Subgroup 3S
Introduction to Hypothetical Facility

Session Objectives

After the session, the participants will be able to:

1. Extract necessary information from the Exercise Data Book.

2. Characterize and design a physical protection system (PPS) for the hypothetical facility for this course by using the (PTR) Research Reactor.

Prior to beginning this exercise read pages 1 -14 in the Exercise Data Book.

Exercise 1 – Familiarization with General Information

Use the *EXERCISE DATA BOOK* to answer these questions.

1. How important is the Lagassi Nuclear Research Institute (LNRI) to the national interest?

2. What is the relationship of the Lagassi Nuclear Research Institute to neighboring foreign countries and the city of Hashbakar?

3. List some of the major features of the Lagassi Nuclear Research Institute.

4. Make a subjective assessment of the threat based on supplied threat data.

5. List the various security forces that have jurisdiction at the Lagassi Nuclear Research Institute and describe how each of these forces is deployed to protect the facility during both operational hours and non-operational hours. : How many are there for each shift? Where are they located? How well are they trained? How well are they equipped?

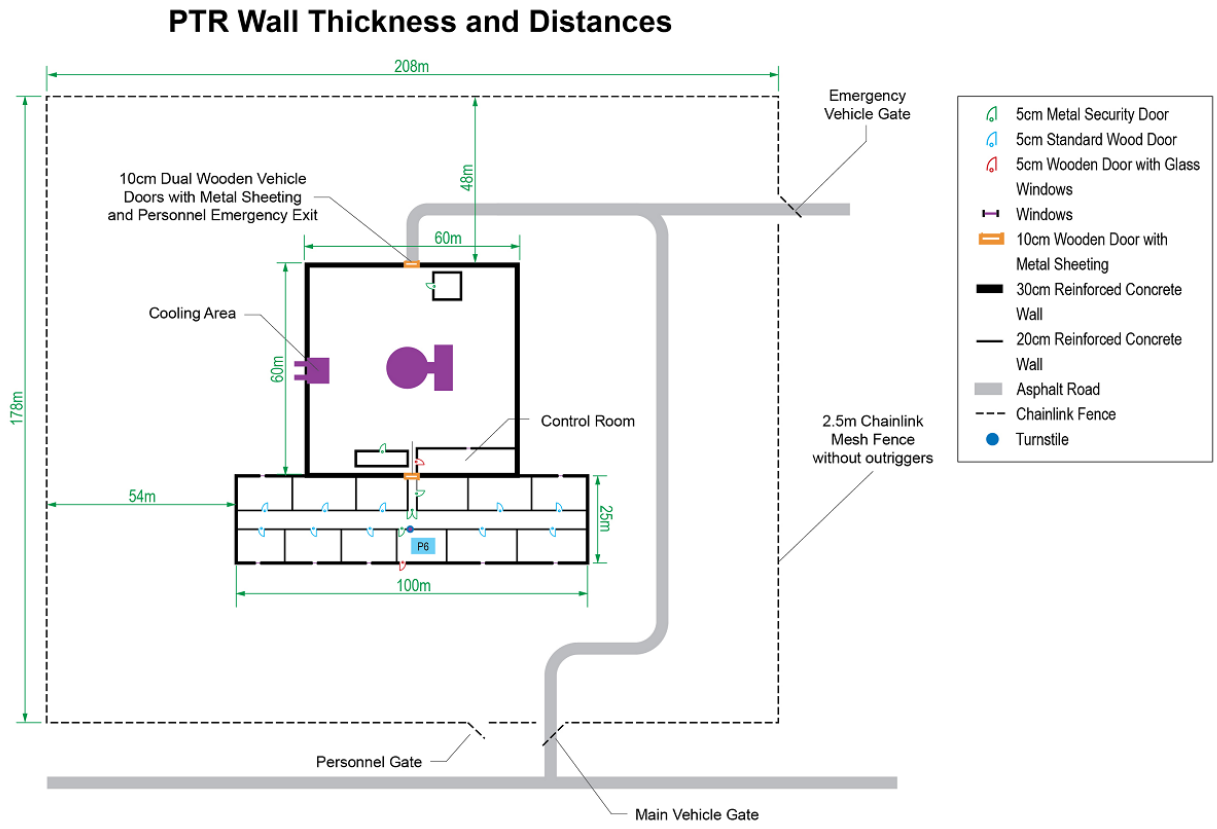
Exercise 2 – Familiarization with the PTR Research Reactor

Use the *EXERCISE DATA BOOK* to answer these questions.

