GLOBAL THREAT REDUCTION INITIATIVE

SAND2013-6055P

Subgroup Exercise 1: Target Identification

Read about and become familiar with the hypothetical facility before working on these exercises.

Session Objectives

After the session, the participants will be able to do the following:

1. Identify targets given different operational conditions at the hypothetical facility using manual inspection.
2. Identify whether targets are more likely to be a damage/sabotage or theft target at the hypothetical facility, given different operational conditions.

Exercise 1A: Target Attractiveness

1. What makes a particular target "attractive" to a potential adversary?

2. List the characteristics that make something a better "theft" target.

3. List the characteristics that make something a better "damage or sabotage" target.

4. What, in your opinion, would be a target's level of radiation in order to make it "self-protecting"? Would this level be the same for a disgruntled employee as it would for a terrorist?

Sandia National Laboratories

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. . SAND#

Exercise 1B: Determining Target Type

Given the location and operational condition shown of various targets, determine if that target would be **more attractive** to an adversary as a theft or as a damage/sabotage target. In some cases, the target may be equally attractive as a theft and damage/sabotage target. Given the target type, choose the tools needed by the adversary to complete the task of theft, damage/sabotage, or both.

Operational Condition	Target Type	Tools Needed for Theft	Tools Needed for Damage/Sabotage
Gamma Knife— Non-operational hours 20:00 –07:00	☐ Theft only ☐ Damage and/or Sabotage	☐ Hand Tools ☐ Power Tools ☐ Explosives ☐ Shielding Device ☐ Vehicle ☐ other _____	☐ Hand Tools ☐ Power Tools ☐ Explosives ☐ Shielding Device ☐ Vehicle ☐ other _____
Explain your reasoning for the target and tools selected :			
Blood Irradiators— Operational Hours (24 hrs/day)	☐ Theft only ☐ Damage and/or Sabotage	☐ Hand Tools ☐ Power Tools ☐ Explosives ☐ Shielding Device ☐ Vehicle ☐ other _____	☐ Hand Tools ☐ Power Tools ☐ Explosives ☐ Shielding Device ☐ Vehicle ☐ other _____
Explain your reasoning for the target and tools selected :			
Research Irradiator (near Vivarium) Night time	☐ Theft only ☐ Damage and/or Sabotage	☐ Hand Tools ☐ Power Tools ☐ Explosives ☐ Shielding Device ☐ Vehicle ☐ other _____	☐ Hand Tools ☐ Power Tools ☐ Explosives ☐ Shielding Device ☐ Vehicle ☐ other _____
Explain your reasoning for the target and tools selected :			
Research Irradiator (near Vivarium) Day Time	☐ Theft only ☐ Damage and/or Sabotage	☐ Hand Tools ☐ Power Tools ☐ Explosives ☐ Shielding Device ☐ Vehicle ☐ other _____	☐ Hand Tools ☐ Power Tools ☐ Explosives ☐ Shielding Device ☐ Vehicle ☐ other _____
Explain your reasoning for the target and tools selected :			

Operational Condition	Target Type	Tools Needed for Theft	Tools Needed for Damage/Sabotage
Gamma Knife— During a re-sourcing of the Gamma Knife	☐ Theft only ☐ Damage and/or Sabotage	☐ Hand Tools ☐ Power Tools ☐ Explosives ☐ Shielding Device ☐ Vehicle ☐ other _____	☐ Hand Tools ☐ Power Tools ☐ Explosives ☐ Shielding Device ☐ Vehicle ☐ other _____
Explain your reasoning for the target and tools selected :			

GLOBAL THREAT
REDUCTION INITIATIVE

Subgroup Exercise 2: PPS Overview

Session Objectives

After the session, the participants will be able to do the following:

1. Understand the difference between deterring and defeating an adversary.
2. Be able to identify the basic functions of physical protection (detection, delay, and response).

Exercise 2A: Deterrence and Defeat

The physical protection system of a facility can prevent an adversary from accomplishing his mission in two ways:

- DETERRING the adversary from ever trying to attack the facility or
- DEFEATING the adversary's attempt if he does attack

This exercise focuses on deterrence, which discourages an adversary from attempting an attack by making a successful attack appear very difficult or even impossible. Using the hypothetical facility as an example, list all of the deterrence elements that already exist in that facility. Then, create new ones that the facility could realistically install that could be effective.

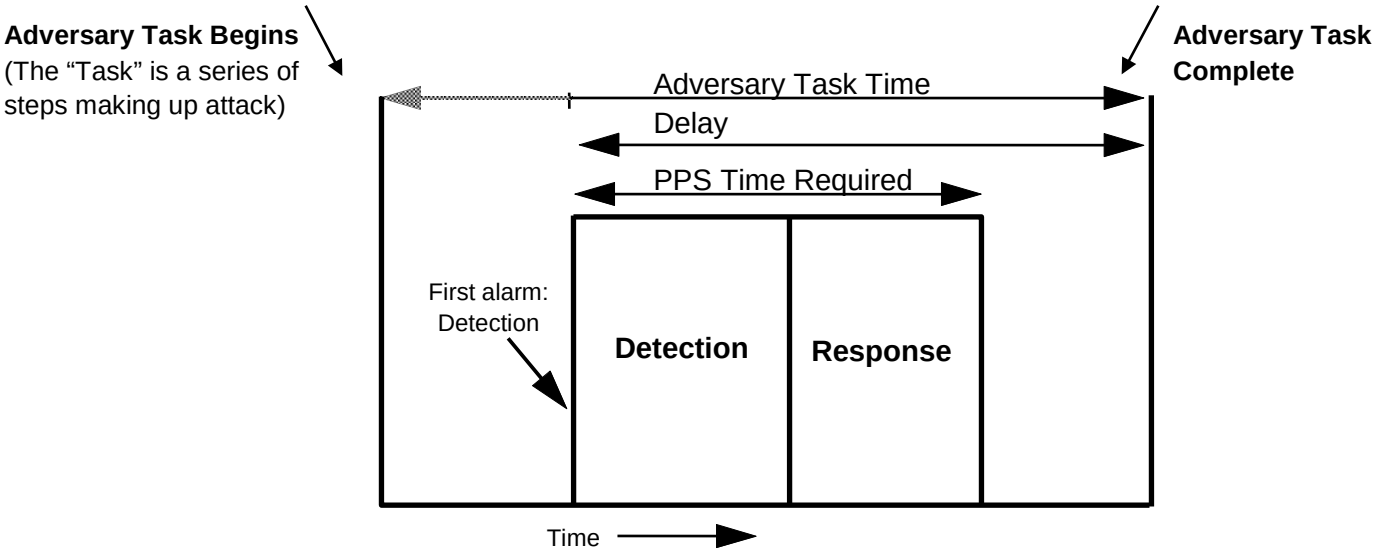
Deterrence Elements	
1	**6**
2	**7**
3	8
4	9
5	10

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. . SAND#

Exercise 2B: Time Comparisons

Below is a diagram showing "Adversary Task Time vs. PPS Time Requirements," with periods of time blocked off for each of the following:

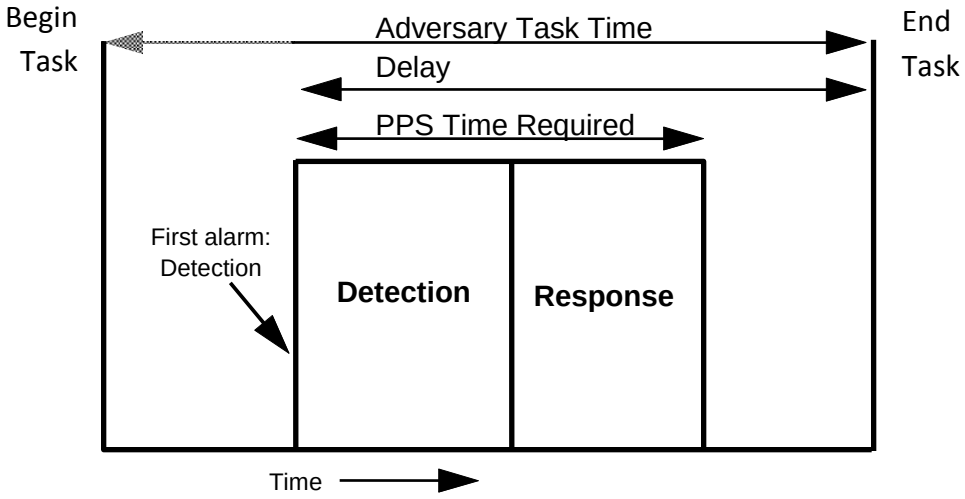
- Detection: Time needed for security personnel to detect an alarm and assess it as a valid intrusion.
- Response: Time needed for security personnel to communicate, prepare, and strategically locate themselves for neutralization.
- Delay: Time period from first detection of the adversary to completion of his task.



Discuss with your group how the diagram will change based on the conditions given in the different scenarios in the following pages. Using the diagram above as the baseline or starting point, redraw the new PPS time requirements over the diagrams provided, based on the conditions specified in each scenario.

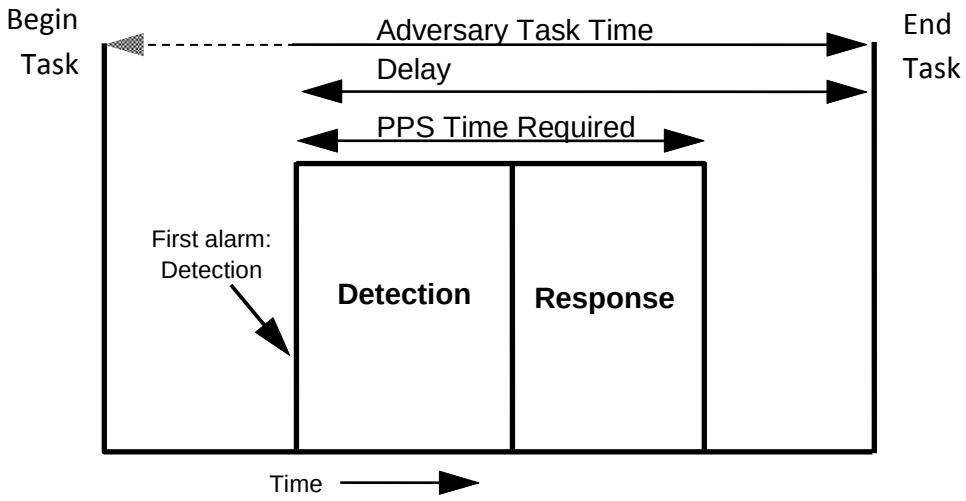
Scenario 1:

The response force cannot respond to a new alarm in their normal (average) time because they are already responding to an alarm elsewhere in the hospital. It takes the response force five times as long as their normal time to respond to this new alarm. Will the response force arrive in time to interrupt the adversary?



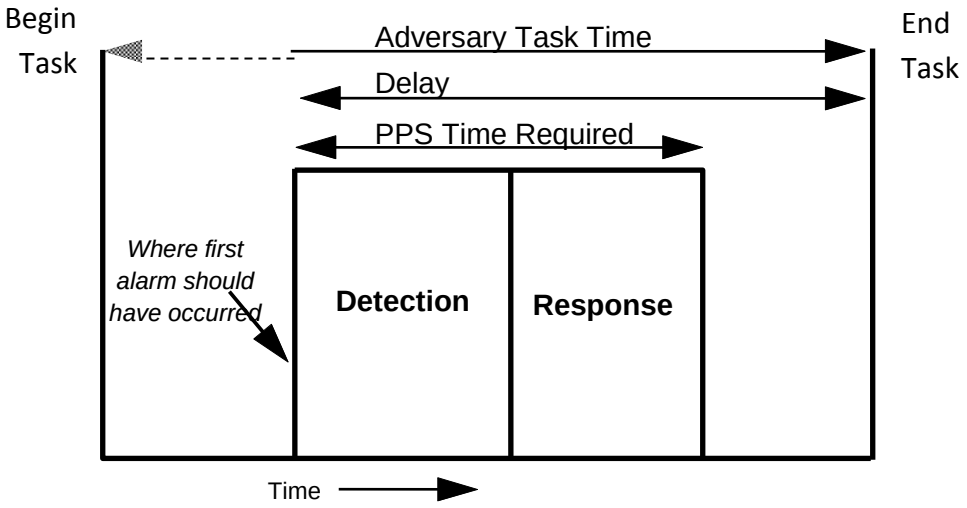
Scenario 2:

An alarm indicates the entrance door to the research wing was opened, but it cannot be confirmed for a long period of time (e.g., the camera viewing the entrance has been pointed in the wrong direction), so the university alarm monitoring station dispatches security personnel to visually inspect the area and assess the situation. It takes an additional 25% as long to assess the alarm. Will the security personnel dispatched arrive in time to interrupt the adversary?



