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The Environmental Practice
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Our Ref.: 998/2

Date: 14 February 2022

Dear Colleen

FULL SCALE WASTE TREATMENT & LEACH PLANT CONTAMINATION ASSESSMENT

Umvoto Africa (Pty) Ltd. (hereafter Umvoto) were appointed by The Environmental Practice (Pty) Ltd. to undertake a high-level contamination assessment for a proposed waste recovery, treatment and recycling plant on Erf 299 in Atlantis Industria, City of Cape Town Metropolitan Municipality, Western Cape Province. The full-scale plant plans to process waste ("wood chip", rubber mill liners, spent activated carbon and poly metallic mill liners) and variable metal ore (including but not limited to manganese and gold-bearing ore). This letter outlines potential contamination associated with the proposed plant, and related activities. The assessment is done in support of the Scoping Report of the Environmental Impact Assessment (EIA) currently underway in terms of the National Environmental Management Act ([NEMA] Act No.107 of 1998).

The contamination assessment is informed by a site visit undertaken by Umvoto in January 2022 and by understandings gained from the following supporting documentation provided to Umvoto:

- Word document titled "*LCOA wood chip burn-off pilot facility on Erf 299, Atlantis: activities on site February 2021 – July 2021*" received 11/01/2022
- Word document titled "*LCOA Full Scale Plant Proposal*" received 24/01/2022
- Word document titled "*Site Sensitivity Verification Report: Erf 299, Atlantis Industrial*" received 21/01/2021
- PowerPoint document titled "*LCOA PFDs full scale plant all processes Nov 2021*" received 21/01/2021
- PDF titled "*Appendix E Site Photos*" received 21/12/2021
- PDF titled "*Appendix A – locality maps*" received 21/12/2021
- PDF titled "*137 Neil Hare RD- ERF NO- 299*" received 21/12/2021
- PDF titled "*MSDS of Wood chips*" received 24/01/2022
- PDF titled "*SDS of Woodchip September 2021*" received 24/01/2022
- PDF titled "*Safety Data Sheet - Fine carbon, Agnico Eagle*" received 24/01/2022

- PDF titled "*Polycorp - Protective Linings – Rubber Linings Material Selection*" received 24/01/2022
- PDF titled "*1017-SDS – Polycorp Safety Data Sheet, Semi-hard Natural Rubber*" received 24/01/2022
- PDF titled "*Hardox Data Sheet*" received 24/01/2022

The information provided outlines the processing steps for the different waste materials and classifies various materials into waste classes according to National Environmental Management: Waste Act (Act No. 59 of 2008):

- **"Wood chip"**, classified as **general waste**, comprises small brown wood fragments, silicate gangue and metal ore minerals (e.g., chalcopyrite). Processing includes burning off the wood content and resizing the remaining gangue-ore mix for beneficiation off site.
- **Rubber mill liners**, classified as **general waste**, comprise rubber (with embedded ore minerals) and metal (steel) components. Processing will include burn-off of rubber from steel, resulting in rubber ash (containing residual ore minerals for beneficiation off site) and scrap metal (to be sold to scrap merchants).
- **Spent activated carbon**, classified as **hazardous waste**, comprises fine carbon (this may include calcium dihydroxide, sodium hydroxide, crystalline silica, lead, mercury, cyanide, and other trace metal leached from ores). The spent carbon will be air dried, milled and blended with the "wood chip" product for beneficiation off site. It is understood that trace reagents are neutralized at the mine prior to delivery to site. Hazardous waste requires special handling and storage compared to general waste.
- **Poly metallic liners,** classified as **general waste**, will be mechanically refurbished by shotblasting. The resulting steel will be sold to scrap merchants while the bag filtered dust from shotblasting (containing ore minerals) will be sold for beneficiation off site.
- **Variable ore** (e.g., gold, manganese) is not classified as waste but the proposed beneficiation (leaching, electrowinning/cementation) is a waste generating process which may require additional considerations and authorisations.

