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## **[Guangzhou Daily] Create an "Aircraft Carrier" for Virus Prevention and Control**

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Asia's first P4 biosafety laboratory was completed in 15 years and preserved several powerful viruses Interview with Song Donglin, director of the project office

Song Donglin put on positive pressure overalls for routine inspections.

Wuhan P4 laboratory.

Bacteria or virus? This was a dispute between the scientific research team in the early stage of the SARS outbreak 15 years ago. The SARS outbreak also made Song Donglin, who had a background in molecular microbiology, faced a new life choice at the age of 40.

SARS raged in 2003, and the country required the Wuhan Virus Research Institute to undertake the task of building a P4 laboratory from a strategic height. At that time, domestic scientists knew almost nothing about this laboratory with the highest level of biosafety. Song Donglin, who is currently engaged in the industrialization of molecular microorganisms, was

appointed as the director of the project office because of his experience in research and industrialization management. This transformation has become Song Donglin's life goal.

After fifteen years of sharpening a sword, in August 2017, Wuhan P4 laboratory officially opened. Song Donglin was very pleased. The country has the highest-level biosafety laboratory, where all the most powerful viruses in the world can be studied. "Even the French experts who directed the design of our laboratory called it a laboratory of the 22nd century."

Text, picture/Guangzhou Daily All-Media Reporter Yang Yinan

Speaking of the SARS 15 years ago, Song Donglin still has lingering fears. "Usually bustling and crowded Wuhan has almost become an empty city. Schools are closed and there are not many people in Xinhua Bookstore. This has never happened in my life." He mentioned a particularly impressive "sequelae", "Now when someone takes the elevator, it still Just dare to poke (button) with your fingertip or key."

What he didn't expect was that it was in this year that Wuhan Institute of Virology was ordered to build the P4 laboratory. The then deputy director Yuan Zhiming was responsible for the preparation and he was the director of the project office.

Wearing typical scholar glasses, Song Donglin has a gentle appearance. Since then, he has left applied and environmental microbiological research to undertake this unique and extremely dangerous large-scale scientific engineering construction project.

### **"three nos" condition**

### **My eyes touch black and take the task**

The current P4 (P stands for protection, meaning protection) laboratory is a few unremarkable gray buildings, which will be the largest virus collection center in Asia. And fifteen years ago, it was just a barren land.

The ravages of SARS have caused Wuhan Virus to receive the task of building a P4 laboratory with almost "three noes": no equipment and technical standards, no design and construction team, no PhD talents and experience. The P4 laboratory is the highest level of biosafety laboratory in the world, and can study infectious pathogens that cause serious or fatal fourth-level hazards in humans.

At that time, there were only P3 laboratories established in China based on the Military Academy of Sciences and the Import and Export Quarantine Department after absorbing foreign experience. "The standards are not high, and they are not standardized." Song Donglin sighed. At that time, the experts could only go to the food and drug verification test in the gray brick

building next to Beijing Tianqiao Park. The cutting-edge national scientific research team also encountered a laboratory infection accident while studying the SARS virus process.

"Is it a bacteria or a virus? Experts can't help it." Song Donglin said with some regret. "Strictly speaking, SARS virus testing should be done in the P4 laboratory. But at that time our country did not." He raised his voice and said, "What is P4, then? At that time, most of the scientists engaged in biosecurity and virology research had no idea."

Without knowing anything about laboratory structure, biosafety protection system, etc., and even not good at design, site selection, and construction, the laboratory team produced an EIA report within three months. And the deputy director of the Institute of High Energy Physics of the Chinese Academy of Sciences who undertook the large-scale scientific project of the electron-positron collider said, "You are so courageous, you will take up the task when your eyes are dark."

### **Contention**

#### **Ran to Beijing more times than Hankou**

Pouring a glass of water, Song Donglin said it was more than two hours. He remembers every stage of the laboratory from scratch.

Initially, apart from Deputy Director Yuan Zhiming and other part-time leaders, Song Donglin had only 3 people in the project office.

His first task is to complete the laboratory project proposal, and make feasibility reports on dozens of systems including virology experts, standards committees, architecture and design. "I often write until midnight." Song Donglin settled his mind, and all links such as equipment selection, process requirements, and functional requirements were repeatedly determined.