Scenario 3:

The sensor on an exterior emergency exit door fails to activate when an intrusion occurs (i.e., the sensor does not work). A second sensor along the intruder's path, which is on an interior door, is activated at a point on the diagram which is 2/3 of the way into the average detection time window, had the first sensor been working. Detection time for the second alarm is the same as the first alarm. Will the response force arrive on time to interrupt the adversary?



Application Considerations

1. It is often said, "The role of physical protection is to encourage the adversary to attack someone else's facility." Is that the role of physical protection? Explain.

2. If all analyses point out that the earlier the adversary is detected, the better the chances of defeating him, then what prevents a facility from moving sensors out to the very limits of their property?

3. Explain the difference between "alarm communication" and "response communication"?

GLOBAL THREAT
REDUCTION INITIATIVE

Subgroup Exercise 3: Interior Sensors

Session Objectives

After the session, the participants will be able to do the following:

1. Evaluate the effective placement of intrusion sensors and the likelihood of alarm.
2. Determine when detection occurs during a sequence of events.

Exercise 3A: Evaluate Placement of Interior Sensors

UMC has various types of intrusion detection sensors installed in their facility. For each area and given time listed, identify the sensors used and list them in the "Type of Sensor" column on the chart below. Evaluate the placement of these sensors and whether the placement is effective in terms of:

- Boundary penetration (i.e., wall, doors, windows, vents, etc.)
- Motion detection within the area (i.e., inside the building, target areas, office areas, etc.)
- Proximity detection in vicinity of targets (i.e., in the irradiator rooms, gamma knife room, etc.)

Remember that employees & security personnel can also act as sensors. Indicate in the last column the likelihood of an alarm occurring, given the different operational conditions, using a qualitative rating of High (H), Medium (M), or Low (L). Do not confuse this with probability of detection (P_d); instead consider it the likelihood of an alarm being activated.

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. . SAND#

Detection Method	Area and Facility Condition	Type of sensor (activated)	Is placement effective? (Why or Why not?)	Likelihood of an alarm (L, M, H)
Boundary penetration detection (i.e., at wall, doors, windows, vents, etc.)	**Blood Bank** (Daytime)			
	Research irradiator (Nighttime or Weekends)			
	NSC (Holidays)			
Motion detection within the area (inside the building, rooms, target or office areas, etc.)	**NSC** (Daytime)			
	Blood Bank (3rd shift)			
	NSC (Nighttime)			
Proximity detection in vicinity of the targets (Areas immediately around the irradiators, gamma knife, etc.)	**Blood Bank** (Daytime)			
	Research Irradiator (Daytime)			
	Research Irradiator (Holidays)			

Exercise 3B: Determining Point of Detection

Let us assume, for this exercise, that the hospital has integrated sensors and cameras so they can immediately assess any alarm via CCTV, and that there are cameras viewing **all** entrances and emergency exits. Assume that there is an alarm station at the front/security desk in the hospital with a monitor for assessing the alarms. For the following two sets of sequences, read through the list of events described below and determine the point (step) at which intruder detection takes place.

A1. A BMS sensor alarm signal is generated from the basement exterior maintenance door on the research wing.

A2. Alarm signal is transmitted to console.

A3. Operator is alerted of an incoming alarm at Door Number B2.

A4. Operator scans the CCTV images of alarming sensor for cause of alarm from Door Number B2.

A5. In searching for cause of alarm, operator observes an unauthorized person opening the maintenance door and entering the basement.

A6. Operator radios other hospital security personnel, identifying nature and location of intrusion.

A7. Security personnel interdicts intruder.

B1. A BMS sensor alarm signal is generated from the basement exterior maintenance door on the research wing.

B2. Alarm signal is transmitted to console.

B3. Operator is alerted of an incoming alarm at Door Number B2.

B4. Operator is unable to assess alarm immediately because her 6-year old, who she is babysitting because her ex failed to pick up the child before her work shift began, is using the monitor to play Pac-Man. The 6-year old screams her bloody head off and refuses to allow the operator to switch the monitor back to its intended use, so the operator radios the roving patrol and instructs him to check out Door Number B2, which is the code for the Basement exterior maintenance door. The roving patrol is currently in the visitor cafeteria and it takes him approximately 1 minute and 35 seconds to get to Door Number B2.

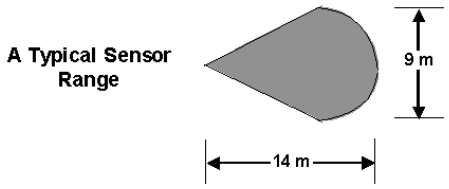
B5. The patrol arrives at Door Number B2 and finds nobody there and the door shut.

B6. The patrol radios the operator and informs her that there is nobody in the area and the door is shut.

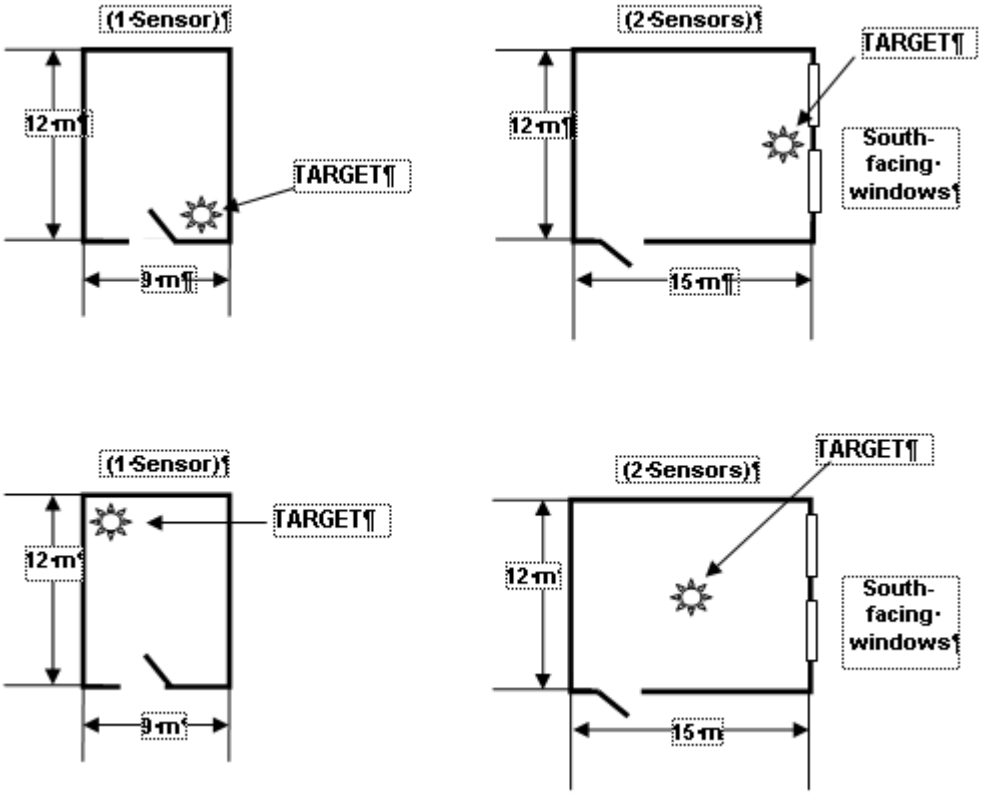
B7. Patrol returns to cafeteria. Operator writes up alarm as a false alarm.

Exercise 3C: Interior Sensor Location

Passive infrared sensors (PIRs) respond to energy emitted by a human intruder. A typical detection zone has a pattern and a range as shown below.



In the following four example floor plans, show how to best arrange the specified number of passive infrared sensors within each room, given the location of the target, and show the area of coverage. If a PIR sensor should not be used, explain why.



Application Considerations – Interior Sensors

1. What kind of environmental conditions can affect interior sensor systems?

2. For a very sensitive (i.e., security must be high) piece of equipment, would you recommend a dual-tech interior sensor?

3. Why would a facility not want to install glass-break sensors at the windows around a 24-hour cafeteria?

GLOBAL THREAT
REDUCTION INITIATIVE

Subgroup Exercise 4: Alarm Assessment

Session Objectives

After the session, the participants will be able to do the following:

1. Determine who is responsible for assessing the alarm(s) given a facility state and operational condition and evaluate the effectiveness of the assessment system.
2. Evaluate the effectiveness of camera placement.

Exercise 4A: Likelihood of Assessment

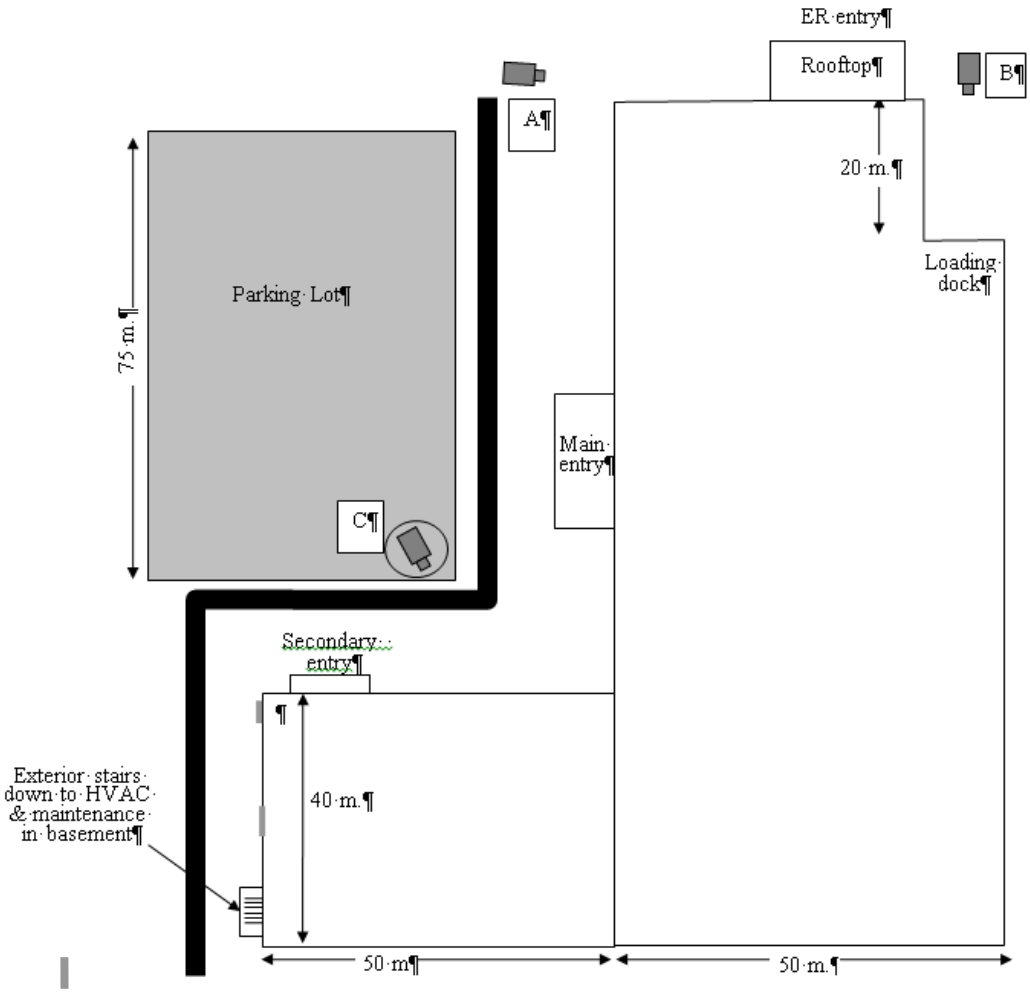
Complete the table below using the hypothetical facility description. For the different facility states, operational conditions, and suspicious activity, determine who is most likely to assess the situation. Then determine the likelihood of assessment using the qualitative ratings of High (H), Medium (M), or Low (L). Remember that assessment can be accomplished via cameras (if available), employees, a roving security patrol (randomly), or a roving security patrol (upon being dispatched).