In assessing potential soil, surface water and groundwater contamination related to the location of Erf 299 and the activities proposed to take place, consideration needs to be given to the Atlantis Water Resource Management Scheme (AWRMS). The AWRMS, operated by City of Cape Town, supplies potable water to Atlantis and surrounds and incorporates groundwater supply from the primary, unconfined Atlantis Aquifer (which underlies Erf 299) and includes the practice of Managed Aquifer Recharge (MAR) with treated effluent and stormwater from the Atlantis residential and industrial areas. This has relevance to Erf 299 in terms of potential contamination to the aquifer directly underlying Erf 299 as well as to the effluent and stormwater run-off generated on Erf 299. The quality or contaminant load of dirty waters (stormwater and industrial effluent) should be well defined to inform pollution management practices undertaken by City of Cape Town.

The full-scale plant plans to connect to municipal water infrastructure (supply and/or disposal) and will need to, as part of a stormwater management plan (SWMP), consider dirty areas, dirty water systems and clean water systems as defined in Government Notice 704 relating to Regulations on Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources (Government Gazette 20118 of June 1999). GN 704 is considered applicable as the activities prosed to occur on Erf 299 align with the definition of "activity" in Section 1b) of the Notice and contaminated stormwater run-off can result in contamination of the aquifer and AWRMS. Additionally, a monitoring network and programme for stormwater, process water and groundwater monitoring is recommended and should, as far as possible, align with *Minimum Requirements for Water Monitoring at Waste Management Facilities*, as

detailed in the Waste Management Series issued by then Department of Water Affairs and Forestry, 1998.

Erf 299 and immediate surrounds are devoid of surface water features or water courses (rivers, wetlands, springs) resulting in no direct threat of contamination to any surface waters. Depression wetlands indicated on the City Wetlands layer (City of Cape Town, 2017) and shown in the Site Sensitivity Verification report (Confluent, 2021) are mitigated from impact by Neil O'Hare Road and prevailing surface water drainage directions.

The ground surface has been levelled and covered with a layer of laterite and a 20 x 20 metres concrete slab. The impervious concrete underlying the future plant area (see **Figure 1**) and the compacted laterite layer aid in preventing infiltration of contaminants into the underlying Atlantis Aquifer, but require consideration related to stormwater management. Additionally, the water table beneath Erf 299 is ~3-5 m deep, which naturally provides a vadose zone (comprised of silicate sand) for attenuation of contaminants that may have percolated beyond the laterite (partially mitigating direct infiltration to the aquifer). It is recommended that the area under the future Pilot Leach Plant, generator and current feedstock storage areas be made concrete/impervious to mitigate potential contamination to the aquifer and allow controlled management of surface runoff generated from these "dirty areas" by means of a SWMP.

Clean stormwater runoff is expected to be limited in volume (due to direct infiltration across large portions of the site and limited permanent infrastructure on site) and where necessary (from rooftops of the office, workshop, and laboratory) clean stormwater can be directed to discharge directly to the municipal stormwater system located in Neil Hare Road. Municipal stormwater reticulates to Basin 10, a municipal stormwater retention basin that retains stormwater flow prior to releasing it to the Coastal Recharge Basins (CRBs) of the AWRMS (disposal point of AWRMS). The CRBs are located in Koeberg Nature Reserve and are known to harbor biodiversity, warranting some definition or control of these contributions, however this stormwater component is not expected to pose contamination risk to any surface or groundwater resources.

Dirty stormwater (runoff from laterite and impervious surfaces / bunded storage areas) poses greater contamination risk to the soils, aquifer and AWRMS. As part of the SWMP, runoff from the laterite covered area should be directed by swales/berms (or basic subsurface drainage infrastructure) to an on-site and lined retention basin to avoid pooling (as currently seen on site). Stormwater generated from the current concrete pad and future recommended impervious surfaces (leach plant, liner storage area, chemical, fuel, and catalyst storage areas) should also be directed to and captured by the detention basin. Detention of dirty stormwater, by a lined dam will allow settling of fine particles (decreasing suspended solids) and afford opportunity for contamination mitigation (e.g., oil/litter/grease traps, neutralization, or complete removal and offsite disposal) prior to discharge to the municipal stormwater system (Basin 10 and CRBs).

