BioPREVAIL Built Environment Design Challenge: High-Impact Results

Challenge at a glance

In under 12 months and on budgets of about CAD 20,000 per team, the BioPREVAIL Built Environment Design Challenge delivered seven validated laboratory biosecurity solutions, more than double its target of three. Seven teams from the Philippines, Kenya, Cambodia, South Africa and the United States piloted in eight countries, reaching at least 14 laboratories and health facilities and over 180 direct users and stakeholders between May 2025 and June 2026.

7
Validated solutions delivered vs. a target of 3

516
Stakeholders engaged overall vs. a target of 337 (+53%)

66
Applications received from 31 countries (27% women-led teams)

8
Countries with pilot activity: South Africa, Zimbabwe, Tanzania, Kenya, Lesotho, Philippines, Cambodia, USA

14+
Laboratories and health facilities reached

180+
Direct users and stakeholders in pilots

76
Mentorship sessions delivered, plus a nine-session BioPREVAIL Academy

3
Teams with follow-on funding or adoption commitments secured; 7 with documented scale-up pathways

8,210 - 20,000
Budget per team approximately, in CAD

Team outcomes

Each solution closes a specific pathway by which a pathogen or hazardous agent could escape, spread, be diverted or go undetected. Six of seven teams completed full field pilots; the seventh (UCT) completed laboratory validation with a confirmed field site. Every team documented a scale-up pathway.

1 AFMS Contain and Sustain – Effluent decontamination

● FIELD PILOT COMPLETE South Africa, Zimbabwe, Tanzania

x4
safety margin on bacterial inactivation

SECURITY IMPACT Reduces the risk of uncontrolled release of viable pathogens, tuberculosis in particular, from laboratory drains into municipal sewers and surrounding communities, and with it the risk of deliberate acquisition or accidental exposure. At the Central Veterinary Laboratory (Harare) and NPHL Mabibo (Dar es Salaam) no effluent treatment existed before the pilot, so this is the first containment step ever applied to those waste streams.

EVIDENCE Standardised bacterial testing at all three sites showed complete inactivation at 15 minutes against a 60-minute minimum retention time, a four-fold safety margin. Chlorine residual compliance was 100% across 17 monitored cycles and operational uptime was 100%, against a 40 to 55% availability baseline for imported systems. At the University of the Free State the manual unit matched the existing automated system with better uptime.

MOMENTUM AFMS has committed corporate funding to manufacturing and a standardised deployment package for replication across similar African laboratories.

2 RWP SL-BioLock – Smart biomedical waste bins

~90%
reported improved accountability and biosafety confidence

● FIELD PILOT COMPLETE Kisumu County, Kenya

SECURITY IMPACT Reduces the risk of deliberate acquisition of infectious material or accidental exposure by intervening at the point where infectious waste is most exposed to workers and most vulnerable to diversion. Controlled access, digital weighing and SMS alerts create a chain of accountability from generation to disposal.

EVIDENCE A baseline survey of 41 health workers found 55% reporting poor containment, 63% no waste weighing, 63% no real-time monitoring and 63% perceiving significant occupational risk. Seven prototypes were deployed across six public, faith-based and private facilities and 88 workers trained; about 90% reported improved accountability, containment security and biosafety confidence.

MOMENTUM Provisional patent filed through KIPI, the FutureLife Research Foundation established, and advanced talks with The Global Fund on more than 10,000 units for Kenya's national laboratory network.

3 GSSHealth Uptime – Solar-battery power for GeneXpert diagnostics

100%
concordance with referral laboratory results across 83 tests

● FIELD PILOT COMPLETE Kisumu County, Kenya

SECURITY IMPACT Sustains early detection and rapid containment by keeping molecular diagnostics running. Power loss halts runs, spoils cartridges and delays TB and drug-resistant TB results, leaving infectious cases undiagnosed and transmitting. The team frames reliable electricity as a core biosecurity requirement.

EVIDENCE Phase I ran 83 TB and TB-AMR tests at two rural health centres with 100% concordance against referral laboratory results. Phase II measured 0.034 kWh per test and 0.06 kWh per four-test batch, giving about 93 tests, or 4.5 working days, on a full battery with no solar input. Zero theft or tampering incidents were recorded.

MOMENTUM A Version 2.0 path is mapped: enclosure design, safety certification and deployment at two to three controlled sites.

4 IPC CoLab – Laboratory plastic waste to resource

~80%
of IPC laboratories segregating waste, from a 20% baseline

● FIELD PILOT COMPLETE Cambodia

SECURITY IMPACT Strengthens waste governance at Institut Pasteur du Cambodge: segregation at source is a precondition for keeping contaminated and clean waste streams separate, and recycled containers support safe pathogen storage, reducing the risk of loss, theft or accidental exposure. The lead mentor, a biosafety specialist, embedded contamination-risk, emissions and worker-safety controls in the CoLab space design and SOP.

EVIDENCE Segregation rose from a 20% baseline to about 80% of IPC laboratories; 866 kg of polypropylene and polyethylene was diverted from landfill and 644 kg converted to feedstock. The team built an injection-moulding machine on site and produced the first usable objects ever made on campus from IPC's own recycled plastic.

MOMENTUM Gates Foundation grant of about USD 5,000, a letter of support from the Pasteur Network Executive Director, a Pasteur Network-wide presentation in October 2026 and a Climate Action Accelerator partnership.

5 T2 Design Lab – Participatory Laboratory Design Methodology

30+
stakeholders across two NPHL sites, including Ministry of Health leadership

● FIELD PILOT COMPLETE Tanzania

SECURITY IMPACT Reduces the risk of high-risk pathogen work being carried out in unregulated or lower-containment space. A non-functional BSL3 either sits idle, pushing dangerous work elsewhere, or is rebuilt to imported specifications that fail under local energy and maintenance constraints. Locally validated user requirements determine whether Tanzania's national high-containment capacity actually contains dangerous pathogens.

