CLAIMS

1. An airborne molecular contamination (AMC) monitoring apparatus comprising:

a manifold including:

an inlet tube adapted to be fluidly coupled a plurality of individual sampling tubes in a sampling tube bus, wherein each individual sampling tube is fluidly coupled to the inlet tube by a three-way valve,

a buffer tank fluidly coupled to the inlet tube via a three-way valve, and

a plurality of outlet tubes, each outlet tube fluidly coupled to the buffer tank and each outlet tube being fluidly coupled to an analyzer via a three-way valve,

wherein the three-way valves that fluidly couple the individual sampling tubes to the inlet tube, the three-way valve that fluidly couples the inlet tube to the buffer tank, and the three-way valves that fluidly couple the outlet tubes to the analyzer, can be configured so that the manifold can be flushed out;

one or more analyzers, each fluidly coupled to one of the one or more outlets of the manifold to analyze fluid drawn into the manifold through one or more of the plurality of individual sampling tubes; and

a control and communication system coupled to the one or more analyzers.

2. The AMC monitoring apparatus of claim 1 wherein each individual sampling tube is coupled a chamber of a process equipment station.

3. The AMC monitoring apparatus of claim 1 wherein the one or more sensors can include an individual or total volatile organic compounds (VOC) detector, an acid compound detector, a base compound detector, a sulfide compound detector, an amine compound detector, an air particle or aerosol count detector, a humidity detector, a temperature detector, a chemical coolant detector, an anion detector, a cation detector, a metal ion detector, or a doping ion detector.

4. The AMC monitoring apparatus of claim 1 wherein the manifold further comprises a clean air inflow and a clean air outflow coupled to the buffer tank to flush out the interior of the buffer tank.

5. The AMC monitoring apparatus of claim 4 wherein the manifold further comprises a pump fluidly coupled to the interior of the buffer tank.

6. The AMC monitoring apparatus of claim 5, further comprising one or more analyzers coupled to the inlet tube upstream of the three-way valve that couples the inlet tube to the buffer tank.

7. The AMC monitoring apparatus of claim 6 wherein the one or more analyzers coupled to the inlet tube upstream of the three-way valve include a temperature analyzer or a humidity analyzer.

8. The AMC monitoring apparatus of claim 1, further comprising a pump fluidly coupled to the three-way valve that couples the inlet tube to the buffer tank.

9. An environmental monitoring system comprising:

two or more sampling buses each comprising a plurality of individual sampling tubes, each sampling bus corresponding to a process equipment module, wherein each individual sampling tube in a sampling bus is adapted to be fluidly coupled to one or more chambers of the corresponding process equipment module;

a single airborne molecular contamination (AMC) apparatus configured to be fluidly coupled and uncoupled to one of the two or more sampling buses, the airborne contamination apparatuses comprising:

a manifold having a plurality of inlets and one or more outlets, wherein each individual sampling tube from the sampling bus to which the AMC apparatus is coupled is adapted to be fluidly coupled to one of the plurality of inlets of the manifold,

one or more analyzers, each fluidly coupled to one of the one or more outlets of the manifold to analyze fluid drawn into the manifold through one or more of the plurality of individual sampling tubes, and

a control and communication system coupled to the one or more analyzers; and

a remote server communicatively coupled, wirelessly or by wire, to the control and communication system;

wherein the single AMC apparatus is mobile, so that it can be moved from a position where it is fluidly coupled to one sampling bus to a position where it can be fluidly coupled to another sampling bus.

10. The system of claim 9 wherein each process equipment module includes a load port to receive a moveable carrier carrying items being manufactured, and wherein at least one

individual sampling tube is fluidly coupled to each load port to sample the environment inside the movable carrier when the movable carrier is placed on the load port.

11. The system of claim 10 wherein individual sampling tubes are adapted to be fluidly coupled to an interface chamber, a lock load chamber, and a process chamber of the process equipment module to sample the environment within each chamber.

12. The system of claim 11, further comprising a load port attached to the AMC apparatus and fluidly coupled to at least one individual sampling tube of the AMC apparatus.

13. The system of claim 9 wherein the manifold comprises:

an inlet tube fluidly coupled to each of the plurality of individual sampling tubes by a three-way valve;

a buffer tank fluidly coupled to the inlet tube via a three-way valve;

a plurality of outlet tubes, each outlet tube fluidly coupled to the buffer tank and each outlet tube being fluidly coupled to an analyzer via a three-way valve;

a clean air inflow and a clean air outflow coupled to the buffer tank to flush out the interior of the buffer tank.