1. Determine and list the number of access control points along an employee's normal path from the parking lot of the Lagassi Nuclear Research Institute (LNRI) to the control room of the (PTR) Research Reactor.

2. Determine the number of opportunities to detect an adversary along a path from off site of the Lagassi Nuclear Research Institute to the control room of the PTR Research Reactor.

3. Identify at least six physical protection elements shown in the schematic of the protected area and PTR building below. Indicate whether these protection elements are exterior or interior.



Exercise 3 – Data Research

Use the *EXERCISE DATA BOOK* to answer the following questions.

1. What is the size of the “military tactical response team” and what distance are the teams from the Lagassi Nuclear Research Institute (LNRI)?

2. How portable is each of the fresh fuel elements for the reactor?

3. How many entrances are there into the “_____ (PTR) Protected Area?”

4. What is the main function of the guard at location P6?

5. Describe the immediate indication the guard receives when an alarm occurs at the PTR.

Application Considerations

1. What effect would high explosives have on reactor fuel assemblies?

2. What effect will the general economic and cultural conditions in Lagassi have on the Physical Protection System (PPS) at the Lagassi Nuclear Reactor Institute (LNRI)?

3. Supplier countries are recalling research reactor fuel that is more than 20 percent enriched. . Why would they do this? Would the LNRI's reactor need to change its fuel? If it did change fuel, would it affect the PPS?

4. At the LNRI, there are two security control stations. A central alarm station at P-1 and a secondary alarm station at P-6. What do you think is the purpose of having two alarm stations?

Subgroup 9S
Alarm Assessment

Session Objectives

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

1. Determine the optimum placement of cameras within a detection zone.
2. Identify necessary hardware for a complete video assessment system.
3. Identify the disadvantages of a lighting system.

Exercise 1 - Object Distance

1) Using the formula below, complete the following table by calculating the distance from the camera to the fields of a given width for a 1/2-inch (8mm) format camera with 800 pixel resolution.

D= W (f/w)	**Where:** **D** is distance from camera (m) **W** is width of field of view (m) at distance D **f** is focal length of lens (mm) **w** is width of imagers sensitive area (mm)

