

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION**

ORDER NO. R4-2006-0071

**WASTE DISCHARGE REQUIREMENTS
FOR
FORMER NORTHROP GRUMMAN SYSTEMS CORPORATION
(EAST COMPLEX FACILITY IN HAWTHORNE, CALIFORNIA)
PILOT TESTS TO EVALUATE IN-SITU BIOREMEDIATION OF
VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER**

(FILE NO. 06-089)

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

1. The Northrop Grumman Systems Corporation (NGSC) (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 NGSC East Complex Facility (Site).
2. The Site encompasses approximately 40 acres of land and is located at One Northrop Avenue in the City of Hawthorne, Los Angeles County, California (Latitude 118.3293W, Longitude 33.9214N, see Figure 1). The facility has been used between approximately 1940 to 2000, for the manufacture, design and testing of subassemblies for military aircraft and skin assemblies for commercial aircraft, including Boeing 747. Vought Aircraft Industries, Inc. owns the land and the Site.
3. The industrial activities at the Site included the use of a variety of products such as fuels (including gasoline, diesel and jet fuel), solvents including isopropanol, 1,1,1-trichloroethane (TCA) and tetrachloroethene (PCE), acid sludge, fluorescent dye and hydraulic oil. Site investigations indicated that soil and groundwater were contaminated with VOCs. The groundwater was impacted with VOCs including total petroleum hydrocarbons (TPH), PCE, trichloroethene (TCE), cis-1,2-dichloroethene (DCE), 1,1-dichloroethane, 1,1-DCE, chloroform, carbon tetrachloride, and benzene. However, TPH was not detected in the soil and groundwater at the pilot test area.
4. Previous soil investigation in the Plant 1 area indicated TCE, PCE, and 1,1-DCE as the primary contaminants. In October 2004, a Soil Vapor Extraction (SVE) system with a network of 20 SVE wells was installed and operated in January 2005. Approximately 3,800 pounds of VOCs were removed until February 2006 when the system was shut down for rebound testing and system performance evaluation.
5. Shallow groundwater beneath the Site is first encountered at approximately 50 feet below ground surface. Three separate groundwater zones or horizons have been identified within the Bellflower Aquitard at the site. Bellflower Horizons A, B, and C correspond to depths of 50 to 60, 70 to 85, and greater than 95 feet below ground surface (ft. bgs), respectively. These horizons are separated by semi-continuous layers of clay, silt-clay, and clayey-silt that vary in

thickness from five to 20 ft. The Gage Aquifer underlies the Site at an approximate depth of 110 ft. The groundwater flow direction is toward South.

6. Previous investigations indicated that the presence of PCE and TCE in the shallow and mid-depth aquifers (Bellflower Horizons A and B) at the Site. Concentrations of PCE and TCE in Bellflower Horizon A groundwater were detected as high as 8,200 and 44,000 micrograms per liter ($\mu\text{g/L}$), respectively. Concentrations up to 25 $\mu\text{g/L}$ and 3,500 $\mu\text{g/L}$ of PCE and TCE, respectively, in Bellflower Horizon B groundwater.
7. The Site was granted Resource Conservation and Recovery Act (RCRA) Interim Status by the State of California Health and Welfare Agency, Department of Health Services (DHS) in 1981. The Department of Toxic Substances Control (DTSC) has been designated as the sole oversight agency for RCRA Correction Action.
8. Water supply wells located within one mile radius of the Site indicate no detection of VOCs including PCE and TCE, provided by the Water Replenishment District of Southern California.
9. The Discharger submitted a pilot test work plan, "Enhanced In Situ Bioremediation Work Plan", dated November 2004, and its addenda, dated July 19, 2006, and August 27, 2006, prepared by GeoSyntec Consultants & ENSR International. The Work Plan proposes a pilot test to evaluate the performance of enhanced in situ bioremediation (EISB) to remediate VOCs in shallow and mid-depth groundwater (Bellflower Horizons A and B) at the Site by injecting a carbohydrate solution consists of emulsified soybean oil (Newman Zone) and dehalorespiring microorganisms (KB-1TM culture) into a limited area. The Work Plan and its addenda were approved by the Executive Officer on July 24 and August 28, 2006.
10. The 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.
11. Groundwater will be treated using enhanced in-situ bioremediation as presented in the Pilot Test Work Plan (Work Plan). The Work Plan includes temporary injection of the carbohydrate solution and Dehalococcoides culture (KB-1TM) into the shallow and mid-depth groundwater (Bellflower Horizons A and B, respectively) to determine an extent to which VOCs concentrations, mainly PCE and TCE, can be reduced to ethene and carbon dioxide over time. The EISB pilot test activities include installation of ten injection wells (five injection wells in each Bellflower Horizons A and B), thirteen additional monitoring wells, injection of the carbohydrate solution and KB-1TM, groundwater monitoring, and reporting.
12. 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-1TM 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 KB-1TM.