EVIDENCE All four methodology phases were completed across two NPHL sites with more than 30 stakeholders, including Ministry of Health senior leadership in Dodoma, the national biosafety technical working group and Africa CDC-certified assessors. Phase I confirmed the urgent need to upgrade Mabibo and surfaced a national gap in biosafety infrastructure guidelines. Delivered on the smallest budget in the cohort, about CAD 8,210.

MOMENTUM The Kibong'oto BSL3 manager has requested the same process; the outputs are positioned to seed Tanzania's national BSL3 guidelines; the methodology is now in use at the ONSSA reference laboratory in Morocco with a Fiocruz (Brazil) pilot planned for fall 2026.

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6 **BioAssets** – Mobile Biocontainment Laboratory

26–29°C
held while operating, against a 33°C inactive baseline

● **FIELD PILOT COMPLETE** Philippines

SECURITY IMPACT Brings containment and diagnostics to the outbreak site, eliminating the risk of theft, diversion or spoilage of infectious specimens during long-distance shipment and cutting time-to-result for zoonotic and animal disease investigations in remote areas. Temperature stability protects reagents, equipment and operators inside a sealed containment space; vibration control protects instruments and sample integrity in transit.

EVIDENCE Across 22 environmental tests and three deployments, including a 200 km, seven-hour transit to a farm in Quezon Province, the laboratory held 26 to 29°C while operating against a 33°C inactive baseline, on the hottest and most humid day recorded. Vibration mitigation cut stationary median velocity from 2.6 mm/s to under 1 mm/s; transit results were inconclusive and need further trials. Nine users rated perceived safety highest, at 4.6 out of 5.

MOMENTUM Isuzu has agreed to supply a dedicated six-wheel platform for MBL 2.0; funding partners are being identified.

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7 **UCT/WNWN GTC Bioremediation** – Chemical waste from HIV diagnostics

>99%
degradation of GTC in real HIV diagnostic waste

● **LAB VALIDATION COMPLETE**

Lesotho, with Zambia and South Africa sites

SECURITY IMPACT Guanidine thiocyanate (GTC) lysis buffer inactivates HIV, rendering diagnostic waste useless to malicious actors, but its toxicity (corrosive, harmful to aquatic ecosystems, cyanide gas when mixed with common detergents) limits safe use. A low-cost disposal route protects the decentralised HIV testing laboratories that surveillance depends on and enables wider use of GTC.

EVIDENCE Greater than 99% degradation of GTC in real Roche-platform HIV diagnostic waste across shake flasks, 1 L bioreactors and a simplified stirred-beaker configuration designed for laboratories with minimal infrastructure. Four pilot sites were identified across three countries.

MOMENTUM Implementation confirmed at the National Reference Laboratory in Maseru with the field pilot from July 2026, and a two-pronged rollout planned for larger facilities and decentralised HIV testing laboratories across sub-Saharan Africa.

Cross-cutting impact

Together the seven solutions close distinct pathways by which pathogens or hazardous material can escape, spread or go undetected, and they do it with designs that local staff can build, run and maintain.

- **Containment introduced where none existed.** Two national laboratories (Harare, Dar es Salaam) now treat effluent for the first time; six Kenyan facilities now track infectious waste from generation to disposal.
- **Detection kept running.** Solar-battery power sustained TB diagnostics off-grid with no loss of accuracy, keeping infectious cases from going undiagnosed.
- **High-containment capacity rebuilt on local terms.** Locally validated requirements for Tanzania's Mabibo BSL3 reduce the risk of high-risk pathogen work drifting into lower-containment space.
- **Replicable, not one-off.** Every solution is built from locally sourced parts or locally led processes, and each team produced a documented replication or scale-up pathway, which is what shifts national rather than single-site risk.
- **Lean and fast.** All of this was delivered on per-team budgets of roughly CAD 8,000 to 20,000 within a single project cycle of under 12 months, with a mentor network of 76 sessions and an independent 23-expert judging panel behind it.

A common barrier surfaced across four teams: containment improvements remain voluntary where no national standards mandate them. T2's work on Tanzanian BSL3 guidelines and AFMS's effluent data are the first steps toward closing that gap.

What comes next

Three teams have already converted pilot evidence into follow-on support, and all seven have a defined next step.

TEAM	MOMENTUM BEYOND THE CHALLENGE
AFMS Contain and Sustain	Corporate funding committed for manufacturing, a standardised deployment package and commercialisation
RWP SL-BioLock	Provisional patent filed; Global Fund talks on 10,000+ units for Kenya; next phase 20 to 30 facilities
IPC CoLab	Gates Foundation grant secured; Pasteur Network-wide presentation October 2026; Climate Action Accelerator partnership
T2 Design Lab	Methodology in use at ONSSA (Morocco), Fiocruz (Brazil) pilot fall 2026; Kibong'oto BSL3 requested; input to Tanzanian national guidelines
GSSHealth Uptime	Version 2.0 sprint, then deployment at 2 to 3 controlled sites
BioAssets MBL	MBL 2.0 on a dedicated Isuzu six-wheel platform; funding partners being identified
UCT/WNWN GTC	Field pilot at Maseru National Reference Laboratory from July 2026; two-pronged rollout across sub-Saharan Africa

Watch the Built Environment Design Challenge Showcase
16 December 2025, on YouTube - youtu.be/LZA6r78FGN0

Sources: BioPREVAIL Built Environment Challenge Narrative Report (final, 16 September 2026) and the seven team final narrative reports in the BPFinalReport_Materials folder.

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