Facility State	Area & Condition	Suspicious Activity	Who is most likely to assess the situation?	Likelihood of Assessment (L, M, H)
Daytime (operational hours)	**NSC:** Gamma knife not in use	Person enters via emergency exit door (when employee uses this exit) and runs to gamma knife surgery room		
	Blood Bank: both irradiator units in use	Foreign national taking pictures of security features in the research wing		
	NSC: midway through the re-sourcing process	Suspicious package on sidewalk next to south wall of Gamma knife room		
	Basement: Research irradiator not in use	Person with large backpack attempting to open the irradiator lab door.		
Night time and weekends (operational hours)	**NSC:** Security just checked that lobby doors were locked	Person attempting to open emergency exit door		
	Blood Bank: both irradiator units in use; grave shift	Non-employee (no hospital ID) runs into the blood bank		
	Research Wing:	West emergency exit door on ground floor has been opened; there are breaching tools lying on ground		
Holidays (non-operational hours)	**Basement:** Research irradiator not in use.	Outside around the exterior maintenance door		

Exercise 4B: Effectiveness of Camera Placement

Using the hypothetical facility, assume that the hospital has cameras installed on the exterior of the facility as shown below. Cameras A and B are fixed; camera C is a pan-tilt-zoom camera. Camera A is intended to cover the ER entrance, Camera B covers the loading docks, and Camera C is on a pre-set surveillance pattern that pans from the main entry to the secondary entry to the exterior stairs leading down to the HVAC maintenance area. All three cameras are installed on light poles.

Assume that the diagram of the "field of view" on page SG4-4 is for a 25mm lens, which is the lens each of these cameras is using. Sketch the approximate assessment zones for each of the cameras in the figure below.



Questions

1. Does camera A meet security's needs? _____

   If not, explain why not: _____

   _____

2. Does camera B meet security's needs?_____

   If not, explain why not: _____

   _____

3. Does camera C meet security's needs? _____

   If not, explain why not: _____

   _____

4. What kind of bonus should the camera layout designer get this year?

   ☐ $ 0.50 ☐ $ 25.00 ☐ $ 100.00 ☐ $ 500.00 ☐ $ 1000.00

Application Considerations

1. Discuss the following application considerations:
   a. 100% of the detection area should be assessed.

   b. Coaxial video cable and power cables should be located separately.

   c. The cameras' views should be free of any blockage, such as fence lines, to assess perimeter sector.

2. How could the placement of video equipment (poles, cables) disturb intrusion sensors?

3. How could assessment time be reduced?

GLOBAL THREAT REDUCTION INITIATIVE

Subgroup Exercise 5: Access Delay

Session Objectives

After the session, the participants will be able to do the following:

1. Develop and use example representative data to determine delay times for given paths and penetration equipment.

2. Compute delay times for theft and sabotage/damage scenarios and determine the total task time required for an adversary to complete their objective.

3. Recognize where to add barriers that will effectively increase delay time for the adversary.

Exercise 5A: Collecting Delay Times for Hypothetical Facility

The table below contains delay times for various barrier features at the hypothetical facility. The table is partially completed. Use the information presented during the Access Delay module and your own personal judgment or expert opinion to fill in the missing delay times for the table. This data will be used for Subgroup Exercises 5 and 6.

Barrier Feature	Penetration Equipment	Mean Time
18-inch thick concrete walls	Hand tools	A long time
	Power tools	
Hospital Exterior walls	Hand tools	30 min.
	Power tools	
Hospital Interior (frame/sheetrock) walls	Hand tools	
	Power tools	5 min.
Standard construction (hollow-core metal) exterior personnel doors	Hand tools	1.0 min.
	Power tools	
Standard construction interior personnel doors	Hand tools	
	Power tools	
Standard construction windows	Hand tools	
	Power tools	

Sandia National Laboratories

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. . SAND#

Barrier Feature	Penetration Equipment	Mean Time
Travel times	Driving rate (vehicle)	20 m / sec
	Running rate (people)	4 m / sec
	Walking rate (people)	1.3 m / sec
Disassemble Pneumatic Drive system on Gammacell-40 Medical Research Irradiator	Hand tools	30 min.
	Power tools	15 min.
Penetrate Gamma Knife body (shielding) to access cobalt pencils	Hand Tools	A very, VERY long time
	Power Tools	30 minutes

Note: This data is representative of the general delay times provided by each barrier and attack type. However, the data may not represent actual delay design information.

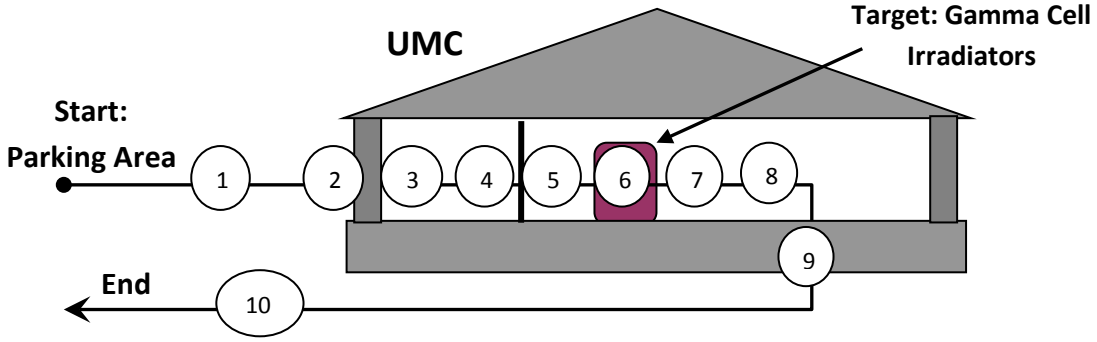
Exercise 5B: Computing Delay Time for a Damage/Sabotage Scenario

An employee who was fired is very angry about losing his job at the UMC. This ex-employee still has his badge which gives him "authorized" access to the Research Wing of the hypothetical facility. He also has a friend who owes him a big favor. The two of them intend to damage/sabotage the blood irradiators in the blood bank at the UMC facility. Their intent is to cause damage, disrupt blood services, and create negative PR for the hospital. The adversaries have been planning the attack for several weeks and have made sure they are familiar with the operations, the facility layout, and who works on each shift in the blood bank. The attack will use deceit and will occur on the grave-yard shift of the Friday night/Saturday morning of a 3-day weekend. They are equipped with an all-wheel drive vehicle, two 4 liter containers of automotive anti-freeze, two 32-ounce industrial size tubes of Good-Grief Glue, a small sledge hammer, radiation symbol stickers, and a dolly that the friend borrowed from the company he works for. (The friend works for a company that installs commercial safes.) The following describes the fired employee's damage scenario.

0. On Thursday night, the night before the planned attack, the adversaries drive by the facility and use a pellet gun to shoot out a couple key exterior lights near the Research Wing entry so that nobody will be able to recognize them on the exterior video recordings after the crime is accomplished.
1. When the Friday night grave yard shift is almost half over, they drive to the north side of the Research Wing, and park near the entrance.
2. They use the ex-employee's "authorized badge" to allow them to enter through the Research Wing entrance. The adversaries enter with backpacks, where they have hidden 2 one-gallon containers of anti-freeze and two kg tubes of Super Good-Grief Glue, a small sledge hammer, and radiation stickers; they also wheel in a heavy-duty dolly.
3. They make their way to the blood bank, which is open 24-7.
4. The adversaries enter into the blood bank through the open lab door.

5. Once in the blood bank, the adversaries confirm that there is only one person working this shift (who they made sure was not familiar with the fired employee), as they knew many employees would call in sick at the start of the 3-day weekend. They start talking with the one employee there about how they were called in to substitute for the sick employees. They convince him to take the rest of the night off since "he worked the job of three people for almost 5 hours" and since there wouldn't be enough work for all three of them over the remaining 3 hours of the shift. The adversaries even curse about how they were told to check out a heavy-duty dolly and bring it so they could help move hospital beds during the night for refurbishing. They continue to chat until the blood bank employee decides to leave.
6. Being familiar with the blood irradiator equipment, they fill the specimen cell of each device with Good-Grief Glue and quickly press the switch that moves the specimen cell into the interior of the device. They then unplug both irradiators. Using a pry-bar, heavy-duty jacks, and a come-along, they lift one of the Gamma Cell blood irradiators onto a heavy-duty dolly and push it over to the large window in the blood bank lobby. They then move the other irradiator.
7. The adversaries breach the ceiling-to-floor exterior window in the blood bank lobby using the small sledge hammer.
8. Using the dolly, they tip one irradiator out the broken window and then repeat with the second irradiator. One irradiator tumbles as far as the sidewalk, the other rests in the grass a few feet from the window.
9. They quickly place additional radiation stickers on the two devices, then dump the two gallons of anti-freeze all over the two irradiators and the sidewalk. They also break open many of the whole blood donations (stored in the lab's refrigerator) out onto the sidewalk, onto the equipment, and onto the broken shards of glass from the window.
10. The adversaries leave the facility and the UMC, exiting through the Research Wing entrance and fleeing in their all-wheel drive vehicle.

Use the information provided in the following pages to determine the total mean time required to damage/sabotage the Gamma Cell irradiators, using some of the delay times you established in the table of Exercise 5A.



Barrier	Type	Specification
1	Distance	Park vehicle and walk 13 m from parking area to research wing entrance.
2	Task time	Use badge to enter Research Wing.
3 & 4	Distance	Walk 30 m from research wing entrance to blood bank entrance and into blood bank.
5	Task time	Locate and talk to person in blood bank; convince him to go home early.
6	Task time	Damage interior of irradiators & move them to window area
7	Task time	Break window in blood bank with the small sledge hammer.
8	Task time	Using the furniture dolly, tip the irradiators out the broken window onto the sidewalk.
9	Task Time	Place additional radiation symbols on irradiators lying outside. Dump two gallons of anti-freeze all around, especially on the sidewalk. Break open blood containers and pour/smear everywhere.
10	Distance	Exit blood bank; drive away in the all-wheel drive vehicle (about 67 m back to vehicle from blood bank windows).

5B - Delay Time Worksheet for Damage/Sabotage Scenario

Barrier	Task Description	Task Time (minutes:seconds) Mean	Cumulative
1	Drive vehicle to North side of Research Wing entrance and park; walk (~13 m) to blood bank.		
2	Open door into Research Wing using fired employee's badge.		
3	Enter Research Wing with backpacks and furniture dolly		
4	Make way from Research Wing entrance to Blood Bank Entrance (33 m).		
5	Confirm there is only one blood bank employee; convince him to leave		
6	Insert Good-Grief Glue into irradiators; using furniture dolly, wheel them to large window.		
7	Breach large window in the blood bank lobby with the small sledge hammer.		
8	Using the furniture dolly, dump the two irradiators out the broken window.		
9	Apply radiation stickers to irradiators; dump out anti-freeze and whole blood.		
10	Exit blood bank area through the broken window and walk to vehicle (~66 m); then adversaries drive away.		
	Adversary Total Time (minutes:seconds):		

5B - QUESTIONS

1. Will the response force arrive in time to neutralize the adversaries? _____

   _____

2. Will the response force arrive in time to interrupt the adversaries? _____

   _____

3. At what point are the adversaries (or the attack) detected? _____

   _____

4. What steps could the hospital take to prevent this type of attack? _____

   _____

5. What were the adversaries unaware of that will likely get them caught? _____

   _____

6. How successful were the adversaries in their goal to cause damage, disrupt blood services, and create negative PR for the hospital?