Width of Imagers Sensitive Areas

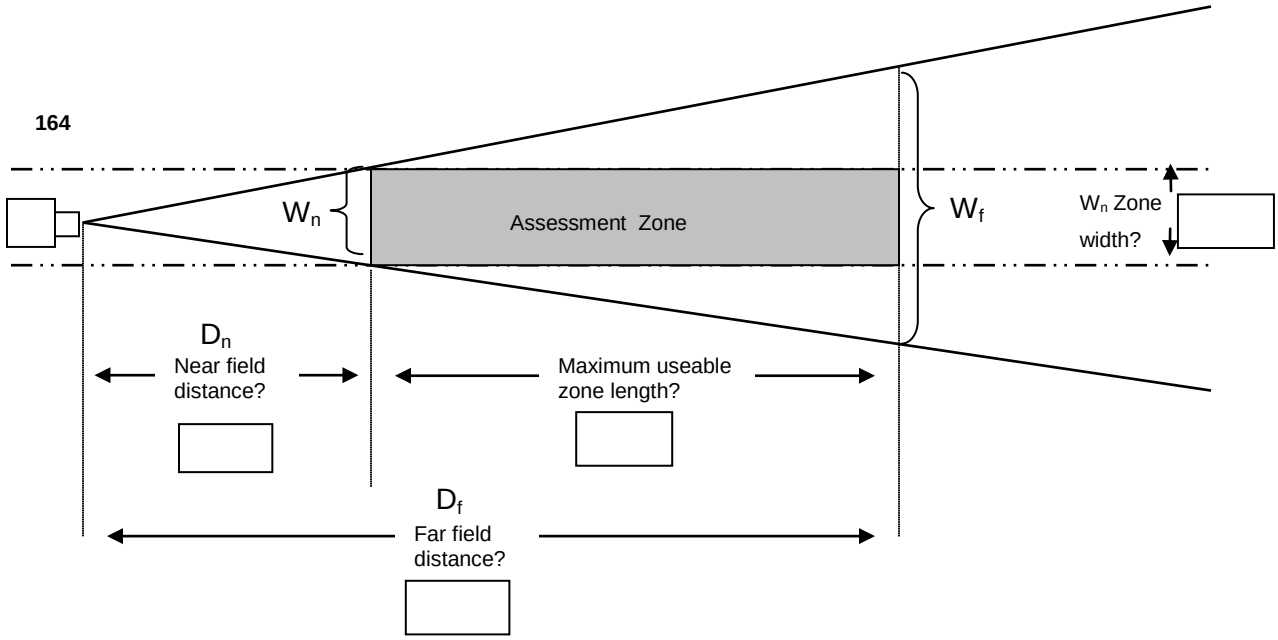
w = 6.4 for 8mm (1/2") format

Assume the isolation zone is 12 meters wide.
The end of the assessment zone is indicated when the field of view is 30m wide.
Why was this width chosen?

	Lens Focal Length **(f)**			
Field of view	4mm	12mm	25mm	35mm
Near field distance $\mathbf{D_n}$ (at beginning of assessment zone, $\mathbf{D_n}$, width of field of view, $\mathbf{W_n}$, is 12 meter)	$\mathbf{D_n}$ =	$\mathbf{D_n}$ =	$\mathbf{D_n}$ =	$\mathbf{D_n}$ =
Far field distance $\mathbf{D_f}$ (at end of assessment Zone, $\mathbf{D_f}$, width of field of view, $\mathbf{W_f}$, is 30 meter)	$\mathbf{D_f}$ =	$\mathbf{D_f}$ =	($\mathbf{D_f}$)=	$\mathbf{D_f}$ =
Maximum usable assessment zone length $\mathbf{D_{max} = D_f - D_n}$	$\mathbf{D_{max}}$ =	$\mathbf{D_{max}}$ =	$\mathbf{D_{max}}$ =	$\mathbf{D_{max}}$ =

2) Diagram the "field of view" for a 35mm lens showing the beginning of the assessment zone, the end of the assessment zone, and the maximum usable assessment zone length. Write the appropriate number in the boxes shown below for:

- zone width:
- near-field distance:
- maximum useable zone length:
- far-field distance:



Exercise 2 - Camera Placement

Using the calculations from Exercise 1:

- Sketch the field of view for one exterior camera using the 35mm calculation.
- Sketch the field of view for two interior cameras using the 4mm and 12mm calculations on the posters provided by your subgroup instructor.

