1.0 INTRODUCTION

The 2012 Five-Year Status Report and Monitoring Report summarizes the results of the groundwater monitoring and asphalt cap repair activities performed in the five-year period beginning Second Quarter of 2007 and ending First Quarter of 2012 at the FMC facility, located at 855 Parr Boulevard, Richmond, California (Site). The report also presents the findings of the perimeter fence inspection. The first Five-Year Report for the Site was submitted in December of 1997, the second Five-Year Report for the site was submitted in January of 2003, and the third Five-Year Report was submitted in June 2007.

The purpose of the 2012 Five-Year Status Report and Monitoring Report is to present the 2010 and 2007 annual monitoring results and demonstrate the effectiveness of the remedial actions implemented at the site.

1.1 BACKGROUND INFORMATION AND REGULATORY HISTORY

The FMC Richmond facility consists of a 20-acre area located in an industrial district in Richmond, California. The property is bounded by Union Pacific Railroad tracks to the West, industrial property to the North, Burlington Northern-Santa Fe Railroad tracks to the East, and Parr Boulevard to the South (Figure 1). A number of buildings and structures which house commercial businesses are located on the property. The FMC Richmond Facility operated as a pesticide formulation plant from 1946 to 1979. Routine plant operations resulted in impacts to soil and groundwater quality in various areas around the property.

In 1982, pursuant to a plan submitted to the Regional Water Quality Control Board (RWQCB) and Department of Health Services (DHS [now Department of Toxic Substances Control (DTSC)]) FMC excavated approximately 20,000 tons of impacted soil. The soil was disposed off-site in accordance with State and Federal regulations.

Sampling and analysis of soil following the 1982 removal action indicated that some impacts remained. FMC then conducted further investigations, performed a risk assessment, and completed a Feasibility Study. The results of these efforts were summarized in the Remedial Action Plan (RAP) that was submitted to DHS in 1989 and approved in 1990.

The remedial measures approved under the RAP consisted of the following:

1. Excavation and deposition on the Richmond site of impacted soils located off-site.
2. Grading of the soils and construction of an engineered asphalt cap over the areas of impacted soil on-site to minimize rainwater infiltration and to prevent human exposure to these soils.
3. Fencing the site.
4. Imposition of deed restrictions to limit future use of the site to industrial and commercial purposes, and to control future construction activities that would compromise the integrity of the cap.
5. Long-term groundwater monitoring.
6. Operation and maintenance with respect to the cap, fencing, and groundwater monitoring system.

DTSC documented the completion of these activities in the Certification of Remedial Action that was issued on May 28, 1992.

The Certification of Remedial Action issued for the Site on May 28, 1992 by the California Environmental Protection Agency, DTSC included requirements for ongoing groundwater monitoring and maintenance of the asphalt cap. The groundwater monitoring before the year 2004 was performed in accordance with the Long-Term Ground Water Monitoring Plan for the facility submitted to the DTSC in July 1991, and the Self-Monitoring Program approved by the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB) on May 20, 1992. Reporting requirements were modified in accordance with the November 5, 1996 letter from RWQCB, *Analytical Data in Self-Monitoring Reports*. Figure 2 shows all monitoring well locations on the Site. The Land Use Covenant to Restrict Use of Property was recorded with the Contra County Recorder's office on November 6, 1991. Inspection and maintenance of the asphalt cap was performed in accordance with the Cap Maintenance Plan submitted to DTSC in July 1991. The schedule of cap and perimeter fence inspection was adjusted from quarterly to annually pursuant to a DTSC letter dated August 6, 2004. Reporting requirements were modified in accordance with the November 5, 1996 letter from RWQCB, *Analytical Data in Self-Monitoring Reports*. The location of the asphalt cap can be found on Figure 3.

Quarterly monitoring of the groundwater and maintenance of the cap and perimeter fences began in the Fourth Quarter of 1992 and continued to the First Quarter of 2003. The schedule of groundwater sample collection was adjusted according to the DTSC letter dated June 12, 2003 and the Revised Groundwater Monitoring Plan (RGMP) issued October 2003. In the October 2003 Revised GMP, FMC proposed to decommission wells 2A, 7A, 9, 21, 22, and 23, upon receiving approval from the DTSC. The DTSC approved the Revised GMP in a letter dated January 12, 2004. Monitoring wells 2A, 7A, 9, 22, and 23 were abandoned on December 10, 2004, and monitoring well 21 was abandoned on May 4, 2005. Wells were decommissioned in accordance with permits issued by the Contra Costa County Environmental Health District (CCCEHD).

