WHAT IS CLAIMED IS:

1. A water treatment system comprising:

a collection station having a well for collecting a body of waste water received from an inflow main;

a dispersion system that receives a portion of collected waste water from the well, the dispersion system comprising a hydrodynamic mixing chamber and a nozzle, wherein an additive is mixed with a portion of collected water passing through the mixing chamber and wherein the mixed collected waste water and additive is dispersed through the nozzle as a spray to one or more of the surface of the body of waste water and a wall of the well; and

a controller comprising one or more processors configured to monitor the level of waste water in the well and further configured to cause a pump to drive a portion of the waste water from the well through an outflow main when the level of waste water in the well exceeds a threshold level, wherein

the controller is further configured to control a rate of flow of the additive to the mixing chamber.

2. The water treatment system of claim 1, wherein the dispersion system comprises a manifold that provides the portion of collected water and the additive to the mixing chamber.

3. The water treatment system of claim 1, wherein the additive comprises liquid ozone.

4. The water treatment system of claim 3, wherein the controller controls rate of flow of the liquid ozone based on measurements provided by sensors deployed in the well.

5. The water treatment system of claim 4, wherein the measurements include a measurement of residual ozone level in the collected waste water.

6. The water treatment system of claim 4, wherein the measurements include a measurement of sulfide in the collected waste water.

7. The water treatment system of claim 4, wherein the measurements include a measurement of hydrogen sulfide in the well.

8. The water treatment system of claim 1, wherein the controller is configured to control a main treatment system, wherein the main treatment system mixes ozone with waste water in one or more of the inflow and outflow mains.

9. The water treatment system of claim 8, wherein the controller controls rate and frequency of treatment of the wastewater in the one or more mains based on a measurement of sulfide ions in the one or more mains.

10. The water treatment system of claim 8, wherein the controller controls rate and frequency of treatment of the wastewater in the one or more mains based on a measurement of residual ozone in the one or more mains.

11. The water treatment system of claim 8, wherein the controller controls rate and frequency of treatment of the wastewater in the one or more mains based on a measurement of wastewater flow in the one or more mains.

12. The water treatment system of claim 8, wherein the one or more mains includes a force main.

13. The water treatment system of claim 8, wherein the controller controls rate and frequency of treatment of the wastewater in the one or more mains based on a measurement of contaminants measured in the well.

14. A water treatment method comprising the steps of:

measuring a concentration of one or more contaminants in a collection station, the collection station maintaining a body of waste water received from an inflow main;

providing a portion of the waste water to a dispersion system comprising a hydrodynamic mixing chamber and a nozzle;

controlling the flow of an additive to the mixing chamber, wherein the additive operates to neutralize the one or more contaminants;

dispersing a mixture of the waste water and the additive through the nozzle onto one or more of the surface of the body of waste water and a wall of the well; and

evacuating a portion of the body of waste water through an outflow main.

15. The method of claim 14, wherein the flow of the additive is controlled based on a measurement of a level of the one or more contaminants in the well.

16. The method of claim 15, wherein the additive includes ozone.

17. The method of claim 14, further comprising the steps of:

measuring a concentration of at least one contaminant in the outflow main; and

causing a downstream treatment station to mix the additive with the evacuated portion of waste water when the measured concentration of the at least one contaminant exceeds a predetermined threshold concentration.

18. The method of claim 14, wherein the additive comprises ozone, and wherein the outflow main is a force main, and further comprising the steps of:

detecting a flow of waste water in the force main; and

causing a downstream treatment station to introduce ozone to the force main when waste water is flowing in the force main.

19. The method of claim 14, wherein the additive comprises one or more of ozone and oxygen, and further comprising the steps of:

measuring a concentration of at least one contaminant in the well; and

causing an upstream treatment station to pre-treat waste water in the inflow main with the additive based on the measured concentration of the at least one contaminant in the well.

20. A control system for managing waste water treatment, comprising:

a first sensor provided in a well of a collection station, the first sensor monitoring a contaminant level in the well;

a second sensor provided in an outflow main, the second sensor monitoring a contaminant level in the outflow main;

a pump provided in the collection station, wherein the pump operates to evacuate waste water from the well when the volume of waste water in the well exceeds a predetermined threshold volume;

a dispersion assembly deployed within the collection station and adapted to mix a portion of the waste water from the well with ozone received from an ozone generator,

and configured to spray one or more of a wall of the well and a surface of the volume of waste water in the well with a mixture of the ozone and the waste water; and

an outflow main treatment system operable to mix a portion of the waste water from the outflow main with ozone received from the ozone generator and configured to reintroduce the mixed ozone and waste water from the outflow main into the outflow main,

wherein a processor controls the rate at which ozone is provided to the dispersion assembly and to the outflow main treatment system based on measurements of contaminants received from the first and second sensors, and wherein the processor is configurable to maintain the level of contaminants in the well and the outflow main below a desired threshold level.

