

**State of California
Regional Water Quality Control Board
Santa Ana Region**

May 8, 2020

Staff Report

Item: *8

Subject: Amendment of Order No. R8-2016-0061, Individual Waste Discharge Requirements for In Situ Remediation of Groundwater Impacted by Chlorinated Volatile Organic Compounds Associated with the Former Raytheon Facility, Orange County – Order No. R8-2020-0015

Discussion

On December 16, 2016, the Santa Ana Regional Water Quality Control Board (hereinafter Santa Ana Water Board) adopted Order No. R8-2016-0061 (hereinafter Order), prescribing waste discharge requirements to the Raytheon Company for their former Raytheon Facility (hereinafter Site) for the in-situ injection of chemical amendments to promote enhanced in situ biological degradation (EISB) of chlorinated volatile organic compounds (VOCs) and petroleum fuel hydrocarbons that are present in the groundwater as a result of historical operations at the Site. On April 3, 2020, Raytheon Corporation completed a merger with United Technologies Corporation and changed their name to Raytheon Technologies Corporation (hereinafter Discharger or Raytheon).

The Santa Ana Water Board is overseeing the investigation and cleanup of the former Site. The Site, which contains the current addresses of 500 through 540 Superior Avenue, is located between Superior Avenue, Industrial Way, Dana Road and Newport Boulevard in the city of Newport Beach, and was formerly referred to as the Newport Technology Center. Beginning in 2008, the Site was redeveloped as medical offices for the Newport Healthcare Center. The Site is approximately ½ mile north of the lower Newport Bay.

From the 1950's until 2000, the 14-acre Site was used by Raytheon for the development, manufacture, and assembly of electronic components. These operations included the use of solvents that contained VOCs, primarily tetrachloroethylene (PCE) and trichloroethylene (TCE). In 1981, a former underground storage tank that stored waste solvent was confirmed to be leaking. Subsequent environmental investigations conducted at the Site detected VOCs and petroleum fuel hydrocarbons in soil, soil gas, and groundwater. The source of VOCs was primarily from the historic storage and use of solvents in an area east of a former building at the Site. The building has been demolished and replaced with an open-air parking garage structure.

Groundwater beneath and around the Site is highly brackish and saline, and contains naturally occurring petroleum, hydrogen sulfide, and methane. The groundwater in the area generally flows in a south-southeasterly direction, toward Newport Bay. The

results of investigations indicate that groundwater beneath the Site has been significantly impacted by elevated concentrations of PCE and TCE, extending hundreds of feet downgradient (south-southeast) of the Site. Elevated concentrations of vinyl chloride, a breakdown compound of PCE and TCE, have been detected approximately 1,000 feet downgradient of the Site.

EISB was selected as the groundwater cleanup method for the Site, based on the findings that the underlying groundwater conditions promotes the natural degradation of the PCE and TCE into breakdown compounds. This EISB involves the injection of a vegetable oil/sodium lactate mixture that serves as an electron donor and nutrient source for naturally occurring bacteria that destroy the chlorinated VOCs. The breakdown process generates a series of intermediate breakdown products, including vinyl chloride and ethenes, and ultimately, harmless end products. The goal of in-situ bioremediation is to feed the microbes to accelerate the rate of natural VOC degradation that is already occurring in groundwater at the Site. To further enhance the VOC cleanup process, non-pathogenic, naturally occurring bacteria (*Dehalococcoides ethenogenes* culture) are also added with the vegetable oil. These naturally occurring bacteria have been used at several other sites in California for groundwater cleanup purposes. The bacterial population wanes once the vegetable oil is completely used up as a food source. Multiple phases of EISB injection are often warranted to maintain subsurface conditions favorable for EISB and complete degradation of the chlorinated VOCs.

EISB was successfully performed at the Site during pilot testing, and as part of limited interim groundwater cleanup activities from 2005 to 2007. Full scale implementation (first phase) of EISB was performed from March 2009 to August 2009, and a second phase of EISB injections of a more limited scale was performed in November 2011. A third phase of EISB injections were conducted at the Site between March to April 2017 under the provisions and discharge limits specified in the Order.

Based on the evaluation of performance results derived from data gathered through groundwater monitoring conducted under the Monitoring and Reporting Program No. R8-2016-0061 (MRP), Raytheon's consultant determined that an additional injection phase of chemical amendments is necessary to maintain subsurface conditions favorable for EISB. On September 23, 2019, Raytheon submitted "*Remedial Action Plan Addendum Number 5.*" (RAP-5). Santa Ana Water Board staff reviewed RAP-5 and determined that the proposed injection pressure and EISB injection amendments would remain generally the same as those prescribed in the Order. Raytheon proposes to inject the following chemical amendments into the subsurface: anoxic water treated with zero valent iron, Newman Zone® emulsified food grade vegetable oil (55 percent emulsified food-grade soybean oil, 4 percent sodium-L-lactate, less than 10 percent food grade additives/emulsifiers/preservatives, and less than 35 percent water), and *Dehalococcoides* microbial culture KB-1.

