

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

**ORDER NO. R4-2002-0025
WASTE DISCHARGE REQUIREMENTS
FOR
ITT INDUSTRIES INC.
(FILE NO. 2001-163)**

CITY OF INDUSTRY, CALIFORNIA

(GROUNDWATER REMEDIATION USING CARBOHYDRATE SOLUTION)

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

1. ITT Industries Inc. (hereafter referred to as the Discharger) owned and operated the former ITT Barton Instruments, a manufacturing plant of scientific instruments from 1977 to 1998. The plant is located at 900 South Turnbull Canyon Road, City of Industry, California in a mixed commercial-residential-industrial area (Figure 1). The property was transferred to Barton Instrument Systems in 1998. However, ITT Industries, Inc. has assumed environmental cleanup liability after ceasing operations at the site.
2. The instruments manufactured by the Discharger were used for sensing, measuring, and computing various conditions of liquids and gases. The following operations were conducted as part of facility operations: grinding, drilling, machining, degreasing, acid cleaning, soldering, welding of metal parts, assembly, and painting.
3. The property occupies approximately 13 acres within the Puente Valley Operable Unit, a USEPA Superfund area impacted by past releases of chlorinated volatile organic compounds (VOCs). Due to facility operations, groundwater beneath the site was impacted with VOCs such as tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), and cis-1,2-dichloroethene (c-1,2-DCE). ITT Industries, Inc. is responsible for having discharged or allowing the discharge of VOCs into the soil and groundwater at the property.
4. The former vapor degreaser (VD) area and the former underground storage tank (UST) area have been identified as areas of concern of soil and groundwater contamination at the site. During the sampling event on July 20, 2000, VOCs concentrations in the former VD groundwater monitoring well were 1,100 µg/L of PCE, 650 µg/L of cis-1,2-dichloroethene (c-1,2-DCE), and 350 µg/L of TCE, whereas VOCs concentrations in the former UST groundwater monitoring well were 3,600 µg/L of PCE; 1,100 µg/L of 1,1,1-TCA; 180 µg/L of TCE and 120 µg/L of c-1,2-DCE. The California maximum contaminant levels (MCLs)

for the chemicals are 5 µg/L for PCE, 6 µg/L for c-1,2-DCE, 200 µg/L for 1,1,1-TCA, and 5 µg/L for TCE.

5. Since 1985, the Regional Board's San Gabriel Valley Cleanup Unit has overseen assessment and cleanup activities at this site. The chlorinated VOC groundwater plume covers an area of approximately 90 feet by 140 feet in the former VD area, and an area of 110 feet by 140 feet at the former UST location. PCE was detected in the soil above the groundwater table, ranging from 6.6 µg/kg at 5 feet below ground surface (bgs) to 23,000 µg/kg at 19 feet bgs in the former VD area; and from 12 µg/kg at 10 feet bgs to 3,000 mg/kg at 15 feet bgs in the former UST location. The remediation plan for the site includes the removal of VOCs sources from the vadose zone through a soil vapor extraction system (SVE), and groundwater remediation using an in-situ reactive zone (IRZ) technology at the former VD and UST areas. The SVE system extracts air through the pores of the vadose zone, creating an aerobic environment. Therefore, soil cleanup must be achieved before groundwater remediation because the IRZ requires an anaerobic environment to be effective.
6. The Discharger proposes to use IRZ technology to cleanup groundwater. IRZ technology involves the injection of a food-grade carbohydrate solution (e.g. molasses, cheese whey) into the subsurface to create an anaerobic and reducing condition in groundwater to facilitate the natural reductive dechlorination of VOCs by bacteria. By injecting a carbohydrate source, such as sucrose, glucose, or lactose into groundwater, indigenous heterotrophic microorganisms readily degrade the carbohydrates using available dissolved oxygen (DO). This process drives the system to a more anaerobic and reduced state. Hydrolysis and fermentation of the carbohydrates result in the production of acetate and hydrogen, which serve as sources of energy for bacteria using sulfate and carbon dioxide (CO₂) as electron acceptors. The anaerobic group of methanogens are responsible for reductive dechlorination since they use CO₂ as an electron acceptor which transforms VOCs into less chlorinated intermediates, and finally to CO₂ and water. The metabolic pathway is shown in Figure 2. Final concentrations achieved at other remediation sites include 1 to 7 µg/L for TCE and 20 µg/L for 1,2-DCE.
7. Any injection of carbohydrate solution into the groundwater is considered a discharge of waste into the environment as defined by the California Water Code (CWC). However, the discharge of the carbohydrate solution is intended to provide more efficient remediation of chlorinated VOCs. The nearest downgradient drinking water well is Well B7C, state well number: 1S/10W-31P06S, located approximately 1 mile north of the site which is operated by the San Gabriel Valley Water Company. Figure 3 shows production wells nearby the project. Groundwater is estimated to migrate at a rate of 5.7 feet per year at the site, therefore, migration off site is not expected to occur within the time-frame of the treatment operation.
8. The IRZ system will consist of approximately 39 injection wells and five groundwater monitoring wells. The estimated number of injection wells in the former VD area and former UST Area is 10 and 29, respectively. The exact location and number of wells will be determined in the field after the wells are installed and sampled. Existing wells MW-6 and MW-7 in the former UST and VD areas, respectively, and the cross-gradient well MW-8 will

