General Frequently Asked Questions:

1. What is an Advanced Oxidation Process and how does it work?

An advanced oxidation process is a process whereby oxidation is achieved via the generation of highly reactive radical species. The AgriWater Advanced Oxidation Process **(AW-AOP)** does this by strategically combining energized air and small dosages of hydrogen peroxide to generated hydroxyl radicals in the water being treated. These radicals (as well as the energized air components and hydrogen peroxide directly) effectively and efficiently break down contaminants in the water while also improving general water quality and aeration.

2. How would the AgriWater unit fit into my existing water distribution system?

The AgriWater **(AW-AOP)** unit can easily be added onto any type of water distribution system. The optimal point of installation will be after the main pump and before the filter (if any). A complete installation guide is provided. This shows exactly where and how the side stream to and from the AgriWater unit should be installed on the main water line.

3. What is meant by "energized air/oxygen"?

Atmospheric air flows over a special AgriWater UV lamp as it is sucked into the side stream by the venturi. This lamp transfers photon energy at highly specific frequencies to the air. At this frequency, the energy can stably be loaded onto oxygen molecules (much like batteries). These energy-loading process can transform oxygen molecules to singlet, triplet or quintuplet oxygen molecules as required for balancing the energy load.

4. Are the levels of oxidative species in the treated water measured?

AgriWater **(AW-AOP)** dosages and design dynamics ensures that highly oxidative species are only generate under specific process conditions and immediately dissociates into oxygen, water and carbon dioxide when discharged. In situ process measurements are thus unpractical in farming situations as it would generally need to be done in a lab setup. Oxygen nano- and microbubble content can be measured directly after discharge with probe but similarly as stated before, is unpractical in farming situations. *Thus, we do not monitor or measure either.*

5. Can I measure the oxygen level in the soil?

There are various ways to measure oxygen in soil, but these are mostly used in scientific situations. Indirect measurements are often used. For example, the Brookside Soil Health Test measures respiration and various parameters which indirectly relate back to soil aeration and soil oxygen.

6. What is the function of the hydrogen peroxide in the system?

Hydrogen peroxide is added to the water being treated in small amounts via a dosing pump. In the water, these acts as a catalyst to the advanced oxidation reactions that are active in the water until discharge. The hydrogen peroxide dosing pump is installed after the venturi that pulls the energized air into the side-line.

7. What concentration of hydrogen peroxide is added during AgriWater (AW-AOP) treatment?

Standard calibration is done with a 50% solution of hydrogen peroxide to achieve a maximum concentration of 2ppm continuously inline to serve as catalyst to the AgriWater advanced oxidation reactions throughout the water distribution system.

8. Where can one purchase hydrogen peroxide?

Google local suppliers of hydrogen peroxide such as Evonik or Solvay etc.. Calibration of the treatment process and setting of the hydrogen peroxide dosing pump can be adjusted to account for hydrogen peroxide solution strengths other than the standard 50%.

9. What is the difference between the AgriWater advanced oxidation process and conventional oxidation treatments?

Conventional oxidation treatments depend on high concentrations of oxidative species to be present in water for reactions with certain types of contaminants in water. They would generally require a certain residue of active species in the treated water for optimal efficiency. The AgriWater advanced oxidation process is specially designed to effectively and efficiently oxidize any chemical, organic, inorganic or bacterial impurities in the water begin treated, using low dosages of energized air and hydrogen peroxide which combine with each other in contact with impurities to generate highly reactive oxidative radicals (oxidative potential double that of chlorine). No hazardous residue is present in AgriWater **(AW-AOP)** treated water after discharge. Treated water is instead left with optimized aerated characteristics.

10. If a standard hydrogen peroxide treatment system is to be replaced by a AgriWater (AW-AOP) unit, would there be a saving in hydrogen peroxide usage?

Standard practices of hydrogen peroxide water treatment call for concentration of 15 to 100 ppm dosed into the water. As the AgriWater **(AW-AOP)** system only required up to a maximum of 2 ppm of hydrogen peroxide in the water to active advanced oxidation reactions, significantly less hydrogen peroxide will be used. The same will be true for when replacing any other conventional product used to clean water distribution systems with an AgriWater **(AW-AOP)** system.

11. Does the energized air produced by the AgriWater UV lamps pose any threats to the environment or atmosphere?

Not at all. All active oxidative species that are added to the water are only active under the designed pressure and flow. Once they are discharged from the water distribution system all active oxidative species break down to oxygen, water and carbon dioxide which are then mostly present as micro- and nanobubbles in the treated water. Oxygen and carbon dioxide are thus entrained into the soil as the water enters the soil solution. This carries great advantageous effect to the soil environment. No residual harmful reactants thus persist in the treated water after discharge.

