BSL-3 Laboratory – Questionnaire to be completed by bidder				
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Item	**Spec Ref**	**Specification**	**Conform? (Yes / No)**	**Comments**
CONTAINER HARDWARE				
1		**General**		
1.1	I	The laboratory must consist of high-quality room construction with special consideration given to joints, finishes, and penetrations		
1.2	II	All connections, services and shutoffs (steam, water, and natural gas) must be external to containment and located in the utilities room. The laboratory must be designed for ease of maintenance, so that access to critical mechanical equipment (ventilation ducts, fans, piping, etc.) is outside containment.		
1.3	III	The BSL-3 laboratory shall be constructed into a standard ISO shipping container, length 20 ft., width 8 ft., height 8.5 ft,		
1.4	III	The air handling unit shall be added **outside** of the ISO shipping container and **enclosed** in the lockable utilities room to protect equipment from the environment.		
1.5	IX	A 1.5 m wide, 1.2 m deep leak proof roof (on the outside of the container) covering the main entrance shall be fitted to the container.		
1.6	X	A 1.5 m wide, 1.2 m deep leak proof roof (on the outside of the container) covering the dual port (pass-through hatch) system shall be fitted to the container allowing for operation of the ports.		
1.7	VII	Interior wall and ceiling panels of container consist respectively of 50 mm polystyrene and 79 mm polystyrene both enveloped in 0.58mm Cromadec coated metal sheeting (white finish); intersections of panels are sealed with non-shrinking sealant to ensure the lining is watertight (seepage of water through crevices, shall not be possible). Panels can be cleaned by means of disinfectant and cloth. The isolator unit contains no windows		
1.8	VIII	The laboratory shall have no holes where animals can escape.		
1.9	XX	Work surfaces, floors, walls, and ceilings must be designed, constructed, and finished to facilitate easy cleaning and decontamination.		

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1.10	XXXIV	Compressed gas cylinders should be secured with 2x gas cylinder brackets		
1.11	XXXVIII	The necessary documentation for all equipment installed *i.e.* Autoclave, IVC racks and AHU, Fridge, Freezer, incubator, HVAC system, HEPA filters and Class II BSC should be provided this includes but is not limited to equipment service and maintenance plans, warranties, local representative contact details to receive training and validation certificates		
2		**Entrance lock, change room & doors**		
2.1	XI	The BSL-3 laboratory shall have a personnel entrance/exit airlock, making direct access into the main laboratory impossible. The airlock shall have a footprint of 900 x 1200 mm.		
2.2	XI	Both doors shall open outwards, for purposes of emergency exit, and shall be self-closing.		
2.3	XVI	The entrance airlock shall open into a change room, with a width of 1200 mm, and length the remainder of container width.		
2.4	XVI	The change room door shall open to the inside of the change room itself (not into the laboratory), for purposes of emergency exit.		
2.5	XI	The three doors will be equipped with emergency break glass (must be easily maintainable or replaceable to) to automatically unlatch all three doors.		
2.6	XII	Doors inside the suite should allow for an approximately 6 mm clearance underneath the door for directional airflow.		
2.7	XIII	Doors of the change room should be fixed with ventilation grids, sizes of grids will be determined by contractor as to allow the air changes and pressure cascades to be maintained.		
2.8	XIV	Doors and frames must be of solid finish construction, hardware appropriate for high-use, and kick plates (300mm stainless steel) should be fixed on all doors.		
2.9	XV	Wall-door frame connection should be made airtight at time of frame installation with non-shrinking sealant		

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2.10	XVI & XVII	The change room shall be fitted with a PPE/clothes rack and changing bench: - Provision shall be made for storage of three (3) individual PPE sets. - Five (5) coat hooks shall be fitted. - A powder-coated steel frame bench shall serve as gowning bench.		
2.11	VIII	Only one door shall open at a time therefore an interlocking system is required operated by central power supply with a back-up battery. Thereby preventing loss of negative pressure in containment area. A battery backup ensures that interlock is functional during power disruptions		
2.12	LIV	The main entrance door shall be fitted with an access control system making use of tokens (no electronic logging required)		
3		**Walls, ceilings & floors**		
3.1	IV	The facility shall have gas-impermeable walls, ceilings and floors		
3.2	V	Ceilings shall be monolithic		
3.3	VI	The ceiling must be high enough over the Class II biological safety cabinet (BSC) to allow for a canopy/thimble connection or the opening of canopy/thimble door(s).		
3.4	XVIII	Floors must be easily cleaned, with chemical-resistant flooring *i.e.* vinyl with a slip-resistant, smooth, hard finish.		
3.5	XIX	Flooring shall be covered with seamless/welded vinyl minimum 3 mm thick, covering wall to wall (100 mm high) and coved in corners (not hollow i.e. use bird's beak coving) with a radius of 50 mm for corners. - Light blue suggested in the lab areas. - Light brown suggested in entrance and change room.		
3.6	XXI	The laboratory floor shall form a bunded area to contain water leaks and associated spread of contamination. This implies a retaining barrier/wall at the entrance door to the laboratory, integrated with the flooring (at least 50 mm high).		

