Questions and Correspondence about Arana Water Technologies:

Q: We would appreciate your comments being more specific about how your technologies would be applied and fit into the scenario, regarding treating either 10-20 MBPD or 250 MBP, considering the water composition said in the attached document; besides, how would you take care about heavy metals.

A: ARANA Water Technologies can treat municipal drinking, wastewater, and oilfield frac and produced water. The process varies depending upon the type of water (i.e. its chemical composition) to be treated but the underlying patented technologies utilized by ARANA will be virtually the same. The treatment / removal of heavy metals is one of the primary capabilities of the ARANA oxidation / ultrafiltration process – and ARANA can state with certainty that heavy metals forming non-dissolvable compounds in the oxidation process will be removed.

Q: Something that we have been told by companies, and should be taken into account is that clients wants to recover as much hydrocarbons as they can while processing the produced water, so, in the presentation of ARANA this scenario is not shown as seems that the by-products left after the flocculation described, correspond to a kind of sludge that should be disposed elsewhere.

A: The ARANA process oxidizes and removes suspended hydrocarbons, so a preliminary step must be included if, after first separation, additional hydrocarbons are desired to be removed. What the ARANA process will ensure is that produced water can be treated to the point that hydrocarbons, metals, and organic contaminants will be removed sufficiently to re-introduce this treated salt water into the oceans.

Q: Regarding something else, please clarify if the membranes or the process for ultra-filtration also described, are not getting plugged or affected due to the high contents of dissolved & suspended solids and hydrocarbons.

A: Although most hydrocarbons should be removed by the heavy oxidation and coagulation process they will be exposed to, the ARANA Water process has a backflush feature which backwashes the membranes with oxidized water, thereby breaking up and removing any hydrocarbons on membranes and removing any solids captured on membranes. The remaining sludge is projected at approximately 3% of the total water volume, which can be further reduced by approximately 90% if that sludge is allowed to settle for 24 hours and re-treated.

Q: Another thing that should be considered within the design is that the oilfield produced water normally are kind of sour water, so, in your presentation nothing is said in this regard and such scenario could be affecting not only the materials but also the instrumentation and other components that would be included in the skid limit.

A: The patented ARANA process will oxidize and remove H2S.

Q: As far as I have been involved in the oil & gas applications, on produced water plants is not very often seen that you include an ozone unit for oxidation, as it can cause explosive mixture at some point of the process and client rather to have all the units as an enclosed environment (not necessarily pressurized but inert), more or less is the same situation regarding drilling fluids; so, we were wondering how the ARANA technologies would manage this kind of situations.

A: Traditional ozonation systems utilized driers, blowers, and an open plasma-generating system (corona discharge) exposed to any volatile situations that may occur. The patented ARANA ozonation system produces virtually unlimited amounts of ozone in a proven reliable process without the driers, blowers, and in an enclosed plasma-generating system. The actual treatment of produced water and resulting oxidation with ultrafiltration is utilizing principles of physics and chemistry and with low energy consumption. At no point in the process are volatiles exposed to sparks or an igniting type of situation.

If an unusual amount of gases remains in solution after the separation process, then that issue may need to be addressed, both for the fact that this energy is wasted in the ARANA process and possibly a slight safety issue. Standard oil/gas/water separation systems should remove this issue.

Of course, we welcome discussion with anyone to address all safety issues at all points and with any possibilities, but at this point, we believe there should be less risk than with many types of electrical equipment.

Q: A very important question that has been made, is in regard to what is the price per barrel for treating produced water in the conditions shown in the enclosed file, considering that customers want also that the effluent would be disposed directly into the ocean while accomplishing what is stated in the Norms & Laws; if feasible for ARANA, what would be the footprint or the size of the said two cases 10-20 MBPD & 250 MBPD?

A: ARANA management and experts project that a total cost, energy, maintenance and operational costs would be approximately seven cents per barrel to restore produced water to your country's Norms & Laws conditions. The estimated size of a 10 – 20,000 barrels per day ARANA system is approximately 50 square meters or 535 square feet.