Santa Ana Water Board's staff concurs with the implementation of RAP-5 to promote

additional EISB in the groundwater at the Site, however, final approval will be conditionally granted by the Executive Office as part of the RAP addendum approval process. RAP-5 and the conditional approval letter signed by the Executive Officer would be made an enforceable part of the Order through this proposed amendment. Therefore, Santa Ana Water Board staff recommends that the existing Order be amended to authorized additional EISB injection phases at the Site. It is appropriate to amend the Order to update information and add a remedial action plan addendum approval provision to authorize the Executive Officer to conditionally approve the proposed fourth EISB injection phase and future injection phases needed to further mitigate the past discharges of VOCs to the soil and groundwater at the Site.

The following shows the proposed changes to Order No. R8-2016-0061. Additions are bold and underlined and deletions are stricken-out.

1. Order No. R8-2016-0061, page 1, Findings, replace Finding 2, as follows:
 2. Groundwater cleanups at such sites may be accomplished via physical removal; and treatment of site contaminants or may employ the addition (discharge) of chemicals and other reactive materials (amendments) to the soil and groundwater (in situ), to promote remediation. A person or entity applying or proposing to discharge such amendments to soil or groundwater to promote groundwater remediation within a specific treatment zone is referred to as a Discharger. For purposes of this Order, the Discharger is identified as ~~The Raytheon Company~~ **Raytheon Technologies Corporation (hereinafter Raytheon).**
2. Order No. R8-2016-0061, page 1, Findings, replace Finding 4, as follows:
 4. This Order includes Waste Discharge Requirements (WDRs) to regulate the specified discharge for in situ bioremediation/reduction of the specified waste constituents, namely VOCs and petroleum hydrocarbons in groundwater at the Site. Although the California Water Code (CWC) section 13263(i) and Regional Board Order RB-2013-0029 previously established criteria to be met in order to prescribe general WDRs, the Regional Water Board finds that the lack of appropriate locations to meet the specific requirements of the Compliance Points, individual WDRs are being prescribed herein to regulate the discharge at the Site. **Three separate phases of injection of chemical amendments have been implemented at the Site through April 2017 for in-situ bioremediation of the groundwater underlying the Site. Based on the results and experience gained from the previous injection phases, on September 23, 2019 the Discharger proposed a fourth injection phase to continue remedial efforts and additional phases may be proposed in the future to complete the groundwater remediation at the Site. This fourth proposed**

injection phase and additional injection phases that may be needed in the future at the Site may be authorized by Executive Officer of the Regional Water Board upon submittal by the Discharger of an acceptable addendum to the remedial action plan for the Site. This Order includes a provision that authorizes the implementation of the proposed fourth injection phase and additional proposed injection phases in the future, upon approval by the Executive Officer of the Regional Water Board. The remedial action plan and addendums and terms included in the conditional approval letters issued by the Regional Water Board’s Executive Officer for each injection phase are hereby made an enforceable part of this Order.

3. Order No. R8-2016-0061, page 2, Findings, replace Finding 9, as follows:

9. ~~For purposes of this Order, the covered discharge includes injection of chemical amendments with the following specifications into the Terrace Upper Sand Unit area along the downgradient property boundary of the subject site (attached Figure 6): A total of 81,000 gallons of solution is permitted to be injected into the nine upper sand unit injection wells. The injection volume per well is summarized in attached Table 3. The injection volume into the Upper Sand unit includes~~ **For purposes of this Order, the covered discharge includes injection of chemical amendments into the Terrace Upper Sand Unit area along the downgradient property boundary of the subject Site (attached Figure 6) through up to nine Upper Sand Unit injection wells. Three separate injection phases have been implemented at the Site through April 2017. During the third injection phase a total of 81,000 gallons of solution was permitted to be injected. To continue the in-situ bioremediation of groundwater at the Site, the Discharger proposes a fourth injection phase that includes the injection of a total of 75,505 gallons of solution into eight Upper Sand Unit injection wells. The injection volume per well that is summarized in Table 3 of the Order, “Summary of Proposed Full Scale Enhanced In-situ Bioremediation Injections,” has been updated by the Discharger in their proposal for the fourth injection phase and will be updated by the Discharger for the additional injection phases that may be needed in the future. During the third injection phase the injection volume into the Upper Sand Unit included** 1800 gallons anoxic water, 9 liters of *Dehalococcoides* microbial cultural KB-1®, and 79,100 gallons of 1.2 percent mixture of emulsified food grade vegetable oil (a mixture of potable water and Newman Zone® emulsified food grade vegetable oil solution consisting of 45 percent emulsified food-grade soybean oil, 4 percent sodium-L-lactate, less than 10 percent food grade additives /emulsifiers/preservatives, and less than 45 percent water).