   _____

   _____

Exercise 5C: Computing Delay Time for a Theft Scenario

Two highly motivated adversaries equipped with a utility vehicle, appropriate hand tools, and hand guns intend to steal a radiological source from the Gamma Cell-40 medical research irradiator in the basement of the hypothetical facility (UMC). They intend to sell the source to the highest bidder. The adversaries have been planning the attack for several months and are familiar with the operations, facility layout, and security system. The attack will occur at nighttime during shutdown. Use the data you established in Exercise 5A for delay times. The following describes the theft scenario:

1. The adversaries enter the hospital area under disguise of being students. In their backpacks are small power and hand tools, a modified radiation shielding container, and two handguns.
2. They walk to the stairway in the Research Wing (1st floor), down to the basement (~40 m).
3. They breach the door at the bottom of the stairwell into the research area with hand tools.
4. The adversaries proceed to the Medical Research Irradiator lab (~30 m).
5. They then breach the lab door into the Gamma cell area with hand tools.
6. Upon entering the lab, the adversaries begin disassembling the pneumatic drive system on the Gammacell-40 Medical Research Irradiator with power tools.
7. Once the drive system is disassembled, the source is removed from the irradiator and placed into a modified shielding container in a backpack.
8. The adversaries then exit the lab back up the stairs, and walk to the hospital entrance (~60 m).
9. They walk to their vehicle and leave the area with the radiological source (~8 m.).

Determine the total mean time required to steal the source from the irradiator, given the barrier data described above, using some of the delay times you developed in Exercise 5A.

5C - Delay Time Worksheet for Theft Scenario

Barrier	Task Description	Task Time (minutes:seconds) Mean	Cumulative
1	Enter hospital disguised as students with backpacks.		
2	Walk to stairway in the Research Wing (1st floor) and head down to the basement entrance.		
3	Breach door entrance to basement at the bottom of the stairs with hand tools.		
4	Proceed to medical research irradiator lab (30 m).		
5	Breach lab door and enter irradiator lab.		
6	Disassemble the pneumatic drive system that provides access to the radiological source.		
7	Remove source and place in shielding contained in backpack.		
8	Walk from the basement into the hospital area (60 m).		
9	Without raising suspicion, exit hospital to their parked vehicle and load source into vehicle; they drive away.		
	Adversary Total Time (minutes:seconds):		

5C Questions

Will the intruders be detected? If so, how? _____

_____

What steps should the hospital take to make this type of attack more difficult? _____

_____

_____

Application Considerations

1. Would an adversary always choose the fastest penetration method? What situations would lead an adversary toward making a slower penetration effort?

2. Why is it important to ensure that the floor, ceiling, and walls of a room are balanced—that is, all surfaces provide the same delay?

3. Why is it important to use multiple barriers as well as different types of barriers?

4. Why you think barriers near the target can be a very "cost effective" delay mechanism?

GLOBAL THREAT
REDUCTION INITIATIVE

Subgroup Exercise 6: Response

Session Objectives

After the session, the participants will be able to do the following:

1. Understand how to calculate the time it requires for the response force or law enforcement to respond to the scene of an emergency.

2. Compare the timeliness of different responses, given various detection points.

3. Identify potential ways to increase the effectiveness of the response force.

Exercise 6A: Response Time Analysis for Damage/Sabotage Scenario

Using the results from Subgroup Exercise 5, review the results from Exercise 5B (the damage/sabotage scenario). Below are examples of various points where detection might occur during the damage/sabotage scenario. For each detection point, determine if the response force (LLEA) can respond soon enough to interrupt the adversary, given the various detection points. Assume that an officer is on the 1st floor (above ground) and is within 3 minutes of responding to the area.

Detection Point 1

The blood bank operator, whom the adversaries thought they had convinced to go home early, was actually very suspicious about the two men who came to work in the blood bank. After the legitimate blood bank operator leaves the blood bank, he finds a phone in a nearby open lab about 1 minute later. He is able to give clear and concise information to the hospital dispatcher, along with his assessment of the situation.

- Will the response force arrive in time? _____
- If so, how much time is left before the adversaries are able to complete their objective? _____

  _____
- If the response cannot arrive in time, how late are they? _____

  _____

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. . SAND#

Detection Point 2

Assume the same scenario as for Detection Point 1, except that when the legitimate blood bank operator leaves the blood bank, he waits till he gets to his vehicle to make a call to the hospital operator from his cell phone. This is about 10 minutes after he leaves the blood bank (– he had to stop at his locker to get the novel he was reading during his break and then fill out his time card before leaving). When the legitimate blood bank operator speaks with the hospital operator, he is able to give clear and concise information, along with his assessment of the situation.

- Will the response force arrive in time? _____
- If so, how much time is left before the adversaries are able to complete their objective? _____

  _____
- If the response cannot arrive in time, how late are they? _____

  _____

Detection Point 3

A medical resident moving equipment near the service elevators just northwest of the blood bank notices the two "employees" with large backpacks and a heavy-duty dolly entering the blood bank. The medical resident follows them into the blood bank and asks if they could possibly help her move her medical equipment with their heavy-duty dolly. The "employee" handling the dolly rudely tells the medical resident to "get lost". When the medical resident passes by the blood bank about 30 minutes later, she hears a few loud noises coming from that area. The medical resident immediately runs to call emergency from a hospital phone.

- Will the response force arrive in time? _____
- If so, how much time is left before the adversaries are able to complete their objective? _____

  _____
- If the response cannot arrive in time, how late are they? _____

  _____

Detection Point 4

A hospital security guard patrolling the parking area north of the research building notices from a distance that two individuals park north of the building illegally. After he watches the two men enter the Research Wing, the security guard walks up to the vehicle to see the license plate (~33 m). The guard calls the dispatch center and asks for a check on the license plate; about 1 minute later he finds out that the vehicle belongs to one of their ex-employees, who he personally helped get fired. He calls for backup and begins searching the research wing for the adversaries.

- Will the response force arrive in time? _____
- If the response cannot arrive in time, how late are they? _____

_____

Exercise 6B - Response Time Analysis for Theft Scenario

Using the results from Subgroup Exercise 5 that you completed earlier, review the results from Exercise C (the theft scenario). Below are examples of various points where detection might occur during the theft scenario. For each detection point, determine if the response force (LLEA) can respond in enough time to interrupt the adversary, given the various detection points. Assume that it normally takes the police 8 minutes to respond after an emergency call.

Detection Point 1

A hospital security guard is making his rounds through the hospital and research area at night. He discovers that the basement door at the bottom of the stairwell leading to the research area has been breached. (Assume he discovers this within 1-minute of the adversaries' breach time). The officer uses his radio to call for armed police officers to respond.

- Will the response force arrive in time? _____
- If so, how much time is left before the adversary is able to complete the objective? _____

_____

- If the response cannot arrive in time, how late are they? _____

_____

Detection Point 2

As the adversaries are disassembling the irradiator's pneumatic drives (about halfway through the task time), a student in the next door vivarium hears someone inside the irradiator lab using some sort of power tools. Since the student is good friends with the doctor who manages that irradiator and he realizes he would know about it if someone was supposed to be working on it, he becomes suspicious and calls emergency.

- Will the response force arrive in time to interrupt the adversaries before they are able to complete the theft of the radiological source? _____
- If so, how much time is left before the adversary is able to complete the objective? _____

  _____
- If the response cannot arrive in time, how late are they? _____

  _____

Detection Point 3

As the adversaries are exiting the basement back into the hospital area, a hospital security guard challenges them. The security guard has become suspicious because of the late hour and begins to inquire what the "students" are doing in the area. The adversaries shove the officer aside and run towards the exit. The officer immediately calls on his radio for armed university officers to respond (the university officers just happen to be patrolling nearby at this time and can arrive in 3 minutes).

- Will the response force arrive in time? _____
- If so, how much time is left before the adversary is able to complete the objective? _____

  _____
- If the response cannot arrive in time, how late are they? _____

Exercise 6C: Response Force Effectiveness Evaluation

Based on both the theft scenario and the damage/sabotage scenario for the UMC, what suggestions do you have for improving the response force effectiveness?

Application Considerations

1. Discuss the following:

   a. Response force personnel should be well trained for deployment and use of weapons.

   b. Neutralization must be done by an officer; it cannot be done by equipment.

   c. Response force personnel do not need to understand about the various radiation sources the hospital has, they only need to be able to recognize the radiation symbol.

2. What additional training might be beneficial for members of the response force?

3. What are some of the individual factors that affect response force performance?

GLOBAL THREAT REDUCTION INITIATIVE

Subgroup Exercise 7, Part 2: Scenarios 1-4

SCENARIO 1

Inspection Task: Use the Inspection Procedure and review this facility's compliance with IC 2 (group A) and IC 4 (group B).

Licensee: Moderate sized industrial radiography company located in a small industrial park in a suburban section of Gotham City. Performs radiography at temporary job sites (TJS) using Ir-192 portable cameras. Also performs radiography of larger equipment in the permanent radiography cell using a Co-60 mobile camera.

Staffing: Licensee has 45 full time employees;
16 Radiographers (4 are senior radiographers);
16 Assistant radiographers;
4 Management;
9 Support staff (secretaries, accountants, etc.)

Materials:

Isotope	Activity (Ci)	Location
Ir-192	6.0	In storage cabinet when not at TJS
Ir-192	78.8	In storage cabinet when not at TJS
Ir-192	18.0	In storage cabinet when not at TJS
Ir-192	20.0	In storage cabinet when not at TJS
Ir-192	83.5	In storage cabinet when not at TJS
Ir-192	12.1	In storage cabinet when not at TJS
Co-60	40.0	Does not leave radiography cell

Storage: When not in use, the portable Ir-192 cameras are stored in a locked cabinet within the licensee's facility (see diagram). The Co-60 camera is stored and used in the permanent radiography cell.

Access Control: Key-cards are issued to those individuals authorized for unescorted access to the materials, which includes all radiographers for access to the Ir-192 cabinet; and senior radiographers who are the primary users of the Co-60 permanent cell. Each use of a key-card is recorded by computer.

Sandia National Laboratories

NNSA National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. . SAND#

Monitoring, Detection, Assessment: Main entrance door and the entrance door to the permanent cell are equipped with balanced magnetic switches. Two motion detectors are located within facility. The magnetic switches and motion detectors are tied into a security system which is linked to ABC Security, Inc. located in Gotham City. Signals from the alarm system are sent to ABC Security by land-line phone lines.

LLEA: The Gotham City Police Department has been informed of the materials in use and stored within the licensee's facility. The General Manager of the radiography company has spoken with a Lieutenant of the police department, who has assured him that the department would respond to a call from ABC Security of an alarm from their facility at night.

Scenario 1 Assignment/ Discussion

You are the inspector, and you are reviewing IC 2 (group A) and IC 4 (group B).

- What questions do you ask the licensee?

- What personnel would you talk to?

- What are the potential findings? Why?

- Anything else?

You can use the guidance in the Inspection Procedure, Appendix A.

SCENARIO 2

Inspection Task: Use the Inspection Procedure and review compliance with IC 2 (group B) and IC 4 (group A).

Licensee: Moderate sized radiography company that mainly does work at temporary job sites. You are performing an inspection on the outskirts of Gamma City and observe the radiography truck in the parking lot of the hotel at which you are staying.

Staffing: Working on this particular job in Gamma City are two fully certified radiographers and one radiography helper.

Materials: One portable radiography camera was stored in the radiography truck, and it contained 30 Ci of Ir-192.

Storage: The radiography truck/darkroom was built on a pickup truck. The tailgate was locked, and had to be lowered to open the door to the darkroom. The door of the darkroom was also locked. Inside of the darkroom, the camera was stored in a metal box that the licensee had fabricated and welded to the floor of the darkroom. This box had a hinged lid that was also locked.

Access Control: The keys to the radiography truck, darkroom, and camera storage box were all on one key ring which was under the control of the senior radiographer on the job. Sometimes he will give the keys to the other radiographer to aid in efficiency on the job site. The radiographer also uses "The Club" on the steering wheel when they are not in the immediate vicinity of the truck.

