Weiss Associates *Environmental Science, Engineering, and Management*

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December 28, 2015

Mr. Max Shahbazian
Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, California 94612

RE: Response to Comments
Draft Groundwater Focused Feasibility Study
Former Fairchild Semiconductor Facility
101 Bernal Road, San Jose, California
RWQCB File No. 43S0036 (MS)
Weiss Job No. 363-2016.08

Dear Mr. Shahbazian:

On behalf of Schlumberger Technology Corporation (STC), Weiss Associates (Weiss) has prepared responses to the United States Environmental Protection Agency's (USEPA) comments on the Draft Groundwater Focused Feasibility Study (FFS) for the site referenced above. On September 17, 2015, the Regional Water Quality Control Board (Water Board) forwarded comments from the USEPA to Weiss and requested that STC revise the FFS accordingly. Table 1 presents the USEPA's comments and our responses. Table 2 compares the estimated costs for each alternative as presented in the Draft FFS with estimated costs for Alternative 3 under the different assumptions posed in the USEPA's comments. Detailed information to support the cost estimates is included in Attachment A.

After careful review of the USEPA's comments, Weiss recommends finalizing the FFS with no changes except with updated site data collected since the draft was submitted. Because the FFS demonstrates that Alternative 2—Long Term Groundwater Monitoring, Slurry Wall and Institutional Controls—is the most suitable option for the site, we recommend this alternative for the final site cleanup requirements order. Unless directed otherwise by the Water Board, Weiss will submit a draft final FFS, ready for public review, within 60 days of the date of this letter.

Weiss Associates' work at the Schlumberger Technology Corporation Former Fairchild Semiconductor Facility in San Jose, California, was conducted under my supervision. To the best of my knowledge, the data contained herein is true and accurate, based on what can be reasonably understood as a result of this project while satisfying the scope of work prescribed by the client for this project. The data, findings, recommendations, specifications, and/or professional opinions were prepared solely for the use of the Schlumberger Technology Corporation in accordance with generally accepted professional engineering and geologic practice. We make no other warranty, either expressed or implied, and are not responsible for the interpretation by others of the contents herein.

Please feel free to contact me at tjf@weiss.com or (510) 450-6143 if you have any questions or comments.

Sincerely,
Weiss Associates

Thomas Fojut, PE, PG, CHg
Principal Engineer

Attachments: Tables 1 and 2
Attachment A – Detailed Cost Information

cc: Melanie Morash, United States Environmental Protection Agency
Virgilio Cocianni, Schlumberger Technology Corporation

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TABLES

Table 1. Response to Comments by the United States Environmental Protection Agency on the Draft Groundwater Focused Feasibility Study, Former Fairchild Facility, 101 Bernal Road, San Jose, California

No.	FFS Section No.	Comment	Response
1	6	Alternative 1 proposes that the slurry wall would remain in its current state with no ongoing maintenance or monitoring, no groundwater monitoring would occur, and removing Institutional Controls (ICs) (groundwater use) in the form of current deed restrictions for the Site. Alternative 2 proposes long term groundwater monitoring in conjunction with the continued use of existing slurry wall (no maintenance is noted in the FFS), and maintain the existing groundwater use ICs in place. Unlike Engineering Controls which may have an impact on cleanup timeframes, keeping or removing ICs will have no effect on the speed of cleanup at a site. Rather ICs are simply administrative and legal controls to minimize the potential for human exposure to contamination and/or protect the integrity of the remedy. Whether groundwater monitoring is conducted or not natural attenuation will occur at the same rate in Alternative 1 and 2.	Agreed.
2	6.3.5 & 6.4.5	In the Development of Remedial Alternatives section of the FFS, the FFS states that the MCL for 1,1-DCE under Alternatives 1 and 2 will be met in over 350 years. Additionally, the FFS in this section notes that Alternatives 3 and 4 which employ more “aggressive” treatment technologies (i.e. In-Situ Chemical Oxidation (ISCO) and groundwater extraction and treatment respectively) would result in a similar cleanup time of 350 years. It seems unlikely that a passive remediation technology such as natural attenuation proposed in Alternatives 1 and 2 would result in meeting cleanup target levels in the same timeframe as Alternative 3 and 4 using an active remediation approach. Rather, the FFS should note that groundwater cleanup target levels for the contaminants of concern may be met much faster using either Alternatives 3 or 4.	Alternatives 3 (i.e., ISCO) and 4 (i.e., pump and treat) would not significantly reduce the cleanup time because these technologies would target dissolved VOCs in the permeable portion of the B Zone, not the adsorbed VOCs in the fine-grained soil of the adjacent aquitards. If either alternative was implemented, the VOCs in the aquitards would desorb into the permeable soil of the B Zone at a rate significantly slower than the treatment rate of Alternative 3 or the pumping rate of Alternative 4. In other words, the rate of mass desorption is the controlling factor of the overall cleanup time. Although the more aggressive treatment technologies would treat the dissolved VOCs faster, the mass desorption would not increase substantially. Therefore, the overall cleanup time for each alternative is estimated to be a minimum of 350 years, even with multiple treatment events or continuous pumping. For cost estimating purposes in the Draft FFS, a 100-year project life was used for Alternatives 3 and 4.