Q: Is it necessary for any pretreatment for the influent prior to putting into your package plant?

A: The only recommended pretreatment is to run this water through separators to try to get as much hydrocarbons out as possible as the ARANA process will not capture these hydrocarbons. Now the backflush can be further separated to capture those hydrocarbons to maximize recovery.

Q: Is this able to be automated?

A: The patented ARANA process is fully automated and diagnostics, usage, and other data can be accessed remotely by cellular and/or GSM – satellite communication. ARANA will also train any personnel necessary to ensure on-site knowledge of the ARANA systems, and can provide any operational experts necessary.

Q: If the quality of the water at the discharge is not achieved, would your packages being able for measuring on line that quality for recirculation of the effluent back to the inlet, if so, what happens to the rest of the influent?

A: The ARANA systems do not contain real-time water analysis but rather operate upon established regimens to ensure that the proper principles of physics and chemistry are achieved in the treatment process. Water analysis systems do exist that could be installed after the ARANA water treatment process with the necessary monitoring and reporting capabilities.

ARANA types of systems have redundancy and have operated reliably since 1998, but if an ARANA system fails in the field, then some type of backup situation that has been established with clients and ARANA will be implemented, likely a recirculation or piping of effluent water to an alternative/redundant treatment process.

Q: Regarding the technologies said in the presentation, considering only the cases for produced water, what would be the energy consumption?

A: Depending on the size of the system, energy consumption will vary, but, if energy is purchased at retail prices, energy consumption for the treatment of produced water by an ARANA system is projected at approximately .05 cents per barrel of water treated (approximately $40 per million gallons).

Q: Is it necessary to add any kind of chemicals, if so how many & how often?

A: No chemicals are necessary for the treatment of produced water by an ARANA oxidation and ultrafiltration system. We have found, however, that occasionally a minute amount of

metal, such as iron oxide, introduced into the water can sometimes in the process aid in the flocculation (coagulation) of other contaminants and accelerate the flocculation process.

Q: How many technicians are required to operate the plant? Could you explain a bit further what about maintenance & spare parts are required?

A: Maintenance does not require anything specific or difficult, as the ARANA systems are technically fairly simple with few moving parts and standard equipment as much as possible.

Suggestions & recommendations.

Q: I would like to suggest you to prepare a simple set of cases of study from the engineering or technical stand point, considering what is questioned above, while attaching to such cases, a list of concrete users of similar plants to what you include in the cases of study, stressing what are the benefits that those users are getting by the use of ARANA Technologies.

A: Systems based on Arana processes work in many areas such as the food industry, drinking water treatment, waste and sewage water treatment and, of course, in the oil/gas industry. The following problems arise and are being solved in these industries: water sterilization, elimination of floats and colloidal particles, oxidation of dissolved organic compounds (reduction of COD), elimination of oil products (hydrocarbons), iron and manganese, oxidation of H2S and similar compounds, etc. Using certain extra steps in addition to the main process, certain kinds and amounts of salts can be also eliminated, but require more equipment and cost.

Q: Please consider in the information that I am requesting is mostly technical as the commercial aspects should be handled directly by us, et al.

In brief, we think that the technologies shown in the ARANA presentation seem to have a potential market in our country but we need your kind assistance in our learning process of your technologies. Should any further information be required at your end, fell free to contact us at your convenience. I look forward to hearing back from you soon.

A: I have hopefully answered these preliminary questions sufficiently and I look forward to discussing this further and showing you and others our systems and technologies. We believe there is a perfect fit for what we do and the needs to cost effectively and reliably address its produced water needs.

2ND Correspondence:

Q: During your presentation you mentioned that your technologies are able to leave some chemicals present into the water, in case clients want so; from the technical stand point,

nothing about that is said in the presentation I reviewed from ARANA; so, I will appreciate your comments & clarification on that. The concerns are that if a client spent some money in chemicals for conditioning the water, they do not want to lose them unless is absolutely necessary.