It is not expected that these stormwater management practices will trigger a water use in terms of the National Water Act (NWA, Act No. 36 of 1998) as stormwater will ultimately be discharged to the municipal system and not a natural water course. The stockpiling of material and storage of wastewater for re-use in the ±65m^3 lined dam and JoJo tanks may have potential triggers of NWA in terms of Section 21 g) but are expected to be within the GA limits for Section 21b), this should however, be confirmed. The proposed abstraction of 100m^3/d (~1 l/s) of groundwater exceeds the General Authorisation limit for catchment G21B (150m^3/ha/a) and will require a Water Use Licence in terms of Section 21a) of NWA. An assessment of possible water uses and the need for an Integrated Water Use Licence (IWULA) is recommended as this may carry additional requirements related to water contamination monitoring.

The materials that will be processed by the full-scale plant are considered to carry limited threat of groundwater contamination while dry and measures to keep these materials dry should be put in place (to limit potential leachate/run-off). The feedstocks (wood chip, rubber mill liners and poly metallic liners) are predominantly inert, with low proportions of metal ore minerals present. Due to the expected volume/tonnage, means of storage and handling, it is unlikely that contamination related to the oxidation and hydration of these minerals will occur or result in severe or catastrophic contamination (e.g., acid mine drainage). The storage of the variable mineral ore and the resultant product possess a low-mild risk that increases should it get wet; this can be mitigated by the SWMP. The volume of chemicals and hydrocarbons (diesel) stored on site are not expected to pose catastrophic contamination risk, however some risk (low) of soil and groundwater contamination by these is a reality. Mechanical cleanup of the affected soils and impervious areas will assist in limiting the contamination risk (good housekeeping). Fine materials that spill should be vacuumed, not washed, or swept to avoid mobilisation by runoff or wind, respectively. The appropriate and responsible storage and use of hazardous chemicals and water containing waste (e.g., acids and waters used/heated in an industrial process) is important, as spilling these in large quantities or frequently over a prolonged period may result in contamination of groundwater, soils, or stormwater contributions to AWRMS.

Aerosol deposition from emissions is a likely source of contamination of soils and groundwater. Over time, rainfall mobilises these from the soils into the aquifer. This is a long-term contamination at low concentrations of potentially harmful contaminants as these depositions can be widespread across the aquifer. The effectiveness of air filters and the wet scrubber is considered crucial to manage and as far as possible, mitigate the effects of this contamination.

The hazardous waste component (spent activated carbon) brings with it the highest risk of contamination; this risk can be mitigated provided it is properly stored and handled in line with, *Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste* as detailed in the Waste Management Series issued by then Department of Water Affairs and Forestry, 1998. Due to the possible presence of cyanide, it is recommended that operations involving the milling and storage of activated carbon be closely monitored and adjustments made if mitigating measures are observed to be inadequate (e.g., uncontrolled dust, storage containers break, etc.), and if a spill of this dry material does occur, or if the material gets wet and leaks onto any surface, proper remediation protocols, as stipulated in existing legislation, for contaminated land and/or water should be followed.

Table 1 summarises the contamination severity and probability associated with the future activities on site. Each activity is linked to a potential contamination event which may result in a hazard. The severity of the event is considered in relation to the probability of its occurrence. Mitigation measures are also considered.

The final outcomes in **Table 1** show severe contamination is possible from the spent activated carbon, albeit a low probability of occurring. Further to this, contamination is considered negligible to moderate from the variety of activities on site and based on the scale of the operation and predominance of materials used, events and hazards carry a low probability of occurring. If appropriate and responsible mitigation (or avoidance) is practiced, the contamination to soils, surface water and groundwater is not expected to make the planned activities unfeasible.

