Elmosa Seawater Intake and Outfall Systems
Intelligent, Natural, and Simple
Super Seawater Intake Technology with Site Recognition Capabilities

The low velocity InvisiHead detects pump energy pulses, recognizes site characteristics, operation conditions, and application requirements, and commences flow management as planned.

The Elmosa system is all passive, screen-less and contains no moving parts. The system starts at the InvisiHead and ends at the NatSep as an intake, and starts at the siphon chamber and ends at the InvisiHead diffuser as an outfall. No O&M or any related expenses are involved in the IH operation. We design the pipes to be self-cleansing. No bio growth or sediment and debris settlement occur inside the intake and discharge pipes.

Open Sea

American Eco Systems and Amecosys design seawater intakes and outfalls to be operation and maintenance – free, to provide full flow capacity under all operation and weather conditions non-stop for over 50 years. The system is environmental-friendly and supports biodiversity. The 4-compartment NatSep delivers clean water to the pumps and provides a non interrupted operation during cleanup that is done once every 5 years.
American Eco Systems Revolutionizes the Operations of Seawater Withdrawal and Discharge

No maintenance associated with the InvisiHead, no expenses and cheaper than the O&M-intensive wedge wire screen and mesh intakes

The InvisiHead Sea Outfall; flow attains local ambient conditions as soon as it is out

BTA as per US EPA Section 316(b), the InvisiHead meets and exceeds the Final Cooling Water Intake 316(b)Rule requirements
Seaweed Proliferation

Because of Global Warming, climate is changing so is seaweed growth.
Seaweeds are taking over a once sandy floor
Sea weeds are deadly to mesh screens and wedge wire intakes when they become waterborne; sediments go unhindered through screen mesh wire. The InvisiHead is weed and sediment proof.
The Screen Clogging Weeds that tangle in wedge wire screens when they become waterborne. They are not cleared off by airbursts. The InvisiHead is unaffected by them. The same goes for traveling and band screens.
Seaweeds mature by the end of summer and start braking up in the fall, threatening open channel and screened and wedge wire intakes.
Buoyancy of seaweed fluctuates throughout the water column. The weeds do not affect the InvisiHead or hinder its operation but deadly to wedge wire screens.
Dense dead seaweed washes-up near the shore and becomes an operational nightmare for seawater users
In the proactive Elmosa Seawater intake system: elements A (the InvisiHead) & B (the NatSep), are all you need to supply any quantity of high quality raw water.

That’s all you need, simply natural and easy.

No maintenance or maintenance expenses for life, low capital cost, robust structure, supported for G5 hurricane force.

Useful life: 50+ years.
The InvisiHead manages and controls the quality of the intake system

- Passive operation;
- Self-operating & maintaining;
- No Maintenance or O&M expenses associated.

US EPA: Best Technology Available (BTA)
Robust and stable under all operating conditions
The IH is hydraulically invisible to suspended materials:
Super slow entrance velocity (0.09 m/s) guarantees the absolute minimum of:
 Fish, sand, seaweed, mussels, trash & debris to enter the intake system;
 The IH system has been upgraded for 2013 to have better-tuned sequence of the four flow phases to eliminate marine life, sediment and debris inflow;
 System maintenance-free operation makes money by saving O&M expenses. It is also cheaper to buy than wedge wire screens.

The flow goes through 4 phases:
 Approach, 0.002m/s,
 Stabilization,
 Acceleration, and
 Steady State.
Any suspended solids flow into the IH as part of the water settle near the upstream end of the NatSep.

- Clean cooling water flows into the pump chamber;
- Screening systems are completely eliminated;
- Seawater pump self-cleaning strainers are no longer required;
- NatSep is also used in water/oil separation process.
The IH is hydraulically invisible to suspended materials, super slow entrance velocity (0.09 m/s max), absolute minimum of: Seaweed, Sand, Fish, Mussels, Trash & debris

- Radial Diffusion of effluent with multi directionality;
- High heat transfer rate allows quick attainment of equilibrium; conditions and achieves the required dilution rate within the vicinity of the outfall;
- Ideal for power plant coolant and RO brine discharge;
- Ideal for deep sea discharge of treated industrial and municipal effluents;
- Effluent and outfall pipe is bundled with intake pipes and construction costs are reduced.
COMPARISON
The Round Surround Up and Down Multi Plume 3-D Effluent Dispersing InvisiHead vs. Linear Jet Diffusers

The diffusing-like action of the effluent can be made symmetrical or asymmetrical and the streamline terminal velocities are decided as per site requirements. The InvisiHead outfall is highly site-specific and velocity selective.
Effluents need to come under pressure created by pumping energy to create jets and disperse fluids through nozzles like cooling water, RO brine, and wastewater.
Linear diffusers consume valuable sea space as well as pumping energy to force the fluid through the diffuser spray nozzles. The fluid is sprayed over a relatively large area to accomplish the required dilution within 60-75m away from the release point. As shown in this diffuser, a RO concentrate of 66,000 ppm is released to be diluted to the required limit of 36,000 ppm at the end of the mixing zone. The InvisiHead achieves that goal at less than 1m away from the release point. Velocity in diffusers has to be high enough to prevent deposition of sludge, grease etc. Use of linear diffusers lead to increased energy use and operating costs in addition to the relatively high capital costs.

RO plant brine TDS would be around 79,000 ppm on the average for a 41,000 raw seawater. The required dilution should be around 25 or about 42,000 ppm reached at about 75-100m away from the discharge jets. Natural seawater is 41,000. The InvisiHead would achieve the required dilution in 1-2m away from the discharge point. The brine would blend with seawater to a TDS of 41,600 ppm 20m away from the discharge point. Dilution rapidly approaches the natural limit, see the table in the next page.
The InvisiHead slowly releases brine and disperses it in small narrow thin plumes in a round surround up and down fashion which insures the highest possible contact with the local seawater and produce max dilution within the vicinity of the outfall.