Monitoring, Detection, Assessment: On each of its radiography trucks, the licensee has installed an alarm system. The alarm system is attached to all of the truck cab doors and the darkroom door. If the alarm system detects motion or a door is opened, it will send a signal via satellite to a pager which is worn by the senior radiographer.

LLEA: The Operating & Emergency procedures state that if assistance is needed from LLEA while at a TJS, the radiographers should call 911.

Scenario 2 Assignment/ Discussion:

You are the inspector, and you are reviewing IC 2 (group B) and IC 4 (group A).

- What questions do you ask the licensee personnel?

- What are the potential findings? Why?

- What potential shortfalls might you expect to encounter if you were reviewing IC 1 for this scenario?

- Anything else?

You can use the guidance in the Inspection Procedure, Appendix A.

SCENARIO 3

Inspection Task: Use the Inspection Procedure and review this facility's compliance with IC 1 (group A) and IC 2 (group B).

Licensee: Large medical facility located on the northern edge of Gotham City (the largest major metropolitan city in the State of Compliance).

Staffing: Radiation Safety Staff: RSO + 4 Rad Safety Techs
Eye Applicator Nurses: 7
Blood Bank Staff trained to use the self-shielded Blood Irradiator: 22

Materials: Nuclear medicine department, I-125 seed implant program, a 40 mCi Sr-90 eye applicator, and a 3600 Ci Cs-137 self-shielded blood irradiator.

Storage: The Blood Irradiator is located inside of the "Isotope Room." Access to the Isotope Room is through an office. Inside of the Isotope Room the licensee is storing the Sr-90 eye applicator, and the Blood Irradiator.

Access Control: The door to the office is accessed by physical keys that are issued to the Radiation Safety staff. Sometimes the office door is left open during the day. The door to the Isotope Room is controlled by a physical key. The Radiation Safety staff as well as the eye applicator nurses and blood bank staff all have access to the key to the Isotope Room.

T & Reliability: Since January 2011, the hospital has done background checks on new employees. These checks are done by the HR department.

Monitoring, Detection, Assessment: During the day there are personnel in the vicinity of the Isotope Room who can detect unauthorized access. During the night, there are occasional patrols by the medical facility security. The licensee has decided that any unauthorized access to the material would be easily detected since the Blood Irradiator is far too large (5000 lbs.) to be easily removed. Also, the source rods are welded inside of the unit with no access from the exterior, thus increasing the task time and making detection more probable.

LLEA: The licensee met with the Gotham City Fire Department to inform them to let the Isotope Room just burn in case there was a fire. The licensee met with medical facility security staff (unarmed contract guards) and asked them to put the office/Isotope Room on their nightly and weekend patrols.

Your inspection observations: You observed a member of the blood bank staff using the Blood Irradiator. Because the individual was alone in the room, you asked how the individual gained access to the room. The individual replied that the office door was open and that she had the key for the isotope room door. The individual noted that there was one key issued to the Blood Bank and that the key was stored in a desk drawer.

Blood bank personnel use the Blood Irradiator several times a day, including during the

night shift. The irradiator itself is kept in the "on" position at all times (irradiator key placed in "on" position with key removed).

You also interviewed the eye applicator nurses regarding their access to the Isotope Room. Likewise, they reported that often, during the day, the office door is open and that they share one key for the Isotope Room. They noted that they keep the key for the Isotope Room in a locked cabinet with controlled substances. Only senior nurses have access to the locked cabinet. They do not use the Blood Irradiator but are aware that if there was a problem, such as a constant red light indicator, they should call the RSO.

Scenario 3 Assignment/ Discussion:

You are the inspector, and you are reviewing IC 1 (group A) and IC 2 (group B).

- What questions do you ask the licensee?
- What personnel would you talk to?
- What are the potential findings? Why?
- Anything else?

You can use the guidance in the Inspection Procedure, Appendix A.

SCENARIO 4

Inspection Task: Use the Inspection Procedure and review this facility's compliance with IC 1.

Licensee: Small radiography licensee located in New Gotham City. Does radiography at temporary job sites, mainly in the local Scamoco petroleum refinery.

Staffing: Owner/Manager/RSO/Radiographer: 1
Senior Radiographers: 3
Assistant Radiographer: 1

Materials: Two Ir-192 portable radiography cameras, ranging in activity from 25-75 Ci.

Storage: The licensee's policy is that all radiography cameras return to the main storage facility at the end of the day. The cameras are then stored in a locked storage locker inside of a locked storage shed.

Monitoring, Detection, Assessment: The licensee's storage shed is alarmed with a motion detector and a balanced magnetic switch on the shed door. The alarm system is monitored by New Gotham Alarm Company.

Access Control: All licensee employees have a set of keys for the storage shed and camera storage locker. Additionally, all employees know the access code for the storage shed's monitored alarm system.

T & Reliability: The Owner states that all employees have been granted unescorted access to the licensed material. One of the senior radiographers has been employed by the licensee for 5 years. Two of the senior radiographers have been employed for less than 3 years.

The Owner did an on-line check of these individuals' T&R. It consisted of a credit check and a criminal background check.

One of the senior radiographers was hired 4 days ago. He used to work for the radiography company's competitor. The Owner stated that the former employer had performed the T&R checks on the individual.

The assistant radiographer was hired a year ago. He is the brother of the Owner and used to work for a trucking company. The Owner didn't do a T&R check because it was his brother.

Scenario 4 Assignment/ Discussion:

You are the inspector, and you are reviewing IC 1.

- What questions do you ask the licensee?

- What documents do you want to review?

- What are the potential findings? Why?

- Anything else?

You can use the guidance in the Inspection Procedure, Appendix A.

GLOBAL THREAT REDUCTION INITIATIVE

Working to reduce and protect vulnerable nuclear and radiological material located at civilian sites worldwide.

Subgroup Exercise 7

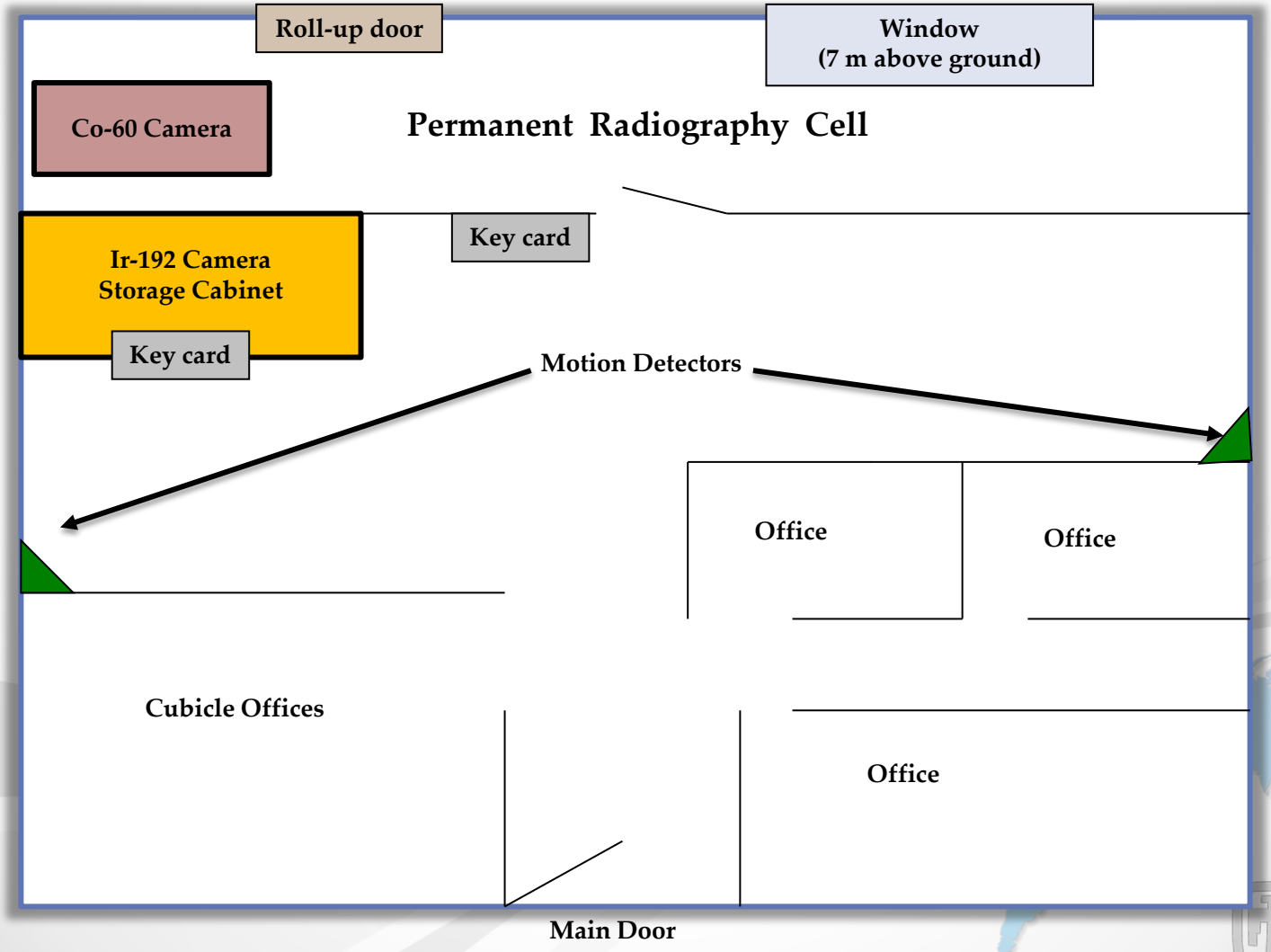
Part 1: Scenarios 1-4

U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

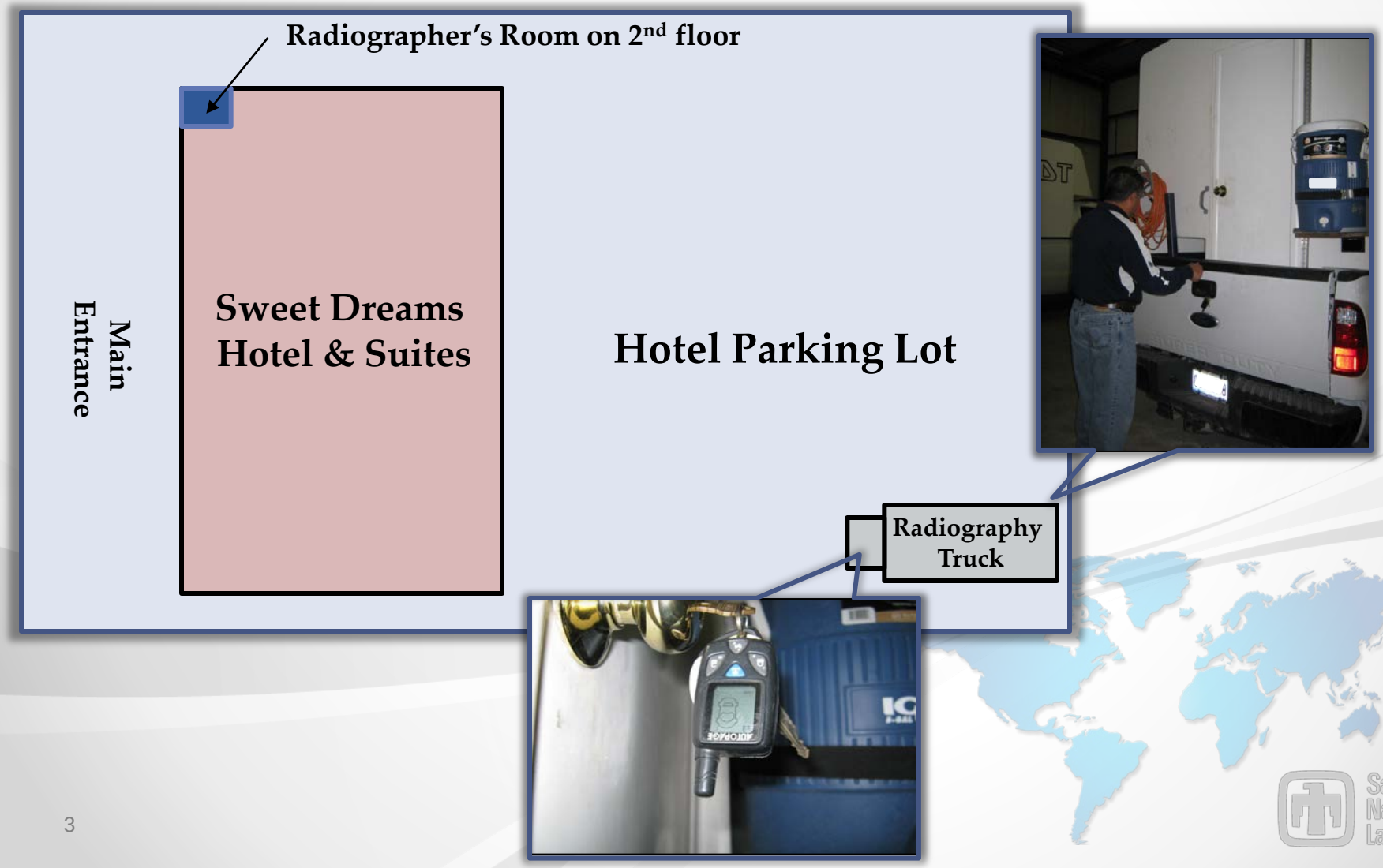
Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia National Laboratories

