

PRIMARY CONTAINMENT
ARCHITECTURAL RENOVATIONS
CUSTOM DESIGNED SOFT-WALL CLEAN ROOMS
ISOLATION ENVIRONMENT
HEPA-FILTERED CLEAN AIR EQUIPMENT
QUARANTINE ENVIRONMENTS
BIOSAFETY LEVELS 3 & 4

bioBUBBLE

CONTROLLED ENVIRONMENTS | CUSTOM SOLUTIONS

AN EFFECTIVE CUSTOMIZED
BIOCONTAINMENT ENCLOSURE
FOR MODERN CELL SORTERS

AIRLOCKS AIR SHOWERS
BEDDING DISPOSAL UNITS
ENVIRONMENTAL SEPARATION
TRANSPORT CARTS

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AN EFFECTIVE CUSTOMIZED **BIOCONTAINMENT ENCLOSURE** FOR MODERN CELL SORTERS

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Modern cell sorters already provide optional aerosol management within the immediate proximity of the sort chamber where sort fractions and waste decisions are made. A Bio Safety level facility must provide protection against the aerosolization of live samples that possibly contain blood borne pathogens such as hepatitis and HIV for example.

A cost effective, primary containment barrier, the bio**BUBBLE**, was designed and built around a modern sorter with total exhausted HEPA filtered air. The negative pressure enclosure protects the operator and environment not only from aerosols generated within the sort chamber but also from the sample introduction area. User customized window access patches add versatility to specific experimental needs. The enclosure allows generous access for service due to its simplistic design.

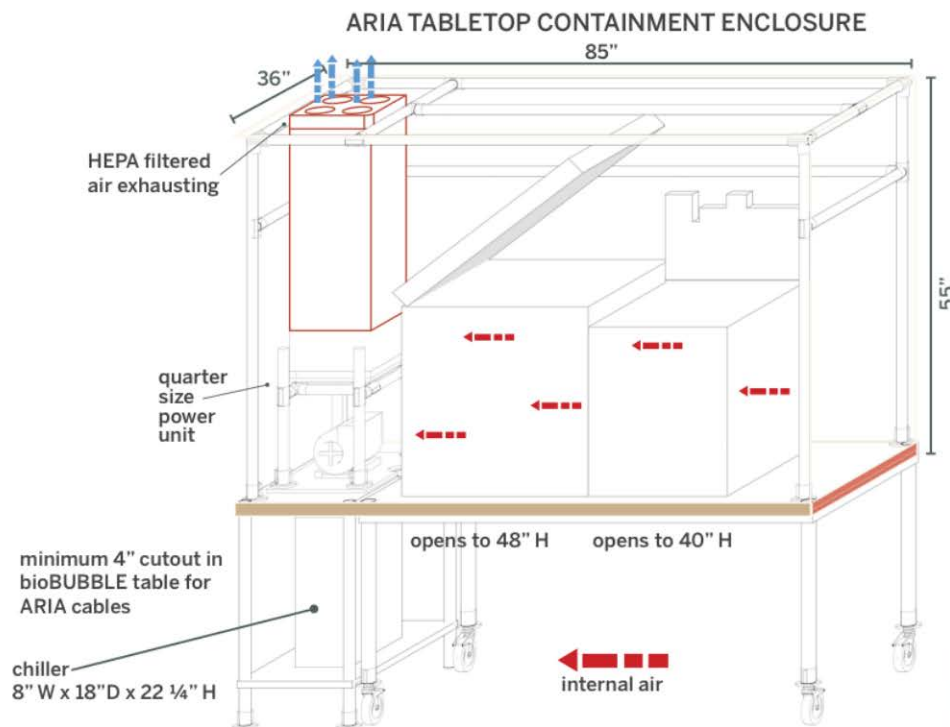
We demonstrate the effectiveness of aerosol containment under different operational scenarios using particles mimicking air borne pathogens. Sorter instrument internal temperature risk exposure, noise and air change data will be presented.



INTRODUCTION :

A cost effective Bio-Safety cabinet design was collaborated with bio**BUBBLE** of Fort Collins, Colorado (www.bioBUBBLE.com). The purpose to provide a primary containment enclosure for the FACS ARIA cell sorter.

SPECIFICATIONS :



