



Tuesday, April 26, 2016

Stream 1A - Sustainability Indicators and Metrics

Location: Level 3, Salons 6&7

9:00 am – 9:20 am

Well 12A Case Study: Use of Green Remediation Contract Requirements and Reporting Practices During Excavation Activities

Maleena Lemiere, U.S. Army Corps of Engineers

The objective of the presentation is to provide an overview of the Well 12A case study which provides an example green remediation contract requirements and reporting practices and their adaptability to other projects.

Abstract

Green remediation (GR) contract requirements and reporting practices were developed and used to reduce the environmental footprint of soil excavation activities at Well 12A Superfund Site in Tacoma, Washington. Remediation contract requirements and reporting practices aligned with the U.S. Environmental Protection Agency (EPA) Region 10 Clean and Green Policy and included GR best management practices (e.g., cleaner fuel, minimizing idling and recycling waste materials), a GR plan, discussion of GR objectives during progress meetings, monthly GR progress updates, and a final GR report. To summarize and report project level GR efforts to EPA, the U.S. Army Corps of Engineers developed a template based on the Clean and Green Policy to track each GR action with its associated measure, cost impacts, environmental benefit, basis for consideration, and the justification for the decision not to implement some actions. Results included improved coordination among project team members, accountability for GR objectives, implementation of contractor-proposed GR actions, and documentation of implemented and considered actions which can be referenced for future use on the site.

Site background: Chlorinated volatile organic compounds and other contaminants discovered in the groundwater at the Well 12A site were linked to filter cake that was historically generated during oil recycling practices and used as fill material. A 2009 Record of Decision Amendment called for continuation of the existing groundwater extraction and treatment system and added excavation of filter cake and contaminated soil, in-situ thermal remediation, and enhanced anaerobic bioremediation to reduce the contaminant mass flux leaving the site. Based on the results of an environmental footprint analysis conducted for the selected remedial actions, the team concluded that the excavation activities provided the best opportunity for environmental footprint reduction and should therefore be the focus of GR efforts for the site.

9:30 am – 9:50 am

Comparing Sustainable Natural Source Zone Depletion to Active Remediation Technologies – A Surprising Conclusion

Liz van Warmerdam, CH2M HILL

The objective of the presentation is to provide a semi-quantitative comparison of environmental impacts of measured natural source zone depletion and engineered solutions for rates that fall within or exceed the range of mass removal rates when using active remediation.

Abstract

Environmentally-affected sites related to oil and gas activities are in need of cost-effective remediation solutions. Many technologies exist, but arguably the single most effective and sustainable approach is naturally occurring. After a subsurface release, the mass of petroleum hydrocarbon light non-aqueous phase liquid (LNAPL) is degraded by the intrinsic processes of volatilization, dissolution, and biodegradation. These collective processes have been termed natural source zone depletion (NSZD). Recent published literature indicates that NSZD is substantial and may contribute to LNAPL pool stability. Several methods are available to monitor NSZD rates, but the use of carbon dioxide (CO₂) efflux measurement (N.J.Sihota et. al., 2011 and K.McCoy et. al., 2014) is currently the most prevalent, providing accurate and repeatable results. Results of field measurements using these new methods generally confirm that NSZD rates are substantial and often exceed rates of active remediation systems, making NSZD a more sustainable option than other active remediation technologies.



This presentation will discuss NSZD rates within a practical context by comparing measured NSZD rates to mass removal rates achieved by other, more energy intensive active remediation technologies. The intent is to accurately quantify NSZD rates and demonstrate that the field measurements reasonably lie within, and often times exceed, engineered solutions, making it a more sustainable option.

NSZD rates from eight sites where CO₂ efflux monitoring was performed (including six sites in Canada) will be reported alongside data from an additional 50 active petroleum remediation sites. Remediation technologies used in the evaluation include LNAPL skimming, groundwater drawdown-enhanced skimming, bioventing/biosparging, soil vapour extraction, air sparging, and multiphase extraction.