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4		**Pass-through hatch**		
4.1	XXXIX	The laboratory shall be fitted with a dual port (pass-through hatch) system. One port shall large enough in size to accommodate the autoclave canister. The two ports shall be vertically stacked, with the entry-port at the top. The estimated size of the ports are: - top port: 600 w x 700 l x 500 h - bottom port: 600w x 700 l x 750 h The bottom of the bottom port shall be 250 mm above floor level (if possible)		
4.2	XXXIX	The door opening shall be 500 mm (high) by 600 mm (wide) on both sides.		
4.3	XXXIX	Each port shall have manual interlocks on the external and internal doors.		
4.4	XXXIX	The internal door shall have a glass window, to allow observance inside the airlock		
4.5	XXXIX	The internal cavity shall provide for surface sterilization of objects that are transferred. (Method(s) of sterilization shall conform to BSL-3 requirements)		
4.6	XXXIX	Visible lighting (separate from UV-C for sterilization purposes), adjustable from 20 to 0 lux, shall be provided for the internal cavity.		
5		**Electrical & UPS**		
5.1	App A	The container shall be equipped with a minimum of twenty two (22) electrical outlets situated as follows (refer to preliminary layout Appendix A): - Two (2) in entrance lock; - Two (2) in change room; - Sixteen (16) in laboratory; - Two (2) for utilities room. - If equipment requires isolators, provision for isolators will be made to comply		

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5.2	XLIII	The electrical supply, ventilation, cooling and Pressure of the container shall be monitored via latest auto-bleep or similar system communicating to a designated cell phone in the event of electrical failure.		
5.3	XLIV	A UPS is required to supply back-up power to the control system (BMS), door interlocks and emergency lights.		
5.4	XLV	For the BMS allow for 100 m cabling to G-70.		
5.5	XLVI	An external backup power supply is required for the IVC AHU unit (estimate = 6kVA)		
6		**Workbench & cupboards**		
6.1	XXVII	The laboratory shall be equipped with a work bench (900 mm high) made of 316L stainless steel (minimum 38 x 2 sq.) tubing with a Trespa (16 mm) counter top. 600 mm deep.		
6.2	XXVIII	The laboratory work bench shall be fitted with one set of steel powder coated under counter drawers (4) and an under counter cabinet with removable and adjustable shelving (2) adjacent to the drawers. The cabinet should have double doors minimizing the space required for opening.		
6.3	XXVIII	Fixed casework, if used, must be sealed/caulked to the walls on installation to facilitate cleaning and prevent harborage for vermin or a box frame should be used to be sealed off with bird's beak coving		
6.4	XXIX	Fixed casework, if used, should be installed before the coved flooring so that the coving can extend up toe-kicks (100 mm high as previously mentioned).		
6.5	XXX	The laboratory shall be fitted with 300 mm deep steel powder coated cabinets and equipped with removable/adjustable shelves (1). The cabinets shall be mounted against the wall for the remainder of the wall length after the incubator has been installed. Clear Polycarbonate 5 mm slide panels should be used for opening and closing.		

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7		**Plumbing**		
7.1	XXIV	The laboratory shall be equipped with a wash basin that contains a hands free hot-cold water, pre-mixing faucet, 316 stainless steel sink (single sink-right, ± 600mm x 400mm x 250mm) and dry rack. , This should be installed at the same level as the work bench and preferably adjacent to it.		
7.2	XXIV	The sink must be accompanied by a paper towel dispenser and a hands-free soap dispenser mounted within easy reach.		
7.3	XXIV	An extra cold water tap (¾ inch) should be installed next to the basin faucet for the use of the wash station and one water tap/shut off valve for the autoclave.		
7.4	XXIII	Space should be allocated in the laboratory for one IVC cage wash station (domestic dustbin), between the autoclave and wash basin, see Appendix A of the Specification document.		
7.5	XXV	Movement space from the sink to the exit door shall be open and uncluttered		
7.6	XXVI	A 10 L under counter hot water boiler (kwikot) located beneath the basin should be installed.		
7.7	XLVII	All liquid effluent from the facility (sink) must be accumulated in autoclave glass bottles (x2) both fitted with shutoff valves to allow ease of operation (when one is full it can be shutoff and the other one can be opened).		
7.8	XLVIII	All penetrations must be perpendicular to the surface and must be sealed to be water tight.		
7.9	XLIX	Penetrations must be sealed with nonrigid, nonshrinking, silicone or latex sealant, pipes must be rimed with rubber at these sites before securing in place.		
7.10	L	All pipes into the BSL-3 laboratory should be secured to prevent movement.		
7.11	LI	Fixtures must be resistant to corrosion of bleach and other disinfectants.		