The round surround plume figure in red and the table are produced by the US EPA Visual Plume Model.

Required dilution achieved 0.078m away from the invisithead outfall.
The flow Control Discharge Chamber Gravity outfall

The InvisiHead Sea Outfall; flow attains local ambient conditions as soon as it is out

Parabolodal InvisiHead diffuser

4-D Flow: 3 space + 1 time = round surround up sideways & down funneling out

The effluent plume is uniformly dispersed and diluted to rapidly reach ambient conditions within the vicinity of the outfall.

The diffusing-like action of the effluent can be made symmetrical or asymmetrical and the streamline terminal velocities are decided as per site requirements. The InvisiHead outfall is highly site specific and velocity selective.
The O&M-Free InvisiHead Brine Diffuser Gravity Driven System – No pumping
The InvisiHead needs no maintenance or any parts replacement or any costs associated with the O&M process for life

Dispersion is gravity-driven. **No pumping is involved.** The extremely low discharge velocity allows fluids to slowly disperse and reach a high dilution ratio within the vicinity of the diffuser structure. A brine with a TDS of 77,000 ppm would reach the required dilution ratio of about 25 to dilute to 43,000 ppm if the seawater TDS is about 42,000 ppm. This rate of dilution is achieved at about 1 m away from the diffuser. Dilution would reach about a 100 some 12 meters away from the diffuser structure where the TDS would be about 42,350 ppm. A few meters away TDS sensors will record no change in the ambient seawater of the 42,000 ppm. The following two pages demonstrate a similar InvisiHead RO brine discharge performance made at the Atlantic where the ambient TDS is about 37,000 ppm. This brine TDS was 78,820 ppm.
US EPA Visual Plume Model shows the InvisiHead performance to dilute 100,000 m³/d of brine for the Bilmoral RO plant, NW Australia

About 20m away from the source the dilution reaches a 100. Max dilution of 24.97 as per the US EPA regulations is reached at 0.878m away from the discharge point.
US EPA Visual Plume Model shows the InvisiHead performance to dilute 3,923 m³/h of wastewater for the sewage treatment plant in Ontario, Canada.

About 2m away from the source the dilution reaches 1000; about 50m away it reaches 5183. Max dilution of 171.9 as per the regulations is reached at 0.055m away from the discharge point.

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<th>Depth (m)</th>
<th>Amb-cur (m/s)</th>
<th>P-dia (kg/kg)</th>
<th>Polutnt (m)</th>
<th>Dilutn (%)</th>
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- Horizontal distance from point of release
- The dilution ratio required

trap level, acute zone, bottom hit, surface,
Linear Diffuser Operation and Maintenance Economics

An illustrative example

Outfall Cleaning and Diffuser Repair Bid Analysis
Assumptions (based on 2005/2006 work):
1) To remove debris from the pipe interior will take ten (10) 8-hr. work days for a total of 80 hours.
2) To replace the one known missing diffuser will take two 8-hour days allowing for mobilization of the crane for a total of 16 hours.
3) That we will have about a thirty day permitted In-water work window subject to river level and flow. The objective will be to begin the project as late as possible In August allowing for the lowest river level while still having adequate time to complete the entire scope of work. This will require overtime rate.
4) Because of uncertainty of the amount of material in the pipe and the length of time required to remove It a contingency amount of 20% is added.

Estimated Total: $90,420  2011$
     $95,575  2015$
Conclusion

The InvisiHead outfall system is a technical and a commercial breakthrough in the intake and outfall seawater Industry. Attaining a certain dilution rate in a given radius around the outfall might be obligatory in order to meet mixing zone regulations. Technically it meets and exceeds environmental requirement and achieves high dilution ratio in just a short distance from the brine outlet. It protects the environment since it inflects no adverse impact on the ambient. The InvisiHead diffuser system involve no human or machine interference to operate it or maintain it. The technology is O&M-free.

Commericially, the InvisiHead diffuser system is lower in costs to buy. No costs are involved neither with its operation nor with its maintenance. The money spent in running other diffuser systems can be saved in the case of the InvisiHead. The savings pay back the money spent to buy the system. The payback period in this case is about 3 years.
The InvisiHead makes money
CONCLUSION

Why the InvisiHead is a Best Technology Available (BTA) as designated by the US EPA

The InvisiHead, a smart super seawater intake & outfall technology

The smart InvisiHead intelligently guides sediment, debris, and marine life out of the system and diverts them back into the environment by integrating the natural order into its O&M process.

Flow sequence: 4 phases:

PHASE I. Approach starts at about 5m away from the entrance; streamlines take off stealthily from the seafloor at lower than 0.002m/s-too slow to disturb sediment, fish eggs, larvae, and debris;

PHASE II. Entrance at 0.09m/s too slow to attract, fish, seaweeds, sand, and debris;

PHASE III. Stabilization and IH outlet at 0.11m/s much slower than the local marine currents to let fish, sediment, and debris if the stray in they end up in the ambient again;

PHASE IV. Steady State for clear naturally filtered high quality water to flow to the plant. No fish mortality+0$ on O&M = BTA; the InvisiHead Actually makes money and pays back its capital.
American Eco Systems, LLC

Amecosys Ltd.

Thank You!

Elmosa Seawater Intakes Systems
American Eco Systems, LLC
1620 S Wood Ave, Linden NJ 07036 USA
p. +1 908-342-0240

www.amecosys.com/elmosa
e. elmosa@amecosys.com