Exercise 3 - Video Assessment Upgrade

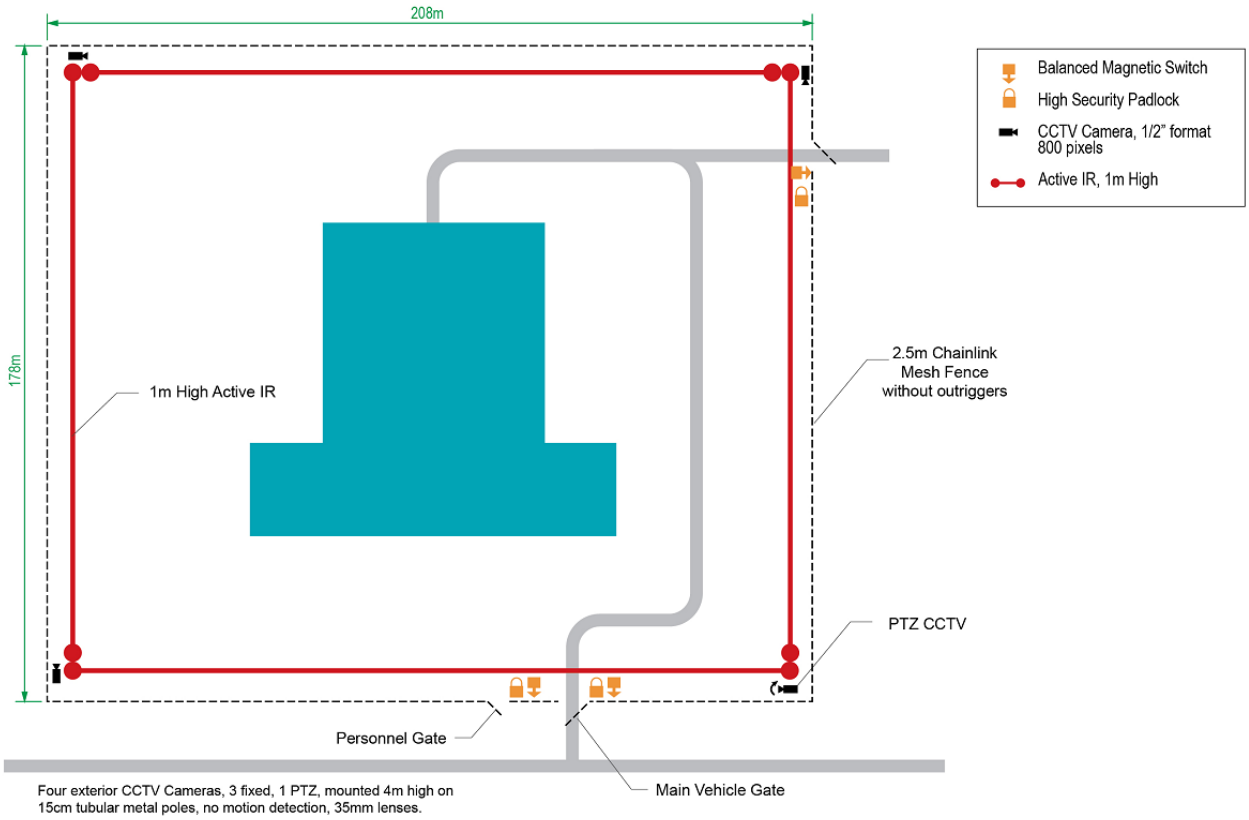
1) Identify the single largest deficiency in the exterior camera arrangement shown on the poster from Exercise 2.

2) Upgrade the assessment system by relocating the cameras or adding additional cameras on the poster.

3) Specify the type of camera (4mm, 6mm, or 8mm format) and lens (12mm, 25mm, or 35mm) used in each location.

4) Estimate the effort to upgrade and correct the identified problems.

PTR Exterior Physical Protection Elements



Exercise 4 - Lighting Equipment

The PTR research reactor floodlights are mounted on the reactor building to illuminate the isolation zone for assessment purposes. See Exercise Data Book page 25 and 26.

- Thirteen 1000-watt incandescent floodlights are mounted on the reactor building at 6 meters high.
- Beam half-angle is 26 degrees.
- The surface is low reflectivity dark gravel with some vegetation.
- Lights are activated by exterior IR sensors.

- _____ (LUX) at perimeter are shown in boxes. 10 LUX=1 footcandle.

Approximate center-line illumination is given in the table below:

Meters:	**25**	**50**	**75**	**100**
LUX:	**8**	**2**	**1**	**0.5**

List the disadvantages you see in this lighting arrangement.