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7.12	LII	Backflow to utility supply shall be prevented.		
7.13	LIII	All pipes, gas lines and ventilation must be identified by use of labels and tags and flow direction should be indicated.		
8		**HEPA-filters**		
8.1	XL	All HEPA filters shall be removable via bag-out, and shall fit the autoclave for sterilisation prior to disposal		
8.2	XLI	HEPA filter housings must be no more than five-feet high in order to facilitate filter change-out.		
8.3	XLII	When HEPA filters are installed, a magnehelic gauge or other pressure-monitoring device must be installed, with the display placed in the most accessible location that is practical, to measure pressure drop across the filters.		
9		**Ventilation**		
9.1	I,II,III	The laboratory shall be ventilated by filtered air. In most cases, the HVAC system should be Constant Air Volume (CAV). No recirculation of air is allowed and the filtration shall conform to BSL-3 requirements.		
9.2	IV	The outside exhaust must be dispersed away from occupied areas and air intakes, the exhaust must be HEPA-filtered (to effectively remove infectious agents prior to release from facility) and discharged upwards at a velocity greater than 3,000 fpm, the directed air should be protected from rain water intake		
9.3	V	Treatment of supply air is also through a HEPA filter which effectively protects the environment in the event of reverse air flow during mechanical failures		
9.4	VI	The air balance must accommodate biological safety cabinet canopy/thimble connection or Class II cabinet exhaust requirements.		

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9.5	VII	The BSL-3 lab must not become positively pressured if the exhaust system fails. Whenever possible, electrically interlock the supply and exhaust fans.		
9.6	VIII	Exhaust ductwork must not be positively pressurized		
9.7	IX	Supply and exhaust dampers should be gas-tight and closable from outside the facility to facilitate decontamination with gaseous paraformaldehyde.		
9.8	X	Local visual and audible ventilation system failure alarms are required for laboratory personnel.		
9.9	XI	Air supply diffusers must be located so that airflow at the biological safety cabinet face is unaffected (laminar diffusers preferred).		
9.10	XII	Ductwork should be gas-tight 316 stainless steel up to the HEPA filter (if present)		
9.11	XIII	If the exhaust ductwork is welded, recommend welded joints for all connections except for the damper(s) (use flange and bolt connections for quick change-out in the future)		
9.12	XIV	Coil units (for supplemental cooling) should not impact cleaning or provide a breach of containment		
9.13	XV	Limit elbows whenever possible to reduce the amount of background noise generated		
9.14	XVI	The system shall allow for at least 6 air changes per hour in the laboratory area		
9.15	XVII	The pressure inside the facility shall be negative with respect to the atmosphere to always ensure air flow inwards towards the facility (in event of leaks or door opening)		

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9.16	XVIII	Filters on the extraction side of the HVAC, in the utility area, shall also be safe change filters to avoid direct contact with filters and spread of contamination/pathogens during maintenance actions. The exchanged filters shall preferably fit into the autoclave for sterilization prior to decay and disposal. However, if the filters need to be larger for practical reasons, the filters can instead be stored in a safe place until suitable decay is achieved prior to sterilisation at a dedicated facility (not on Necsa site). The anticipated replacement frequency of these filters is once in 5 years		
9.17	XIX	Inlet air shall also be filtered to reduce the frequency of replacement of outlet filters		
9.18	XX	Climate control shall be provided. Air temperature shall be controllable between 20 and 30 °C, within 2 °C of set point. The normal set point shall be 22 °C. Environmental extremes to be designed for are: - Winter night temperature: -5 °C - Summer day temperature: 40 °C		
9.19	XXII	Air flow shall be sustained from clean towards potentially contaminated areas. This shall be ensured by pressure differential and linear velocity of flow from one area to another.		
9.20	XXII	Pressure differential for each volume or area must be instrumented, and indicated both locally and remotely. The reference for each measurement shall be to atmosphere.		
9.21	XXIII	A validation certificate should be available for the airflow system which must be verified annually		
9.22	XXIV	Air pressure within laboratory room is maintained at negative pressure of 35 ± 2Pa while air in the change room is maintained at a negative pressure of 15 ± 2.5Pa and the entrance lock is maintained at 0Pa to ensure unidirectional airflow from the outside to inside of laboratory		
9.23	XXIV	The HVAC system shall be automated to control pressure differentials, adjusting to loading on the filters.		

