



COLORADO
Department of Public
Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

August 30, 2016

Chandler Johnson
World Water Works
4000 SW 113th St.
Oklahoma City, OK 73173

Subject: **UPDATED** Acceptance of the inDENSE™ Hydrocyclone Sludge Settling Enhancement as an Alternative Technology for Use in Domestic Wastewater Treatment Works in Colorado

Dear Mr. Johnson:

The Water Quality Control Division (Division) has received and reviewed information for the inDENSE™ hydrocyclone sludge settling enhancement in accordance with section 1.8.0 of *Design Criteria for Domestic Wastewater Treatment Works Policy WPC-DR-1* (wastewater design criteria). The inDENSE™ hydrocyclone sludge settling enhancement design is accepted for use as an alternative technology subject to the design criteria in Table 1. This acceptance is not intended as a third-party certification of the technology.

This acceptance addresses the following item:

- inDENSE™ hydrocyclone sludge settling enhancement using the hydrocyclones as an external selector to improve sludge settleability. Configurations include either surface wasting at the aeration basin or clarifier wasting following settling.
Note: The inDENSE™ technology was previously called the S-Select® technology.

This acceptance applies only to the inDENSE™ hydrocyclone sludge settling enhancement and does not constitute construction approval for installation in domestic wastewater treatment facilities. **Review and approval for the design of any domestic wastewater facility proposing to use this technology will be further reviewed on a site-specific basis by the Division as required by Section 22.11(1) of the *Site Location and Design Approval Regulations for Domestic Wastewater Treatment Works 5CCR 1002-22* (Regulation 22) and the Colorado Water Quality Control Act (Act), Section 25-8-702, C.R.S. which states in part that: "No person shall commence the construction of any domestic wastewater treatment works or the enlargement of the capacity of an existing domestic wastewater treatment works, unless the site location and the design for the construction or expansion have been approved by the division."**

Any modifications to the physical attributes or characteristics of this treatment technology must be submitted to this office for review and acceptance by the Division prior to sale in Colorado. This condition includes changes made to the manufactured model and configurations (e.g., piping, mechanisms). For any changes to the process or equipment following the issuance of this letter, the Division will review any additional third party verification reports and issue a revised acceptance letter, or denial, as appropriate.



Table 1. inDENSE™ Design Criteria:

Design Criteria
<ol style="list-style-type: none">1. The approved inDENSE™ hydrocyclone sludge settling enhancement design capacity must be based on the anticipated peak wasting load to the hydrocyclone(s). Design loading rate with upstream valves fully open must not exceed the hydrocyclone capacity (i.e., total number of hydrocyclones at individual capacity of 22 gpm, 44 gpm, or 88 gpm). During the site-specific design review, calculations must be submitted in the Process Design Report (PDR) to justify the basis of design.2. The technology function relies on continuous consistent flows and the design must minimize design scenarios where flows to the hydrocyclones are intermittent or pulses. The design must provide for unrestricted flow from the hydrocyclones through the overflow and underflow.3. If multiple hydrocyclones are included in parallel, adequate flow splitting devices must be provided to ensure equal flow and solids concentrations to each unit of similar size.4. The process design report must include a description of the flows to and from the hydrocyclones with particular focus on flows being directed to other unit processes including the overflow and underflow. The design for the receiving processes must be evaluated for hydraulic and treatment impacts and provisions must be included to mitigate impacts from the hydrocyclone flows to other processes, as needed (e.g., WAS pumps, RAS pumps, RAS flow splitters/mixing box). The PDR must demonstrate downstream pipes/pumps/processes are capable of handling flows and expected TSS concentrations based on nozzles which establish the desired underflow/overflow proportions, including a range of flow splits if the design includes the option to switch nozzles. When this technology is added to an existing facility as part of the clarifier wasting configuration, downstream WAS and RAS pump rates are expected to increase and decrease, respectively, as the RAS sludge concentration increases. Suitability of the existing pumps for new conditions (i.e., hydraulic and solids concentrations) must be evaluated. The process flow description must include methods for handling flows such as gravity flow, use of pumps, etc. and identify connection points (e.g., feed pumps and gravity or tank/pumps for hydrocyclone overflow and underflow).5. Pump Equipment. The design must demonstrate adequate size and capacity for pumps based on site-specific conditions and treatment requirements. Feed pressure to hydrocyclones must be at least 25 psi and generally less than 35 psi.6. Overflow Elbow. The overflow elbow outlet opening must not be located below the hydrocyclone feed level or must include another provision to prevent a siphon effect (e.g., vent pipe).7. Treatment Credit. Although the technology targets improved sludge settling, the use of the technology does not increase the allowable design surface loading rate or solids loading rate criteria for secondary clarifiers. Similarly, although the technology targets improved phosphorus removal through sludge settleability, no quantified phosphorus removal credit is granted for the treatment technology.8. For facilities where ambient temperatures can be below freezing, the design must include adequate cold weather provisions (e.g., heat trace lines, insulated covers, installation in a temperature-controlled enclosure for above ground wet components).9. Alarm. Alarms must be provided for high/low feed pressure and high/low tank level (if tank included in design). The design must identify how the alarm signal will notify operators of alarm activations, when the facility is attended and unattended.