Disadvantages

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

Subgroup 10S
Entry Control

Session Objectives

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

1. Select generic equipment for an effective entry control system to verify identity and search for contraband.
2. Analyze the strengths and weaknesses of a personnel entry portal.
3. Choose between key locks, combination locks and electronic entry control methods.

Exercise 1 - Selection of Badge, PIN, Biometric, and Contraband Detection Equipment/Method

Using the information from the lecture and slides, choose a combination of badge, PIN, biometric and contraband detection equipment or method suitable for the following situations.

Situation 1 – Entry into a very secure Category I vault

Equipment/Method selected_____

_____

_____

Reasoning _____

_____

_____

Situation 2 – At the main gate of a research reactor complex

Equipment/Method selected_____

_____

_____

Reasoning _____

_____

_____

Situation 3 – At the entrance of reactor building

Equipment/Method selected_____

_____

_____

Reasoning _____

_____

_____

Situation 4 – Entry into a warehouse which stores the spare PPS equipment

Equipment/Method selected_____

Reasoning _____

Situation 5 – Entry into the accounting paymaster's office

Equipment/Method selected_____

Reasoning _____

Situation 6 – Entry into the Reactor Control Room

Equipment/Method selected_____

Reasoning _____

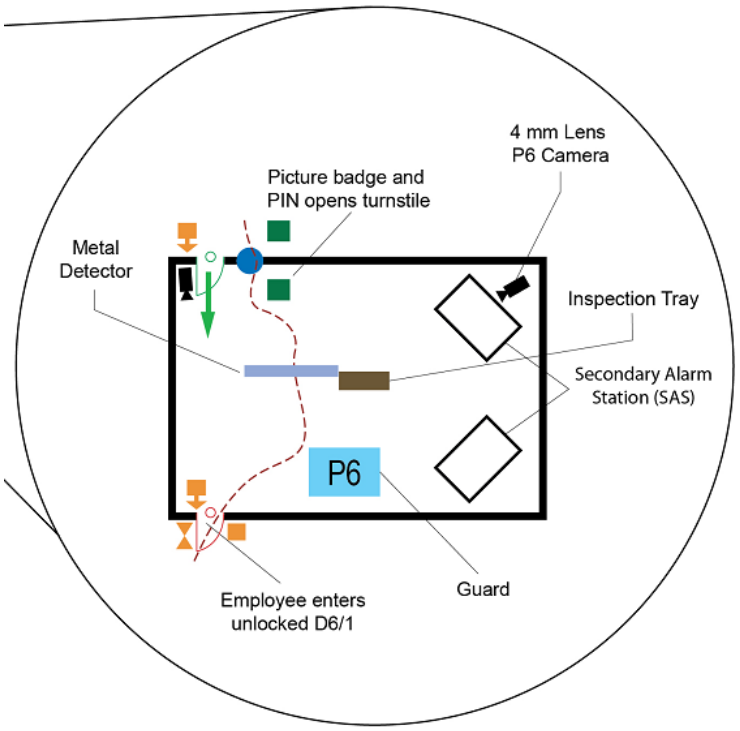
Exercise 2 - Personnel Portal

The diagram below shows the P6 personnel portal permitting access to the PTR protected area. Read the entry and exit procedures below. Make recommendations for improvement, based on the description of a good entry control system from the lecture.

PTR Personnel Portal (P6)
(1 unarmed guard during normal working hours)

Entry Procedure

1. The employees enter through the unlocked outer door one at a time.
2. Each person presents his picture badge to the guard.
3. If the picture on the badge and the person's face match, the person continues.
4. Under the observation of the guard, the person walks through the metal detector.
5. If there is an alarm or if a package is suspicious, the guard performs an inspection.
6. Once past the metal detector, the employee scans the badge and enters his personal identification number (PIN).
7. If the PIN is correct, the turnstile becomes operable and allows entry into the building.
8. The guard allows the next employee to repeat the process.



