

MOBILE VIROLOGY RESEARCH LAB AND DIAGNOSTICS LABORATORY **(MVRDL)**

FOR COVID-19

DRDO developed first of its kind mobile lab called MVRDL in India to speed-up the COVID-19 screening and R&D activities. It was conceptualized April 06 and the all activities have been completed record time by 20 April i.e. 15 days.

NEED OF THE LABORATORY

COVID-19 Pandemic requires as many test laboratories as possible. The test laboratories are expected to carry out the following activities:

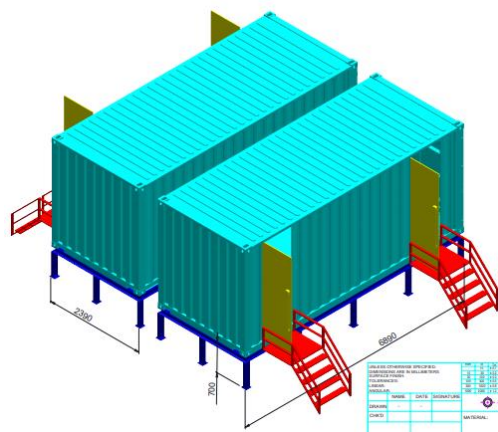
1. Conduct diagnostic test for COVID-19, real-time Reverse Transcription Polymerase Chain Reaction (rRT-PCR) Test
2. Virus culturing for drug screening, convalescent plasma derived therapy,
3. Aid in development of vaccine
4. Development of diagnostics kits

THE INITIATIVE

A laboratory which normally would take six months to build was taken up as a task to be done within a fortnight. DRDO in discussions with ESIC Medical College, Hyderabad team configured a combination of two labs. One Bio-Safety Level 3 (BSL-3) lab and another one Bio-Safety Level 2 (BSL-2) labs are connected to carry out the above activities.

DRDO came up with an immediate solution for establishing the facility in Mobile Shelters which can be positioned anywhere in the country in a very short period of time. A schematic is shown in Figure 1.

Figure 1: Schematic of the Shelters BSL-2 and BSL-3



DESIGN & IMPLEMENTATION

A schematic of the labs is shown in Illustration 2. The safety levels of two containers are are:

- Bio-Safety Level– 3 Lab standard
- Bio-Safety Level– 2 Lab standard

The Clinical specimen inactivation is to be performed in a Bio-Safety Level-3 laboratory (Negative Pressure, HEPA filters, anteroom and self locking doors) and subsequent to this step, routine testing is to be performed in a Bio-Safety Level-2 Laboratory.

The entire area is conditioned with HVAC system with a design of 100% fresh air ensuring no recirculation. Room temperature of 24 ± 4 °C is maintained, relative humidity is maintained less than 60% as per specifications of BSL-3 and BSL-2 labs. The labs built as per WHO and ICMR bio-safety standards to meet the international guidelines.

The system is equipped with access control, LAN, telephone cabling and CCTV. For maintaining safety fire alarm system is provided. The system has built-in furniture and is equipped with pass boxes for transfer the samples from container to other container. Personnel protective equipment is provided for personnel to cross over box. The detailed equipment in the laboratory modules is given in Annexure – I

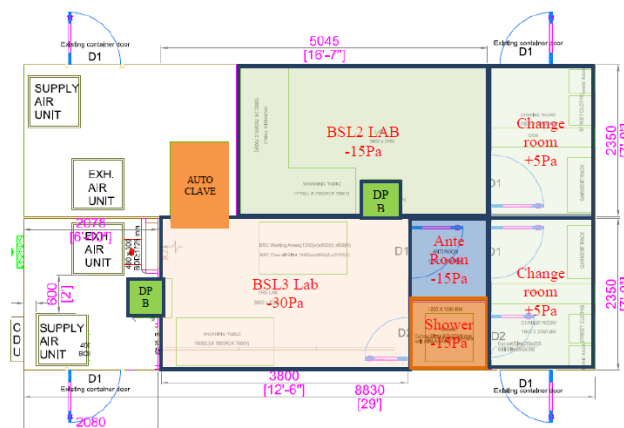


Figure 2: Design of the Laboratory

INDUSTRY SUPPORT

- M/s iCOMM, Hyderabad identified for building shelters
- M/s iClean, Hyderabad, a company with years experience in building the containment facilities augmented the laboratory with required safety levels
- M/s HiTech Electronics for Foundation Structure

ACTIVITIES AT THE LABORATORY

The laboratory is designed to carry out following activities:

- a) The laboratory screens 1000-2000 samples per day
- b) Drug screening
- c) Therapeutics
 - Convalescent Plasma therapy
 - Therapeutic value of milk exosomes for COVID-19
 - Stem cell therapy to reduce inflammation and fibrosis
- d) COVID-19 Diagnostics
 - Covid *i*-Chip - A simple, fast and highly sensitive detection of asymptomatic SARS COV2
 - IgG/IgG - Antibody rapid antibody test
 - Single Tube PCR test using isothermal amplification
 - Direct sequencing of corona viruses from clinical specimens, using nanopore digital target selection
- e) Vaccine Development - Comprehensive immune profiling of COVID-19 patients towards vaccine design and early clinical trials specific to Indian population.

ADDITIONAL APPLICATIONS OF MVRDL

- a) It can enable the test services at remote places
- b) The laboratory will enable extensive research on identification of viruses and identification of other agents causing morbidity significant to public health
- c) It will enable the researchers and medical practitioners to undertake research activities and develop diagnostics assays and therapeutics
- d) To understand and conduct surveillance of existing as well as new viruses.
- e) To develop diagnostic kits

ACKNOWLEDGEMENTS

DRDO acknowledges the contributions of M/s iCOMM for provision of container & M/s iClean team for design and building of BSL-2 and BSL-3 labs at a very fast pace. Foundation structure at ESIC is built by M/s HiTech Hydraulics, Hyderabad. Continuous guidance and support of Dr. Srinivas, Dean and staff of ESIC medical College and Hospital helped in delivering this BSL lab for COVID testing in a time bound period.

Pictures of Actual System





ANNEXURE - I

BSL-3 MODULE

The BSL-3 Lab is equipped with a Negative pressure (-30 pa) with, Ante room and Air lock with HEPA filters in Exhaust air design for specimen processing and virus culture, as per WHO guidelines. It is designed to clean the air > 12 times per hour. This lab is equipped with the following:

- a) Class II BSC type B2 (900 mm internal size)
- b) Centrifuge
- c) Ice box
- d) CO₂ incubator
- e) 1.5 ml Eppendorf tubes
- f) Sink
- g) Autoclave

BSL-2 MODULE

The BSL-2 Lab has facility to maintain the Negative pressure (-15 pa). This Lab is equipped with the following:

- a) Frost free freezer (-20 Deg C) – 100l
- b) Microwave Oven
- c) Refrigerated centrifuge
- d) CO₂ incubator
- e) Class II BSC Type A2 (900 mm size)
- f) Automatic Nucleic acid extractor
- g) Mini Spin
- h) Fridge (4 °C)
- i) Pipette – 3 different sizes
- j) Vortex mixer
- k) Frost free freezer (-20 °C) – 100l
- l) Real time PCR with work station
- m) RTPCR (Real time polymerase chain reaction)
- n) Computer and A4 size printer
- o) Mini plate spinner
- p) pH meter