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Security Issues Related to Designing High-Containment Facilities

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Author's Note

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Introduction

As architects, we deal with security as one of the components required to be coordinated and balanced with biosafety and life safety issues in facilities; however, our primary goal, with respect to designing facilities, is to accommodate the science. If we were to design facilities strictly to contain the agents, they would look significantly different. We balance the quality of life aspects as well as the security issues. From a security point of view, three things affect us when designing these facilities: Communication, Design, and Construction.

Communication

Communication encompasses how we communicate with everyone during design and during construction. As architects or as designers, we're responsible for communicating a significant amount of information. Being security-conscious, we're really restricted as to what and how to communicate since much of the information is controlled. We are challenged with respect to how we communicate and maintain security at the same time. Security relies on limiting access to information, which results in not writing down certain elements, and limiting the distribution of such information, which creates a host of challenges. The people we need to communicate with to get a facility up and running are the owners who need to communicate to the architects and engineers in terms of what the requirements are. The architects and engineers need to communicate to their consultants and to the contractor, and the contractor to the sub trades, and everyone constructing and designing the facility to the operators, and the operators to the users. The information, in terms of how the facility operates and all the security information, gets distributed thoroughly, but it needs to be controlled. That is definitely a challenge with respect to designing new state-of-the-art facilities that are both safe and secure.

While a lot of our people are classified, this information isn't classified. It's controlled. And being controlled, there really are no defined rules. Most of our clients have their own methods that they request us to employ to restrict the information. The blast requirements and setback requirements, things of that nature, are controlled which necessitates that we institute a few elements of control within our organization, with the concurrence of the client. The prime consultant retains most of the main information and then distributes it to other consultants who need to work with it. That way it's not distributed on such a wide basis. The requirements are designed into the facilities. Instead of stating, "This wall shall resist a specific requirement," the wall is designed to accommodate the requirement and thus reflected in the documents.

The design team signs nondisclosure forms. The biggest advantage of these forms is that a record of

who had contact with the drawings and who has the information is developed. All the documents are numbered and tracked, returned to our office post review, and destroyed to eliminate or reduce the amount of drawings that are not utilized. Personnel who work on these documents are subject to government-level checks. With respect to the security of the documents, the biggest challenge comes during construction, due to the wide audience of people who need to come in contact with these documents during the construction phase.

Design

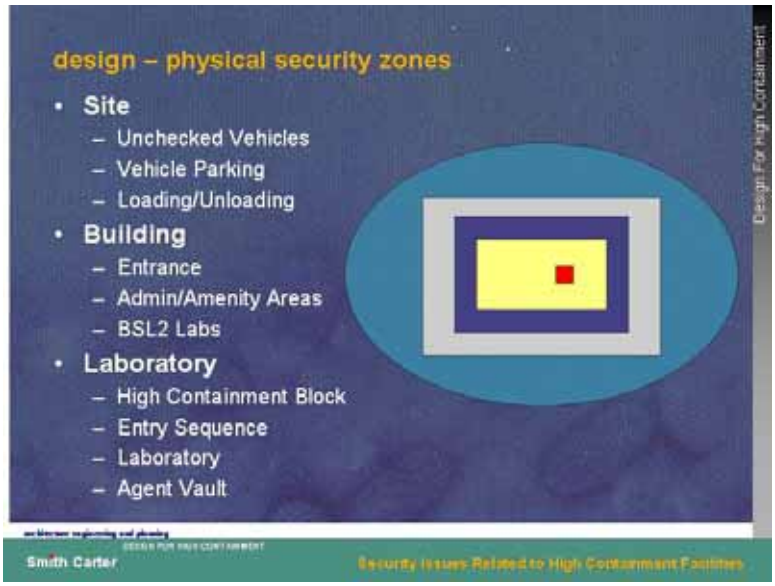
The second part of security is designing the facility to meet the requirements and the challenges they add to creating a working laboratory. There are a wide range of regulations that we use as guidelines, in addition to the specific agency requirements. Some of the sites have specified threat levels (low, medium, or high), which determines the setbacks for the facility, and we need to adhere to those. The Department of Justice (DoJ) defines the classification of a building, with Level 5 being the highest. The Pentagon, as an example, is a Level 5. GSA security guidelines apply to all government buildings where government employees are housed. The Select Agent Act governs the security of the agent and along with biosafety guidelines governs the safe use of agents. The building codes encompass life safety aspects that are critical for all facilities.

Regarding the physical security goals, the security of the high-containment areas is the priority; however, some apply to all laboratory types. The security goals are to protect the facility, protect its occupants, and contain and secure the agents within the facility. The security program is not only a facility solution; it also includes the security management, the planned development, the physical security solutions, the "what" and the "how" we are doing, and the monitoring and surveillance.