10. Design Redundancy. Firm capacity (i.e., largest unit out of service) for hydrocyclones, feed pumps, and associated downstream sludge pumps must be available at the site to provide design requirements. The backup hydrocyclone may be an uninstalled unit, provided the installed unit can be easily removed and replaced. The redundant feed pump and downstream sludge pumps must be installed. The design may include provisions to bypass the hydrocyclones and provide firm capacity of pump equipment required to operate in the bypass configuration.
11. Hydrocyclone Locations. Hydrocyclones are polyurethane and not heat resistant so the design location must be away from heat sources that could adversely impact the hydrocyclones.
12. Maintenance Access. Design must include provisions that allow the operator to access, operate, and maintain the treatment technology.
13. Manufacturer Review. A review letter issued by the manufacturer indicating the installation was designed in accordance with manufacturer recommendations must be included with the site-specific design submittal. The manufacturer's review may not supersede criteria in this acceptance. The manufacturer's review may not be substituted for all required engineering documentation and calculations stamped and signed by a Colorado licensed Professional Engineer.

Additional Operations and Maintenance Criteria

1. Design must include provision for operator training including, but not limited to: start-up operations, normal operations, hydraulic fluctuations, temperature impacts, sludge monitoring, removal, and residual management.
2. An Operations and Maintenance (O&M) Manual must be provided for all installations and be available for review by the Division during compliance inspections.
3. Facility Classification. This technology will not alter the classification of the domestic wastewater treatment facility at which it is located, as determined in accordance with Regulation 100 Water and Wastewater Facility Operators Certification Requirements.

The owner of the domestic wastewater treatment works is responsible for proper design, operation, and maintenance of the facility to meet permit effluent requirements.

Please be aware that any point source discharges of water from treatment facilities are potentially subject to a discharge permit under Colorado's State Discharge Permit System. Any point source discharges to state waters without a permit are subject to civil or criminal enforcement action.

As part of this review, the Division has evaluated the following documents:

- June 16, 2015 Submittal from World Water Works requesting alternative technology acceptance for inDENSE™ hydrocyclone sludge settling enhancement.
- March 2, 2016 Submittal from World Water Works providing additional information for the alternative technology review for the inDENSE™ hydrocyclone sludge settling enhancement.
- August 19, 2016 Submittal from World Water Works providing additional information for the alternative technology review for the inDENSE™ hydrocyclone sludge settling enhancement.
- Various additional correspondences.

Please direct any further correspondence regarding this acceptance to:

David Kurz, P.E.
Colorado Department of Public Health and Environment
Water Quality Control Division
4300 Cherry Creek Drive South
Denver, CO 80246

If you have any questions or comments, please contact David Kurz at david.kurz@state.co.us or 303-692-3552.

Sincerely,

David Kurz, P.E.
Lead Wastewater Engineer
Engineering Section | Water Quality Control Division
Colorado Department of Public Health and Environment