At that time, the key equipment required by the laboratory, such as chemical shower system (abbreviated as chemical shower), inflatable airtight door, life support system, etc., was hardly heard by the team, and could only be scattered from the design institute and expert team. Understand one or two.

Recalling that he felt a little angry and funny, "At that time, we wanted a good inflatable airtight door, ten thousand yuan is enough. Later, I found experts at home and abroad to find out that it would cost 300,000 yuan. It cost nearly 170,000."

In 2005, the project budgetary estimate was also initially completed, and the Wuhan Institute of Virology formally approved the construction of the P4 laboratory. He laughed and said, "Back and forth, I have gone to Beijing more times than to Hankou."

**cost 300 million**

### **Build a 200-mu three-level protection park**

In 2011, auxiliary projects such as general laboratories, park roads, and power distribution were completed; in 2015, the core laboratory completed civil construction, equipment procurement, installation and preliminary verification, etc., and the following two years commissioned equipment, trained personnel, and won CNAS accreditation Qualification for infectious pathogen activities issued by the National Health and Family Planning Commission. It was not until the end of 2017 that the laboratory announced its official operation.

Regarding the final cost, Song Donglin only revealed roughly that the investment in a laboratory for medium-sized animal experiments is about 300 million yuan.

Now, the laboratory park has three levels of strict security covering an area of 200 acres, as a buffer zone, the public cannot enter and leave. National security approval is required to enter the third-level visit corridor.

The main building of the laboratory is small, the bottom floor is the sewage treatment and life support system; the second and third floors are the core laboratory, the filter system and the mezzanine pipe system; the top floor is the air conditioning system. The core laboratory is more than 300 square meters, including 3 cell laboratories, 2 animal laboratories, 1 animal dissection room, disinfection room, etc.

For more than ten years, although some development zones have been formed in the surrounding areas, the natural state of being surrounded by mountains on three sides is still maintained within one kilometer of the laboratory. "In the event of an accident, we can guarantee the safe and orderly isolation and evacuation of personnel."

With reference to foreign training systems, the laboratory has formed a green-orange-red three-level induction system. Only after reaching the corresponding level can you enter the laboratory for research. "At present, only 10 people have obtained the qualifications for (research activities). There is no researcher with a red level (independent research and training). We are still helping and learning from each other."

Now, as the deputy director of biosafety, Song Donglin manages a team of about 30 people. Every day he enters the laboratory to inspect the equipment and make a preliminary assessment. The biosafety team inspects personal protective equipment, communications and personnel protection, and he signs two documents to ensure dynamic supervision of the laboratory.

### **Set up a model laboratory**

### **Gradually replace imports**

As a major participant in the construction of China's first P4 laboratory, Song Donglin is unambiguous, "100% of the key equipment is imported. Biosafety must be established on a mature, experienced, and reliable basis. There are no time-tested products and technologies. Plan, you cannot enter the laboratory."

In order to improve safety, imported materials are used for sewage treatment equipment, inflatable airtight doors, air conditioning systems, air ducts, maintenance structures, and even sealing elements and floors. What made him gratified was that even French designers commented, "This is advanced equipment of the 22nd century."

However, Song Donglin, who has turned to biosafety research, has been thinking: If you don't know the inflation, the number of uses, the cycle and other parameters of the nearly 200 kg inflatable airtight door, how can it be replaced? If there is a problem with a sealing element, do I have to rely on imports?

In order to "prevent sudden choking of the neck abroad", Song Donglin undertook the project research of the localized model laboratory. "After two years of layout, the current model laboratory (simulation exercises, equipment, and no real pathogenic research objects) can achieve 80% localization, but it cannot be used immediately. It is necessary to strengthen quality and safety, and partially replace imports."

## **Stumbling**

### **Fifteen years to sharpen a sword**

Fifteen years have passed. Seeing the P4 laboratory change from a noun to a huge laboratory in front of him, Song Donglin, who spoke concisely, said "stumbled" several times.

He was very pleased to talk about the country's emphasis on biosafety. "This year the two highest national science and technology awards are awarded to the field of infectious diseases. This is the country's recognition of public health safety and the ability of disease prevention and control teams."