Each project's unique setting offers unique challenges regarding site security. The information is generic because security, by its nature, requires control of the information. Locations vary from urban settings adjacent to densely populated areas, to locations on military bases with their own security controls. Some have a built-in security-layered support to access the site, while at others it is necessary to create the boundaries. There is no formula to say, "Well, let's just put a fence around it" because some of these sites aren't able to just have a fence around them or the setbacks achieved, which requires balancing the hardening requirements versus the capabilities or the allowances that the site allows you to have.

Figure 1

Design—Physical Security Zones



Security zoning is based on the layered approach; essentially, we use the onion as an analogy. Each layer must be accessed prior to accessing the next layer (Figure 1).

Utilizing this concept of site layers, there are approximately eight or nine layers before you get to the laboratory, with additional layers inside the laboratory for special storage areas. So, each one of these—from unchecked vehicles, to vehicle parking, to loading, to the building entrance, amenities, BSL-2 labs, then into the high-containment block, to entry sequence, to lab, to the agent vault—is designed so that you have to access one area before you get to the other area, creating the layered effect of security.

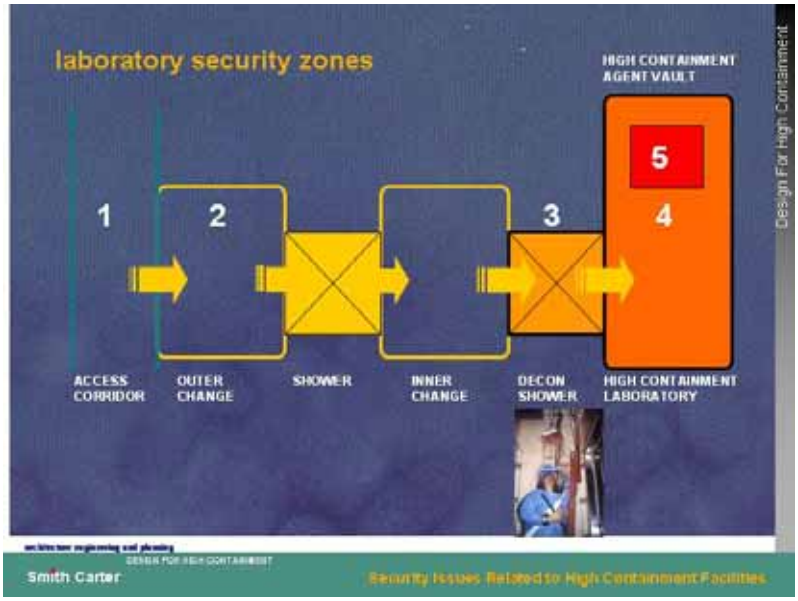
The siting of the facility needs to take into account restricting vehicles from getting close to the facility. Locating the loading area, boilers, and chillers in an outer zone will allow greater access and minimize internal access. Tunnel connections to buildings allow another point of access that must be considered or preferably not included in the design. The goal is to restrict the number of access points you have into the building. A single point of access is the most ideal.

Whether parking is on the inside of the pedestrian standoff or outside, it impacts the design. If the setbacks aren't able to be maintained, more cost is added to the building in order to be able to resist the blast challenges that are defined.

Zoning on a site needs to consider which part of the building is located where. The office and general labs, which require more light, can be more visible and exposed to the community. The high-containment area, which doesn't have as many windows and is not designed to have long views from the community, is sequestered on the site with internalized windows. BSL-3Ag or BSL-4 labs have a built in inherent security since the laboratories are further internalized with a buffer corridor around them and are generally located above grade. If the outer envelope must be designed for certain blast criteria, it's not the containment barrier that must meet the requirement. We are equally concerned that these labs be great places to work, which includes allowing natural light into a high-containment laboratory. A secure way of dealing with natural light, without compromising security, is to create some type of internalized space to get secondary light to the lab to provide a good quality of light and, at the same time, connect the lab to the facility, so that it becomes part of the overall complex. The high-containment labs need to have a level of separation from the other parts of the facility, making these labs a destination location, not part of the general circulation.

Figure 2

Laboratory Security Zones



Additionally, how the high-containment component of the building or the laboratories blends in with the rest of the facility affects the overall security concept for the facility.

The zoning continues from the site to the facility to the high-containment block into the change area, into the lab, and then into the internalized parts of the lab. The high-containment block is treated much like a building. There is a single point of access, which creates a challenge in coordinating the life safety aspects, the biosafety aspects, and the security aspects. Generally, these blocks have entry control in and out, with card access required for personnel to get in and out, so that it's always apparent who has been in and who has actually left the block. In order not to compromise this feature during a life safety situation, such as someone pulling a fire alarm, nothing changes the security system; personnel still need to provide a valid card to go out. This requires the separation of life safety (exit stairs) and security considerations, so that no security is compromised during a life safety event. Nobody can be trapped inside. Each person has to be able to get out in a life safety situation utilizing emergency overrides. However, these are constructed in such as way so that personnel have time to go through proper protocols to decontaminate themselves through showers and wash down areas.