A: *We would please need to know these chemicals and try to incorporate into the separation process, the ability to separate certain targeted chemicals in addition to the hydrocarbons. It may be possible, and a customized step integrated into separation to specifically target and remove these chemicals is well within the capabilities of ARANA.*

Q: As said in both your and my e-mail about client wishes to recover as much hydrocarbons as they can, that are present in the flow stream of produced water to be treated at ARANA's equipment, in your reply to me, you said that ARANA does not perform that kind of recovering nor separation; in order to show clients an integrated system, would you be able to recommend any particular vendor that can be attached your packages, for offering clients both, the recovery of hydrocarbons and the benefits of ARANA´s technologies?

A: *We can provide separation prior to our oxidation and ultrafiltration process. Hydrocarbons, solids, and water separation technologies are fairly standard and well-known by our experts, so we can provide this capability prior to our process which will surely remove these and all other contaminants to levels acceptable to disposal / re-introduction of the resulting treated water into the ocean.*

Q: They got impressed about the potentialities that ARANA could be offering for them, but wanted to check how flexible your technologies could be, i.e., there is a case for upstream applications, where the "produced water plant" is indeed a residual water treatment plant, the influent could vary from produced water to process water to oily water, drilling fluids or some other types of industrial water, the flow rates could also be varying during the normal operation; therefore, either the chemistry of the water and the process parameters (such as flow rate, pressure, temp. etc.) are not fixed but able to change very often, eventually, the only thing that could be known or defined, corresponds to the sources of the water streams. In this particular case, what client is looking for is a 4x4 technology, suitable as the SUVs to work in any terrain; the question about ARANA is if your technologies would be able to work in any scenario as described herein? If so, would it be a single package or should be different packages tied together in a single unit? If so, what happens with your energy consumption? Would you require chemicals?

A: *There is not exactly a 4x4 system that would do everything as a blanket application, but I can with certainty tell you that ARANA has, arguably the best physicists and engineers in the world that will design and construct the best system with as close to 4x4 capabilities as can possibly be built, allowing for the laws of physics and mechanical functionality. Industrial wastewater usually is no problem either. In fact, we are about to file new patents on refinery wastewater recycling, utilizing the existing energy within the plant to treat/recycle the*

wastewater.

Most of ARANA's experts were educated in the elite Russian education system from early childhood on to be the best at specific disciplines of physics, and in our case, applied to the treatment of water and air, and if there is a solution to a treatment question, ARANA can likely come up with the best possibilities.

ARANA Water Technologies, LLC has designed systems for treating oilfield cuttings, drilling fluids, frac water, produced water and virtually every aspect of oilfield fluids and water treatment in general, and, with your assistance, given all of the variables and situations, can design and construct the best application possible for the situations you've proposed. We can treat the water from clean brine all the way to distilled water quality, however the regulatory requirements and budgetary targets dictate. I can say that with confidence.

Thank you again for your time and consideration thus far. I hope I have answered your questions sufficiently but will make myself available to discuss these matters all you desire. I am looking forward to meeting you tomorrow and moving forward with the tremendous potential we now have.

3rd & 4th Correspondence:

Q: I have some answers from our discussion on energy consumption and effluent gases from hydrocarbons:

A: The projected energy consumption of a 2 million gallon per day system is approximately 70 kw, primarily used by pumps. If the water is already being pumped by another process and we can integrate into that, or our pumps can remove the other process's pumps, we would realize a significant decrease in this consumption, almost half...

A: About the problem of hydrocarbons and organic by products in off gas:
Most hydrocarbons in solution will be flocculated with bivalent and trivalent metals and other contaminants to a colloidal state and trapped in the ultrafiltration membranes. Those that are not will be oxidized into an off gas.

Off gas will contain high concentrations of residual ozone which blows a trough catalytic ozone destructor to remove this residual ozone by catalyst. If there is some amount of organic compounds in this off gas it will be oxidized by ozone to final products (CO2 and H2O) on the surface of the catalyst.

The bottom line is that, after our oxidation and ultrafiltration and catalytic destruction, little or no gases that require any safety considerations will remain.