Figure 1 **Photograph taken by Umvoto of the pilot plant for processing of "wood chip". Components of the plant are labelled 1-8. (1) Telehandler loads feedstock into hopper from bags. (2) Feedstock is transferred from hopper via open screw conveyor belt into rotary kiln. (3) Feedstock is burned in rotary kiln at ~800-900°C. (4) Unfiltered aerosol emissions and dust from kiln door. (5) over size drop-out box and catchment tray. (6&7) Cyclone and filtered fines dropping into uncovered drum. (8) Filtered air discharge. (9) Limited trial screening of feedstock undertaken.**

Recommendations for future contamination mitigation include, reducing aerosol emissions/deposition, keeping the feedstock and product areas dry, appropriate bunding and impervious surfacing for all processing operations/equipment areas (incinerator, mill, leaching plant/tanks, shotblasting booth and screens), bunded areas for storage of fuels, chemicals and contaminated water storage, use of drip trays, spill kits, and separation of clean and dirty stormwater based on a SWMP (qualitative assessment underway). Small-scale leachate tests to assess the mobilization of contaminants when the different feedstocks or products get wet is recommended to account for uncertainty in the Safety Data Sheet (SDS). In addition, it is recommended that a specialist groundwater study and detailed contamination risk assessment be undertaken to aid the EIA process. A monitoring network and programme for soil, process water and groundwater should be developed and implemented prior to restarting operations to further substantiate findings presented in **Table 1**.

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Table 1 Contamination assessment for planned activities on Erf 299, Atlantis.

Site Activity	Event / Occurrence	Hazard	Severity	Probability	Mitigation description
Site preparation (earth works, surface preparation)	hydrocarbon spill	soil contamination, infiltration to aquifer	negligible	low	machines in working order, no on-site refuelling or repairs, spill kits
On site transport and storing of feedstocks/products/catalysts	rainfall on feedstocks/products/catalysts (spills or stockpiles)	run-off/leachate generated, infiltration to aquifer	mild	low	bagged and covered, loose concrete converted to impervious surface, SWMP
	dry spill of activated carbon or rainfall on spill/stockpile	Soil contaminated, hazardous components mobilised: run-off/leachate generated, infiltration to aquifer, input to AWRMS system	severe	low	Properly stored and handled, SWMP, remediation protocols in place
Processing feedstock (incl. burning off wood/rubber, shotblasting, leaching/cementation/electrowinning)	spill from diesel burners	soil contamination, infiltration to aquifer	mild	low	impervious surfaces, bunding, spill kits, SWMP, drip trays
	emissions/aerosol deposition on ground	soil contaminated, infiltration to aquifer	mild	medium	filters, wet scrubber, monitoring
	rainfall on spilled drop-out / product (all sizes)	run-off/leachate generated, infiltration to aquifer	negligible	low	concrete/laterite surfaces, SWMP
	rainfall on oversize material during cooling	run-off/leachate generated, infiltration to aquifer	negligible	low	Tarpaulin/roof cover, impervious surface, SWMP
	rainfall on bagged final product (all sizes)	run-off/leachate generated, infiltration to aquifer	negligible	low	Tarpaulin/roof cover, impervious surface, SWMP
	Contaminated water spill (water containing waste)	soil contamination/run-off generated, infiltration to aquifer	moderate	low	Limited volume, impervious/laterite surfaces, SWMP, lined dam – overflow to dirty stormwater system
Storing and handling hydrocarbons (diesel, oil, grease)	hydrocarbon spill	soil contamination, infiltration to aquifer	mild	low	Limited volume, concrete/laterite surface, bunded areas, SWMP, spill kits
Storing and handling chemicals (e.g., acids)	chemical spill (pregnant liquor, acids)	soil contamination, infiltration to aquifer, input to AWRMS system	moderate	low	concrete/laterite surface, bunding, SWMP
Electricity supply - diesel generators	hydrocarbon spill	soil contamination, infiltration to aquifer	negligible	low	concrete/laterite surface, low volumes, spill kits, SWMP
Detention of dirty stormwater	Storage capacity inundated (spill/crack)	Run-off generated, soil contamination, infiltration to aquifer	moderate	low	Lined detention basin, basin maintenance, SWMP
Dust suppression, washing surfaces	wetting and mobilisation of contaminants	run-off generated, infiltration to aquifer	negligible	low	Impervious and laterite surface, SWMP, housekeeping protocols
Sanitation - chemical toilet	chemical or organic waste spill	soil contaminated, infiltration to aquifer	mild	low	regular servicing, laterite surface, SWMP, connection to municipal services