The measured NSZD rates fell within, and sometimes exceeded, the range of active remediation mass removal rates and thus prove that the methods of CO₂ efflux monitoring are producing reasonable results, and providing further support for its use as an effective remediation technology.

Practical information will be presented that will allow the audience to evaluate the potential use of CO₂ efflux monitoring methods at their sites. Additionally, a semi-quantitative comparison of environmental impacts of NSZD and engineered solutions will also be presented.

10:30 am – 10:50 am

How To Follow-up Sustainability During Remediation and What We Have Learned From It

*Thomas De Romagnoli, Pieter Schrooten, Cécile Rao
ERM, Belgium*

The objective of the presentation will be to discuss what drives the CO₂ emissions during remediation based on the results of a sustainability follow-up on two large remediation projects.

Abstract

Including sustainability aspects in the appraisal of the different remedial alternatives has become common practice in the Flanders region. These aspects are integrated into the official multi-criteria analysis procedure which involves comparing the remedial alternatives and determining which option scores the best and should be implemented. However, minor attention is given to the sustainability in the project implementation. To better understand if the initial theoretical approach is representative for a real situation ERM has started to follow-up on sustainability during remediation projects, to evaluate their performance and to learn how choices during the project implementation influence the sustainability of the project.

To date, ERM Belgium has looked into sustainability during two remediation projects, one ex-situ and one in-situ. For practical reasons the follow-up was limited to the CO₂ emissions related to the works executed and materials used. This included transport of persons and material, as well as the production of the materials used, the substrates injected and the electricity consumed. All required data was gathered on-site.

The results often showed that large amounts of CO₂ emissions are related to certain actions that are not incorporated in the initial multi-criteria analyses used to determine the best alternative. They are more related to certain common activities. For example, a lot of CO₂ is emitted in the production of cement used in grout, and therefore avoiding the use of cement where possible can create a very significant improvement of the sustainability of the remediation, without necessary disadvantages in the remediation performance. When looking closer at alternatives, materials with a lower specific CO₂-footprint did not necessarily mean lower CO₂-emissions for the project. The lifetime or performance of the material selected can have a significant impact on the total CO₂ emission. This follow-up has confirmed that the initial multi-criteria analysis does not provide an accurate assessment of the CO₂ emissions of the actual project, therefore creating a false assurance of having selected the best, most sustainable alternative.

Apart from having a better understanding of what drives the CO₂ emissions during remediation, the objective of the follow-up process is to evolve from a reactive monitoring, evaluating what is done, to a proactive approach where the lessons learned are integrated in the future remedial design and are implemented before the first shovel hits the ground. This will be discussed in more detail in the presentation.



11:00 am – 11:20 am

A Retrospective Analysis of Sustainability Metrics for Remedial Alternatives at Two Sediment Remediation Sites

Frank J. Messina¹, Amanda D. McNally², Anne Fitzpatrick²

¹*ExxonMobil*

²*AECOM*

The objective of the presentation will be to present the results of a comparative analysis of remedial alternatives at three contaminated sediment sites using selected environmental footprint models to demonstrate differences among the models, and how the results may be incorporated into the decision making process at similar sites in the future to identify the most appropriate sustainable remedy.

Abstract

A comparative analysis of remedial alternatives was conducted at three contaminated sediment sites using selected green and sustainable remediation (GSR) evaluation models. The specific objective was to determine if a quantitative evaluation of environmental metrics is beneficial to help identify a more sustainable remedy for contaminated sediment sites. This project includes the use of quantitative and semi-quantitative models to evaluate reasonable remedial alternatives for contaminated sediment sites where a remedy has already been selected using selection criteria and metrics required within the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) framework to evaluate how the incorporation of sustainability metrics may have influenced the remedy selection process. The results could then be applied to future projects where sustainability is reasonably expected to have a significant impact.