Groundwater monitoring was conducted annually from 2004 to 2007 in accordance with the RGMP approved by the DTSC by a letter dated January 12, 2004. The schedule of cap and perimeter fence inspection was adjusted from quarterly to annually according to the DTSC letter dated August 6, 2004. The Operation and Maintenance Agreement (Docket No. HSA-A 051-6-019) between FMC and DTSC was executed on August 14, 2006.

During the 2006 annual groundwater monitoring activities at the FMC Richmond Site, it was noticed that well 17 had been damaged. A well damage assessment was presented in the 2006 Annual Monitoring Report dated May 31, 2006. In a letter dated June 16, 2006, the DTSC requested that the existing well 17 be abandoned and a replacement well installed. Parsons conducted well installation in the vicinity of well 17 on October 18, 2006. The new well was designated "17R". Well 17 could not be located and therefore was not abandoned.

Site groundwater monitoring requirements were reduced to once every three years pursuant to a DTSC letter dated August 8, 2007 (DTSC, 2007). The next sampling event is scheduled for 2013.

2.0 GROUNDWATER ACTIVITIES AND CHEMICAL ANALYSES

Groundwater monitoring activities were performed in accordance with the DTSC letter dated August 8, 2007. Groundwater level measurements and samples are required every three years from wells 3A, 4A, 6A, 10A, 16A, 17R, 20, DW2, DW3, and DW4. It was noted that well 17 was damaged beyond repair during the 2006 annual sampling event. A new groundwater monitoring well, identified as 17R, was installed in the vicinity as a replacement for well 17 on October 23, 2006. Two groundwater sampling events have occurred during the five-year reporting and monitoring period: The first in May 2007 (Parsons, 2007), and the second in April 2010 (Parsons, 2010). The 2007 report also included a five-year review in which historical chemical concentration trends were evaluated. The April 2010 sampling analyses revealed similar historical trends as discussed further in Section 3.1.

2.1 WATER LEVEL MEASUREMENTS

Water levels are measured in site monitoring wells 3A, 4A, 6A, 10A, 16A, 17R, 20, DW2, DW3, and DW4 with an electronic water level meter. Well locations are shown on Figure 2. Water levels are used to calculate groundwater elevations for the shallow water-bearing zone (upper 30 feet below ground surface) and the lower water-bearing zone (below 30 feet below ground surface). Water level data is shown in Table 1.

Table 2 compares water elevation data from May 2007 and April 2010. April 2010 is the last time water levels and groundwater samples were taken. Figures 4 through 7 illustrate the groundwater elevations at the Richmond site in the shallow and lower water-bearing zones, respectively. Groundwater elevations in shallow zone wells have changed since the 2007 groundwater monitoring event, ranging from an increase of 0.81 feet at well 20 to an increase of 3.22 feet at well 3A. Groundwater elevations in the lower water-bearing zone decreased 2.77 feet at well DW4 and 1.47 feet at DW2 and increased 8.63 feet at well DW3. Groundwater elevations increased an average of 2.16 feet in shallow zone wells, while water elevations increased an average of 1.46 feet in the lower water-bearing zone. Water elevation data are shown in Tables 1 and 2, and on Figures 4 through 7. The historic data presented on Figure 8 suggests that the overall trend in groundwater levels is strongly correlated to precipitation.

2.2 GROUNDWATER SAMPLING

Groundwater samples are required triennially from shallow water-bearing zone wells 3A, 4A, 6A, 10A, 16A, 17, and 20. Triennial samples are also required from wells DW2, DW3, and DW4, which are screened in the lower water-bearing zone.

2.2.1 Well Purging

Water level data were recorded prior to sample collection and were used to determine the casing volumes and minimum purge volumes necessary for each well. Groundwater samples were collected from the required groundwater monitoring wells in April 2010. Each sampled well was purged a minimum of three casing volumes or until the well was dewatered by using a submersible pump. Where wells were dewatered, samples were collected following 80 percent recovery. Due to well 20's remote location, it had to be sampled using a portable bladder pump. Field personnel could not get the submersible pump along with required sampling equipment near its vicinity. Instead of using the standard three volume purge method at well 20, low-flow sampling procedures were used. Lab analyses revealed no detections at well 20, which is consistent with historical results. During the purging of all wells, including well 20, field measurements of pH, specific conductance, turbidity, and temperature were recorded to evaluate the physical and chemical characteristics of the groundwater prior to sampling. Stabilization of these parameters indicates the well is adequately purged and that the sampled water is representative of the formation groundwater. Sampling was conducted in accordance with industry standards. Sampling field forms documenting water quality parameters are included in Appendix B.

