ATTACHMENT 15: Contingency Planning Example Exercise

Site Remediation Contingency Evaluation Form

Site Name: Site X

Project Name: 123.4567.89

#	Uncertainty/Contingency Category [1]	Contingency Statement		Status	Probability (%)	Impact ($)	Exposure ($)	Schedule Impact	Mitigation	Measurements
		Condition	Consequence							
Unique ID		Capture the "likely cause" of the contingency. Be detailed enough so that you can start forming mitigation plans.	Capture the result of the contingency, should it happen. If the consequences cannot be mitigated, you will have to deal with them in a contingency plan.	Active, retired, no concern	Estimate of the probability the contingency will occur.	Estimate of the amount of impact or severity of the contingency.	Probability x impact in $. Sort by this column to prioritize biggest $ impacts.	Estimate of the amount of time delay/extension that could be caused by the contingency.	Document plans to lower the probability or to lower the impact ahead of time. It may require a more detailed plan written up separately.	Describe what measurements and at what frequency they will be taken to monitor for the occurrence of the contingency
High Priority (high cost and/or high probability occurrence)										
H1	Persulfate ineffective at treating chlorobenzene (i.e., the COC) in fine grained sediment within the glacial till. Contaminant rebound occurs.	Oxidant and/or activator (ferrous sulfate) may not sufficiently make contact with contaminants in fine-grained sediment to reduce contaminant concentrations within it	Mass flux will not change, pre- and post-treatment COC concentrations in bulk aquifer will be similar. An additional oxidant injection event will be needed to achieve treatment goals.	Active	70%	$141,000	$98,700	Up to 3 years	Using direct-injection into zones containing fine-grained sediment to maximize distribution into it.	Weekly ORP and Monthly COCs from wells partially screened within and adjacent to the fine-grained sediment zones.
H2	Injection well delivery ineffectiveness	Lithologic heterogeneity may restrict injection rates of persulfate	Injection will fail and activated persulfate will not be adequately delivered and distributed into the aquifer	Active	60%	$75,000	$45,000	Up to 1 year	Performed on-site pilot tests as a basis for injection rates and oxidant delivery quantities.	Hourly injection flow rates and totalizer readings. Water level monitoring from surrounding monitoring wells to asess well efficiency and surrounding aquifer hydraulics.
H3	Short longevity of activated persulfate in aquifer and need for periodic reinjections to achieve goals	A high reduced mineral content and/or natural oxidant demand will shorten oxidation reaction time and limit treatment efficiency	Additional activated persulfate injections would be required	Active	40%	$141,000	$56,400	Up to 3 years	Performed on-site pilot tests and observed oxidation reaction kinetics for use as a basis for design.	Daily ORP and oxidant concentration upgradient (untreated) and within the treatment zone.
Moderate Priority (low cost and/or low probability occurrence)										
M1	Insufficient naturally occurring iron for activation	Iron (Fe^{2+}) content of the aquifer sediments is insufficient to activate the persulfate oxidation reaction	Persulfate reaction will not efficiently treat the COCs	Active	20%	$20,000	$4,000	Up to 1 year	Performed on-site pilot tests to estimate design dose of supplemental ferrous iron additive	Daily ORP and Fe^{2+} measurements during injection

Notes:

1. Consider Uncertainty/Contingency Categories of Performance, Schedule, PM Experience, Client, Scope, Resources, Budget, Technology, Endorsement, and Contract.

#	Contingency	Triggers	Assignee
Unique ID	Identify what would have to be done if the contingency were to become reality. This may require a more detailed plan documented separately.	Identify what would prompt the execution of the contingency plan.	Identify who is responsible for tracking this contingency and its changes in probability and impact. The assignee is not necessarily the person responsible for solving the problem, as contingencies often require escalation outside the team.
High P			
H1	(A) Perform an additional injection event and focus efforts on the low permeability media, (B) Reconsider ISCO using iron-activated persulfate treatment technology. (C) Consider other technologies including impracticability of active and reliance on MNA for longer timeframe.	Rebound equal to baseline COC concentrations.	
H2	Assess well efficiency vs formation limitation causes. (A) If well efficiency, then optimize injection well design, perform O&M to improve injection well performance. (B) If formation limitations, then abandon well injection and pursue direct injection approach.	(1) Injection flow rate <50% of design, (2) no observable effect on redox state, and (3) poor ROI <80% of design.	
H3	(A) Conduct activated persulfate reinjection (B) Discontinue ISCO if treatment progress was not made.	(1) ORP and oxidant concentration returning to baseline conditions within 2 days, and (2) COC concentrations increasing	
Modera			
M1	(A) Increase dose of ferrous sulfate or (B) change over to a different activation method to more effectively treat the COCs	Fe^{2+} concentration < 1,000 mg/L	