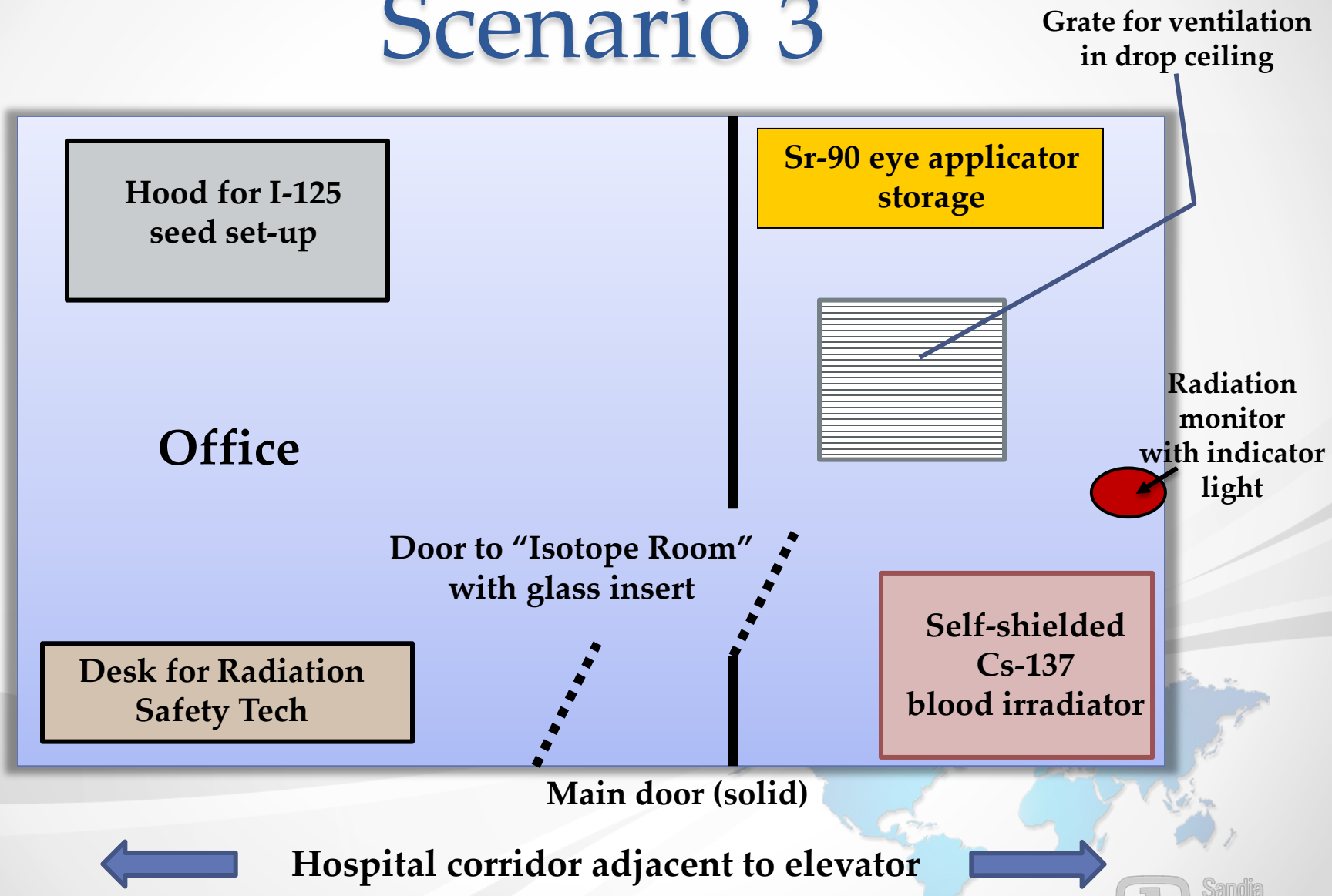
Scenario 1



Scenario 2



Scenario 3



Scenario 4

GLOBAL THREAT
REDUCTION INITIATIVE

Hypothetical Facility:
University Medical Center

Sandia National Laboratories

National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. . SAND#

Table of Contents

1.0 Facility Overview

The hypothetical facility, University Medical Center (UMC), is located downtown next to a large state university, and employs roughly 500 people. The city has a population size of 500,000, and the university has more than 20,000 students enrolled. There are many homes and apartment buildings located within 100 yards of the south-east side of the site. Other commercial businesses occupy two of the other three sides, as shown in **Figure 1**.

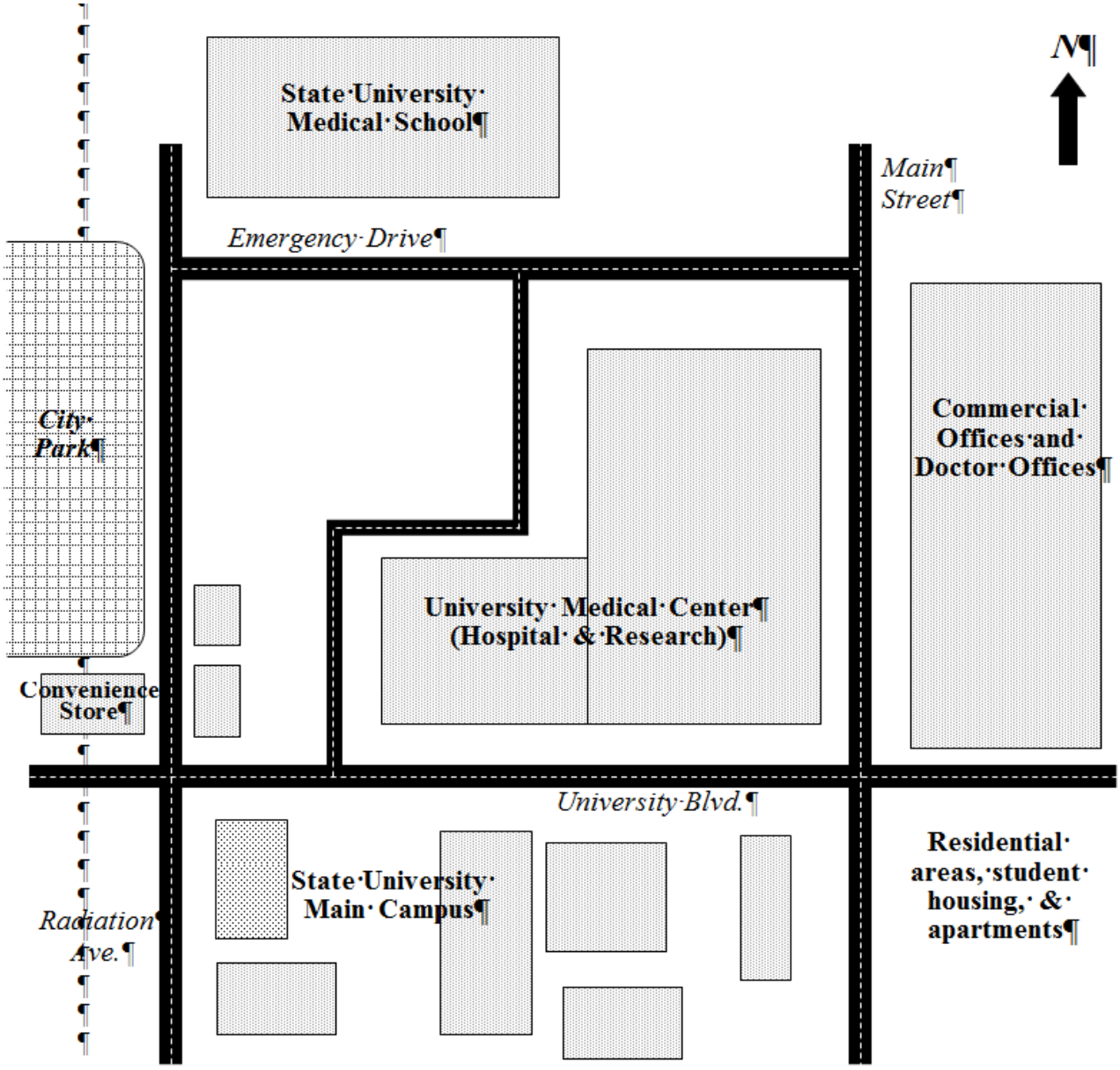


Figure 1: Map of the area surrounding UMC (hypothetical facility - not to scale)

The UMC is located on a 600' by 400' lot on the corner of Main Street and University Blvd as shown in **Figure 2**. The Hospital grounds are an open area with nearly direct vehicle access to the building on all sides. There is a landscaped sidewalk area (trees and an occasional boulder) along both University Blvd and Main Street, and city buses have stops there as well. UMC is a multi-story hospital, but the research wing has only one floor and a basement. Nearly all research activity in the research wing is conducted in the basement.

1.1 General Building Construction

The basic floor plan and layout is shown in **Figure 3**. All exterior walls at UMC are constructed using a brick masonry façade over sheet rock and insulation, on a steel superstructure. The roof over the research wing also uses a steel superstructure and insulation, and is covered in 20-gauge sheet metal. Additionally, there is a 1.3 meter service gap between the false ceiling and the roof for HVAC and other systems. All interior walls within UMC are constructed of sheetrock and insulation on metal studs. Stairways and elevator shafts are constructed of reinforced concrete. Other than regular vehicle parking laws and regulations, there are no vehicle barriers on site.

1.2 Doors & Entrances

The normal entrances (the Emergency Room, main hospital, and research wing entrances) into the hospital are all 2 cm thick automatic glass doors with large glass windows on either side of the doors. This design allows natural light to enter the 1st floor lobby areas. All other exterior doors are hollow core metal with a single 15 cm X 30 cm glass and wire mesh window. The shipping and receiving dock has two large metal roll-up doors, which are closed and locked when not in use. Interior doors are made of wood and do not have windows. All emergency exits are kept locked from the outside, but they can be opened from the inside.

There is a set of double doors (wooden, with 15 cm X 30 cm glass windows) in the corridor between the research wing and the Neurological Surgery Center. These are meant to deter unauthorized persons from entering the area after hours, but they are not locked since hospital staff frequently need to visit the blood bank (which operates 24/7) day and night. There is a similar set of doors in the basement corridor, connecting the research basement with the hospital basement, but these doors are always locked. There is an exterior stairway on the west side of the research wing leading to a maintenance / HVAC systems room in the basement. This door is hollow core metal (no window) and is always locked. Facilities and maintenance personnel have the key. There is also a large 60 X 60 cm duct that vents from the cooler equipment room in the basement to the exterior of the research wing just above ground level.

