

SCIENCE

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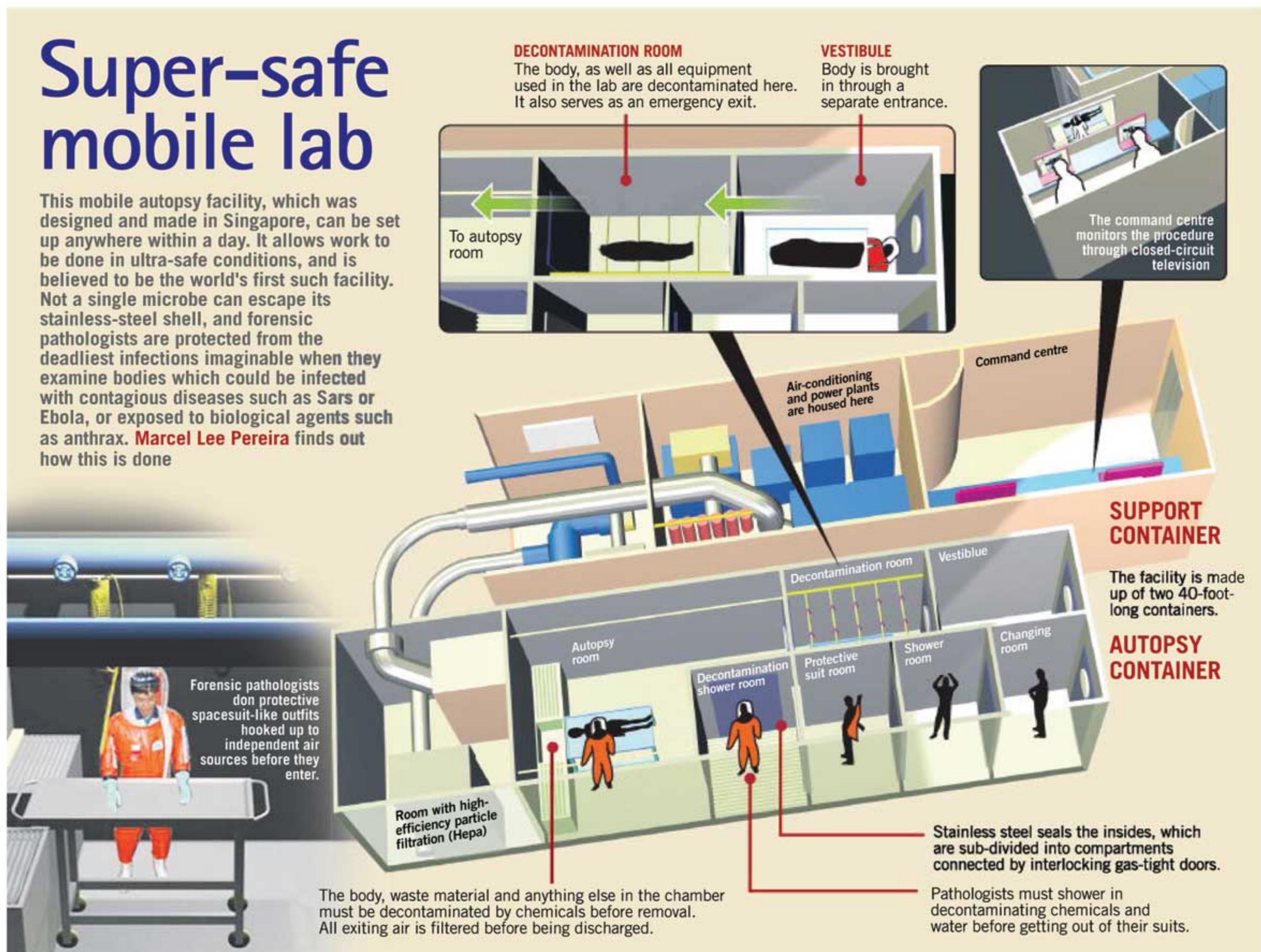
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THE STRAITS TIMES SATURDAY, APRIL 7 2007

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Super-safe mobile lab

This mobile autopsy facility, which was designed and made in Singapore, can be set up anywhere within a day. It allows work to be done in ultra-safe conditions, and is believed to be the world's first such facility. Not a single microbe can escape its stainless-steel shell, and forensic pathologists are protected from the deadliest infections imaginable when they examine bodies which could be infected with contagious diseases such as Sars or Ebola, or exposed to biological agents such as anthrax. **Marcel Lee Pereira** finds out how this is done



Killer disease? No germs can escape biohazard unit

Pathologists also safe from infections while doing autopsies inside S'pore-developed lab

By MARCEL LEE PEREIRA

IF A mystery killer disease hits home, a Singapore-developed autopsy laboratory is ready for use.