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No.	FFS Section No.	Comment	Response
3	7	In the Detailed Analysis of Alternatives section of the FFS, Alternative 1 would incur no associated costs, Alternative 2 would assume a total cost of $4.4 million (100 years), Alternative 3 would assume a total cost of $23.1 million (no timeframe noted on Page 40), and Alternative 4 would assume a total cost of $13.9 million (100 years). Alternative 1 can be ruled out completely as a remedial option as it would exacerbate human health by proposing the lifting of institutional controls already placed on the subject facility and no verification mechanism is provided.	Agreed.
4	7.4.7	As for Alternative 3 under Section 7.4.7 Costs, the persulfate injection events would occur every five years or 20 injection events in 100 years. Alternative 3 overall costs seems inflated given a duration of 100 years is utilized. Using a more aggressive approach persulfate injections every five years with a shorter duration (25-30 years) would reduce the costs dramatically while effectively reducing the Contaminants of Concern (COC) levels than simply using passive remediation (i.e. MNA). Once COC levels have reduced, MNA then could then be implemented if COC remains above their respective cleanup target levels.	Under these modified assumptions, Alternative 3 remains the costliest of the four alternatives. The estimated cost, based on a 5-year injection interval for 30 years, is $16 million. Table 2 compares costs for the different injection durations and the other alternatives. Changing the assumptions of the alternative as suggested in the comment would not achieve cleanup goals more effectively. As described in the response to Comment 2, the rate of mass desorption from fine-grained soil is the controlling factor for the cleanup.

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5	Appendix E	A careful review of Table E-4 in the FFS shows Activator and other associated costs which could possibly be reduced considerably or possibly eliminated entirely if another vendor such as Regenesis was used. For example, Regenesis has a patented technology PersulfOX which according to their literature eliminates complex and potentially hazardous chemical addition required to achieve traditional persulfate activation. Additionally, Regenesis does provide a complimentary consultation, design, and cost estimate (http://www.regenesis.com/ regenesis-resource-center/site-evaluationforms/). Given that this service is complimentary, it may be in good order to have another vendor provide their remedial site evaluation of the subject site. Thus providing a reduced cost estimate since their patented technology doesn't require a separate activator and/or other associated costs as highlighted in Table E-4. The site conditions including the subsurface geology appears to favor an ISCO remedial strategy.	PersulfOx, a product patented by Regenesis, was not commercially available when the Draft FFS was submitted. Weiss recently contacted Regenesis for a consultation regarding injecting PersulfOx instead of the activated persulfate assumed in Alternative 3 of the Draft FFS. Based on Regenesis' input for this site, a cost estimate for PersulfOx injection is presented in Attachment A. Although Regenesis' patented product eliminates the need for on-site mixing of persulfate with an activator, their estimated injection cost of PersulfOx is higher than the previously estimated injection costs of persulfate. These site-specific conditions make ISCO an unfavorable remedial option: • Most of the residual COCs are adsorbed to fine-grained soil units and aquitards adjacent to the permeable portions of the A and B Zones. The injectant cannot effectively permeate into the fine-grained soil units to react with the COCs. • Because there is no discernable groundwater flow gradient inside the slurry wall, ISCO cannot rely on advection to disperse the injectant. Thus, the alternative requires a very dense grid of injection points to distribute the injectant throughout the treatment zone. • The treatment area extends over a significant depth zone, from approximately 65 to 100 feet below ground surface (bgs). Effective treatment over this long interval requires injecting very large volumes of injectant. • Injecting amendment into this significantly deep zone of 65 to 100 feet bgs is challenging; surfacing or daylighting of material due to high injection pressures is not uncommon when injecting at these depths.

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No.	FFS Section No.	Comment	Response
6	7.5	Alternative 4 (groundwater extraction and treatment) would require as the FFS states "a significant overhaul" to the groundwater extraction system since it has not been used for over 13 years. Although, contaminant levels would appear to reduce using Alternative 4 as opposed to solely using MNA (Alternative 2) as an remedial option; we wouldn't see any short term contaminant reduction level benefits, rather a considerable downtime would most likely occur given the significant upfront planned and often times unplanned capital costs required in order to get the dormant system up and running efficiently and effectively. As noted in the FFS, new construction could compromise access thus limiting future monitoring activities.	Agreed.
7	6, 7, 8 & Appendix E	Although the FFS proposes Alternative 2 as the recommended remedial option, it is in my opinion that prior to the implement-tation of Alternative 2 that Alternative 3 should be reevaluated and modified using a shorter treatment duration (25-30 years) instead of 100 years with an option to pursue MNA and/or Alternative 2 once the COC have achieved applicable MNA guidance concentrations. Additionally, selection of a remedial vendor who can provide persulfate direct push injections without costly separate activator costs and/or other unnecessary direct costs as noted earlier would also be in order, which may in turn show that Alternative 3 as a more viable remedial remedy option than the FFS preferred Alternative 2 option.	The responses to Comments 2, 4, and 5 include the requested evaluation. Based upon these responses, Weiss recommends no substantive changes to the Draft FFS. As a result, Alternative 2 remains the most optimal alternative.