Figure 2: UMC -- University Medical Center (not to scale)

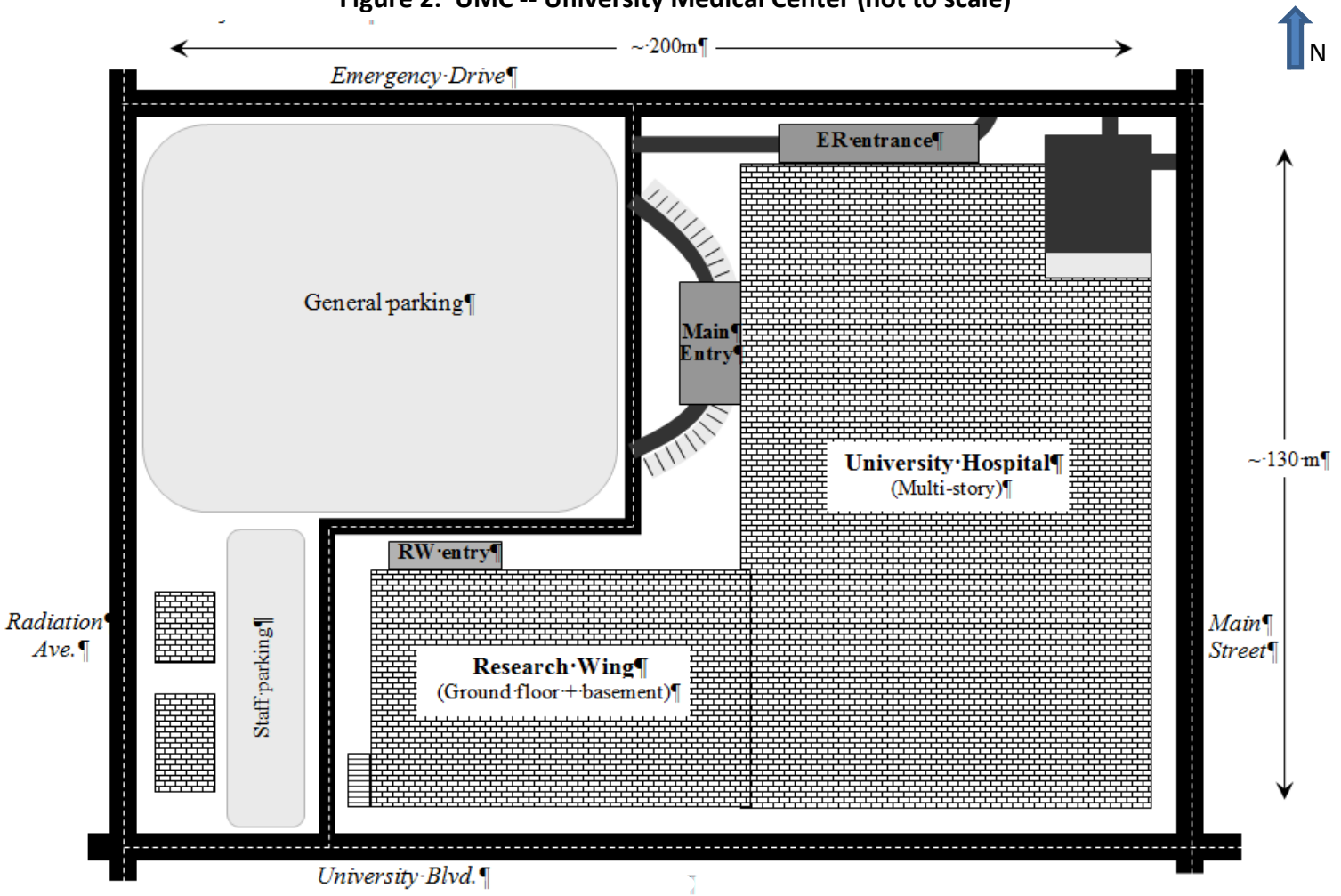
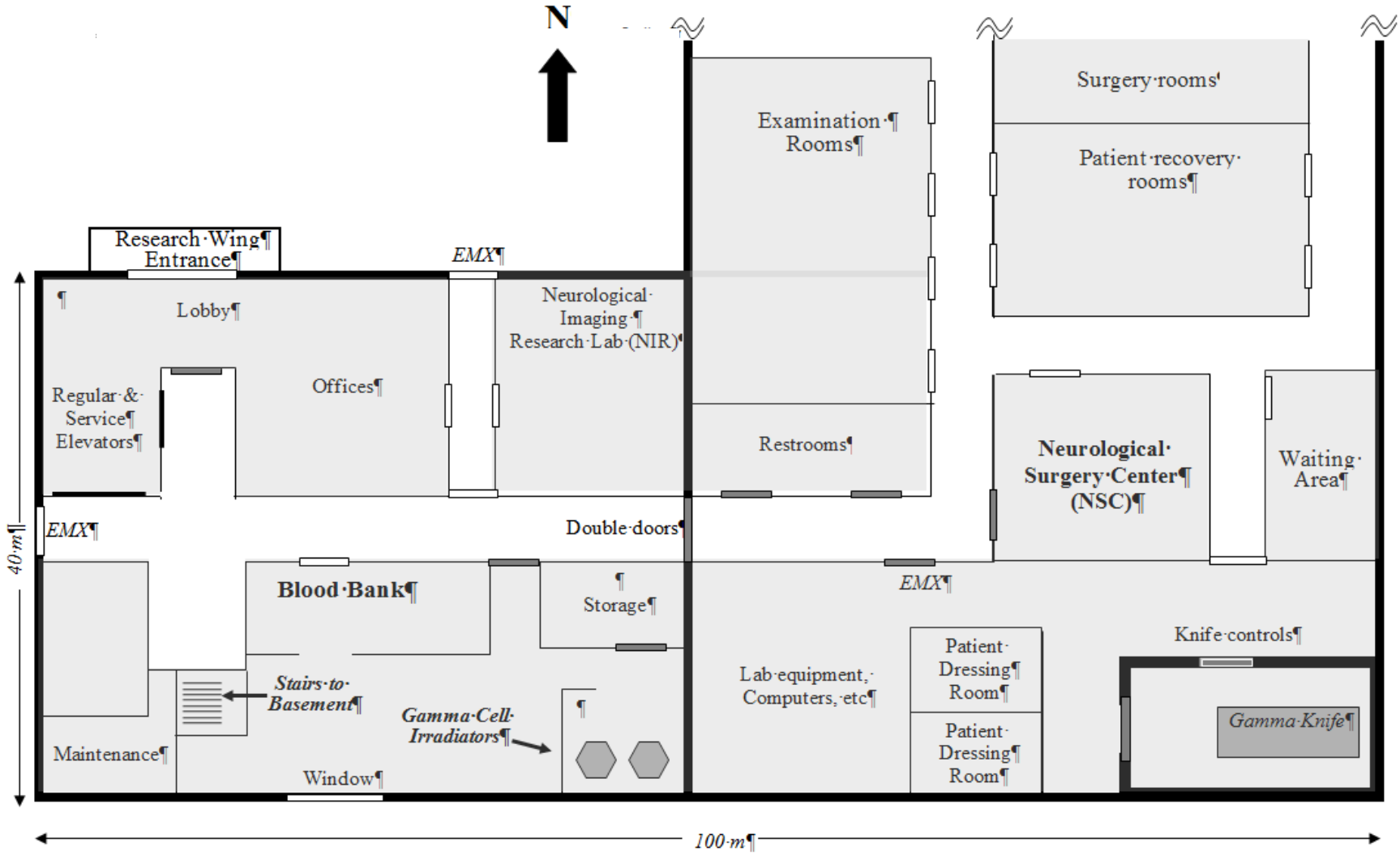


Figure 3: Partial First Floor of UMC Hospital & Research Wing (not to scale)



2.0 Gamma Knife

Since 1998, the UMC has operated a gamma knife facility to treat several types of neurological and structural disorders of the brain. The treatment is accomplished using a Leksell Gamma System Model 24001 Type C. The unit is located in the Neurological Surgery Center (NSC) in the southeast corner of the 1st floor of the hospital. It has 201 double encapsulated stationary Cobalt-60 (Co-60) pencils (approximately 33 Curies each with a total of 6145 curies measured on December 05, 2011) that are located in a hemispherical central shield body. The 201 Co-60 pencils must be replaced every 5 to 8 years. Access to the sources can only be accomplished by disassembly of the hemispherical shield body. The gamma knife surgery room itself has no windows and only one entrance (double wood door).

Two of the 0,5 m thick concrete radiation-shielding walls in the Gamma Knife facility form part of the outer building wall (the roof over the gamma knife is 20 cm concrete). The surgery room double wood door is kept open and unlocked except during operation of the unit. Safety interlocks on the doors are solely for radiation protection purposes and operate in conjunction with the gamma knife unit. If the door is inadvertently opened during operation of the unit, the unit's table and patient will be immediately withdrawn and the source shield doors will automatically close. In addition, an alarm will sound in the immediate area and an emergency light will flash to indicate a problem.

The unit is operated from a control computer located immediately outside the surgery room. There are two viewing cameras that monitor the patient and the unit during operation. A patient is never left unattended while the machine is in operation.

The Co-60 pencils are enclosed within a hemispherical shield body that weighs approximately 20 metric tons. The pencils can be removed if the shield body is disassembled. There is a shield door at the front of the machine that opens while the machine is in operation. The patient is slid in on the table automatically when the machine is put into operation, and the shield doors rise to allow patient exposure. The Co-60 pencils cannot be physically removed from the unit in this manner.

Resourcing of the cobalt pencils in the gamma knife is conducted entirely by the manufacturer. The process is done within the facility by two technicians using an automated reload machine. The reload procedure happens in situ and takes about 2.5 hours (including calibration and verifying the new activity levels after re-sourcing). The reload process requires disassembly of the hemispherical shield body into two halves and movement of the back half which weighs approximately 10 metric tons. An

automated robot is mated to the front half of the hemisphere and removes the old pencils and replenishes them with new pencils. The tools (which are not that specialized) required to disassemble the unit are not kept in the lab. No additional security measures are put in place during a resourcing.

2.1 Detection, Assessment, and Access Control Systems

The only sensors in the NSC are the BMS position sensors on the lobby entry and emergency exit doors. There are no interior cameras in this area. Otherwise, detection capability is limited to people/personnel generally in the vicinity that may have the opportunity, by chance, to detect an unknown person or intruder and alert the police. There is an alarm on the surgery room door, when it is in use, but this is a local alarm and only for safety purposes, as explained above in section 2.0. Hospital security patrols the corridor through the NSC area leading to the blood bank on a random basis and checks doors to assure they are locked after hours. All checks are done from the main corridor only, since hospital security does not enter or patrol inside the gamma knife (NSC) facility.

The gamma knife facility is occupied from 09:00 to 17:00, Monday through Friday. During these normal operational hours, the hospital corridor is active with many people in the area at all times, and the BMS door sensors are not activated. According to operating personnel, the traffic is significantly less during off hours since the gamma knife is located in the out-patient area of the hospital (which closes at 19:00) and next to the research wing (which closes at 18:00). Access to the facility is controlled by lock and key. Housekeeping, two nurse supervisors, and two physicians have keys to the NSC.

2.2 Delay Systems

There are two ways to enter the NSC / gamma knife facility. The main entrance off the out-patient area corridor is a set of large solid wood doors. The doors lead to a second large, solid wood door in the lobby with a glass viewing pane. Both sets of doors are normally locked when the facility is shut down for the night. From this entrance, there is a distance of about 25 meters to the surgery room where the unit/sources are located.

The second entrance to the gamma knife is directly from the hospital corridor through a wood emergency exit door, which is always locked from the outside (there's a crash bar on the inside). The door is supposed to be used only for emergency egress from the facility, but some employees exit through this door instead of the lobby door anyway. Sometimes employees will enter through this door if they happen to notice another employee opening it from the inside. The gamma knife is 15 meters from this entrance. The surgery room door (solid wood) is always unlocked except during operation of the unit. The door is interlocked for safety reasons during operation of the unit.

