**ENVIRONMENTAL MANAGEMENT PLAN FORMAT**

Version 1.0, May 18, 2016

**Project IF ID**: **50064**

**I. MITIGATION PLAN**

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| **Phase** | **Issue** | **Mitigating**  **Measure** | **Cost of Mitigation**  **(If Substantial)** | **Responsibility\*** | **Supervision observation and comments**  **(to be filled out during supervision)** |
| Construction - sorbent production reactor | * Excess noise during construction of reactor | Work to be carried out in enclosed workshop which carries out such activities; workers to adhere to adequate health and safety measures. | n/a | The grant recipient |  |
| Sorbent production | * Discharge of waste process water containing reagents | Monitor reagent concentrations in process effluent: if economically feasible (reagent concentrations high enough), recirculate reagent water into secondary production line (filter), otherwise once below allowed emission limits, discharge to sewer system. | n/a | The grant recipient |  |
| Sorbent production | * Discharge water from secondary filter backwash - may contain reagents | Monitor reagents in filter effluent: if economically feasible, recirculate into next batch, otherwise, if concentrations below allowed emission limits, discharge to sewer system | n/a | The grant recipient |  |
| Sorbent production | * Small amounts of sorbents of differing qualities may be generated during production process optimisation | Reuse excess sorbents as raw material for next production batch | n/a | The grant recipient |  |
| Pilot  investigation – regular operation | * Water used for filter backwashing (e.g. for filter unit capacity 6m3/day, less than 0.5 m3 total wastewater is expected to be required before the filter reaches breakthrough). This water is not expected to contain elevated levels of As and relevant reagents. | [As] and other relevant compounds to be monitored regularly, to ensure concentrations do not exceed allowed emission limits. In unlikely event of concentrations above these values, water will undergo an additional coagulation/ flocculation step prior to discharge to sewer system. Any sludge generated will be collected and treated if necessary before disposal in most environmentally friendly manner. | Small cost for additional reservoirs for coagulation and sludge collection | The grant recipient |  |
| Pilot  investigation | * Saturated sorbent will require regeneration. | The sorbent will be reused after undergoing an additional coating – i.e. used as raw material in sorbent production process. | n/a | The grant recipient |  |
| Pilot  investigation | If necessary, a second chemical regeneration technique could be applied. This will result in wastewater containing As and other materials. | [As] and other relevant compounds concentrations in wastewater will be monitored. This water will undergo coagulation/ flocculation, and the stability of resulting arsenic bearing sludge will be monitored - if required, sludge could be additionally treated if necessary before disposal in an environmentally friendly manner. | Small effect on cost of process – price of additional chemicals purchased offset by resulting extension to product lifetime. | The grant recipient |  |
| Sorbent Disposal | * After several regeneration cycles, spent sorbent will require disposal in landfill | Project will use leaching tests and addition of stabilising agents (if necessary) to ensure sorbent classified as non-hazardous waste before disposal. |  | The grant recipient |  |

# II. MONITORING PLAN

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| **Phase** | **What** parameter is to be monitored? | **Where**  is the parameter to be monitored? | **How**  is the parameter to be monitored/ type of monitoring equipment? | **When**  is the parameter to be monitored-frequency of measurement or continuous? | **Monitoring Cost**  What is the cost of equipment or contractor charges to perform monitoring? | **Responsibility** | **Supervision observation and comments**  (to be filled out during supervision with reference to adequate measuring reports) |
| Sorbent production | Reagent concentrations | Both wastewater streams (RealImpeks) | Analysed off site by UNSPMF | During every batch | Costs included in project budget | The grant recipient |  |
| Pilot investigation | [As] and other relevant compounds | Backwash water  (Pilot site) | Analysed off site by UNSPMF | During every backwash operation) | May have slight effect on overall cost, covered by own resources | The grant recipient |  |
| Pilot investigation | [As] and other relevant compounds | Regenerat  (RealImpeks) | Analysed off site by UNSPMF | Every time chemical regeneration required | Costs included in project budget | The grant recipient |  |
| Sorbent disposal | DIN Leaching test of As and other relevant compounds | Laboratory testing (UNSPMF) | Analysed off site by UNSPMF | At end of project, once sufficient spent sorbent available | Costs included in project budget | The grant recipient |  |