Notes:

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Site Remediation Schedule Impact Assessment
Site Name:

Site x

Project Name:
123.4567.89

Site	Milestone	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Comments
Site X	Infrastructure Construction	■																					
	Activated Persulfate Injection Event		■	■	■	■	■																
	Remedy in Place (DoD milestone)		■																				
	Hourly/Daily Delivery Performance Monitoring		■	■	■	■	■																
	Weekly Treatment Performance Monitoring		■	■	■	■	■																
	Monthly Treatment Performance Monitoring		■	■	■	■	■																
	Quarterly COC Long Term Monitoring (LTM)		■	■	■	■	■	■															
	Active Treatment Goals Achieved				■	■		■															

■ Baseline schedule expectation
■ Moderate-level schedule deviation should a couple high probability contingencies occur
■ Highest-level schedule deviation should all high and moderate probability contingencies occur

Site Remediation Life Cycle Cost Contingency Impact Estimate

Site Name: Site X

Project Name: 123.4567.89

Procedure:

Input the projected project costs (Current Estimated Annual Cost) by year for the site as specified in the existing administrative records. Using the Contingency Evaluation sheet, input the applicable contingency number(s) and best/worst case contingency cost estimates. The spreadsheet will use the current budget and contingency to calculate a best and worst case annual cost and Estimate-to-Complete (ETC).

Year	Current Est. Annual Cost	Current Est. Cost Element Description	Contingency ID	Contingency Condition Description
2009	$218,169	Infrastructure construction	-	None
2010	$330,575	Two activated persulfate injections	H2, M1	H2 - Injection is delayed due to redesign/reinstallation effort M1 - Activator delivery design adjustment Perform only one injection and redesign/reinstallation.
2011	$141,064	One activated persulfate injection	H2, M1	M1 - Activator delivery design adjustment Perform two activated persulfate injections
2012	$78,151	Treatment cessation monitoring and infrastructure abandonment	H1, H3	H1 - Back diffusion from low permeability media necessitates additional injections H3 - Aquifer geochemistry limits persulfate reaction and necessitates additional injections Perform one activated persulfate injection and postpone treatment cessation effort
2013	$0	None	H1, H3	Perform one activated persulfate injection
2014	$0	None	H1, H3	Perform one activated persulfate injection
2015	$0	None	H1, H3	Additional injections postpones treatment cessation monitoring
2016				
2017				
2018				
2019				
2020				
2021				
2022				
2023				
2024				
2025				
2026				
2027				
2028				
2029				
	$767,959	Total Estimate-to-Complete		

Year	Contingency Cost		Estimate-to-Complete (ETC)		Notes
	Best Case	Worst Case	Best Case	Worst Case	
2009	$0	$0	$218,169	$218,169	
2010	$0	-$92,064	$330,575	$238,510	Worst Case Contingency Cost is negative because of the reduction to one injection event
2011	$0	$145,064	$141,064	$286,128	
2012	$0	$76,949	$78,151	$155,100	
2013	$0	$155,100	$0	$155,100	
2014	$0	$155,100	$0	$155,100	
2015	$0	$78,151	$0	$78,151	
2016			$0	$0	
2017			$0	$0	
2018			$0	$0	
2019			$0	$0	
2020			$0	$0	
2021			$0	$0	
2022			$0	$0	
2023			$0	$0	
2024			$0	$0	
2025			$0	$0	
2026			$0	$0	
2027			$0	$0	
2028			$0	$0	
2029			$0	$0	
			$767,959	**$1,286,259**	