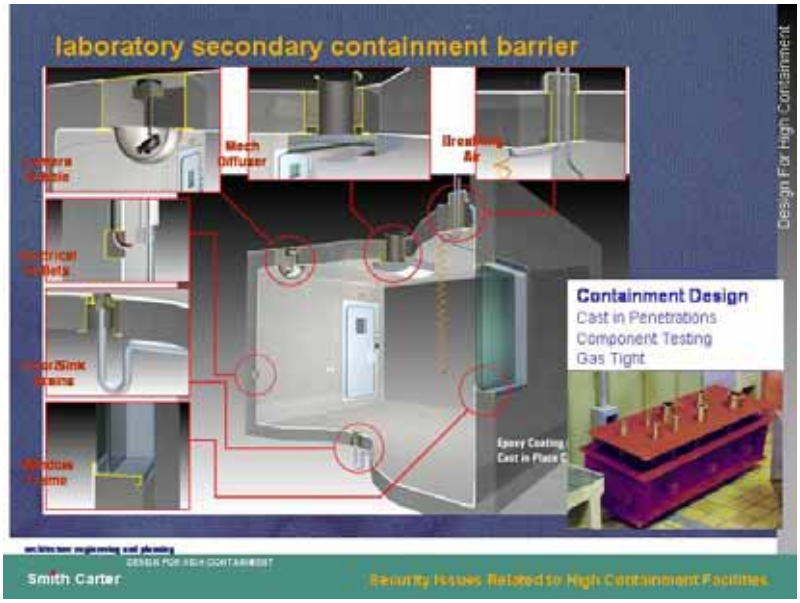
Figure 2 shows a sequence of entering a high-containment laboratory with points of access control. The zones continue from the corridor into the change area, through the shower area, into the chemical shower, into the lab, and into the special inside storage area. The devices on each of these are different, and depending upon whether this is a BSL-4 lab or a BSL-3 Ag lab, there can be an additional access control at the body shower.

The containment barrier has an inherent security safeguard built into it, due to its robust design. Figure 3 demonstrates the containment barrier and its penetrations. The penetration needs to be considered part of the security strategy. How are the windows secured and what type of glazing is utilized to prevent entry? How are the doors secured? What is the coordination between life safety out and the security in? What about the camera bubbles and whether they are accessed from outside or inside? The mechanical spaces above, how big are those ports?

Security consideration for building support functions includes elements regarding decontamination of the air, the liquid, and the waste, which are critical to containment. The bio-waste area needs to have secure access to it. The autoclaves could be a point of gaining access into the laboratories; therefore,

Figure 3

Laboratory Secondary Containment Barrier



secure access to them is required.

Access control devices vary depending on the area being accessed (Figure 4). Proximity card readers are the most common. Some areas may have touch pads and biometric iris scanners utilized to gain final access to the BSL-4 labs. Every person has a unique iris pattern that remains stable throughout life. Biometric devices and touch pads are employed to gain access to the agent vaults inside containment and are being tested to ensure that they can be decontaminated by someone in a containment suit and still function.

CCTV cameras can have a shared use security—for biosafety observation and training. These spaces are well monitored, and it's quite advantageous to be able to have this function as a dual use since the surveillance aspect of these laboratories is a large cost to the operation of a facility, as well as a large capital cost.

Construction

The third challenge is during the construction phase. When building a facility, generally a fence is installed around the site so that access is controlled. However, a lot of people come into these facilities, and a number of institutions now have quite a few regulations regarding how people are screened. This impacts the timing and delivery of materials, which in turn impacts the cost of facilities. To screen all of the people, or at least the supervisory people who work with the drawings on the site, will change the labor pool for some of these projects.

Guards are placed at the gate, monitoring workers as they come in, checking vehicles, making sure that they are scheduled to be there and that they are actually the right vehicles for that site, and checking that the people have been cleared to be on the site. A fence separates the site from other parts of a campus or base. The security requirements, as much as you can document the drawings in terms of how to design it and encompass the intent of the biosafety and security issues, need to be indicated to the contractors so they understand the value of what they are doing and can actually add to that part of it.

Nondisclosure forms and other methods of tracking documents still take place during construction, keeping in mind that in our business the paper work during construction is many times greater than during the design phase.

These are a few of the challenges that exist with respect to designing high-containment facilities. The key is to balance the challenges of security, biosafety, and life safety so that the scientists can work in as unobstructed a manner as possible.

Figure 4

Access Control Devices