Exit Procedure

1. The employees form a line on the inside of the exit door.
2. The first person scans his badge and enters a PIN.
3. If the PIN is correct, the door opens, allowing him to enter the portal.
4. The person walks through the metal detector under the observation of the unarmed guard.
5. If there is an alarm or if a package is suspicious, the unarmed guard performs an inspection.
6. The person exits the portal.

Improvements

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

Exercise 3 – Choosing between Key Locks, Combination Locks and Electronic Entry Control Methods

Using the information from the lecture and slides, choose a method suitable for the following situations:

Situation 1 – A small administrative building with a staff of 12 and no sensitive information

Method selected _____

_____

_____

Reasoning _____

_____

_____

Situation 2 – A large administrative building with 300 offices or laboratories and a staff of 450 where sensitive information is stored

Method Selected _____

_____

_____

Reasoning _____

_____

_____

Situation 3 – Entry into a laboratory that stores radioactive sources with a staff of 9

Method Selected _____

_____

_____

Reasoning _____

_____

_____

Situation 4 – Entry into a warehouse where laboratory equipment is stored, run by a staff of six.

Method Selected _____

_____

_____

Reasoning _____

_____

_____

Application Considerations

1. Discuss the following application considerations:

    a. Swinging metal doors may interfere with entry control devices (e.g., X-ray package search machine, and SNM or metal detectors).

    b. Security personnel should be able to observe entry control equipment (e.g., personnel or via CCTV).

2. Why should portal doors, walls, and the roof provide the same delay as the perimeter or building walls in which they are installed?

3. Discuss entry control problems created by a vehicle portal.

4. What problems would be created by a totally automated entry control system?

5. What problems do you expect to encounter with an explosives detector system?

1. Why might we need a metal detector at the exit of the facility?

2. Discuss the following application considerations:

    a. Controlled, free space should be provided for entering personnel.

    b. A “back out” route should be provided for unsuccessful users.

    c. Enrollment information should be kept under security control.

    d. Security personnel should be able to observe entry control equipment (e.g., personnel or via CCTV).

    e. Special requirements (e.g., fire lanes, break-out doors, etc.) should be considered when designing entry control system.

f. Alternate entry control procedures should be provided for people with special needs, such as the handicapped.

g. Measures should be taken to compensate for unreliability (e.g., power failures and equipment breakdowns), usually with parallel components.

3. In what situations would a protective force (guard) be used for entry control? What impact could this have on the physical protection system, the cost, etc.?

4. Why should portal doors be interlocked so that only one door can be unlocked and opened at one time?

5. What would be the combined Type II error if we consider that entry depends on something you have, something you know, and something about you?
   a. Something you have – picture badge
   b. Something you know – 4 digit PIN
   c. Something about you – Hand geometry set to a 10% Type II error

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Subgroup 16S
Adversary Sequence Diagram

Session Objectives

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

1. Construct a site-specific adversary sequence diagram (ASD).

Exercise 1 - Identify Adjacent Physical Areas

An ASD represents potential adversary pathways into and out of the facility.

Use the Exercise Data Book for the LNRI hypothetical facility to identify the physical areas an adversary would have to cross to acquire the (PTR) fresh fuel rods, beginning with OFFSITE and ending at the TARGET.

1.
2.
3.
4.
5.
6.
7.

Exercise 2 - Show Path Elements

The path elements connect each physical area and represent all of the characteristically different ways to travel between physical areas.

Use the information in the Exercise Data Book to show the path elements between each of the the physical areas (from Exercise 1). Identify the Physical Areas and Path Elements on the poster provided by your Subgroup Instructor.

The table below lists standard path element abbreviations.