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9.24	XXV	Adjustment after opening and closing of doors shall not exceed 90 seconds.		
9.25	XXVI	Aerosol penetration shall not exceed 0.01 % of upstream concentration under sustained conditions.		
10		**Lighting**		
10.1	I	Light fixtures must be flush mounted with bottom service entry		
10.2	II	The illumination shall provide for 4 separate lighting settings. These are: - Off (total darkness) 18:00 to 06:00; - Night cycle entry only: deep red light (100-160 lux) 18:00 to 06:00 - Animal housing light cycle (270-375 lux) 06:00 to 18:00 - Maintenance override cycle: no animals present (> 900 lux)		
10.3	III	The illumination in the service utilities area shall be >900 lux upon switching on.		
10.4	IV	Emergency lighting in all three areas shall be sufficient to evacuate personnel.		
10.5	V	The animal housing room shall be sufficiently light insulated, such that personnel movement and normal activities during daylight hours do not cause fluctuations in illumination levels.		
10.6	V	The maintenance cycle shall be locked out (via physical lock or pass code), so that it cannot be accidentally set during the normal cycle, when animals are present.		
11		**Communication**		
11.1	I	The container shall be equipped with three fixed line telephones (Telkom), one in each room		

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11.2	II	The laboratory shall be equipped with one CCTV camera covering the main room: - with visible and infrared capability; and - Infrared illumination for use during the dark cycle. The camera stream shall be communicated to a Necsa control room. Wireless is preferred but in the case of cabling, allowance must be made for 200 m from source to monitor.		
11.3	III	Fire alarms shall be both local and routed to the Necsa emergency center (Necsa fire brigade).		
11.4	IV	The laboratory shall be equipped with a speaker connected to the Necsa PA system		
12		**Fire protection and alarms**		
12.1	I	The laboratory shall be equipped with two SANS/SABS approved 5kg CO_2 fire extinguishers (SANS 1910) – one mounted inside the main laboratory, as well as one mounted on the outside wall near the access door inside a weather box.		
12.2	II & III	The facility shall be equipped with fire sensors and alarms for the main laboratory as well as utility areas. The alarm signal shall be cabled to the nearest building fire alarm panel (usually situated in the foyer of the building) - Allow for 200 m cabling. From the fire alarm panel of the building, the existing communication to the Necsa Fire Brigade control room shall be utilised to communicate fire alarms to the Necsa Fire Brigade		
12.3	IV	The facility shall be equipped with a panic button that will alert Necsa emergency response personnel to an emergency. The button shall be situated within the main laboratory area, near the exit door. The signal shall be cabled to a Necsa control room, with allowance for a distance of 200 m		
12.4	V	Failure of the HVAC system (ventilation failure and when differential pressure drops below a certain point) shall alarm in the Necsa control room		

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EQUIPMENT				
13		**BSC laminar flow cabinet/ UDF**		
13.1	XXXVII	The laboratory shall be equipped with a five foot (1500 mm) Class II BSC laminar flow cabinet, according to BSL-3 quality requirements.		
13.2	XXXVII	Exhaust air from the laminar flow cabinet shall be filtered through dual HEPA filters in series and shall be combined with exhaust air from the rest of the BSL-3 facility		
13.3		The cabinet shall allow spacing underneath for the storage of a waste bin and chair/(s)		
14		**Autoclave**		
14.1	XXII	The laboratory shall be fitted with one autoclave conforming to the specifications in Appendix B of the Specification document		
15		**Individually ventilated cages (IVC) rack**		
15.1	XXXV	The laboratory shall be equipped with an IVC (individually ventilated cages) rack to house animals. The cage rack shall make provision for at least 36 individual cages capable of housing rodents and guinea pigs. The specific IVC rack shall be Techniplast, Green Line, and fully compatible with Techniplast cages. The IVC cage size shall be 904 cm2. (Green line GR900). See Appendix F of the Specification document for a list of the components which shall be included as part of the facility.		
15.2	XXXVI	The IVC shall be equipped with an air handling unit (AHU) comprising humidity control and filtration. The AHU shall be a Techniplast Clima Flow, or superior unit, and fully compatible with the Techniplast IVC rack. The IVC AHU shall exhaust to the HVAC system.		

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16		**Incubator**		
16.1	XXXIII	The laboratory shall be fitted with a 50 - 60 L incubator (see Appendix E of the Specification document) mounted above the fridge and freezer with reinforced support.		
17		**Refrigerator**		
17.1	XXXI	The laboratory shall be fitted with an under counter refrigerator conforming to the specifications in Appendix C of the Specification document		
18		**Freezer**		
18.1	XXXII	The laboratory shall be fitted with a counter-top single-door freezer conforming to the specifications in Appendix D of the Specification document. The freezer shall be mounted on a roller table for ease of access		