GENERAL DESCRIPTION:
Freestanding Containment Enclosure

OUTSIDE DIMENSIONS:
85" x 36" x 55" high

AREA: 21.24 square feet

VOLUME: 97.27 cubic feet

LIGHTING: None needed, clear vinyl admits outside light

FRAME TYPE: 1 1/4" diameter aluminum

SKIN: 16 mil optically clear hospital grade vinyl

SKIN ASSEMBLY: All hook and loop

AIR CHANGES PER HOUR:
130-140 acph

POWER UNITS: One (1)
Quarter Size Power Unit

AIR VELOCITY: 15-30 feet per minute (FPM) as measured 1' below ceiling

PRESSURE TYPE: Dedicated negative pressure

AIR QUALITY: Class 100 exhaust (negative) on 0.3 micron

HEPA FILTER LIFESPAN:
3 to 5 years

SKELETON CONSTRUCTION OF
1 ¼" ALUMINUM ROUND TUBING



3 SECTIONS OF 16 MIL
HOSPITAL GRADE VINYL: TOP/
SIDES, REAR SHEET, FRONT
SHEET, VELCRO BONDED



CABINET ALLOWS ACCESS
FOR INSTRUMENT SERVICE



CABINET IN OPERATING
CONFIGURATION



RIGHT SIDE INSTRUMENT
ACCESS BY VELCRO SEALED
DOOR



VELCRO SURROUNDS OPENING,
ALLOWS USER DESIGNED CUT
OUT SHEETS TO BE ATTACHED



EL SHAPED
PROTECTIVE
SHEET
IN PLACE
DURING USE



SORT CHAMBER AND
BI AREA ACCESSIBLE



AEROSOL DETECTION MATERIALS AND METHODS:

1

Prepared Glo-Germs were introduced as a concentrated sample into the ARIA BI chamber to achieve a 20K event per second FSC trigger rate. To produce aerosols containing the Glo-Germ particles, a serious clog within the sort chamber was achieved by obstructing the waste trough with a piece of tape.

2

A "Bioaerosol Impact Sampler" system, from Environmental Monitoring Systems (EMS), was used to sample air around the biobubble front access port with an open sort chamber producing Glo-Germ contaminated aerosols. A Cycllex-d concentrator capsule was held in place with a floor stand positioned 8" from the front Biobubble access port. The EMS vacuum pump was adjusted for 20 liters per minute of air flow through the capsule for 3 minutes sampling time.

3

The capsule was opened within a laminar flow hood and the detection slide with silicon gel was placed on a glass slide. The slide was inspected under a fluorescent microscope for Glo-Germs contamination.

4

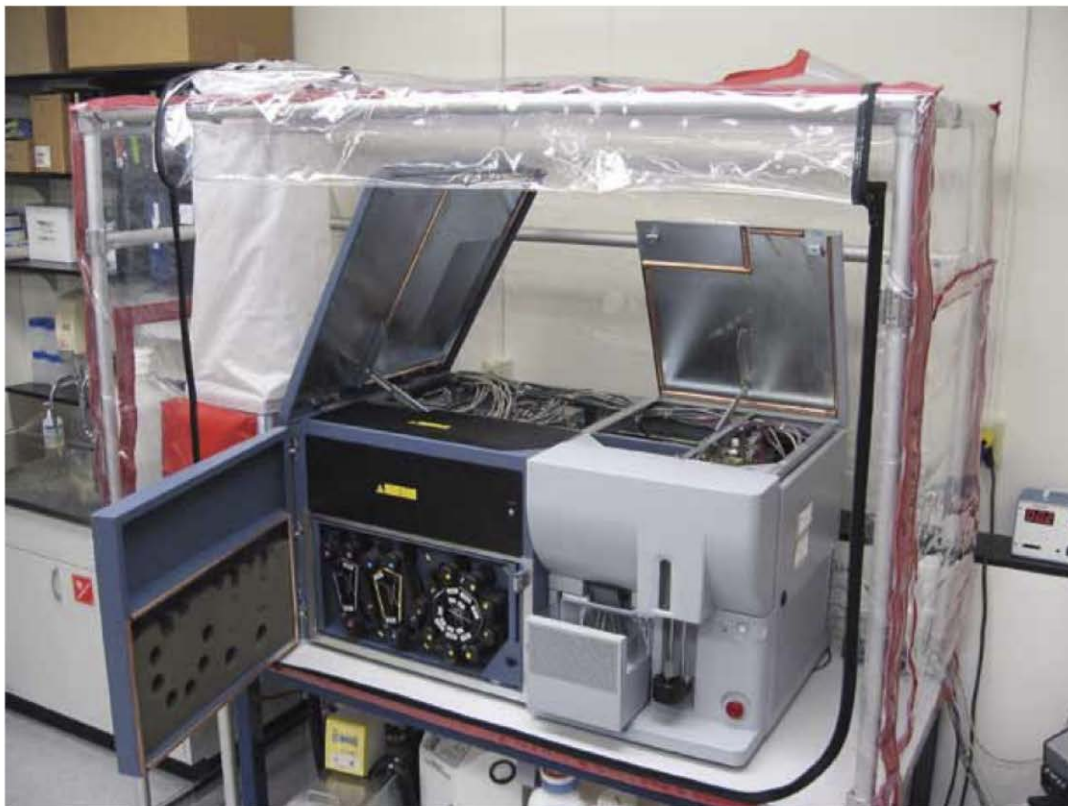
Samples were obtained with the open sort chamber containing aerosols as a positive control. Different sort chamber scenario conditions were set up while taking multiple air samples outside the bioBUBBLE access panel.

