

CLAIMS

1. An airborne molecular contamination (AMC) monitoring apparatus comprising:
 - a manifold having an inlet tube and one or more outlets fluidly connected to the inlet tube;
 - a sampling tube bus fluidly coupled to the manifold, the sampling tube bus comprising a plurality of individual sampling tubes coupled to the inlet tube of the manifold by a three-way valve;
 - two 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 two or more analyzers,wherein the manifold comprises
 - a buffer tank fluidly coupled to the one or more outlets of the manifold via a further three-way valve; and
 - a clean air inflow and a clean air outflow coupled to the buffer tank to flush out the interior of the buffer tank.
2. The AMC monitoring apparatus of claim 1 wherein each individual sampling tube is coupled to a chamber of a process equipment station.
3. The AMC monitoring apparatus of claim 1 wherein the two or more analyzers 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 pump fluidly coupled to the interior of the buffer tank.
5. The AMC monitoring apparatus of claim 4, further comprising one or more analyzers coupled to the inlet tube upstream of the further three-way valve that couples the inlet tube to the buffer tank.

6. The AMC monitoring apparatus of claim 5 wherein the one or more analyzers coupled to the inlet tube upstream of the further three-way valve include a temperature analyzer or a humidity analyzer.
7. The AMC monitoring apparatus of claim 1, further comprising a pump fluidly coupled to the further three-way valve that couples the inlet tube to the buffer tank.
8. The AMC monitoring apparatus of claim 1 wherein the control and communication system is communicatively coupled, wirelessly or by wire, to a remote server, to a process equipment module, or to both a remote server and a process equipment module.
9. The AMC monitoring apparatus of claim 1, further comprising a load port attached to the AMC monitoring apparatus and fluidly coupled to at least one individual sampling tube.
10. An environmental monitoring system comprising:
 - a sampling bus comprising a plurality of sampling tubes, wherein each sampling tube is adapted to be fluidly coupled to one or more chambers of at least one process equipment module;
 - one or more airborne molecular contamination (AMC) apparatuses fluidly coupled to the sampling bus, the airborne contamination apparatuses comprising:
 - a manifold having an inlet tube and one or more outlets fluidly connected to the inlet tube,
 - a sampling tube bus fluidly coupled to the manifold, the sampling tube bus comprising a plurality of individual sampling tubes coupled to the inlet tube of the manifold by a three-way valve,
 - two 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 two or more analyzers,
 - wherein the manifold comprises
 - a buffer tank fluidly coupled to the one or more outlets of the manifold via a further three-way valve; and

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

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

11. The system of claim 10 wherein each process equipment module includes a load port to receive a moveable carrier carrying items being manufactured, so that the items being manufactured are moved into the at one or more chambers of the process equipment module.
12. The system of claim 11 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.
13. The system of claim 11 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.
14. The system of claim 10 wherein the at least one process equipment module comprises a plurality of process equipment modules grouped into two or more sets, each set having its own sampling bus and its own AMC apparatus coupled to the sampling bus.
15. The system of claim 10 wherein the at least one process equipment module comprises a plurality of process equipment modules grouped into two or more sets, each set having its own sampling bus, and wherein a single movable AMC apparatus is adapted to be connected and disconnected from each sampling bus to monitor each set.
16. The system of claim 10 wherein the at least one process equipment module comprises a plurality of process equipment modules, wherein each process equipment module is coupled to a pair of sampling buses and wherein each of the pair of sampling buses is connected to its own environmental monitoring apparatus.
17. The system of claim 10 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.
18. The system of claim 10, further comprising a load port attached to at least one of the one or more AMC apparatuses and fluidly coupled to at least one individual sampling tube of the AMC apparatus to which it is attached.