13. 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 PCE to ethene.
14. 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 West Coast Groundwater Basin. The requirements contained in this Order, as they are met, will be in conformance with the goals of the Plan.
15. The beneficial uses for the West Coast Groundwater Basin are municipal and domestic water supply, industrial and process supply and agricultural supply.
16. The release of VOC at this site affects only shallow perched groundwater sources. Many of the shallow perched groundwater zones within the Los Angeles region contain general mineral content (total dissolved solids (TDS), chloride, nitrate, and sulfate, etc.) in concentrations, which are considered to be naturally occurring and not the result of pollution, that may exceed Basin Plan Objectives for these constituents. The infiltration of treated groundwater that exhibits general mineral content that are naturally occurring and exceed Basin Plan Objectives may be returned to the same groundwater formations from which it is withdrawn, with concentrations not exceeding the original background concentrations for the site.
17. The permitted discharge is consistent with the anti-degradation provisions of the 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 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 West Coast Groundwater Basin.
18. 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.
19. 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 hearing, heard and considered all comments pertaining to the discharge and to the tentative requirements.

IT IS HEREBY ORDERED that The Northrop Grumman Systems 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 Limitations

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 consists of emulsified soybean oil (Newman Zone) with chlorinated-ethene degrading consortium, referred to as KB-1TM, into the groundwater shall be only performed while this Order is in force.
3. During this remediation, the injection volume of carbohydrate solution shall not exceed 40,000 gallons and the injection volume of KB-1TM shall not exceed 18,000 gallons (Bellflower Horizon A) and 22,000 gallons (Bellflower Horizon B) at the Site, unless approved by the Executive Officer at least 30-day in advance of any additional injection.
4. Discharge duration shall not exceed more than two years, unless approved by the Executive Officer at least 30-days in advance of any additional
5. The amendment solution shall be limited to potable water, extracted groundwater, amendments specified in the approved Pilot Test Work, and KB-1TM. The amendment will consist of carbohydrate solution which includes 45% emulsified soybean oil, 10% food-grade emulsifiers, and 4% lactate. Groundwater amended with 2% emulsified soybean oil will be injected into each of the five injection wells. The maximum concentration of KB-1TM shall not exceed 0.1% (by pore water volume of the treatment area).
6. The discharge of wastes shall not cause the pH of the receiving groundwater at the compliance point, downgradient outside the application area, beyond the range of 6.5 and 8.5.
7. The discharge of wastes shall not cause the mineral constituents of the receiving groundwater at the compliance point, downgradient outside the application area, in excess of applicable limits listed on Table 3-10 (Attachment A), DWR Basin No. 4.11, West Coast Basin, are applicable to your discharge.
8. The discharge of wastes shall not cause the concentrations of chemical constituents and radionuclides of the receiving groundwater designated for use as domestic or municipal supply at the compliance point, downgradient outside the application area, in excess of the Maximum Contaminate Levels (MCLs) specified in the following provision of Title 22 of the California Code of Regulations which are incorporated by reference into the Basin Plan: Table 64431-A of section 64431 (inorganic chemicals), Table 64431-B of section 64431 (fluoride), Table 64444-A of section 64444 (organic chemicals), and Table 4 of section 64443 (radioactivity). This incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect.

9. Waste discharged shall not cause the concentration of coliform organisms over any seven days period greater than 1.1/100ml.
10. Waste discharged shall not contain salts, heavy metals, or organic pollutants at levels that would cause receiving groundwater at the compliance point, downgradient outside the application area, to exceed the water quality objectives for groundwater or groundwater that may be in hydraulic connection with surface waters designated for marine aquatic life or body contact recreation.
11. Waste discharged shall not cause the groundwater to contain concentrations of chemical substances or its by-products in amounts that adversely affect any designated beneficial use, outside the application area or treatment zone at the compliance point(s).
12. Waste discharged shall not cause the groundwater to contain in amounts that cause nitrogen as nitrate-nitrogen plus nitrite-nitrogen, 45 mg/L as Nitrate (NO₃), 10 mg/L as Nitrate-Nitrogen (NO₃-N), or 1 mg/L as Nitrite-Nitrogen (NO₂-N), outside the application area or treatment zone at the compliance point(s).

B. Discharge Specifications

1. The Discharger shall stop further addition of amendments to the groundwater if carbohydrate solution amendment and *Dehalococcoides* associated with KB-1TM 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-1TM will not survive due to the loss of the food source. Furthermore, KB-1TM is sensitive to oxygenated water.
2. The Discharger shall not cause KB-1TM, 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-1TM 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-1TM 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 carbohydrate solution with KB-1TM 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-9178. 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.

12. In accordance with section 13263 of the California Water Code, these requirements are subject to periodic review and revision by this Regional Board.
13. 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.
14. 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.
15. Upon review of the results of the injection test and effectiveness of the carbohydrate solution with KB-1™ observed in this pilot test study, an expansion of the injection system for full-scale application to treat the remainder of the East Complex may be proposed under this WDR. After review and approval of the full-scale system by both DTSC and Executive Officer, the Monitoring and Reporting Program for the full-scale system may be revised by the Executive Officer, as necessary.
16. Monitoring frequencies may be adjusted by the Executive Officer if the Discharger requests change and the request is backed by statistical trends of monitoring data submitted.

D. Expiration Date

This Order expires on September 14, 2011.

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 S. 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 September 14, 2006.

Jonathan S. Bishop
Executive Officer