ESKOM HOLDINGS SOC LTD

REQUEST FOR INFORMATION

ON THE ULTRA-HIGH PURITY REVERSE OSMOSIS TECHNOLOGY FOR THE TREATMENT OF WASTEWATER FOR REUSE

E1675CXRTD

DESCRIPTION	QUESTIONS	ANSWERS
Definition of UHPRO - in the introduction and background section of the RFI, the document indicates that Eskom has prescribed to the ZLED philosophy, requiring reuse of wastewater on site. It continues to state that Eskom requires Ultra high ***purity*** reverse osmosis membrane systems to treat and manage wastewater with high scaling, fouling potential. o Reading the description of the RFI, it appears that Eskom is in fact, requesting information on UHP - Ultra-high ***pressure*** reverse osmosis membrane systems, or Ultra-high recovery RO systems	Please confirm if the request for information is specifically targeting Ultra-high pressure membrane systems, up to 120 bar, and if other approaches to high recovery RO and ZLED or minimal liquid effluent discharge (MLED) will be considered?	Yes, the request is for ultra-high pressure membrane systems, up to 120 bar, for application in wastewater treatment and/or high salinity streams
Multiple Applications: The RFI outlines applications of UHP technology in the following areas: o Water in ash water return dams o Contaminated station drains water o Concentrated cooling water o Flue gas desulphurisation (FGD) blowdown water o Ion exchange regeneration wastewater o Tied colliery mine water	• Are these different examples provided so that respondents to the RFI can develop application and location specific solutions for each? • Or are they provided as a general indication of the type of application to be considered for UHP RO membranes?	The various streams are provided as streams for which Eskom is seeking treatment technologies capable of treating the various feedwater qualities. The water qualities are very different is some aspects, therefore we require the respondents to evaluate each for UHPRO application and indicate limitations with

○ Reverse Osmosis plant reject ▪ These wastewater streams are then described in more detail in the RFI, including expected feed water quality and volumes for treatment ▪ The various wastewater streams are described for different power stations, and examples are given for specific stations (for example Tutuka Power Station, Duvha power Station, Kriel Power Station, Kusile Power Station)		use of each feedwater when using UHPRO as the treatment of choice.
Combination of technology: The applications described, in some cases do not appear to be ideal candidates for UHP membrane systems and may require multiple unit process steps for treatment. Some of the steps may be considered with UHP RO membranes ○ For example, some of the Concentrated cooling water conductivity ranges up to a 95th percentile value of 3630 uS/cm. This is within the range of conventional RO, and UHP Ro may. For a final polishing or water volume reduction step. ○ Another example - the ion exchange and RO reject streams exhibit very high conductivity, but also show high levels of Calcium and magnesium hardness. These factors would make UHP membrane treatment severely challenging without other forms of pre-treatment, or combinations with other technologies ○ The FGD Bloodstream (Kusile Power Station) indicates elevated levels of many parameters that would make direct UHP RO treatment difficult or impossible without pre-treatment or alternative treatment	Is Eskom expecting respondents to provide complete treatment solutions for these streams, which may include UHP RO, or only considering how UHP RO systems may play a role in the treatment of these streams, combined with other technologies?	Eskom is not expecting respondents to provide complete treatment solutions for these streams but consider how UHPRO may play a role as a desalination technique for these streams. The respondents are expected to indicate if pretreatment or other technologies would be required prior to UHPRO and specific contaminants to be targeted to for UHPRO to be feasible or viable for application.

Alternative to UHP: some of the applications, for example the wastewater containing high levels of ash and oil, are low conductivity streams, that have elevated organic and other challenges.	As part of the response to the RFI, can we provide information on alternative technologies to UHP RO, for the treatment of these streams?	This is acceptable, yes, respondents may provide additional information, but should not neglect to indicate why UHPRO may have limitations that need to be addressed through other technologies
Extent of response: The RFI requests information ranging from general information (literature) to detailed engineering responses (PFD, P&ID, GA drawings) - It is not clear how to provide this information specifically targeted at UHP RO systems, for multiple applications with very different unit process requirements.	Please elaborate on the expected response requirements PER application are	The response should focus on the use of UHPRO in the applications where water qualities similar to the feed streams provided were involved, for example, high salinity streams with mobile salts such as the IX regen effluent, high salinity/highly scaling waters such as ash water, extremely saline and scaling streams with significant trace metals concentration, and solids such as FGD blowdown stream, etc. In terms of literature review/case studies – is there evidence that UHPRO has been used for these applications- how, on what scale and was it successful, it is viable for the application? What are the costs associated with treatment (O&M) and what was the capital cost for pilots, large scale plant, etc. What is the typical process flow for this, and if the technology as to be piloted, what would the proposed process design be (PFD, capital, O&M and other resources needed to pilot, etc.?) This can be high level information based on previous pilot studies, and larger scale plants previously implemented.
Costing inputs: The RFI asks for capital and operating cost budgets, lead times, consumables and other commercial requirements o Information related to flows is limited in the RFQ for the different applications	Please elaborate on the requirements for each application area in order to be able to provide the requested commercial information - at a minimum, the targeted flows to be treated per application	The flows for Tutuka are provided as worst-case scenario as Tutuka's flows are currently the largest flows for these applications – for a full-scale plant. The minimum flow of 100 L/s and maximum flow of 400 L/s may be used for indicative costing for all the streams