2.2.2 Sample Collection

Groundwater samples collected from wells 3A, 4A, 6A, 10A, 16A, 17R, 20, DW2, DW3, and DW4 were submitted to TestAmerica laboratory (TA), in Pleasanton, California, for chemical analysis. Samples were collected using a submersible pump or a portable bladder pump after groundwater readings had stabilized, or in the case of dewatered wells, until the wells had recharged to 80 percent of their previous volume. Collected samples were placed in chilled coolers, labeled, and delivered to the laboratory with proper Chain-of-Custody documentation.

Samples were analyzed for organochlorine pesticides and herbicides using EPA Methods 8081A and 8151A, respectively.

3.0 DATA EVALUATION

3.1 GROUNDWATER QUALITY EVALUATION

Consistent with previous sampling events, constituents of concern (COCs) were only detected in wells 3A and 16A. A summary of the analytical results is presented in Table 3. Concentrations of these constituents were comparable to those observed during previous monitoring events.

COCs in the site groundwater consist of organochlorine pesticides and herbicides. Groundwater samples collected in May 2007 were analyzed by Severn Trent Laboratories, Inc. (STL)(now TestAmerica Laboratories [TA]) and in April 2010 by TA using EPA Methods 8081 and 8151. No consistent detections of COCs at concentrations above the analytical laboratory's Practical Quantitation Limits (PQLs) have been observed in site groundwater monitoring wells, 4A, 6A, 10A, 17R, 20, DW2, DW3, and DW4 from 1992 to 2010. COCs were detected in wells 3A and 16A at concentrations above the PQLs during the 2010 sampling event.

Groundwater monitoring results are summarized as follows:

- Monitoring wells 3A and 16A remain the only monitoring wells with consistent, low-level detections of site COCs and multiple groundwater contaminant concentrations exceeding the screening levels over the past five years. The concentration of the pesticide Dinoseb exceeded the screening levels at DW-4 in 2007, but was not detected above the reporting limit in 2010.
- There have been no COC detections in wells 10A and 20 since the fourth quarter of 2002.
- Well 17R was installed in 2006 to replace well 17. Consistent with historical results, no COCs were detected in well 17R in the 2010 sampling event.
- Wells DW2, DW3, and DW4 are screened in the lower water-bearing zone. Well DW2 is located upgradient, DW3 is cross-gradient, and DW4 is downgradient (Figure 6). A 10-year history shows that detections have been rare and none of the detected analytes were repeated in subsequent sampling events. Table 6 contains historical concentrations from 2002 through 2012.

3.2 QUALITY ASSURANCE/QUALITY CONTROL MEASURES

Quality assurance/quality control (QA/QC) samples were collected to evaluate the field and laboratory procedures during the 2010 and 2007 sampling events. The Field QC involved the collection of one duplicate sample from Well 16A during both events. The duplicate analytical data are consistent with the primary analytical data.

Sampling personnel performed strict decontamination procedures after sampling each well to assure that all sampling equipment was clean and each sample was an accurate representation of the groundwater. After sampling, all tubing and equipment was thoroughly rinsed with Liquinox (or equivalent) and deionized (DI) water. The submersible pump was placed into a 55 gallon drum full of Liquinox (or equivalent) water and run for several minutes. It was then placed in another 55 gallon drum full of clean water and run for an additional several minutes. This procedure rinsed out the inside of the pump's tubing and assured preservation of sample quality.

Table 5 provides a summary of the laboratory analytical QA/QC. Laboratory QA/QC samples were prepared to determine whether internal laboratory QA/QC procedures were followed during routine operations. Laboratory QA/QC also consisted of analyzing method blanks, surrogate recoveries, and matrix spike and matrix spike duplicates (MS/MSD) for each analytical method requested.

The analyzing laboratory, TestAmerica, determined that the data from the 2007 and 2010 monitoring periods are acceptable. A detailed QA/QC discussion was provided as part of the annual monitoring reports submitted in 2007 and 2010. Analytical data and chain-of-custody documentation are kept on file and available for review upon request.