Path Elements:		SHP	- Shipping/Receiving Portal
DUC	- Duct	SUR	- Surface
EMC	- Emergency Evacuation Corral	TUN	- Tunnel
EMX	- Emergency Exit	VHD	- Vehicle Doorway
EMP	- Emergency Portal	VEH	- Vehicle Portal
FEN	- Fence line	WND	- Window
GAT	- Gateway	**Target Locations:**	
HEL	- Helicopter Flight Path	BPL	- Bulk Process Line
ISO	- Isolation Zone	CGE	- Cage
PST	- Material Pass-through	FLV	- Floor Vault
MAT	- Material Portal	GNL	- Generic Location
OVP	- Overpass	GBX	- Glovebox
DOR	- Personnel Doorway	IPL	- Item Process Line
PER	- Personnel Portal	OPN	- Open Location
SHD	- Shipping/Receiving Doorway	TNK	- Storage Tank

(PTR) Fresh Fuel Rods (ASD)

1.

2.

3.

4.

5.

6.

7.

Boundary Barrier and Penetration Elements

SUR	Surface	Represents walls, floors, and roofs
WIN	Window	
DUC	Duct	Represents penetrations above grade
TUN	Tunnel	Represents penetrations below grade

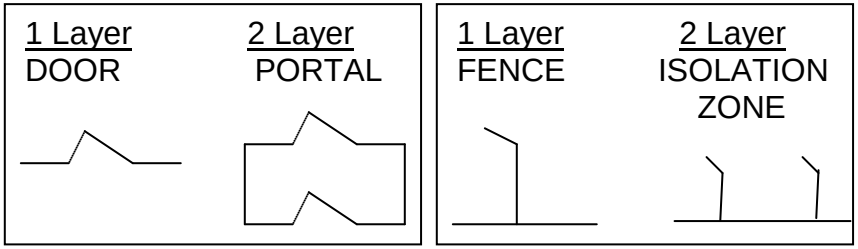
Miscellaneous Elements

HEL	Helicopter Flight Path	Represents transit delay onto site and delays unloading personnel

Single-Layer / Double-Layer Elements

This category includes element types that occur in pairs:

- One of the pair represents a single-layer barrier
- The other pair includes 2 copies of the same barrier (hence double-layer barriers)



Single Layer Elements		Double Layer Elements		Comments
FEN	Fence line	ISO	Isolation Zone	Surrounds exterior area, e.g., Protected Area
		OVP	Overpass	Like Isolation Zone but over Buildings
GAT	Gateway			For Human and Vehicle Movement
DOR	Personnel Doorway	PER	Personnel Portal	For Human Movement
MAP	Material Pass-through	MAT	Material Portal	For Material Movement Only
VHD	Vehicle Doorway	VEH	Vehicle Portal	For Vehicle Movement
SHD	Shipping/Receiving Doorway	SHP	Shipping/ Receiving Portal	For Vehicle Movement-restricted to building boundaries – example: S/R docks
EMX	Emergency Exit	EMP	Emergency Portal	
		EMC	Emergency Evacuation Corral	

Exercise 3 – Document Probability of Detection (P_D) and Delay

Using the Exercise Data Book, determine the P_D and the delay times for all Physical Areas and Path Elements. Show the P_D and delay times on your poster. Use the charts below, as necessary, to document your information and how your information was determined.

Physical Areas

Physical Areas	P_D	Time Delay (seconds)	Standard Deviation (± seconds)	Description
1. Traverse Limited Access Area				
2. Traverse Protected Area to PTR Building				
3. Traverse PTR building to Reactor Hall *				
4. Traverse Reactor Hall to R90				
5. Traverse R90 to Target				
6. Exit to Offsite	N/A			

*Note: Through office area, since traversing directly into the Reactor Hall will be a “jump”

Path Elements

Path Elements	P_D	Time Delay (seconds)	Standard Deviation (± seconds)	Description
1. LNRI Limited Access Area Outer Wall				
2. P2 – Limited Area Pedestrian Entrance				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				

13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				

Application Considerations

1. Can an ASD be constructed for any facility?
   a) always
   b) sometimes
   c) maybe
   d) seldom

2. An ASD represents:
   a) every possible path in and out of a facility
   b) every credible path in and out of a facility
   c) most of the credible paths in and out of a facility
   d) none of the credible paths in and out of a facility

