August 30, 2018

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DIRECTIVE FOR SOIL AND GROUNDWATER INVESTIGATION – PURSUANT TO CALIFORNIA WATER CODE SECTION 13267 – FOR THE FORMER BAXTER BENTLEY BUILDINGS 1 & 2; 17502 THROUGH 17572 ARMSTRONG AVENUE, IRVINE, CALIFORNIA (GLOBAL ID # SL208624048; PCA # 2086200)

Dear Messrs. Etienne, Stephan, and Saunders:

The Santa Ana Regional Water Quality Control Board (Regional Board) is charged with the protection of the beneficial uses of groundwater in parts of Orange, Riverside, and San Bernardino Counties that are located within the Santa Ana River Watershed. The former Baxter Healthcare-Bentley Division facility was located at 17502, 17548 and 17572 Armstrong Avenue (Assessor’s Parcel Numbers 430-082-01 and 430-082-06) in Irvine, California (Site). The Site is within the Irvine Groundwater Management Zone of the Santa Ana River Watershed. Beneficial uses of the groundwater in the Irvine Groundwater Management Zone include Municipal Supply, Agricultural Supply, Industrial Process and Industrial Supply.

Based on historical investigations at the Site, 1,1,2-trichloro-1,2,2-trifluoroethane (Freon-113) has been detected in groundwater beneath the Site and continues to be present at elevated concentrations in monitoring wells at the Site. The groundwater monitoring results from September 2017 indicate that Freon-113 concentration in on-Site groundwater monitoring wells ranges from non-detect (less than 10 micrograms per Liter [µg/L]) to 9,300 µg/L. Edwards Lifesciences LLC, formerly known as Baxter Healthcare-Bentley Division, agreed in 2000 to perform voluntary cleanup of the Site under the Water Board’s Oversight Cost Reimbursement (also known as “Cost Recovery”) Program, but has refused to perform the requested additional work for off-Site downgradient groundwater investigation (i.e. beneath the property southeast of the Site and across the Orange County Flood Control Channel) to fully delineate the extent of
Freon-113 that is present in the groundwater as a result of historical discharges of waste at the Site.

Based on the information available to us, Baxter International Inc. is the parent company that formerly included the Baxter Healthcare-Bentley Division. Pursuant to California Water Code Section 13267, this Investigative Order directs Baxter International Inc. (Baxter), Edwards Lifesciences (Edwards) and JS SJK L.P. as the responsible parties (RPs) to:

1. Conduct on-Site vadose zone investigation for further assessment of the residual contamination in soil at the Site;
2. Conduct a comprehensive off-Site groundwater investigation; and
3. Submit the investigation results and associated technical reports to Regional Board staff in a timely manner.

Failure to comply with this directive will subject you to penalties under the California Water Code Section 13268. Future orders may be issued based on the analysis of information required by this Order.

Background

Former Baxter Healthcare-Bentley Division
The former Baxter Healthcare-Bentley Division (Baxter Bentley) facility was located at 17502, 17548 and 17572 Armstrong Avenue, and manufactured medical devices beginning in 1974. The Site was bounded by KRH Thermal Systems on the east, Armstrong Avenue on the north, St. John Knits Headquarters (17622 Armstrong Avenue) on the west and the Orange County Flood Control Channel on the south. Buildings 1 & 2 of the former Baxter Bentley facility are located where the main operations were conducted at 17502 and 17548 Armstrong Avenue, respectively. The current address for both of these buildings is 17522 Armstrong Avenue.

In 2000, Baxter Bentley was spun off its parent company, Baxter International, Inc. and became an independent entity known as Edwards Lifesciences LLC (Edwards). Edwards has since voluntarily maintained the responsibility for addressing the groundwater issues related to Baxter Bentley's former operation at the Site. As of 2004, JS SJK, L.P. is the owner of the Site. Baxter International Inc., as the parent company to Edwards predecessor, retains the responsibility for environmental investigation and cleanup at the Site.