be used to monitor the performance of the IRZ system. Figure 4 shows the location of the injection and monitoring wells. The injection wells will be completed to an approximate total depth of 25.5 feet bgs and screened between 11.5 and 25.5 feet bgs. Two additional groundwater monitoring wells, MW-9 and MW-10, will be installed downgradient of the remediation areas to detect any migration off-site. If changes are observed in these wells, the carbohydrate solution will cease and, if necessary, groundwater will be extracted from the downgradient well MW-10 following the contingency plan submitted by the Discharger. Groundwater will be extracted from downgradient well MW-10 until background TOC levels are achieved.

9. The purpose of monitoring is to adjust the concentration of the carbohydrate solution, monitor the reactions leading to decrease concentrations of VOCs, and to detect any off-site migration of the carbohydrate solution.
10. IRZ can have the following adverse effects:
 - a) Incomplete reactions can produce cis-1,2-dichloroethene and vinyl chloride, whose MCLs are 6 µg/L and 0.5 µg/L, respectively. However, degradation of these products is expected at a later stage of the remediation process and its occurrence will be monitored.
 - b) Natural background concentrations of parameters like pH, total dissolved solids (TDS), total organic carbon (TOC), oxidation-reduction potential (ORP), nitrate, nitrite, manganese, ferrous iron, sulfate, hydrogen sulfide, alkalinity, dissolved oxygen (DO), specific conductance, temperature, and methane are expected to change in the remediation area. These parameters will be monitored within and outside the remediation area by the monitoring wells. Once the remediation is achieved these parameters will be monitored to observe whether background concentrations are recovered through time.
 - c) Inadequate carbohydrate solution distribution in the aquifer and/or an inadequate dosing may limit the effectiveness of this technology. Therefore, a complete understanding of the geochemical and hydrological conditions of the aquifer and careful monitoring are required to determine the effectiveness of the treatment.
11. The advantages of the IRZ technology include: 1) Indigenous microflora promote the biological reactions, 2) Using food grade electron donor sources (e.g. molasses and whey), 3) Electron donor source is highly soluble and can move through both diffusive and advective processes into difficult lithologies, and 4) Eliminates the need for transferring contaminant mass to other media.
12. The hydrogeology of the former VD and former UST location has been characterized. Three general lithological layers were observed in the former VD area: upper silts, a saturated sand unit (perched zone), and underlying lower silts. This saturated layer was sandwiched between lower permeability layers, such as clayey or sandy silts. The perched zone varies in thickness from approximately 1 to 6 feet in both areas. The location of the perched zone is approximately from 11.5 to 25.5 feet. Visual observation and geotechnical analysis indicate that soil samples collected from above this saturated layer were not saturated, suggesting that perched water preferentially flows within this layer.

13. According to the Water Quality Control Plan for the Los Angeles Region, the existing beneficial uses of the groundwater are municipal and domestic supply, and industrial service and process supply in the Puente Basin in the San Gabriel Valley.
14. The permitted discharge is consistent with the antidegradation provisions of the State Water Resources Control Board Resolution No. 68-16 (Anti-degradation Policy). The discharge may result in some localized exceedance of background concentrations of constituents such as pH, total dissolved solids (TDS), total organic carbon (TOC), oxidation-reduction potential (ORP), nitrate, nitrite, manganese, ferrous iron, sulfate, hydrogen sulfide, alkalinity, dissolved oxygen (DO), specific conductance, temperature, and methane are expected to change in the remediation area, after the injection of the carbohydrate solution. 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 use of such waters, and
 - c) will not result in water quality less than that prescribed in the Water Quality Control Plan for the Los Angeles Region.
15. The Regional Board will serve as the lead agency 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 title 14, California Code of Regulations, section 15063. Based on the Initial Study, the Regional Board prepared a Mitigated Negative Declaration that the project will not have a significant adverse effect on the environment.
16. The Regional Board has notified the applicant and interested agencies and persons of its intent to prescribe Waste Discharge Requirements for this discharge and has provided them with an opportunity to submit their written views 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 ITT Industries Inc., in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, shall comply with the following:

A. Discharge (Injection) Limits

1. The discharge (injection) or its handling shall not cause pollution or nuisance as defined in the California Water Code and all water and nutrients shall be fully contained laterally and vertically, or recovered.
2. Injection shall be limited to potable water and nutrient solution. The maximum concentration of the carbohydrate solution shall be 10% by volume. In addition, a buffering sodium bicarbonate solution may be added to control the pH, if necessary.