4.0 ANNUAL INSPECTION OF ASPHALT CAP AND PERIMETER FENCES

4.1 INTRODUCTION

Inspection and maintenance of the asphalt cap was performed in accordance with the Cap Maintenance Plan submitted to DTSC in July 1991. Quarterly monitoring of site groundwater and maintenance of the asphalt cap and perimeter fences began in the Fourth Quarter of 1992 and continued to the First Quarter of 2003. The schedule of cap and perimeter fence inspection was adjusted from quarterly to annually pursuant to a DTSC letter dated 6 August 2004. Reporting requirements were modified in accordance with the November 5, 1996 letter from RWQCB, *Analytical Data in Self-Monitoring Reports*.

In accordance with the Operation and Maintenance Agreement between Department of Toxic Substances Control (DTSC) and FMC Corporation (FMC), dated August 2006, and the Asphalt Cap Repair Completion Report dated July 2009, Parsons conducted quarterly visual inspection of the asphalt cap beginning in 2010 for signs of settlement, ponding of water, erosion, weathering, cracking, invasion by vegetation, and other signs of cap degradation. Due to natural swell and contraction of the soils underneath the cap and stresses from above-ground activities, the asphalt cap bears regular wear and tear that causes cracking.

4.2 INSPECTION

First quarter 2012 cap and perimeter inspection was performed by Mr. Darren Graffuis of Parsons on March 7, 2012. Mr. Darren Graffuis and Mr. Parker Wills of Parsons conducted the second quarter cap and perimeter inspection on May 15, 2012. The first two inspections of 2012 have found that the entire asphalt cap is generally in good condition. The inspections have confirmed that minor cracking continues to occur in the asphalt cap and crack sealant repairs will be needed in the fourth quarter of 2012. Similar diagnosis occurred in 2011 and 2010. The cracking was more severe in 2009 and therefore Parsons and FMC worked to repave sections of the cap that were damaged beyond minor repairs.

From 2010 to 2011, quarterly cap inspections were performed with the aid of a GPS unit in order to precisely record crack locations so they could be sealed. The asphalt cap was divided into 9 zones to assist locating and tracking repairs. The GPS unit has been found to be inaccurate near the train

tracks running north-south on both sides of the Site and near tall buildings. Therefore, beginning in 2012 Parsons now estimates the crack locations on Site map printouts and uses measuring tools to precisely measure the linear lengths of existing cracks.

From 2007 to 2009, Parsons inspected the cap annually pursuant to the DTSC. After sections of the asphalt cap were repaved in late 2009, Parsons and FMC decided to perform quarterly cap inspections again to maintain the integrity of the cap, After the Operation and Maintenance Agreement between DTSC and FMC, dated August 2006, and the Asphalt Cap Repair Completion Report dated July 2009.

Inspection of the perimeter fence confirmed the fences are intact and there was minimal to no vegetation encroachment on the cap. Parsons schedules annual vegetation removal to thwart encroachment around the outer perimeter of the fence line for safety, to protect the cap, and accessibility. The 2012 vegetation removal is scheduled to take place at the end of May 2012. Parsons will continue to conduct quarterly inspection of the asphalt cap and perimeter fence at the FMC Richmond site. Additional asphalt cap repair activities will be proposed when such activities are warranted based on cap inspections.

4.3 EFFECTIVENESS OF REMEDIAL ACTIONS

As stated in the text of the SMP, the purpose of the self-monitoring program is: *"...to detect any migration of the waste or polluted groundwater, and to enable FMC to remove the waste, to remove or control the polluted groundwater and/or control groundwater movement in order to provide a safeguard against movement toward the deeper water bearing zone and/or off the area enclosed by Wells 4A, 22, 23, 2A and the boundaries of FMC property at 855 Parr Boulevard in Richmond. Inspection is needed to prevent the extraction of groundwater from the above described area unless it is a part of the groundwater cleanup operation. Inspection of the surface seal over the polluted soil on FMC property is also required so that needed surface seal maintenance can be identified and completed before any water percolates through cracks or openings in the seal and reaches the polluted soil."*

Ongoing remedial measures for the site include operation and maintenance of the cap, perimeter fences, and groundwater monitoring system, limiting the use of the site and controlling construction activities.