Groundwater Regime
The principal aquifer system in the Irvine Groundwater Management Zone is divided into three water-bearing zones. Localized semi-perched zones occur within the recent alluvial deposits to the depth of approximately 50 feet. According to historical boring logs, the upper 20 feet in the subsurface consists of silt, with some sand and clay. At approximately 20 feet below ground surface (bgs), the soil becomes saturated, and consists of interbedded sand, silty sand, and silt, to the depth of approximately 33 feet. The semi-perched water-bearing zone is confined, according to the water levels measured in the existing wells, which reflect the potentiometric surface. The average elevation of the potentiometric surface in the monitoring wells is

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1 Phase I Environmental Site Assessment for 17502, 17548, and 17572 Armstrong Avenue, Irvine; November 21, 2008
approximately 25.8 feet above mean sea level (ft amsl). The regional groundwater flow direction in the Site area is generally toward the southwest; however, historical groundwater monitoring data compiled in 2009 by Geosyntec Consultants, Inc. (Geosyntec) indicate that the groundwater flow direction in the vicinity of monitoring wells MW-1 through MW-4 was likely toward the southeast.

Historical maps of the former Baxter Bentley facility indicate that two above ground Freon tanks, two vapor degreasers, an injection molding overflow sump (sump), one underground storage tank (UST), and a hazardous waste storage area were present at the Site when it was in operation. The UST had been used for gasoline storage, and was removed in the late 1980s. The UST cleanup was completed, and the UST case was closed by Regional Board staff in April 1994. A limited soil investigation and removal of the sump was performed in early 1992. In August 1994, additional soil investigation was conducted in the vicinity of the sump. In 1995, after discovery of soil contaminated with volatile organic compounds (VOCs), approximately 700 cubic yards of soil was excavated at the sump area and in its close proximity.

Based on the results from the initial groundwater investigation at the Site in August 1994, Baxter’s environmental consultant, McLaren Hart, Inc. (McLaren Hart), installed four groundwater monitoring wells (MW-1 through MW-4) at the Site, and initiated a quarterly groundwater monitoring program. Freon-113 was detected in groundwater samples at concentrations ranging from 220 µg/L in MW-3 to 20,000 µg/L in MW-2 during the May 1995 groundwater monitoring event. Based on the data from the September 1995 groundwater investigation, McLaren Hart installed four additional groundwater monitoring wells (MW-5 through MW-8) at the Site and added the wells to the quarterly monitoring program. Freon-113 was detected in groundwater samples collected from all the newly installed monitoring wells, at concentrations ranging from 970 µg/L in MW-8 to 11,000 µg/L in MW-6, during June 1996 groundwater monitoring event.

In June 1999, McLaren Hart installed MW-9 southwest of the Site, to assist in defining the southwesterly extent of Freon-113 in the groundwater. Freon-113 was detected in MW-9 (290 µg/L). Additional contaminants of potential concern (COPCs), such as tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1-dichloroethylene (DCE), trichlorofluoromethane (Freon-11), and 1,4-dioxane, have historically been detected in groundwater samples from MW-1 through MW-9; however, Freon-113 is the main contaminant of concern at the Site.

Upon approval by Regional Board staff, McLaren Hart installed a groundwater treatment system at the Site, which used air sparging and soil vapor extraction (AS/SVE) technology. The system operation commenced in June 2003 and continued for about 16 months, eventually shutting down in October 2005. Although the system operation resulted in the decrease in COPC concentrations in some of the monitoring wells, it was not capable to effectively reduce Freon-113 concentrations in all the monitoring wells at the Site. Groundwater monitoring was halted between 2005 and 2009. When monitoring resumed in September 2009 by Edwards environmental consultant, Geosyntec, Freon-113 concentrations in the groundwater had rebounded by an order of magnitude in wells MW-1, MW-4, and MW-6, compared with concentrations detected in September 2005. The highest concentration of Freon-113 (71,000 µg/L) was detected in the duplicate sample collected from MW-4, while the lowest concentration (190 µg/L) was detected at the most southwesterly monitoring well, MW-9. In general, historical groundwater monitoring results indicate significant (i.e. up to orders of magnitude) fluctuations in

Freon-113 concentrations in the Site's monitoring well network. These fluctuations tend to correlate with increases and decreases in groundwater elevation (further discussion is presented in the “Data Interpretation” section of this letter).

Based on the vertical characterization of the saturated zone beneath the Site, a competent clay layer underlies the interbedded sandy water-bearing zone, at approximately 45 feet bgs, thereby limiting the vertical extent of the VOCs in the groundwater. In March 2010, Regional Board staff reviewed the Site cross-sections and analytical data, and concurred that the on-Site vertical delineation of the VOC-impacted groundwater was sufficient3.