CLAIMS

1. A water treatment system comprising:

a well adapted to collect a body of waste water received from an inflow main;

a spray head assembly, wherein the spray head assembly has a hydrodynamic mixing chamber provided therein, and a nozzle;

a multi-port manifold adapted to be attached to the spray head assembly and to attach the spray head assembly to an end of a conduit that carries waste water from the well, wherein the multi-port manifold is configured to conduct waste water from the conduit to the hydrodynamic mixing chamber in the spray head assembly, and further configured to couple a supply of additive to the hydrodynamic mixing chamber in the spray head assembly,

wherein the hydrodynamic mixing chamber is configured to mix the additive with the waste water, and further configured to cause a mixture of waste water and the additive to leave the hydrodynamic mixing chamber through the nozzle, and

wherein the nozzle is configured to disperse the mixture as a spray on to a surface of the body of waste water or a wall of the well; and

a controller comprising a non-transitory memory device having one or more sequences of instructions stored thereon that, when executed by one or more processors of the controller, cause the controller to:

obtain measurements of a contaminant or residual additive in the well;

calculate an amount of the additive to be introduced to the well based on the measurements of the contaminant or the residual additive; and

control a rate of flow of the additive to the mixing chamber based on the amount of the additive calculated for introduction to the well.

2. The water treatment system of claim 1, wherein the hydrodynamic mixing chamber has a structure configured to cause agitation within the hydrodynamic mixing chamber while the additive is mixed with waste water.

3. The water treatment system of claim 2, wherein the additive comprises ozone, and wherein the hydrodynamic mixing chamber is constructed from an ozone resistant material, and wherein the agitation causes the ozone to be instantly mixed with waste water received from the multi-port manifold.

4. The water treatment system of claim 2, wherein the one or more sequences of instructions cause the controller to:

obtain measurements of chemical or biomaterial content in the well from sensors deployed in the well; and

control a rate of flow of the additive through the multi-port manifold based on the measurements of chemical or biomaterial content in the well.

5. The water treatment system of claim 2, wherein the additive comprises ozone, and wherein the one or more sequences of instructions cause the controller to:

obtain a measurement of residual ozone in the well; and

control a rate of flow of the ozone through the multi-port manifold based on the measurement of the residual ozone in waste water collected in the well.

6. The water treatment system of claim 4, wherein the measurements include a measurement of sulfide in waste water collected in the well.

7. The water treatment system of claim 4, wherein the measurements include a measurement of hydrogen sulfide in the well.

8. The water treatment system of claim 1, wherein the one or more sequences of instructions cause the controller to:

determine a concentration of a contaminant or residual additive in a main that provides an inflow of waste water to the well or receives an outflow of waste water from the well;

calculate an amount of additive to be introduced into the main based on the concentration of the contaminant or the residual additive; and

control a rate of flow of the additive introduced to the main by a main treatment system, wherein the main treatment system is configured to:

mix a portion of fluid extracted from the main with ozone; and

reintroduce the portion of fluid mixed with ozone into the main.

9. The water treatment system of claim 8, wherein the controller is configured to control rate and frequency of treatment of the waste water in the one or more mains based on a measurement of residual ozone or sulfide ions in the one or more mains.

10. The water treatment system of claim 8, wherein the controller is configured to control rate and frequency of treatment of the waste water in the one or more mains by exchanging commands and measurements over a data communications network with a controlling device collocated with the main treatment system.

11. The water treatment system of claim 8, wherein the controller is configured to control rate and frequency of treatment of the waste water in each main of the one or more mains based on a measurement of waste water flow in the each main.

12. The water treatment system of claim 8, wherein the controller includes a communication interface configured to communicate with a sensor, a pump, an additive dispenser, or an ozone generator using a two-way data communication network.

13. The water treatment system of claim 8, wherein the controller is configured to control rate and frequency of treatment of the waste water in the main based on a level of contaminants measured in the well.