Abbreviations:

1,1-DCE – 1,1-dichloroethene
bgs – below ground surface
COC – contaminant of concern
FFS – Focused Feasibility Study
IC – institutional controls
ISCO – *In Situ* Chemical Oxidation
MCL – maximum contaminant level
MNA – monitored natural attenuation
VOC – volatile organic compound

Table 2. Alternative Costs for the Focused Feasibility Study, Former Fairchild Facility, 101 Bernal Road, San Jose, California

Alternative	Assumptions	Total	No Further Action	Institutional Controls	Groundwater Monitoring	*In Situ* Treatment	Groundwater Pump & Treat	Review Reports
1	as presented in Draft FFS	$0	$0	---	---	---	---	---
2	as presented in Draft FFS	$4,360,000	---	$509,000	$3,564,000	---	---	$287,000
3	as presented in Draft FFS	$23,120,000	---	$509,000	$3,564,000	$18,760,000	---	$287,000
3	as presented in Draft FFS, except with injection interval of 5 years for duration of 30 years	$15,797,000	---	$509,000	$3,564,000	$11,437,000	---	$287,000
3	as presented in Draft FFS, except with injection of PersulfOx instead of mixed persulfate with activator	$30,786,000	---	$509,000	$3,564,000	$26,426,000	---	$287,000
4	as presented in Draft FFS	$13,871,000	---	$509,000	$3,564,000	---	$9,511,000	$287,000

Abbreviations:

--- - not applicable

FFS - Focused Feasibility Study

Weiss Associates

ATTACHMENT A

DETAILED COST INFORMATION

Table A-1. In-Situ Chemical Treatment Cost using PersulfOx, Focused Feasibility Study, Former Fairchild Facility, 101 Bernal Road, San Jose, California

Task	Quantity	Unit Cost	Unit	Total Cost	Data Source
DIRECT CAPITAL COSTS [1]					
Round 1 PersulfOx	1,200,000	$ 1.75	pound	$ 2,100,000	A
Round 1 Material Shipping	1,200,000	$ 0.10	pound	$ 120,000	A
Round 1 Injection Well Installation (hollow-stem auger)	30	$ 8,500	location	$ 255,000	A
Round 1 PersulfOx Injection	40	$ 5,000	day	$ 200,000	B
Performance Monitoring	2	$ 9,469	event	$ 18,938	C
Direct Capital Costs				$ 2,693,938	
Contingency	10%			$ 269,394	
Direct Capital Costs Subtotal				$ 2,963,332	
INDIRECT CAPITAL COSTS [1]					
Engineering and Design	10%			$ 296,333	
Project Management	10%			$ 296,333	
Indirect Capital Costs Subtotal				$ 592,666	
Capital Costs Subtotal [2]				**$ 3,556,000**	
PERIODIC COSTS [1, 3]					
Performance Monitoring	1	$ 9,469	event	$ 9,469	C
Periodic Variable Costs				$ 9,469	
Contingency	10%			$ 947	
Project Management	5%			$ 473	
Technical Support	10%			$ 947	
Periodic Variable Costs Subtotal				$ 11,836	
Present Worth of Variable Periodic Cost Subtotal [2]				$106,000	
PersulfOx	1,200,000	$ 1.75	pound	$ 2,100,000	A
Material Shipping	1,200,000	$ 0.10	pound	$ 120,000	A
PersulfOx Injection	40	$ 5,000	day	$ 200,000	A
Periodic Five-Year Costs				$ 2,420,000	
Contingency	10%			$ 242,000	
Project Management	5%			$ 121,000	
Technical Support	10%			$ 242,000	
Periodic Five-Year Costs Subtotal				$ 3,025,000	
Present Worth of Five-year Periodic Costs Subtotal [2]				$22,764,000	
Periodic Costs Subtotal [2]				**$22,870,000**	
TOTAL				**$ 26,426,000**	

Notes

1) PersulfOx injection costs and two monitoring costs occur in Year 0. Periodic variable costs are for monitoring and management in Years 1-9 only. PersulfOx injection costs occur every 5 years to 100 years.

2) Subtotals are rounded to the nearest $1,000.

3) Performance monitoring twice in Year 5 (Year 0 monitoring covered under capital costs); annual performance monitoring Years 1, 2, 3, 4, 6, 7, 8 & 9

Table A-1. In-Situ Chemical Treatment Cost using PersulfOx, Focused Feasibility Study, Former Fairchild Facility, 101 Bernal Road, San Jose, California

Task	Quantity	Unit Cost	Unit	Total Cost	Data Source

Assumptions

1) Treatment area: 100 ft x 300 ft
2) Saturated thickness requiring treatment: 35 ft (extending from 65-100 ft bgs)
3) No regulatory oversight costs
4) 100-year project duration.
5) Discount rate of 2.3% from United States Office of Management and Budget, Circular No. A-94. Appendix C, Revised December 2010.
6) Discount, labor, and material rates used above are the same as used in the Draft FFS.

Data Source

A	Vendor quote
B	Weiss Associates estimate
C	Contract laboratory rates and sampling estimate