

**MOBILE VIROLOGY RESEARCH AND DIAGNOSTIC LABORATORY (MVRDL:
BSL-3)***

BY

¹PRAJYOT ROTE*, ²SAI DHOLE, ³LALIT PATIL,⁴SUNANDA SHARMA, ⁵SAMEER AGRAWAL^{1,2,3,4,5}*School of Engineering Ajeenkya DY Patil University, India**Email Id :¹sai.dhole@adypu.edu.in, ²prajyot.chandrakant@adypu.edu.in,**³Lalit.Patil@adypu.edu.in, ⁴sunandan.sharma@adypu.edu.in,**⁵sameer.agrawal@adypu.edu.in***ABSTRACT**

To prevent spread of Coronavirus, World Wellbeing Association (WHO) has shown that activities, for instance, cleaning hands reliably with alcohol based hand sanitizer or washing with chemical and water, doing whatever it takes not to contact nose, eyes, mouth and social isolating should be followed by people. Another critical measure for containing spread is by Trying Testing and Testing. By testing, patients affected by Coronavirus can be separated and further spread from them can be thwarted. For testing, clinical model inactivation should be acted in a bio-prosperity level-3 (BSL-3) research focus and after this movement, routine testing can be acted in a bio-security level-2 lab. Considering the tainting and passing rates in the current pandemic condition, barely any verifiable level bio-security workplaces are expected to manage this deadly contamination related with potential transparency perils. It's everything except a long time, an immense staff and various resources for construct another fixed bio-prosperity office, thusly conceding the expectation and control of the pandemic. Thusly, a flexible BSL-3 lab with both bio-security and flexibility is basically expected to manage the pandemic and new broad prosperity scenes. To meet this essential, the maker has arranged a flexible virology research and indicative lab with commitments from ESIC Clinical School, Hyderabad, recognized two associations which work in production of safe houses and control workplaces, recognized and presented it inside 15 days of time. This front line, one of its sort lab was presented by Hon'ble Raksha Mantri on 23 April, 2020. The MVRDL made by WHO and ICMR bio-security standard (BSL-3) can be used.

* Received 22 September 2021, Accepted 09 October 2021, Published 24 October 2021

* Corresponding Author

KEYWORDS

Bio-safety, Containment, COVID-19, Mobile bio-safety laboratory.

I. Introduction

World Wellbeing Association (WHO) pronounced a General Wellbeing Crisis of Global Worry on 30 January, 2020 and named the illness brought about by SARS-CoV-2 infection as Coronavirus. This infection is spreading all around the world, and take fundamental measures to contain it. The quickly spreading, exceptionally infectious and pathogenic SARS-Covid 2 (SARS-CoV-2) is sent human-to-human has consistently spread to 200 nations. It is must to promptly fabricate, extend, prepare and convey wellbeing laborers to discover, test, confine and treat each case and follow each contact. The two most significant measures to forestall contamination are social separating and Testing–Testing and Testing. Clinical example inactivation ought to be acted in a bio-security level-3 (BSL-3) research center (negative pressing factor, HEPA channels, waiting room and self-locking entryways) and after this progression, routine testing can be acted in a bio-safety level-2 research facility. Be that as it may, the pathogenicity of COVID-19 isn't totally known at this point, consequently BSL-3 lab is suggested for tests preparing. In light of the disease and demise rates, scarcely any undeniable level bio-wellbeing offices are needed to deal with this dangerous infection related with potential openness hazards. It's anything but quite a while, a huge staff and numerous assets to develop another fixed bio-wellbeing office, along these lines deferring counteraction and control of the pandemic.