4.3.1 Engineering and Institutional Controls

FMC has instituted a number of controls for the site including maintenance of the engineered cap and the perimeter fence and deed restrictions, which prohibit the extraction of groundwater and prescribe the methods for handling of soil at the site. Deed restrictions include:

- Development of the Property shall be restricted to commercial or industrial use.
- No residence for human habitation shall be permitted on the Property.
- No hospitals shall be permitted on the Property.
- No schools for persons under 18 years of age shall be permitted on the Property.
- No day care centers for children shall be permitted on the Property.
- Any contaminated soil brought to the surface by excavation, that may occur on the Property, shall be managed as hazardous waste unless shown otherwise by sampling and analysis.
- Any proposed alteration of the asphalt cap shall require written approval by the Department.
- The asphalt cap shall be inspected and maintained in accordance with the maintenance plan approved by the Department.
- The Department and/or the San Francisco Bay Regional Water Quality Control Board (RWQCB) shall have access to the Property for the purposes of inspection, surveillance, or monitoring, as provided for in Chapters 6.5 and 6.8 of Division 20 of the Health and Safety Code and Chapter 4 of Division 7 of the Water Code.
- Uses and development of the Property shall preserve the integrity of the cap and of the groundwater monitoring system installed on the Property pursuant to the requirements of the RWQCB.

4.3.2 Surface Seal Inspection

Surface seal inspections were performed on a quarterly basis prior to 2004. FMC requested a reduction in frequency of required cap and perimeter fence inspections from quarterly to annually in

the First Quarter 2004 Cap Inspection Report submitted to the DTSC on April 26, 2004. The request was approved by DTSC in a letter dated August 6, 2004. Currently, the cap will be inspected on a quarterly basis. Quarterly inspections reveal that minor cracking continues to occur in the asphalt cap and crack sealing will be conducted in the fourth quarter of 2012.

4.3.3 Perimeter Fence Inspection

The perimeter fence has been maintained in good, secure condition. Perimeter fence inspections revealed minimal vegetation encroachment. Vegetation removal is scheduled for the end of May 2012 and will be reported in the corresponding annual report.

No major vegetation encroachments have occurred at the Richmond site from 2007 to 2012. Parsons has conducted annual vegetation removals in late spring to mitigate any potential problems.

5.0 CONDITION OF ASPHALT CAP

As part of the operation and maintenance of the asphalt cap, the condition of the cap was assessed (Section 4.2). Based on the results of these inspections, repairs were made to the asphalt when deemed necessary. Approximately 125,930 square feet and 20,338 linear feet of repairs have been performed from 2002 through 2011.

Repairs were conducted in 2011 in consistency with the repair methods described in the Revised Asphalt Cap Repair Work Plan submitted on September 5, 2008 (Parsons, 2008b), approved by DTSC in a letter dated October 1, 2008.

Due to natural swell and contraction of the soils underneath the cap and stresses from above-ground activities, the asphalt cap bears regular wear and tear that causes cracking. Parsons will continue to document needed repair items during quarterly asphalt cap inspections. Repairs will continue to be scheduled during the fourth quarter of each year, unless immediate action is deemed necessary. Parsons will also continue to ensure no destructive activities take place on the asphalt cap to safeguard its impermeability.

6.0 SUMMARY

The results of the 2010 and 2007 triennial groundwater monitoring events indicate that groundwater quality beneath the site is generally stable to improving. Detections of site-related COCs were only observed in monitoring wells 3A and 16A, and are consistent with historical sampling results. In 2007 Dinoseb was observed in deep zone, off-site well DW-4, and was the only COC observed in a deep zone groundwater monitoring well. It was also the only COC observed in off-site groundwater monitoring wells. No COCs were observed in off-site groundwater monitoring wells or deep zone groundwater monitoring wells in 2010.

The results of the 2012 annual cap inspection indicate that the asphalt cap and perimeter fence are in good working condition, subsequent to the cap repairs implemented in December 2011. Normal cracking continues based on findings in the first and second quarter asphalt cap inspections by Parsons field personnel. Regular crack repairs using crack sealant will be scheduled during the fourth quarter of 2012. As presented in the *Asphalt Cap Repair Completion Report* (Parsons, 2011), FMC will conduct quarterly cap inspections to verify the effectiveness of the remedial actions implemented at the Site and to maintain the impermeability of the cap.

Overall, the results of the groundwater monitoring and cap inspection activities indicate that the existing remedial action for the site continue to be appropriate and effective.