In 2010, Board staff requested a laboratory bench-scale treatability study to evaluate the potential remedial technologies for cleanup of the Freon-113 in groundwater. Between 2010 and 2011, samples from the Site’s monitoring wells were utilized in the study, which was conducted by SiREM laboratories, a subsidiary of Geosyntec. The extremely high concentrations of sulfate in the groundwater at the Site (maximum of 21,000 milligrams per liter [mg/L]) indicated that a pretreatment for removal of sulfate would be necessary prior to the application of any in-situ remedy at the Site. SiREM technical staff proposed using calcium acetate as an agent to reduce sulfate concentrations in the groundwater. Geosyntec implemented a pilot-scale remedy at the Site in winter of 2013, consisting of injection of zero valent iron (ZVI) in the form of two injection barriers, perpendicular to the groundwater flow direction. Well PMW-1 was installed upgradient of the second injection barrier, approximately 50 feet northeast of MW-4. Various degrees of reduction in both Freon-113 and sulfate concentrations have been observed in the Site’s monitoring well network as a result of the pilot-scale remedy. Concentrations of Freon-113 in MW-2 declined to non-detect (i.e. less than 10 µg/L), while the wells with the highest historical concentrations, MW-1 and MW-4, indicate orders of magnitude fluctuations in Freon-113 concentration.

**Former Smith International Corporation**

The former Smith International Corporation facility (Smith Tools) is located South of the Site, across the Orange County Flood Control Channel, at 17871 Von Karman Street in Irvine. Fourteen inactive petroleum underground storage tanks (UST) were removed from the Smith Tools site between 1985 and 1986 due to leaks. Chlorinated solvents, heavy metals, and low concentrations of petroleum hydrocarbons as gasoline were detected in the soil samples collected during the UST removals. A total of 22,250 tons of impacted soil was excavated from the former Smith Tools site. Between December 1991 and July 1994, a groundwater pump-and-treat system was installed, using six on-site extraction wells. The system extracted and treated groundwater with activated carbon, and the treated water was reinjected into the subsurface and/or discharged to the Orange County Flood Control Channel under a permit issued by the Regional Board. The pump-and-treat system extracted and remediated approximately 20 million gallons of contaminated groundwater between June 1997 and May 1998.

The UST portion of the former Smith Tools site was closed on January 29, 1999. Because, Freon-113 had been detected in wells at the Smith Tools site during the May 1998 groundwater monitoring event, Regional Board staff studied the history of industrial activities at the Smith Tools site, and concluded that there had been no source of Freon-113 at that site. The no further action (or “closure”) letter indicated that the source of Freon-113 and some chlorinated

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VOCs was most likely the Baxter Bentley Buildings 1 & 2, which are located across the Orange County Flood Control Channel and upgradient of the former Smith Tools facility. As such, the Regional Board closure letter requested that the monitoring wells at the Smith Tools site not be abandoned, so that they could be used for future monitoring of the Freon-113 in the groundwater.

At the request of Regional Board staff, on June 13, 2017, groundwater level monitoring was conducted and groundwater samples were collected from monitoring wells MW-1, MW-4, MW-5, MMW-229, SMW-230, MW-238, MW-239 prior to the initiation of well abandonment activities. Laboratory results indicated concentrations of Freon-113 ranging from below the detection limit of 5 µg/L in monitoring well MW-4 to 120 µg/L in MW-239. On August 30, 2017, monitoring wells MW-238, MW-4, and SMW-230 were re-sampled to confirm the June 13, 2017 sampling results. Laboratory results indicated concentrations of Freon-113 ranging from below the detection limit of 5 µg/L in monitoring well MW-4 to 480 µg/L in MW-238.

**Data Interpretation**

The concentrations of Freon-113 in monitoring wells on-Site at Baxter Bentley have fluctuated significantly since the implementation of the pilot-scale ZVI barrier walls in 2013. Freon-113 concentrations in monitoring wells MW-1 and MW-4, located near the contaminant source area, have varied by orders of magnitude. Freon-113 concentrations in the monitoring well network have fluctuated from 94 µg/L to 31,000 µg/L in MW-1, with a standard deviation of approximately 8,000 µg/L; and from 110 µg/L to 18,000 µg/L in MW-4, with a standard deviation of approximately 5,500 µg/L. The highest post-remedy detected Freon-113 concentrations in MW-1 and MW-4 (i.e. 31,000 and 18,000 µg/L, respectively) have been detected during the highest post-remedy groundwater level elevations of 27.57 and 27.1 ft amsl, respectively. The general trend of changes in Freon-113 concentrations in PMW-1 following application of the remedy correlates with fluctuations in groundwater level. Historical monitoring data indicated that rise or decline in groundwater elevation resulted in increase or decrease in Freon-113 concentrations, respectively. The standard deviation of changes in Freon-113 concentrations at PMW-1 is 2,500 µg/L.