The comparative analysis includes the use of three unique GSR models on three contaminated sediment sites to compare remedial alternatives. The sites selected for evaluation are representative of large, contaminated, marine or coastal sediment sites where a sustainability evaluation is expected to have added value to the remedy selection process. Each site had a relatively large dredge removal volume selected by United States Environmental Protection Agency (EPA) as the preferred remedy. However, the team hypothesizes that incorporation of environmental metrics into the remedy selection process could have led to a more sustainable remedy that minimizes environmental impacts while achieving equivalent risk reduction.

The models used in this comparative analysis include the following:

- SiteWise™ (Version 3.1), a series of Excel spreadsheets used to calculate the environmental footprint of remediation activities in terms of sustainability metrics developed in a joint effort by Battelle Memorial Institute, the United States Navy, and the United States Army Corps of Engineers.
- AECOM Sustainability Tool (AST), a proprietary tool developed by AECOM and adapted for sediment remediation projects. This tool consists of a single Excel workbook and calculates various environmental and health and safety metrics for several remedial alternatives. It was used by AECOM for the Lower Duwamish Waterway and Pearl Harbor feasibility studies.
- AECOM Quantitative Sustainable Remediation Tool (AqSRT), a propriety tool developed by heritage URS to assign rankings and weights to various environmental, social, and economic metrics for each remedial alternative. This tool allows for the evaluation of social, economic, and environmental impacts that are less easily quantified than those in SiteWise™ or AST.

This presentation will focus on the results of the comparative analysis of remedial options using the selected models and discuss the potential strategies for incorporation of a similar framework for future evaluation of large sediment site with the intention of identifying a sustainable, cost effective remedy for the site.



11:30 am – 11:50 am

Can Sustainability Assessments Lead to Improved Remediation Efficiency?

Lars Rosén, Jenny Norrman, Robert Anderson, Yevheniya Volchko
Chalmers University of Technology

The objective of the presentation is to give an overview of the on-going SAFIRE project and present preliminary results on the effects of choosing remediation strategies based on sustainability assessments compared to “conventional” strategies, given selected efficiency criteria.

Abstract

The main objective of the SAFIRE (Sustainability Assessment For Improved Remediation Efficiency) research project is to evaluate if sustainability assessments can improve the efficiency of site remediation, and, if so, in what ways. Although remediation provides reduced risks to the environment and human health, responsible organizations in Sweden and elsewhere are concerned about the slow progress of remediation and that environmental objectives may not be reached. There is also concern that remediation is too expensive, have a low level of innovation, and may result in substantial environmental footprints. It is now widely recognized that sustainability assessments are needed to provide a holistic decision-support for sound prioritization of remediation efforts. The Sustainable Choice Of REmediation (SCORE) sustainability method, developed at Chalmers University of Technology, Gothenburg, Sweden, is used in five on-going remediation projects in Sweden to investigate the impact of sustainability assessments on remediation efficiency.

The four-year SAFIRE project, which started in January 2015, is comprised of seven work-packages: WP1 is project management and WP7 is dissemination. The first phase of the project includes identification of possible efficiency indicators and mapping stakeholder views with regard to remediation efficiency (WP2). Then, three WPs on SCORE sustainability assessments and efficiency are performed: on how to effectively incorporate SCORE sustainability assessment in the remediation process (WP3), on what impacts SCORE may have on the selection of remedial designs (WP4), and on what impact SCORE sustainability assessments may have on the remediation efficiency (WP5). Finally, the learning process for stakeholders as a result of implementing sustainability assessment is evaluated (WP6). SAFIRE is a trans-disciplinary project between academia, state agencies, Swedish municipalities and private land developers.

The presentation will provide an overview of the on-going SAFIRE project and present preliminary results on the effects of choosing remediation strategies based on sustainability assessments compared to "conventional" strategies, given selected efficiency criteria.