14. A water treatment method performed by a controller and comprising the steps of:

receiving measurements of a concentration of one or more contaminants in a collection station from at least one sensor, the collection station maintaining a body of waste water received from an inflow main;

providing a portion of the waste water to a spray head assembly comprising a hydrodynamic mixing chamber and a nozzle;

calculating a rate of introduction of an additive to the collection station in accordance with a predefined algorithm, wherein the rate of introduction of the additive is calculated based on the measurements of the concentration of the one or more contaminants and a measured rate of flow of the waste water received from the inflow main;

controlling the flow of the additive to the mixing chamber in accordance with the calculated rate of introduction of the additive, wherein the hydrodynamic mixing chamber is configured to mix the additive with waste water as the waste water is transmitted through the spray head assemble, and wherein the additive operates to neutralize the one or more contaminants, wherein a mixture of the waste water and the additive is passed through the nozzle onto a surface of the body of waste water or a wall of the collection station; and

evacuating a portion of the body of waste water through an outflow main when a volume of waste water in a well of the collection station exceeds a predetermined threshold volume,

wherein the spray head assembly is attached to a multi-port manifold that is attached to an end of a conduit and that conducts waste water from the conduit to the hydrodynamic mixing chamber in the spray head assembly, and

wherein the hydrodynamic mixing chamber has a structure configured to cause agitation within the hydrodynamic mixing chamber while the additive is mixed with waste water.

15. The method of claim 14, wherein the rate of introduction of the additive is calculated based on a measurement of a level of the one or more contaminants or residual additive in the collection station.

16. The method of claim 15, wherein the additive includes ozone, and wherein the hydrodynamic mixing chamber is constructed from stainless steel or an ozone resistant material.

17. The method of claim 14, further comprising the steps of:

receiving measurements of a concentration of at least one contaminant in the outflow main; and

causing a downstream treatment station to mix the additive with the evacuated portion of waste water when the measurements of concentration of the at least one contaminant exceeds a predetermined threshold concentration using a data communications network to exchange commands and measurements with a controlling device collocated with the downstream treatment station.

18. The method of claim 14, wherein the additive comprises ozone, and wherein the outflow main is a force main, and further comprising the steps of:

detecting a flow of waste water in the force main; and

causing a downstream treatment station to introduce ozone to the force main when waste water is flowing in the force main using a data communications network to exchange commands and measurements with a controlling device collocated with the downstream treatment station.

19. The method of claim 14, wherein the additive comprises one or more of ozone and oxygen, and further comprising the steps of:

measuring a concentration of at least one contaminant in the collection station; and

causing an upstream treatment station to pre-treat waste water in the inflow main with the additive based on the measurements of concentration of the at least one contaminant in the collection station using a data communications network to exchange commands and measurements with a controlling device collocated with the upstream treatment station.

20. A control system for managing waste water treatment, comprising:

a first sensor provided in a well of a collection station, the first sensor monitoring a contaminant level in the well;

a second sensor provided in an outflow main, the second sensor monitoring a contaminant level in the outflow main;

a pump provided in the collection station, wherein the pump operates to evacuate waste water from the well when volume of waste water in the well exceeds a predetermined threshold volume;

a spray head assembly having a hydrodynamic mixing chamber, a plurality of ports and a nozzle, the spray head assembly being deployed within the collection station and adapted to mix a portion of the waste water from the well with ozone received from an ozone generator, and configured to spray a wall of the well or a surface of the volume of waste water in the well with a mixture of the ozone and the waste water;

an outflow main treatment system operable to mix a portion of the waste water from the outflow main with ozone received from the ozone generator and configured to reintroduce the mixed ozone and waste water from the outflow main into the outflow main; and

a processor that responds to stored instructions that cause the processor to calculate a rate at which ozone is provided to the spray head assembly and to the outflow main treatment system in accordance with a predefined algorithm and based on measurements of residual ozone or contaminants received from the first and second sensors,

wherein the processor is configurable to maintain levels of contaminants in the well and the outflow main below a desired threshold level,

wherein the spray head assembly is attached to a multi-port manifold that is attached to an end of a conduit and that conducts waste water from the conduit to the hydrodynamic mixing chamber in the spray head assembly, and

wherein the hydrodynamic mixing chamber has a structure configured to cause agitation within the hydrodynamic mixing chamber while an additive is mixed with waste water.