Significant fluctuation in Freon-113 concentration indicates that the remaining source of Freon-113 in the vadose zone at the Site has not been addressed through previous remedial measures. Regional Board staff advised representatives of Edwards that a significant amount of Freon-113 was likely still present in the on-Site soil. Furthermore, it does not appear that a thorough assessment of the soil was ever conducted in the areas of the former ASTs (and associated piping), degreasers, or hazardous waste storage area. This data gap must be addressed in order to prevent further impacts to groundwater beneath the Site and the nearby off-Site areas, and to design appropriate remedial measure(s) that will effectively address the contamination.

CDM Smith Construction Engineering Company (CDM) served as the environmental consultant for Smith Tools in the 1990s to conduct the cleanup action that was completed at the Site. According to a CDM map, a portion of the Orange County Flood Control Channel that separated Baxter Bentley and Smith Tools sites used to run straight and in a southwesterly direction. The portion of the Channel directly south of the Baxter Bentley Buildings 1 & 2 was later diverted.

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toward west and the southwesterly portion that used to go through the western portion of the Site was backfilled. Typically for this type of backfill a clean fill consisting of silty, sandy and gravely soil is utilized, rather than concrete slurry, due to cost considerations. If so, the backfilled Channel could have functioned as a conduit for the Freon-113 plume from the Baxter Bentley source migrating beneath the Site. This is further substantiated by the CDM groundwater elevation map that shows the general groundwater flow direction near the Channel is also southwesterly and is readily superimposable on the former path of the backfilled portion of the Channel. CDM found no indication of application or existence of Freon-113 in Smith Tools operation: "A thorough review of the historical documents compiled on the Smith Site, indicated that no Freon-related products have ever been used or stored at the Facility." [Page 5-12, 1998 Groundwater Monitoring Report].

Based on the observed trend for the groundwater data from MW-9 (the most downgradient well at the Site) and the information obtained from the CDM reports, the Freon-113 plume has most likely migrated beyond the western boundary of the Site in a southerly direction. Additionally, both the data from 1990s and 2017 investigations at the Smith Tools site indicate that migration of Freon-113 across the Orange County Flood Control Channel has occurred. Therefore, full lateral and vertical delineation of the Freon-113 plume southeast of the Site and across the Orange County Flood Control Channel, as well as implementation of any necessary and appropriate remedial measure(s), are warranted.

The Need for the Investigation

Based on the existence of known sources of contamination that have been identified at the Site, Regional Board staff concludes that Baxter Healthcare-Bentley Division has discharged, is discharging, or is suspected of having discharged or discharging Freon-113, which has impacted on- and off-Site groundwater. Therefore, Baxter, as the parent company to Baxter Healthcare-Bentley Division, Edwards as the successor to Baxter Healthcare-Bentley Division, and JS SJK, L.P. as the current property owner are considered to be RPs obligated to comply with this Order requiring investigation and remediation at and downgradient of the Site. The empirical data, along with Edwards’ failure to voluntarily submit a work plan to the Regional Board to conduct additional investigation in the on- and off-Site areas, necessitates this Investigative Order pursuant to section 13267(b)(1) of the California Water Code. This Order requires the recipients to provide reports detailing: a) the extent of remaining impacted soil and the magnitude of chemical impact in the vadose zone at the contaminant source area, causing significant fluctuations in Freon-113 concentrations in the groundwater; b) the full extent of Freon-113-impacted groundwater at the off-Site areas (i.e. southeast of the Site and across the Orange County Flood Control Channel); c) an evaluation of remediation alternatives (i.e. feasibility study); and d) a plan proposing the necessary and appropriate remedial action(s), if any.

Section 13267 of the California Water Code provides that the Regional Board may require any person who has discharged, discharges, or is suspected of having discharged or discharging waste that could affect the quality of water within its region, to furnish technical or monitoring reports. Section 13267 of the California Water Code also provides that the "burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports." The information in the reports will be used by Regional Board staff to evaluate the extent of removal of the source, the quality of groundwater, and the extent of Freon-113 impacts to groundwater as a result of the Discharger's operations. The
information will assist in determining the scope of further assessment and/or remediation work to ultimately clean up and/or abate the discharge to protect human health and water quality.