In this way, a versatile BSL-3 lab with both bio-wellbeing and adaptability is desperately expected to oversee pandemic and developing general wellbeing occurrences. The creator has embraced the innovation of containerization of ground support gear for rockets and tidy up rooms innovation for incorporation of high-accuracy rocket parts to suit the bio-security guidelines and has concocted an answer for building up COVID-19 symptomatic lab. Keeping that in mind, a versatile virology research and demonstrative lab was planned with contributions from ESIC Medical College, Hyderabad. Two organizations in Hyderabad in particular, M/s ICOMM which represents considerable authority in creation of havens and M/s iClean Technologies, a turnkey plan and assemble Company with long stretches of involvement with building the regulation offices were recognized for assembling of this lab. As well as screening, the lab can likewise be utilized for directing examination projects identified with drug revelation, therapeutics and immunization improvement as a team with National and International associations. Significantly, BSL3 lab is compulsory for live infection societies and having this office is the fundamental model to carryout research projects. Flare-ups of viral

specialists are successive in India. Ideal finding of these flare-ups is basic to mount suitable general wellbeing reaction. The deficiency prompts pandemics, for instance, SARS and CORONA, where we need framework (Biosafety level 2 or 3) for dealing with infections, diagnostics office to cater patients from everywhere India.

II.Design and Implementation

Every one of the important supplies for meeting goals referenced above are designed in two portable compartments as displayed in the accompanying schematics (Fig. 1).

The clinical example inactivation is to be acted in a Bio-Safety Level-3 lab (negative pressing factor, HEPA channels, antechamber and self-locking entryways) and ensuing to this progression, routine testing is to be acted in a Bio-Safety Level-2 Laboratory.

The whole region is adapted with HVAC framework with a plan of 100% outside air guaranteeing no re-course. Room temperature of 24 ± 4 °C is kept up, relative stickiness is kept up under 60% according to particulars of BSL-3 and BSL-2 labs. The framework is furnished with access control, LAN, phone cabling and CCTV. For keeping up wellbeing alarm framework is given. The framework has underlying furnishings and is outfitted with pass boxes for move the examples from one compartment to other holder. Staff defensive gear is given to faculty to get over box.

III.Process Flow for Virus Diagnostics

A.Personnel Movement in BSL-III

The person enters the change room and wears the BSL-3 lab suits and enters the lab through ante room. After completion of exercises move to fog shower through bet room. After fog shower cycle, will eliminate BSL-3 lab suits/shoes leaves them in the proper spot gave in shower.

B.Sample Movement

The examples will be moved in viral culture medium to the lab. Then, at that point they will be put in powerful pass box (DPB 1) to limit the man development inside the lab. Specialist in BSL3 (Lab 1) will gather the example and interaction in bio-wellbeing bureau Class II sort A2 and B2 utilizing balance support. After balance of infection, cell pellet will be gathered in Eppendorf cylinders and moved to BSL2 (Lab 2) through the unique pass box (DPB2) for screening the infection utilizing RT-PCR machine.

C.Bio-wasteste and Liquid Waste

The bio-waste and strong misuse of BSL-III and BSL-II labs will be stuffed in compartment reasonable for autoclaving and will be conveyed of the lab through Dunk tank to guarantee

surface disinfecting. Likewise, in the lab, the produced fluid waste are sent through the sink gave in the lab and will be gathered in a fluid waste assortment tank gave outside the compartment lab through funneling by gravity. The tank is loaded up with substance cleaning specialist and the defiled fluids gets sterilized artificially and further will be sent for proper treatment. Inside photos of certain bits of MVRDL are displayed in Fig.2.

IV.Resources

DRDO has planned the lab with the sources of info given by ESIC Medical College, Hyderabad. The accompanying modern accomplices partook in acknowledgment of the MVRDL Lab:

- M/s iCOMM, Hyderabad has given two compartments.
- M/s iClean, Hyderabad has fabricated the regulation offices with required wellbeing levels.
- M/s Hitech Hydraulics, Hyderabad has given establishment structure.