The ultra-safe mobile unit is believed to be a world-first.

No germs can escape the steel-lined, two-container unit. Enclosed inside, forensic pathologists are also protected from infection when they do autopsies on bodies infected with contagious diseases such as Sars and Ebola, or which may have been exposed to biological agents such as anthrax.

Laboratories dealing with biological hazards are generally classified into four safety levels - Biosafety Level (BSL) 1 through 4, with BSL4 demanding the highest levels of protection.

The patented mobile autopsy facility has been designed to meet stringent BSL4 standards.

Forensic pathologists enter the autopsy container and don space-suit-like protective gear that is hooked up to breathable air systems, before proceeding into the autopsy

chamber. After the autopsy, the body must be decontaminated before it is removed. This is also the case for everything else that leaves the chamber.

The entire procedure is monitored through closed-circuit television in the second container.

Only a few places in Asia, such as India, Taiwan and Japan, have BSL4 laboratories.

The mobile facility is undergoing international accreditation to qualify for BSL4 status. Singapore does not have any such laboratories now, although institutions such as the Singapore General Hospital and DSO National Laboratories have their own BSL3 facilities.

The mobile unit was the brainchild of local engineering firm Acre Engineering, and the Health Sciences Authority (HSA) back in 2003, during the severe acute respiratory syndrome (Sars) outbreak.

Acre's directors, brothers Peter and Bobby Chong, presented their concept before international experts at the recent Asia Pacific Biosafety Association Conference here, together with Dr Paul Chui, HSA's senior director of the applied sciences group, and the director of its Centre for Forensic Medicine.

Acre has worked with the HSA to design and build autopsy facilities for the authority's Centre for Forensic Medicine. The company has also built mortuary suites for other hospitals here since 1990, al-

The different biosafety levels

BSL1
Used for: Biological agents unlikely to cause disease or harm the environment, such as certain bacteria and moulds.

Practices: Standard microbiological practices such as limited access to laboratories, hand-washing before handling materials, and wearing gloves and protective eyewear.

BSL2
Used for: Agents that can cause diseases, such as dengue and hepatitis C, which can be contracted through injuries on the skin surface, ingestion or exposure through the mucous membrane.

Practices: BSL1 practices plus:
» Biohazard warning signs
» Extra precautions taken with sharp instruments
» Biosafety manual outlining how waste is decontaminated, as well as medical surveillance policies

BSL3
Used for: Agents which can kill, and which spread through the air.

Practices: BSL2 practices plus:

» Controlled access to laboratories
» Decontamination of all waste and laboratory clothing

BSL4
Used for: Dangerous or exotic agents which pose a high risk of life-threatening disease, aerosol-transmitted lab infections, or related agents with an unknown risk of transmission. These include the Lassa fever virus and Ebola.

Practices: BSL3 practices plus:
» All procedures conducted in Class 3 or Class 2 biological safety cabinets (BSCs). BSCs have their own filtered air flows within them, with Class 3 offering more protection than Class 2.
» If a Class 2 BSC is used, protective pressure suits ventilated by a life-support system must be worn
» Decontamination shower must be taken before exit
» All material must be decontaminated before being removed from facility

Sources: American Biological Safety Association, US Centres for Disease Control and Prevention, and US National Institutes of Health

though these were not designed to BSL3 or BSL4 standards.

The mobile facility took about nine months to build, compared with the two to three years needed for a permanent BSL4 laboratory - and it was done at only a fraction of the cost, said Mr Peter Chong.

It follows standards used in BSL4 laboratories in the United States and Canada, as well as biosafety guidelines from the US Centres for Disease Control and Prevention, and National Institutes of Health.

While BSL4 laboratories are usually sited within a building, this facility is completely mobile, and can be set up in less than a day. It is now already on standby at an undisclosed location.

The inventors are working with Dr Stefan Wagener, a biosafety expert with the Public Health Agency of Canada, for it to be officially certified as a BSL4 facility.

Some biosafety experts, however, have pointed out that any bio-containment equipment or mobile facility has to be re-certified every time it is moved, to make sure its ability to contain biological agents has not been compromised.

Responding, Mr Chong said: "Our units are engineered for mobility and transportation. All critical parameters are also tested in situ after transportation before the facility is put into operation."

BSL4 labs in Europe, Canada and Australia, which the inventors visited in the course of designing their lab, have affirmed that the practice is acceptable for a BSL4 facility, he added.

For the unit to be considered truly "mobile", he said, it will also have to undergo frequent deployment exercises and be tested under field conditions. The company is fine-tuning the invention and is taking part in conferences around the world to present it.

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