Q: Process wise, it is understandable what you describe above; however, I would like to know

if it is there any constraint to be applied to the influent regarding the amount of O3 to be generated, in other words, the influent should contain certain water, hydrocarbons and some contaminants, considering that for our case of study 40,000 BPD with a chemistry that could be varying in a range of components, if so, is there any limitation at your equipment for having enough catalytic ozone to oxidize the influent?

A: Technically, we are designing a system capable of treating 48,000 bbls per day, to ensure we are able to handle spikes in contaminants and flow rates. These systems are now in demand because they handle virtually any situation of water treatment, almost the 4x4 scenario on spikes in flow and contaminants you mentioned earlier. In addition, we intend to make these systems integrate with water monitoring equipment to ensure retreating of the spikes if necessary.

Q: I have a few remaining questions about the demonstration systems we are discussing to finalize pricing. For instance, do you want a separation system on the front of our oxidation / ultrafiltration system? Among a few others...

Besides, a question arouse at my engineering staff about the NOX and SOX that could be generated due to the oxidization happening to the influent and its compounds; if indeed there is a certain amount of NOX & SOX, would you be able to treat them for not having fugitive emission to the atmosphere? In the other hand, please consider that if there will be emissions of CO2, this equipment could be considered to be polluting instead of being “green” so, please clarify how such by-products could be handled or captured to avoid climate change.

A: We are using oxygen concentrators and pulsed DBD in our creation of ozone and any minute amounts of NOX are infused into the water and dissolved there, so NOX are of no concern in that regard. Regarding NOX when oxidizing hydrocarbons, NOX are generated at high temperatures and our process never achieves any high temperatures, so there is a high likelihood that no NOX will be generated. H2S in large amounts is a situation we really need to spend some additional time with; but in small amounts, SOX are oxidized into sulfates and would not be emitted into the atmosphere. CO2 is created in very small amounts, approximately 200g per hour (about equal to two people talking or less than half what one cow would generate) so I believe the consideration of CO2 in this application can still be considered "green".

Q: About the ultrafiltration happening at the membranes stage, please consider the number of membranes adequate for handling 40 MBPD with peaks as discusses in our latest phone conversation.

A: We would require approximately 150 membranes in a configuration that would integrate several types of filters to maximize the two types of oxidation processes, contaminants to be treated, and desired results for environmental regulations of disposed water.

I have a few remaining questions about the demonstration systems we are discussing to finalize pricing. For instance, do you want a separation system on the front of our oxidation / ultrafiltration system? Among a few others...

Q: Let´s do this, as He is urging me to expedite the analysis and moving ahead promptly, please finalize the budgetary figures on what you are doing as of now for treating the water with your packages; regarding the separation system, feel free to propose it as an alternative but handle that price separately as an accessory, not as a part of the main oxidation/ultrafiltration system.

A: The 2,000,000 gallons (approximately 48,000 bbl / day) system will cost approximately _____ dollars to build. This would include the engineering and design, construction in a modular manner, FOB our facility, but final assembly once in place, commissioning and startup, proper training for necessary individuals to ensure safe and effective operations for demonstrations as needed, and a warranty to be agreed upon. It is all up for discussion...

Q: For making this analysis, we would require to review a P&ID either from you and from the end user (eventually) for checking both, energy consumption at your equipment and upstream, nevertheless, I would suggest that you may provide what the specs are at your equipment for developing a modular approach based in the criteria of matter-energy balance. Regarding the budgetary figures requested, please define what the requirements are for your package and we will review & comment what can be done locally.

A: We are now preparing a P&ID diagram for a modular system that can be transported by road, rail, and eventually onto an offshore rig and assembled fairly easily on location for operations. This system is a sophisticated system that must be well-balanced between modules and constructed by highly qualified professionals in our facilities. In the long run, perhaps one day we can train the necessary people and import the key individuals into your locations to manufacture these locally. But for now, I feel we need to at least build the first several here in the states. Perhaps the equipment that works with your country, such as monitoring equipment, can be installed there...