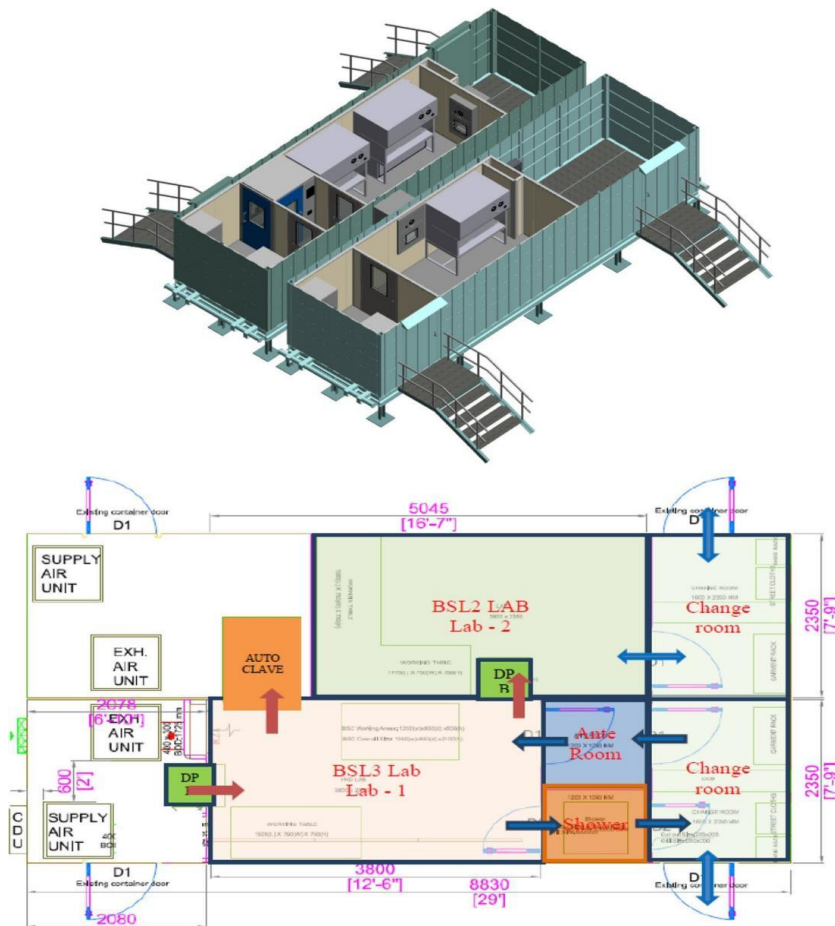


Fig. 1 Layout of MVRDL

V.Results and Discussion

(a) To screen up to 2000 samples per day

(b) To carryout drug screening The creator has embraced the innovation of containerization

(c) Therapeutics ground support hardware for rockets and tidy up rooms innovation for combination of high-exactness rocket segments to suit bio-wellbeing principles and has thought of an answer for building up COVID-19 indicative research facility in a portable holder fulfilling the bio-security guidelines (BSL-3 and BSL-2). This research center is intended to do following exercises.

- Convalescent plasma therapy
- Therapeutic value of milk exosomes for COVID19 up with
- Stem cell therapy to reduce inflammation and fibrosis

(d) COVID-19 diagnostics



Change Room



Ante Room



Shower



Dynamic Pass Box

Fig. 2 Inside pictures of some portions of MVRDL

- Covid i-Chip—A simple, fast and highly sensitive detection of asymptomatic SARS COV2

- IgM/IgG—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.

VI. Conclusion

The versatile virology research and symptomatic lab, which has an ability to deal with up to 2000 SARS-COV-2 infection tests in a day, keeping up BSL-3 norms is planned, acknowledged and introduced at ESIC Medical College, Hyderabad, inside a time period of 15 days. This is a first of kind portable symptomatic research facility can be shipped and quickly sent at COVID-19 areas of interest in any edge of our country. This research facility can likewise help in infection refined for drug screening, recuperating plasma-determined treatment and advancement of indicative packs.

VII. Reference

- I. [https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-\(2005\)emergency-committee-regarding-the-outbreak-of-novel-coronaviruses-\(2019-ncov\)](https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)emergency-committee-regarding-the-outbreak-of-novel-coronaviruses-(2019-ncov)).
- II. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7334626/>
- III. <https://www.civildaily.com/news/mobile-virology-research-and-diagnostics-laboratory-mvrdl/>
- IV. <https://virologyj.biomedcentral.com/articles/10.1186/s12985-020-01418-7>