There are no specialized delay/barrier systems installed in or around the facility. The majority of delay will come from the time required for disassembly of the machine to reach the sources. The pencils can be removed if the shield body is disassembled. Since the unit is probably too heavy to be moved, the only theft potential is through disassembly of the unit and removal of the pencils. Disassembly of the unit consists of removal of several hexagonal bolts located around the shield body. It is estimated that the disassembly of the unit will provide some significant delay since this is the only way to get at the sources.

3.0 Blood Bank Irradiators

The university medical center operates a blood bank with two Gammacell 1000 Model B blood irradiators. Each weighs approximately 1200 kgs and contains a single source of about 900 curies of Cs-137. The source (cesium chloride powder pressed into pellets) is doubly encapsulated in stainless steel capsules with fusion welded end caps. Each source is sealed inside the machine and has never been replaced. Each unit is housed inside a fire-resistant cabinet which measures 70 cm wide by 65 cm length by 135 cm height.

The key required to operate the irradiator is located in the open cabinet directly underneath the machine. The sample chamber will not open without the key. The sample chamber rotates clockwise to allow access for loading of the samples. The Cs-137 source cannot be accessed through the sample chamber area.

The blood bank operates 24 hours per day, 365 days per year with the following staffing:

- Day Shift: 8 – 10 personnel
- Swing Shift: 6 personnel
- Grave Shift: 3 personnel

3.1 Detection, Assessment, and Access Control Systems

There are two entrances into the blood bank: a normal and controlled entrance. Since there is always someone present in the area, and the hospital staff needs to access the blood bank at all hours, the normal entrance is never locked, even on holidays (holidays are staffed at the swing shift level or below). The second controlled entrance leads directly into the irradiator area and is always locked. Access through this door is controlled by badge swipe which operates an electronic strike. Both doors have crash bars, and neither is alarmed.

There are no CCTV cameras or intrusion sensors in the blood bank facility. Workers are badged, know each other well (at least for each different shift), and are supposed to challenge anyone they do not recognize in the lab area without an escort and call security; only employees are allowed past the secretary's desk in the blood bank. The chances of detecting suspicious behavior or an intruder and alerting security are highest during the day and lowest during the grave-yard shift.

3.2 Delay Systems

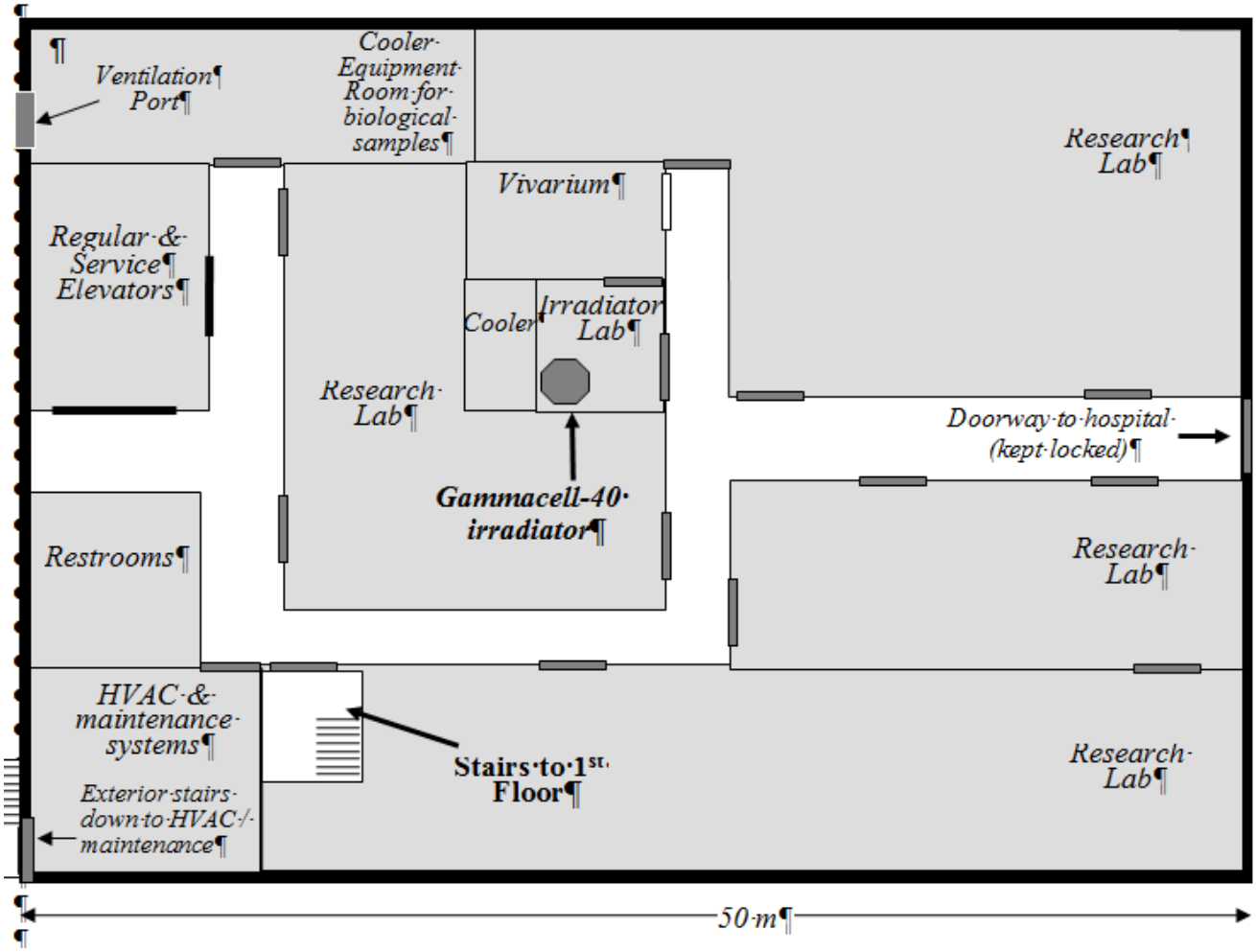
Other than the doors, there are no significant barriers in the blood bank area. The majority of the delay against theft will come from the irradiator itself. It is likely that this device would be too heavy to steal intact. An adversary would have to remove the sources from the device, which is possible. The task time for accomplishing this will depend on the tool set used to remove the sources from the machine. The closest door out of the facility is about 13 meters away from the irradiators.

4.0 Medical Research Irradiator

The UMC has one other irradiator, located in the basement of the research wing, to expose cells, tissues, animals, and other biological samples to a controlled dose of ionizing radiation. The irradiator is a Gammacell-40 model irradiator with a pneumatic drive system. The machine is very large and cannot be moved through the existing doorway. It weighs approximately 3000 kgs. The unit contains two Cs-137 sealed sources (3812 total Ci) located in the rear of the machine. On average, the irradiator room is used once a week for no more than 3 hours.

Figure 4 below shows the floor plan of the basement and the location of the irradiator. The irradiator is adjacent to a vivarium containing research animals (insects and small rodents), and a cooler containing biological samples and agents. Normal entrance to the basement is from the first floor, down the stairs or the elevator. The door at the bottom of the stairwell is locked by security at 19:00, and opened again at 06:00. All lab supervisors have keys to this door so they can access the labs and work at night if necessary.

Figure 4: Basement Floor Plan of Research Wing (not to scale)



The elevator is set to operate only during normal hours (06:00 to 19:00 daily). After normal hours, the stairs are the only access to the basement. The service elevator operates 24/7, but not without the elevator key. It is seldom used, and generally only by housekeeping or maintenance staff.

The irradiator room is always locked when not in use and the key is controlled through a manual sign-out system. The key is located on a clipboard hanging on the inside of the NIR lab on the first floor. The sign-out sheet contains the name of the individual, why the equipment is needed and time of scheduled use for the irradiator. All users of the irradiator must be trained on its use and be on the approved users list before they can check out the key and operate the irradiator (unescorted).

4.1 Detection, Assessment, and Access Control Systems

There are no specialized detection systems installed in the basement. Detection capability is limited to lab personnel who are generally in the vicinity. They might , by chance, detect suspicious activity or an intruder and then alert police. There are no CCTV cameras which can be used for surveillance or assessment. There is a Balanced Magnetic Switch position sensor on the exterior door of the Heating Ventilation and Air Conditioning (HVAC) / maintenance room, and it is always active.

4.2 Delay Systems

There are no specialized delay/barrier systems installed in or around the irradiator. The majority of delay will come from the time needed for disassembly of portions of the research irradiator to reach the sources. This is possible with the right tools and enough time.

5.0 General Hospital Security Information

5.1 Security (Response) Personnel

Response force operations are conducted and managed by the University Police Department. All university police officers are fully trained and certified police officers. There are 4 unarmed, hospital-employed security officers and 2 armed university security officers on duty at all times, per shift. On holidays, these numbers are cut in half. Of the two university security officers assigned, one is a roving patrol and the other is stationed in the emergency room area at all times. Of the four hospital security personnel, two are stationed at the front desk and generally do not leave this post to respond to calls or alarms. The other two rotate throughout the building, respond to calls and assess alarms. All six security personnel carry 2-way radios.

Hospital security is dispatched through the hospital page operator. If additional armed support is needed, one of the university officers is radioed for assistance. If further assistance is needed, the page operator (or security personnel) will engage additional university officers through the 911 center. The hospital security is also responsible for locking the entry doors of the research wing (secured 18:00 nightly) and then unlocking them in the morning (06:00 daily). The main and ER entrances to the hospital are open 24/7, but after 19:00, visitors (unbadged persons) must sign in at the front information/security desk where they are issued a visitor pass.

Since security and police officers are located directly in the facility, the time it takes to respond to a page / call should be relatively quick depending on the location and the situation. Due to the size of

the hospital facility and the fact that the officers are on foot patrol, the average expected response time is 5 - 8 minutes.

5.2 Assessment and Surveillance

The hospital has two fixed cameras and one pan-tilt-zoom camera that monitor entrances, including the shipping/receiving dock area on the north east side of the hospital, and the emergency and maintenance doors on the west side of the research wing. They are linked to the alarm system for alarm assessment purposes, but only for alarms that are activated (most alarms are not active during the day). For this reason, the cameras are used primarily for assessment during the night, and for deterrence and after-the-fact assessment of reported incidents occurring during the day. Images are recorded (5 frames per second) and monitored at the university alarm monitoring station (a division of the University Police) and stored for 3 weeks before being written over with new images.

5.3 Badging

Hospital employees and university research personnel have an identification badge that is to be worn at all times while they are at the hospital or in the research area. This identifies workers that are authorized for various areas, although no formal ID checks are done.

5.4 Security Policies and Procedures

The hospital and research area both keep a dusty copy of the security policies and procedures. The policies and procedures are reviewed and updated (if necessary) on an annual basis, about 4 weeks before state auditors arrive. Interviews of management, staff, contractors, visitors, etc. have not been conducted to determine to what degree the policies and procedures are understood and implemented, and whether there are any consequences enforced if the policies/procedures are violated.

5.5 Employee Training

New employees receive training on safety and security (with emphasis on safety) on the first day of employment (generally conducted one-on-one with the supervisor or manager in that area). All other employees receive a safety/security refresher memo once a year, which includes reminders on topics of interest. There is no formal mechanism in place to determine the effectiveness of the training.

5.6 Historical Threats

There is a significant amount of criminal activity in the general area at night due to its location in the city and proximity to various entertainment venues, night clubs, and fraternity housing. It is well known in the community that the gamma knife exists and what radionuclide it uses, but there has been little interest or inquiry to date other than from university students. On average there are 5 cars per

year stolen or vandalized in the hospital parking lot. On one occasion, a drunk driver veered off of University and stopped just short of crashing through the wall and into an irradiator in the blood bank.

There was an organized protest two years ago, in which some student "activists", alleged members of the group *People for Ethical Treatment of Animals* (PETA), and others protested the presence and use of the research irradiator and vivarium in the basement. Both were uneventful, but gained a lot of media attention. The hospital and university have doubled the number of security officers on duty during the protest.