5

The area around the BI chamber was also sampled during a manual activation of depressing the, "Stop" button to detect any spray from the sudden depressurization of the BI chamber.



Multiple temperature chart recorders monitored temperature differences outside, inside the bioBUBBLE and within the instrument.



THE “BIOAERSOL IMPACT SAMPLER” SYSTEM CONSISTED OF A FLOW REGULATED VACUUM PUMP AND A AIR CONCENTRATOR SAMPLER CAPSULE.



THE AIR CONCENTRATOR SAMPLER CAPSULE CONSISTED OF A SQUARE GLASS SLIDE COVERED WITH A SILICON GEL TO TRAP PARTICLES (MANUFACTURED BY EMS).



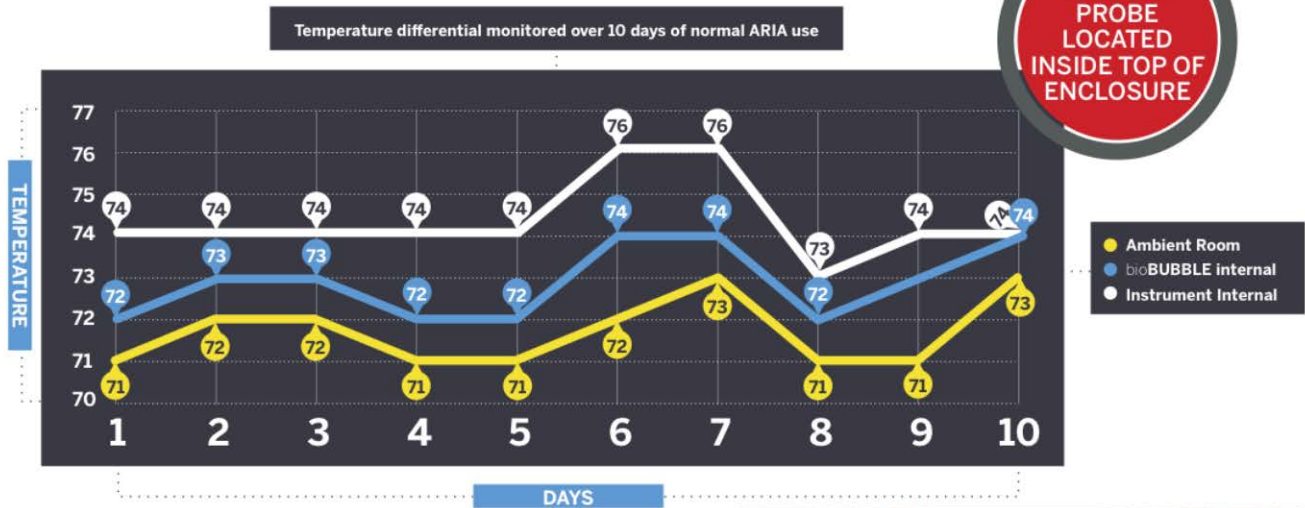
AFTER EXPOSURE, THE CAPSULE IS DISASSEMBLED UNDER A LAMINAR FLOW HOOD AND THE SILICON GEL GLASS PLATE WAS PLACED ON A SLIDE



FLUORESCENT MICROSCOPE USING A FITC CUBE USED TO DETECT GLO-GERMS TRAPPED BY SILICON GEL SLIDE



RESULTS:



REMOTE
PROBE
LOCATED
INSIDE TOP OF
ENCLOSURE

SMOKE TEST WAVED LEFT TO RIGHT 8" IN FRONT OF ACCESS PORT

CONDITIONS: HEPA negative air pressure running,
front access port fully open

RESULT: Smoke pulled into bioBUBBLE



DETECTABLE GLO-GERMS OUTSIDE bioBUBBLE WHILE AEROSOLS ARE CREATED CONTAINING GLO-GERMS

> SORT DOOR CLOSED, LID
CLOSED FRONT ACCESS FULLY
OPEN AMO ON, ADJ. TO 80%

> SORT DOOR OPENED, LID
OPENED FRONT ACCESS FULLY
OPEN AMO TURNED OFF

> SORT DOOR OPEN, LID OPEN
FRONT ACCESS WITH EL SHAPE
PATCH INSTALLED AMO ON,
ADJ. TO 80%



NO
GLO-GERMS
DETECTED



GLO-GERMS
DETECTED!



NO
GLO-GERMS
DETECTED

CONCLUSIONS:

■■■► The bio**BUBBLE** is an effective Bio-Safety cabinet when the front access panel has the proper accessory patch in place.

■■■► The instrument internal temperature is not adversely affected by temperature rise due to the enclosure.

■■■► The sorter instrument is accessible for service using the bio**BUBBLE** and can be removed if absolutely necessary.

■■■► Daily access to the optical filters or to instrument fluidic right side door easily accessible by unzipping entire front panel of the bio**BUBBLE** and flipping on top of the enclosure.

■■■► There is also an access door built into the right side of the bio**BUBBLE** leading the fluidic compartment but not necessary when unzipping the front section.