14. An environmental monitoring system comprising:

two or more sampling buses each comprising a plurality of individual sampling tubes, each sampling bus corresponding to a set of process equipment modules, wherein each individual sampling tube in a sampling bus is adapted to be fluidly coupled to a chamber of a process equipment module in the corresponding set of process equipment modules;

a single airborne molecular contamination (AMC) apparatus configured to be fluidly coupled and uncoupled to one of the two or more sampling buses, the airborne contamination apparatuses comprising:

a manifold having a plurality of inlets and one or more outlets, wherein each individual sampling tube from the sampling bus to which the AMC apparatus is coupled is fluidly coupled to one of the plurality of inlets of the manifold,

one or more analyzers, each fluidly coupled to one of the one or more outlets of the manifold to analyze fluid drawn into the manifold through one or more of the plurality of individual sampling tubes, and

a control and communication system coupled to the one or more analyzers; and

a remote server communicatively coupled, wirelessly or by wire, to the control and communication system;

wherein the single AMC apparatus is mobile, so that it can be moved from a position where it is fluidly coupled to one sampling bus to a position where it can be fluidly coupled to another sampling bus.

15. The system of claim 14 wherein each process equipment module includes a load port to receive a moveable carrier carrying items being manufactured, and wherein at least one individual sampling tube is fluidly coupled to each load port to sample the environment inside the movable carrier when the movable carrier is placed on the load port.

16. The system of claim 15 wherein individual sampling tubes are adapted to be fluidly coupled to an interface chamber, a lock load chamber, and a process chamber of the process equipment module to sample the environment within each chamber.

17. The system of claim 14, further comprising a load port attached to the AMC apparatus and fluidly coupled to at least one individual sampling tube of the AMC apparatus.

18. The system of claim 14 wherein the control and communication system is communicatively coupled, wirelessly or by wire, to a remote server, to the at least one process equipment module, or to both the remote server and the at least one process equipment module.

19. The system of claim 14 wherein the manifold comprises:

an inlet tube fluidly coupled to each of the plurality of individual sampling tubes by a three-way valve;

a buffer tank fluidly coupled to the inlet tube via a three-way valve;

a plurality of outlet tubes, each outlet tube fluidly coupled to the buffer tank and each outlet tube being fluidly coupled to an analyzer via a three-way valve;

a clean air inflow and a clean air outflow coupled to the buffer tank to flush out the interior of the buffer tank.

20. An environmental monitoring system comprising:

an airborne molecular contamination (AMC) apparatus configured to be fluidly coupled and uncoupled to one of the two or more sampling buses, the airborne contamination apparatuses comprising:

a manifold having a plurality of inlets and one or more outlets, wherein each inlet of the manifold is adapted to be fluidly coupled, by a three-way valve, to one of a plurality individual sampling tubes that are fluidly coupled to one or more chambers of at least one process equipment module,

one or more analyzers, each fluidly coupled to one of the one or more outlets of the manifold to analyze fluid drawn into the manifold through one or more of the plurality of individual sampling tubes, and

a control and communication system coupled to the one or more analyzers;

a remote server communicatively coupled, wirelessly or by wire, to the control and communication system; and

an AMC load port attached to the AMC apparatus and fluidly coupled to at least one inlet of the manifold, wherein the load port can receive a moveable carrier.

21. The system of claim 20 wherein each process equipment module includes a load port to receive a moveable carrier carrying items being manufactured, and wherein at least one individual sampling tube is fluidly coupled to each load port to sample the environment inside the movable carrier when the movable carrier is placed on the load port.

22. The system of claim 21 wherein individual sampling tubes are adapted to be fluidly coupled to an interface chamber, a lock load chamber, and a process chamber of the process equipment module to sample the environment within each chamber.

23. The system of claim 20 wherein the control and communication system is communicatively coupled, wirelessly or by wire, to a remote server, to the at least one process equipment module, or to both the remote server and the at least one process equipment module.

24. The system of claim 20 wherein the manifold comprises:

an inlet tube fluidly coupled to each of the plurality of individual sampling tubes by a three-way valve;

a buffer tank fluidly coupled to the inlet tube via a three-way valve;

a plurality of outlet tubes, each outlet tube fluidly coupled to the buffer tank and each outlet tube being fluidly coupled to an analyzer via a three-way valve;

a clean air inflow and a clean air outflow coupled to the buffer tank to flush out the interior of the buffer tank.