgradient of the extraction wells. The amended groundwater will promote biological reduction of TCE to ethene in the subsurface within a biologically active zone around the injection wells. At the remaining three areas, an amendment solution will be injected into the areas presented in the respective remediation work plans 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. 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.

18. Any injection of a solution into the groundwater is a discharge of waste as defined by the California Water Code. However, the discharge of the 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.

19. 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 KB-1 will improve groundwater conditions by ensuring complete degradation of TCE to ethene.

20. 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 Facility. On January 15, 2003, the Discharger was granted coverage under the General WDR and issued Monitoring and Reporting Program No. CI-8520 for the injection of carbon source amendments. The General WDR does not cover the use of KB-1, therefore, these individual waste discharge requirements have been developed for the addition of KB-1 at this Facility. Currently, addition of KB-1 is proposed at three locations with in the facility, 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 KB-1 at any other areas within the Facility. Additional usage of KB-1 is already anticipated at least one other location. Once work plans are reviewed and approved by the Regional Board's Executive Officer, the expanded use of KB-1 will be included under the coverage of these individual waste discharge requirements and the monitoring and reporting program will be modified as appropriate.

21. 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.

22. The beneficial uses for the Central Groundwater Basin are municipal and domestic water supply, process supply, industrial process supply, and agricultural supply.

23. 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.

24. 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.

25. 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.

IT IS HEREBY ORDERED that Boeing Realty Corporation 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 the 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 of KB-1 shall not exceed 55 gallons in the Building 1D remediation area, 60 gallons in the Building 3 remediation area, 35 gallons in the Building 14 area, and 55 gallons in the Building 36 remediation area, 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 maximum concentration of amendments other than KB-1 are specified in the General WDR permit. 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 KB-1 solution 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.

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 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-8566. 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 facility, and leaves unaffected any further restraints on the facility that may be contained in other statutes or required by other agencies.

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 April 3, 2008.

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, Dennis A. Dickerson, 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 April 3, 2003.

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Dennis A. Dickerson
Executive Officer