Although he is no longer engaged in pure scientific research, the laboratory platform he participated in can now provide service support for researchers in virology around the world: "As a research and development center, many topics will be deployed here to provide a platform for scientists; The Virus Collection Center approved by the National Health and Family Planning Commission, we will provide sampling research for the discolored viruses discussed by Ebola; as a reference laboratory for the United Nations pathogen research, we can quickly report on new viruses in the future."

The laboratory that has just been running for a few months has already made new research results on influenza. Song Donglin said with confidence, "After three to five years of

verification, our ability to fight against powerful viruses will be greatly improved. Samples of the most dangerous viruses in the world can be sent for research. In the event of a severe infectious disease event, we can Become an irreplaceable laboratory."

**Dialogue**  
**every potent virus**  
**has a talent pool**

Guangzhou Daily: How do you understand the strategic position of Wuhan P4 laboratory?

Song Donglin: Strategic demand does not refer to industrial and economic benefits, but to play a fortress role and social benefits. It turns out I don't understand strategy. The Chinese Academy of Sciences continues to invest, but we have only obtained two certificates for so many years, and it is only in the early stage of research. This kind of continuous investment is to really play a role when the virus emerges, allowing us to continuously train our troops and expand our knowledge and talent pool.

Guangzhou Daily: In the future, if new SARS-like viruses appear, how can the P4 laboratory respond?

Song Donglin: After SARS, the team of technical measures for the prevention and control of infectious diseases has been continuously improved. We hope that the laboratory can do better. For example, strain diagnosis can be quickly verified in the laboratory and establish norms and conclusions. We have animal models in our laboratory, and vaccine antibodies can be developed by studying the route of transmission. We need to have more technical reserves, so that every type of virus has a safe talent pool.

**The public can rest assured that the virus is stored**

Guangzhou Daily: What powerful viruses are currently stored in the P4 laboratory?

Song Donglin: We currently have the ability to do research on viruses like Ebola, but what type of virus has been preserved, how many, where it has been preserved, how the virus has been preserved, and what research has been done. The disclosure must be controlled.

Guangzhou Daily: How to prevent the virus from leaking in the laboratory?

Song Donglin: Preventing pathogens from infecting workers and spreading to the environment is the main purpose of the laboratory.

We have four aspects of protection: For personnel, we use positive pressure work clothes and a shower system. The breathing and air supply of personnel are all separated from the laboratory air to ensure that people will not be infected by potentially contaminated pathogens.

For the toxic waste that may be generated in the laboratory, such as air, the laboratory uses an organized negative pressure system and pipes to prevent any air with potential environmental threats from spreading naturally. Then pass through two high-efficiency filters to intercept harmful pathogens in the air and ensure that residual pathogens will not be released.

For solid waste such as paper scraps and plastic tubes, the laboratory uses an autoclave for high temperature sterilization, packs them into bags, and transports them to the supporting medical waste company in Wuhan for harmless incineration. The transportation process is checked by a special vehicle, and information feedback is maintained with the laboratory throughout the process.

The liquid is collected through the double-layer sewage pipeline to the sewage treatment station on the first floor, disinfected by high temperature and high pressure, and discharged into the environment harmlessly. For the three wastes, the standard we pursue is zero emissions.

### **For ordinary people, efficiency is life**

Guangzhou Daily: What is the future research direction of the laboratory? What is the real impact on the lives of ordinary people?

Song Donglin: The fourth-level laboratory focuses on more than a dozen pathogens. The only ones that are really close to us are the historical Xinjiang hemorrhagic fever and Southeast Asian Nipah virus. But once a powerful virus spreads, it will have a great impact on ordinary people. Virus research and monitoring methods have been established to enable rapid diagnosis and tracking at an early stage. If someone is sick, we can immediately know the voyage of the sick flight and determine the scope of control. Efficiency is life. For virulent viruses, early detection is critical.

Guangzhou Daily: Do one thing for more than ten years, and gradually deviate from your previous research direction, have you regretted it?

Song Donglin: I can give full play to my expertise. This is also the direction of my personal career.

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