Baxter, as the operator at the time of discharge, Edwards as the successor to the liabilities of Baxter Healthcare-Bentley Division, and JS SJK L.P. as the current property owner, bear the liability for the environmental contamination at the Site. Therefore, the recipients of this Order are responsible for providing the required technical reports to Regional Board staff. Furthermore, the burden, including costs of the work plan, investigation implementation, and investigation reports bear a reasonable relationship to the need for these documents and the benefits to be obtained from them by the public, including the owners and tenants at the neighboring properties downgradient of the Site. If the Freon-113 impacted groundwater are not contained or remediated, the future costs associated with cleanup of impacts to the underlying municipal water supply would likely be significantly greater than the cost of investigation and cleanup of the off-Site shallow groundwater. JS SJK, L.P. as the current owner is responsible for providing access for the requested investigations and subsequent remediation.

Therefore, pursuant to Section 13267 of the California Water Code, it is hereby ordered that the recipients submit the following:

**Deadlines**

1) A work plan for on-Site soil investigation to define the area and magnitude (residual mass of chemical impact) in the vadose zone in the contaminant source area(s) must be submitted to Regional Board Staff no later than **October 29, 2018**. The work plan must reference and include the historical investigation and remedial actions (including excavation), and propose step-out sampling, using a high-resolution characterization approach for delineation of potential remaining contamination in the soil. The work plan must include a Gantt chart indicating the proposed schedule for the tasks to be completed. The work plan and schedule will be subject to the approval of the Regional Board’s Executive Officer.

2) A work plan for complete characterization of groundwater to assess the full lateral and vertical extent of Freon-113 in groundwater beneath the off-Site areas, southeast of the Site and across the Orange County Flood Control Channel, must be submitted to Regional Board staff no later than **October 29, 2018**. The work plan must include a Gantt chart indicating the proposed schedule for the tasks to be conducted, including drilling of boreholes, groundwater sampling, and reporting. The work plan and schedule will be subject to the approval of the Executive Office.

3) The investigation pursuant to the work plans must commence within **30 days** of the Executive Officer’s approval of the work plans.

4) For any future phase of the investigative work that is needed to complete this investigation, a report summarizing the work must be submitted to Board staff within **45 days** of completion of the field work. The report must include (at a minimum): a narrative explaining the results of the investigation; the borehole logs; well construction details (if any); groundwater elevation data; groundwater analytical results; and recommendations for the next phase of investigation. The reports will be subject to the Executive Officer’s approval.

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5 The Regional Board reserves the right to add additional responsible parties based on information that becomes available during the investigation. This includes, but is not limited to, the Trustee of the John R. Saunders Trust.
Failure to submit the work plans and technical reports to Regional Board staff by the requested dates may subject you to administrative civil liability in the amount of up to $1,000 per day, per report, pursuant to Section 13268(a) and (b) of the California Water Code. This is in addition to liability for any actions that caused or contributed to the discharges and which may be needed to remediate discharges.

Section 13267 of the California Water Code requires that reports are submitted under penalty of perjury. Every report must include a perjury statement:

"I, [NAME], certify under penalty of law that this document and all attachments were prepared by me, or under my direction or supervision, in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Recovery of Regional Board Expenses

California Water Code section 13365 addresses the billing process for the Regional Board to recover reasonable expenses for overseeing investigation of illegal discharges, contaminated properties, and other unregulated release that may adversely affect the State's waters. It is the Regional Board's intent to recover such costs for regulatory oversight work conducted in accordance with this Order.

Any person affected by this action of the Santa Ana Water Board may petition the State Water Board to review the action in accordance with section 13320 of the Water Code and CCR Title 23 section 2050. The petition must be received by the SWRCB (Office of Chief Counsel, P.O. Box 100, Sacramento, California 95812 within 30 days of the date of this Order. Copies of the law and regulations applicable to filing petitions will be provided upon request.

If you have any questions, please contact Mona Behrooz at (951) 782-3237, or by email: mehrnoosh.behrooz@waterboards.ca.gov, or you may contact Nick Amini, Chief of our Site Cleanup Section, at (951) 782-7958, or by email: nick.amini@waterboards.ca.gov.

Sincerely,

Hope A. Smythe
Executive Officer

cc list on the following page.
cc: Julie Macedo – SWRCB, Office of Enforcement (julie.macedo@waterboards.ca.gov)
Jay Wertheim – Edwards Lifesciences (jay_wertheim@edwards.com)
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