3. Injection shall not exceed 9,000 gallons and 24,000 gallons for the former VD and former UST areas, respectively, to complete remediation.
4. Nutrient injection shall be limited to the perched zone and the soil immediately above and below it.
5. The Discharger shall not cause the groundwater outside the remediation area to exceed background concentrations of chloride, total dissolved solids, nitrate and nitrite, sulfates, sulfides, total organic carbon, iron, and manganese.

B. Discharge Prohibitions

1. The discharge of the carbohydrate solution or any by-products into any water course, surface water, or drainage course is prohibited.
2. Discharge of wastes to any point other than specifically described in this Order is prohibited and constitutes a violation thereof.
3. The Discharger shall not cause the permeability of the aquifer, either inside or outside of the treatment area(s), to be affected to such a degree that the Discharger is unable to effectively operate a groundwater pump-and-treat systems, if the IRZ technology is shown to be ineffective.
4. The Discharger's activities shall not cause the groundwater outside the treatment area(s) to contain taste, color or odor producing substances in concentrations that cause nuisance or adversely affect beneficial uses.
5. The Discharger's activities shall not cause the groundwater to contain concentrations of chemical constituents, including carbohydrates and its by-products, in concentrations that may adversely affect municipal, domestic, industrial or agricultural uses as a result of the remediation project.

C. Provisions

1. This Order includes the attached "Standard Provisions and Applicable to Waste Discharge Requirements." If there is any conflict between provisions stated herein and the attached "Standard Provisions", those provisions stated herein prevail.
2. In the event of any change in name, ownership, or control of this facility, the Discharger shall notify the Regional Board in writing and shall notify any succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to the Regional Board.
3. A copy of these requirements shall be maintained at an on-site office and be available at all times to operating personnel.

4. The Discharger shall submit a workplan by March 21, 2002, acceptable to the Executive Officer, which shall provide specific methods to be used to evaluate any changes to the aquifer's transmissivity, hydraulic conductivity and/or storativity inside the treatment area(s). Mathematical and computer models should be used to predict groundwater flow and contaminant movement, when necessary.
5. The Discharger shall provide hydraulic control, that is, full and complete containment of any by-products of the biological degradation process, beginning no later than 4 months after the last injection of carbohydrate solution in the remediation area, or as soon as the carbohydrate solution is detected in downgradient wells.
6. This Order includes the attached Monitoring and Reporting Program No. CI-8373. If there is conflict between provisions stated in the Monitoring and Reporting Program No. CI-8373 and the Standard Provisions, those provisions stated in the former prevail.
7. The Discharger shall notify Regional Board staff by telephone within 24 hours, followed by written notification within one week, in the event it is unable to comply with any of the conditions of this Order due to:
 - a) Breakdown of waste treatment equipment,
 - b) Accident caused by human error or negligence,
 - c) Other causes such as acts of nature, or
 - d) Site construction or development operations.
8. In the event that wastes are transported and disposed of to a disposal site, the Discharger shall report types of wastes and quantity of each type; name and address of each hauler of wastes (or method of transport if other than by hauling); and location of the final point(s) of disposal for each type of waste.
9. The Discharger shall submit a Summary Report detailing the results of the remediation program within 60-days from completion of the remediation project. The report should include an evaluation of the effectiveness of using IRZ technology to remediate VOC-contaminated groundwater at the facility, the impact of any by-products on groundwater quality, the hydraulic properties of the aquifer, and any other effects the *in-situ* treatment may have.
10. The Discharger shall comply with all conditions of this Order, including timely submission of technical and monitoring reports as specified in Monitoring and Reporting Program No. CI-8373. Violations may result in enforcement action, including Regional Board or court order requiring corrective action or imposing civil monetary liability, or in revision or rescission of this Order.
11. The use of the nutrient (carbohydrate) solution shall not cause a condition of pollution or nuisance as defined by California Water Code section 13050.

12. The Discharger shall cleanup and abate the effects of injecting nutrient (carbohydrate) solution including extraction of any by-products which adversely affect beneficial uses and shall provide an alternate water supply source for any municipal, domestic or other water use wells that become contaminated in exceedance of water quality objectives as a result of injecting the nutrient (carbohydrate) solution.
13. 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 submittals that the registered professional in direct responsible charge actually supervised or personally conducted all the work associated with the project.
14. All technical submittals must be wet stamped by a California registered civil engineer, registered geologist, or certified engineering geologist displaying expiration date of license.
15. These requirements do not exempt the Discharger from compliance with any other laws, regulations, or ordinances, which may be applicable. They do not legalize the waste treatment facility, and they leave unaffected any further restraints on the facility that may be contained in other statutes of and/or required by other agencies.
16. This Order does not alleviate the responsibility of the Discharger to obtain other necessary local, state, and federal permits to construct facilities necessary for compliance with this Order; nor does this Order prevent imposition of additional standards, requirements, or conditions by any other regulatory agency.
17. 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.
18. These waste discharge requirements expire on January 24, 2005. The Discharger must file a Report of Waste Discharge no 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 that 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 January 24, 2002.

Dennis A. Dickerson,
Executive Officer