For the proposed fourth injection phase, the injection volume into the

Upper Sand Unit includes 1600 gallons anoxic water, 8 liters of Dehalococcoides microbial cultural KB-1® and 73,190 gallons of 1.2 percent mixture of emulsified food grade vegetable oil (a mixture of potable water and Newman Zone® emulsified food grade vegetable oil solution consisting of 55 percent emulsified food-grade soybean oil, 4 percent sodium-L-lactate, less than 10 percent food grade additives/emulsifiers/preservatives, and less than 35 percent water). The **Upper Sand Unit** upper Sand unit injection wells are constructed at various depths ranging from 19 to 28 feet above mean sea level (asml), with screened intervals ranging from 15 to 20 feet in length. The injection flow rate into this water bearing zone will be between 3 and 12 gallons per minute (gpm) with a maximum injection pressure of 30 pounds per square inch (psi). **For future injection phases, details regarding the volume and formulation of the chemical amendments and number of injection wells to be operated will be included in the proposed addendum of the remedial action plan for the Site.**

4. Order No. R8-2016-0061, page 2, Findings, replace Finding 10, as follows:

- 10 For purposes of this Order, the covered discharge includes injection of chemical amendments with the following specifications into the Terrace Lower Sand Unit area along the downgradient property boundary of the subject site (attached Figure 6): A total of 41,000 gallons of solution is permitted to be injected into the five Lower Sand unit injection wells during the remediation period. The injection volume per well is summarized in attached Table 3. The injection volume into the Lower Sand unit includes **For purposes of this Order, the covered discharge includes injection of chemical amendments into the Terrace Lower Sand Unit area along the downgradient property boundary of the subject Site (attached Figure 6) through five Lower Sand Unit injection wells. Three separate injection phases have been implemented at the Site through April 2017. During the third injection phase a total of 41,000 gallons of solution was permitted to be injected. To continue the in-situ bioremediation of groundwater at the Site, the Discharger proposes a fourth injection phase that includes the injection of a total of 41,202 gallons of solution with similar composition as the previous phases. The injection volume per well that is summarized in Table 3 of the Order, “Summary of Proposed Full-Scale Enhanced In-situ Bioremediation Injections,” has been updated by the Discharger in their proposal for the fourth injection phase and will be updated by the Discharger for the additional injection phases that may be needed in the future. During the third injection phase the injection volume into the Lower Sand Unit included** 1000 gallons anoxic water, 5 liters of *Dehalococcoides* microbial cultural KB-1®, and 40,200 gallons of 1.2 percent mixture of emulsified food grade vegetable oil (a mixture of potable water and Newman Zone®).

For the proposed fourth injection phase, the injection volume into the Terrace Lower Sand Unit includes 1000 gallons anoxic water, 5 liters of Dehalococcoides microbial cultural KB-1®, and 40,200 gallons of 1.2 percent mixture of emulsified food grade vegetable oil (a mixture of potable water and Newman Zone®). The Lower Sand Unit The injection wells are constructed at various depths ranging from 7- 8 feet amsl, with screened intervals ranging from 10 to 15 feet in length. Raytheon proposes that the injection flow rate into this water bearing zone will be between 3 and 12 gpm with a maximum injection pressure of 30 psi. **For future injection phases, details regarding the volume and formulation of the chemical amendments and number of injection wells to be operated will be included in the proposed addendum of the remedial action plan for the Site.**

5. Order No. R8-2016-0061, page 6, Discharge Limitations and Specifications, replace Discharge Limitation and Specification 11, as follows:

11 The Executive Officer is hereby authorized to revise the information included in the Monitoring and Reporting Program, **as the Executive Officer deems appropriate** as deemed appropriate.

6. Order No. R8-2016-0061, page 6, Discharge Limitations and Specifications, insert Discharge Limitation and Specification 12, as follows:

12. **If the results of performance monitoring under M&RP No. R8-2016-0061 indicates that additional phases of injection of the amendments are necessary to remediate the VOC-affected groundwater, then the Discharger shall submit an addendum to the Remedial Action Plan to implement the proposed additional injection phase, subject to approval by the Executive Officer. The Executive Officer is hereby authorized to approve the volume, flow, and formulation and add pertinent conditions to an approval letter for the proposed fourth injection phase and any future proposed injection phase, as deemed appropriate.**

7. Order No. R8-2016-0061, page 8, Monitoring and Reporting Requirements, replace Monitoring and Reporting Requirement 1, as follows:

1 The Executive Officer is hereby authorized to prescribe a Monitoring and Reporting Program, as he **the Executive Officer** deems appropriate.

Recommendation

Adopt Order No. R8-2020-0015 as presented.

Comment Solicitation:

Comments were solicited from the discharger and the following agencies and interested parties:

State Water Resources Control Board, Office of the Chief Counsel – Teresita Sablan
State Water Resources Control Board, DWQ – Annalisa Kihara
State Water Resources Control Board, DDW – Paul Richter
Hargis and Associates – Ken Puentes
California Commercial Real Estate Services – Jessica Beegle
Orange County Health Care Agency – Lauren Robinson
Orange County Water District – Jason Dadakis
Orange County Public Works – Chris Crompton
Orange County Coastkeeper – Garry Brown
City of Newport Beach – Bob Stein and John Kappeler

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