12. Are there any circumstances under which the AgriWater (AW-AOP) will not cause beneficial results?

As long as the AgriWater **(AW-AOP)** system is installed correctly according to the specific design and routine operation check are regularly done, beneficial results such as clean water distribution systems and improved soil aeration are always seen. Note that adjustments to management practices according to improved soil characteristic etc. will be necessary as the benefits of improved water quality is carried over to the soil over time in order to maintain said benefits.

13. Is there a certain amount of the total water applied per hectare/acre that must be treated by the AgriWater (AW-AOP) to achieve beneficial results throughout the water distribution system and in the soil?

The AgriWater **(AW-AOP)** treats all the water – all the time. The AgriWater **(AW-AOP)** unit switches on automatically as the main water distribution pump switches on and continuously operated while it is running to treat all water flowing through the distribution system. No adjustments to scheduling is required to achieve the beneficial results throughout. As soil characteristics improve adjustments to timing and amount of water applied has to be adjusted accordingly to maintain benefits.

14. Will AgriWater (AW-AOP) treatment affect iron and manganese borehole water?

AgriWater **(AW-AOP)** treatment oxidizes iron, manganese and chloride into less available and less toxic forms that are small enough to pass though the water delivery system and soil profile without accumulating and causing detrimental effects.

15. Will AgriWater (AW-AOP) treatment clean already dirty and clogged water distribution systems?

Yes – the AgriWater **(AW-AOP)** will clean dirty water delivery systems throughout and remove any built-up contaminants causing blockages. Whole water delivery systems from filters to pipes to drippers/micros/nozzles will efficiently be cleaned and kept clean. Dripper lines will still occasionally be required to be flushed, especially while debris are being cleaned from the water distribution system at the initiation of AgriWater **(AW-AOP)** treatment, but the use of chemicals to clean your lines will no longer be necessary. You will thus have the peace of mind that all drippers are working and giving effective water delivery.

16. Can active biological material be injected through water distribution systems treated by the AgriWater (AW-AOP)?

We recommend switching the AgriWater **(AW-AOP)** unit off while injecting biological material through the water distribution system to ensure no living species are oxidized during distribution. Once the application thereof is completed the AgriWater **(AW-AOP)** unit must be switch on again to maintain cleaning of the water distribution system (any slime formation that can be caused by biological material injection will quickly be cleared) and benefits to soil aerobic functioning.

17. How is the size of the AgriWater (AW-AOP) unit decided?

To determine the sizing of the AgriWater **(AW-AOP)** installation, we required the water delivery rate and pressure for the pump of the water delivery system onto which the treatment system will be installed. As a pro-active measure we also request a recent irrigation water quality test.

18. How can the efficiency of the system be measured?

The measurements are very practical, and guidelines are provided on purchase of a system. Basically a farmer must check their irrigation system is cleaned and kept clean. Example:

- Cut open the dripper lines to ensure they are clean
- Check nozzles, drippers or other emitters for even unhindered water deliver
- Frequency of backwashing of filters should be reduced
- Cleaning of filters should be much reduced
- Pressure difference build-up over filters will be greatly decreased.

19. How can we be sure that we do not overdose?

If the installation and settings are as specified – you cannot overdose. Furthermore, given that our doses are so low, any danger of an overdose is insignificant. Note that the dosing pump should not be use for any other purpose than specified with the AgriWater **(AW-AOP)** installation and no other

products/compounds other that those specified with the installation should be added as part of the AgriWater **(AW-AOP)**.

20. How do you calibrate the unit?

Calibration is done as part of the sizing and design of the system before installation. No additional calibration is required – just install the AgriWater **(AW-AOP)** unit according to design specification.

21. Can AgriWater (AW-AOP) treatment accommodate fluctuation in water quality?

Design and sizing of the AgriWater **(AW-AOP)** unit is based on the flow rate and pressure of the specific system, as well as the water quality (results of a recent water quality analysis is preferably required). Sizing is thus done to ensure the capability of the AgriWater **(AW-AOP)** to handle any worsening of water quality. For occasional quality problem such as an algal bloom, the hydrogen peroxide concentration can be raised by changing the settings.

22. Can we use the AgriWater (AW-AOP) to treat water in the pack-house?

We do not normally recommend the AgriWater **(AW-AOP)** for pack-houses as it does not sterilize the water and kill all pathogens as required for pack-house water use. Our treatment should always reduce counts but might not reduce them to max cfu/100ml levels required.