○ Information related to final water quality requirements (for reuse as example) are not given in the RFI		with the exception of FGD blowdown stream which is 25m3/h, max 50 m3/h. Pilot scale flow rate to be informed by pilot skid sizes available in the market and equipment sizing requirements. As an example, the Dirty water dam flows at Tutuka Power Station are given as ranging from 100 - 400 l/s (to treat this water would not require UHP RO necessarily), but the treated water quality for reuse is not indicated, which may change the election of technology for this application.
Water recovery rates: In all applications, we assume the intention is to approach ZLED, and minimise brine volumes	please indicate the water recovery rate (% of water recovered from feed) expected for each application.	Yes, the intent is to approach ZLED and minimise brine volume, thus a recovery of > 98% is desirable
Ash Water: On page 16 of the RFI, a description of Ash Water with high pH is given, indicating that multiple Stations have problems with this water, and RO plants have been applied to treat this water with problematic results. ○ A typical water composition is given in Table 3 (for Duvha Power Station) and further information for Ash Return Water at Kriel Power station.	please provide flow information, required treated water quality, and anticipated or preferred water recovery for these Ash Water systems	As indicated above, respondents may use the 100 L/s as the minimum flow requirement for the purpose of the RFI. However, in practice the throughput of each plant would vary from station to station, ranging from 3MLD to 15MLD for station drains treatment. CW treatment plants can be larger depending on the station need and design.
	Also please indicate if UHP RO systems are considered as a retrofit solution to these existing RO plants, or as part of a new solution, including various unit processes needed for pre-treatment?	UHPRO could be retrofits in existing installations if performance is better than the conventional processes currently utilised, and would be new installations in new installations, with the appropriate pretreatment and/or hybrid technologies as needed to achieve the treatment objective.
	Is this flow indication specifically related to the CCW? Or is this also indicative of the	The flow of 3 – 6 ML/d is what has been typically targeted for ash water treatment at various sites.

• **Cooling Water:** On page 24 of the RFI, information is provided for CCW at Kriel (concentrated cooling water) - this seems to be repeated on page 44. • The flow for each of the sites is indicated as 3 - 6 ML/day	Ash water return systems at different power stations?	
	It is not clear how to propose solutions (with a focus on UHP RO and ZLED) to these different applications, as each application can be treated with a range of different technologies, depending on the product water quality, recovery rates, and pre-treatment requirements It is also not clear if the information requested is for retrofits and upgrades to existing systems. (E.g. RO) or completely new systems to supplement or replace existing Ro systems	As indicated above, the station needs are different. A few stations have RO plants where retrofits may be considered, for other stations Eskom is evaluating for new installations to address excess effluent management on site.
	Question related to the CCW at Kriel and Tutuka describe don page 44 - what is the flow rate of the CCW to be treated?	As indicated above, the throughputs would vary based on the specific station need. The respondents are to utilise 100L/s -400L/s. alternatively, as indicated above also, the throughputs of the plants range from 3 to MLD for station drains treatment.
	Is this intended for high recovery RO using UHP RO?	Yes
	What recovery rate is expected?	>98%
	What water quality is required for this reuse application?	Permeate is typically recovered to CW circuit, therefore the permeate quality should be better than the raw water quality (of the specific scheme from which the power station draws water.
FGD bleedstream: On page 34 the RFI describes FGD bleed stream at Kusile power station	Is it the intention of the RFI to evaluate technology options for treatment of the Kusile FGD bloodstream with alternative or	Yes, this would be evaluated for future planning/considerations

	replacement of the existing thermal evaporator?	
	Is it the intention of Eskom to evaluate solutions for a new FGD bloodstream treatment process for Medupi Power Station?	Yes, this would be evaluated for future planning/considerations
	Treated water targets are not given, please advise?	Permeate quality should be suitable for reuse and recovery to the demin process and well as service and makeup water for FGD plant operations
	On page 35, It is indicated that the contractor must make allowance for recycle of the concentrate stream in order to cycle up the ions. It is not clear waht is meant by this in the context of developing a solution for treatment of FGD bleed stream	Respondents to please ignore in relation to GFD bleed stream.

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