



KERP: Kuwait Environmental Remediation Program

Remediation Experienced Gained

“Restoring Kuwait Treasures”

25th January 2015



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Presentation Objective:

Key lessons learnt from current KOC soil remediation project (Project SEED) addressing crude oil impact across South & East Oilfield Asset.



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Introduction to KOC Remediation (SEED)

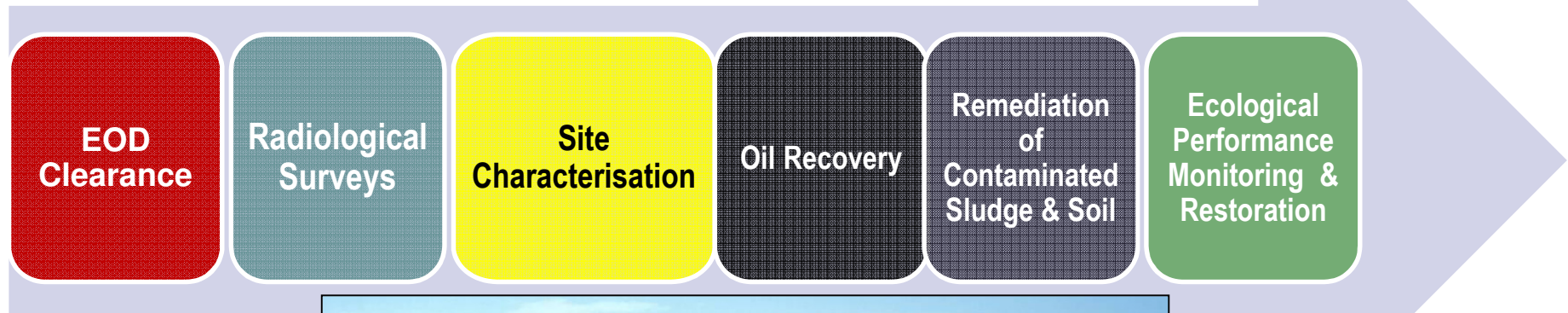


- Issue - Historical legacy of KOC operations have given rise to localised environmental pollution and damage to the natural desert environment.
 - Sludge Pits;
 - Effluent Pits;
 - Gatch Pits; and
 - Contaminated Soil Piles.
- Project Objective - To remediate features to acceptable levels and
- Phase 1 - split into 3 distinct East Kuwait Asset.



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Overview of Scope of Works



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Nature of Hydrocarbon Contamination & Soil Properties

Impacts to Planned Production as stated by current Contractors.

- *Variable TPH concentrations, higher than anticipated, requiring pretreatment of feedstock;*
- *Weathered crude oil comprising high proportion of high end unspecified hydrocarbons (i.e. resins, waxes, asphaltenes etc...);*
- *Generation of “tar-balls” through mechanical agitation (i.e. excavation, sieving and treatment plants), consider pre-treatment;*
- *Variable fines content (may be up to 40%);*
- *Saline soils in areas subject to shallow groundwater challenge bioremediation / soil washing effectiveness.*

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UXO Surveys & Intrusive Anomaly Investigation of Oily Areas

- *Wet oil/oily sludge areas present extreme practical issues with seasonal (temperature) variation to undertaking:*
 - *Transit with geophysical equipment; and*
 - *Subsequent investigation of anomalies.*
- *Potentially high % of metallic oil field buried waste debris to be investigated as anomalies.*
- *Signal interference of live and redundant oil field infrastructure.*



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Physical State of Weathered Crude Oil vs Seasonal Variation

Seasonal variances on weathered crude oil viscosity and impact on works;

- Presence of oil sludge - change in nature with ambient temperature;
- Impacts method of excavation, access, productivity.



Remediation Experienced Gained Weather / High Ambient Temperatures

- Health effects – adequate breaks and water intake;
- Cooling times for thermal plants extended for maintenance schedules;
- High evaporation, therefore increase water usage;
- Abrasive nature of wind blown sand on working parts, prevention shield measures and spare parts in-country.



**Summer Average
Daily
Temperature
45°C**

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Water Supply

- Limited and variable water availability – Many oilfield activities draw on water supply (drilling, water injection, on-going remediation, construction etc);
- Supply Logistics – Water Tanker deliveries, Contractors responsibility;
- Shallow groundwater very brackish and requires licence to abstract;
- High evaporation rates for 5 months of the year;
- Treatment plant water evaporation ponds – winter months below capacity vs minimal evaporation;
- Contractors consider sustainable water sourcing, use and recycling.

Remediation Experienced Gained Subcontracting

- Key Categories of Work have pre-existing Company prequalified specialist subcontractors – see Company web site;
- All subcontractors prequalified or not require Company approval and legally entitled to work in Kuwait.
- Issues have occurred where subcontractor has not fully understood the scope and practical site issues at bidding;
- Issues with adequate subcontractor man-power and plant as other local projects draw resources.



Remediation Experienced Gained Financial Issues

- Composite Treatment Unit Rate – includes excavation, transport and treatment. Only on verification of treated material can payment be made – lag time of early activity vs payment.
- Performance Treatment Specification – Treatment technology not specified, one unit rate for soil treatment irrespective of Contractors requiring multiple technologies and treatment trains.
- Invoicing – Monthly re-measure and invoicing must be supported for payment by full back-up documentation to support payment authorization. Underestimated by Contractors.



ELEMENTS OF THE TOTAL REMEDIAL SOLUTION



Questions?