RENEX CONTAMINATED SOIL TREATMENT TECHNOLOGY EQUIPMENT EVALUATION AND SELECTION

Renex Group Pty Ltd ('Renex'), as an investor of advanced waste treatment technology, understands the cost-benefit of investing in proven "best practice", sophisticated high-quality technology.

Selection of "best practice" technology meant that the technology selected was proven and was believed to be the most effective means of treating the particular type of contaminated soil, such as Polychlorinated biphenyls (PCB) contaminated soil, which is an organochloro compound with high chlorine content. The selection of "best practice" technology was not limited to the availability of the technology in Australia, but extended to innovative technologies used and proven overseas.

Renex has carried out the evaluation based on existing available published and unpublished information on the technologies for off-site treatment of persistent organic pollutants such as PCB/PAH in soils. Some of this information listed in the table below for comparing the different technologies for treating PCB/PAH contaminated soils may not be complete or fully accurate but it serves as a guide to Renex which already has experience with In-direct heated pyrolysis rotary kilns with thermal combustion.

TABLE: Comparison of technologies relevant to treating PCB/PAH contaminated soil

Technology Features	**Thermal Desorption with thermal oxidiser/combustion**	**Pact Plasma Arc**	**Gas Phase Chemical Reduction with thermal desorption**	**Based Catalyzed Decomposition (BCD) with thermal desorption**	**Supercritical Water Oxidation (SCWO) with supercritical fluid extraction**	**Bio-remediation**
Excellent destructive removal efficiency	YES	YES	YES	NO	YES	NO
Treat high concentrated waste	YES	YES	YES	YES	YES	NO
Continuous flow system	YES	YES	YES	NO	YES	NO
Simple gas cleaning equipment for air emission	NO	NO	NO	NO	YES	YES
No need for disposal of toxic residue	NO	NO	NO	NO	YES	YES
Low space	YES	YES	YES	YES	YES	NO

requirement per tonnage capacity						
simple process and easy to control	YES	NO	NO	YES	NO	NO
Cost effectiveness	YES	NO	NO	YES	NO	YES
Commercially available and proven	YES	YES	YES	NO	NO	NO

The above table and research on combustion, demonstrate thermal desorption with thermal oxidiser/combustion is the best and most economical technology for treating persistent organic pollutants such as PCB and PAH in soils. This type of thermal soil treatment technology must combine with the Maximum Extent Achievable air cleaning system to minimise environmental impact usually related to any combustion process.

Direct and In-direct heated thermal processes

Thermal desorption and thermal oxidiser/combustion can be broadly divided into Direct and In-direct thermal desorption using rotary kiln/dryer. Renex selects the pyrolysis rotary kiln for the thermal desorption process with In-direct heating. This differs from Direct heated treatment processes used in Victoria in the past. The table below indicates the Environmental Best Practice and MEA Features that differentiate the Renex technology from direct heated technologies.

Environmental Best Practice and MEA Features
Storage of contaminated soils in fully enclosed building with impervious base and bund and treat all ventilation air with high efficiency dust filter and carbon filter
Predryer to remove moisture and highly volatiles of contaminated soils at lower temperature less than 110 ^{o}C to reduce energy consumption and greenhouse emission prior to higher thermal treatment
First stage thermal decomposition and desorption under limited oxygen to reduce dioxins generation
In direct heating to 450 to 550 ^{o}C at first stage thermal decomposition and desorption to avoid charring of soils for reuse purpose
Direct/in direct heating: Lowest generation of dioxin gases to treat a unit of soil
Gas conversion or burning chamber can operate at temperature greater than 1100 ^{o}C and 2 seconds retention time for complete thermal destruction
No addition of contaminated filter dust and spent scrubber liquor to Clean

soils
Treated soils are stored inside fully enclosed building with impervious base and bund prior to any test to determine that it is being treated or clean.
Gas cleaning consists of dry and wet system (bag filter and chemical scrubber)
adsorbent and/or absorbent injection and reaction reactor prior to bag filter for enhanced removal efficiency of acids, heavy metals, dioxins and PAH.
A fixed carbon bed as a polishing and emergency safeguard to remove residual pollutants in the treated gas from the dry and wet gas cleaning system prior to discharge to environment to ensure minimum emissions or environmental impact.
Plant component failure does not produce discharge to air of gases NOT treated to acceptable levels
Treated air prior to discharge to environment are heated above the saturation temperature in the wet scrubber to prevent visible discharge plume, increase effective dispersion and reduce environmental impact.
Continuous stack monitoring for Hg together with NO_2, SO_2, HCl, CO, CO_2 and O_2
Water reduction measures using closed loop system for mechanical sealed and cooling
Meet European Standards of air emmission
Diesel electricity generation plant and UPS system to run the whole plant safely on lack of power supply?

Conclusion

Renex selects the in-direct pyrolysis rotary kiln with thermal oxidiser primarily due to it being commercially available and proven technology, having excellent destruction removal efficiency of PCB/PAH in soils, cost effectiveness, ability to treat high strength waste, continuous flow system, treated soil structurally intact for reuse and prior experience in the technology.

References

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[4] Supercritical Fluid Technology for Remediation of PCB/PAH Contaminated soil/Sediments by L.L. Tavlarides, W. Zhou and G. Anitescu, Department of chemical Engineering and Materials Science, 411 Link Hall, Syracuse University, Syracuse NYB244

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