3. ASDs can be used to determine:
   a) minimum detection pathways
   b) detection balance between areas
   c) detection protection in depth
   d) all of the above
   e) none of the above

4. ASDs can be used to determine:
   a) shortest delay pathways
   b) delay balance between areas
   c) delay protection in depth
   d) all of the above
   e) none of the above

5. An ASD is:
   a) an analysis tool
   b) a design tool
   c) a single solution for PPS defects
   d) both a and b
   e) none of the above

6. An ASD
   a) must always be developed on a computer
   b) must sometimes be developed on a computer
   c) can never be developed on a computer
   d) can always be developed by hand (on paper)
   e) can never be developed by hand (on paper)

7. An ASD is:
   a) only as good as the analyst who created it
   b) only as good as the computer it runs on
   c) independent of the analyst
   d) independent of the computer

8. An ASD
   a) always predicts the most vulnerable path
   b) might predict the most vulnerable path
   c) never predicts the most vulnerable path
   d) might predict a non-credible most vulnerable path

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Subgroup 17S
Path Analysis

Session Objectives

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

1. Use a computerized EXCEL™ version of EASI.
2. Apply EASI to evaluate the physical protection system of the research reactor.
3. Interpret the results of EASI.

Exercise 1 - EASI Analysis of Fence Intrusion

Part 1: Using the information in the Exercise Data Book and information from Exercise 3 from your ASD Subgroup, determine the probability of detection, delay time and standard deviation to complete the table for the sabotage path below. When all delay times have been identified, complete the Adversary Task Time Countdown Column.

Probability of guard force communication = _____

Guard response time = _____

Standard deviation of guard response time = _____

Adversary Action (Tasks)	**Probability of Detection**	**Location**	**Time Delay (seconds)**	**Standard Deviation** (± seconds)	**Adversary Task Time Countdown**
1. Climbs the outer wall					
2. Runs to the PTR					
3. Climbs the fence					
4 Runs to the reactor building					
5. Penetrates the vehicle access doors					
6. Runs to R91					
7. Penetrates R91					
8. Locates the Plutonium and sets explosives.					**0**

Note: Be sure to use the same unit of time throughout the problem.

Exercise 1 - EASI Analysis of Fence Intrusion (continued)

Part 2: Use EASI to compute the probability of interruption (P_I) for this sabotage attempt under normal daytime operating conditions

Load and run the computerized EXCEL™ version of EASI.

An example path has been entered into the tool. Modify the entries and evaluate the sabotage path.

1) For this path:

A. Where is the CDP? _____

B. What is the Adversary Task Time after CDP? _____

C. What is the probability of interruption given by EASI? P_I = _____

2) If the guard response time drops to 90 seconds:

A. Where is the CDP? _____

B. What is the Adversary Task Time after CDP? _____

C. What is the probability of interruption given by EASI? P_I = _____

3) What is the probability of interruption if two minutes of access delay are added at the reactor core (with the 90 second guard response time)?

A. Where is the CDP? _____

B. What is the Adversary Task Time after CDP? _____

C. What is the probability of interruption given by EASI? P_I = _____

4) What is the probability of interruption if a fence vibration sensor is added to the inner fence (with both changes above)?

A. Where is the CDP? _____

B. What is the Adversary Task Time after CDP? _____

C. What is the probability of interruption given by EASI? P_I = _____

Exercise 2 - EASI Analysis of the Most Vulnerable Path

Using EASI, analyze the following path to determine the probability of interruption. Be careful when you consider the detection sequence in the personnel portals. For this exercise, assume the adversary has a stolen badge and PIN and will use force after detection. Analyze the following theft path.

To compute the probability of detection of a series of sensors, multiply the probabilities of nondetection; then subtract from 1.0 to get the combined probability of detection.

Probability of guard force communication = _____

Guard response time = _____

Standard deviation of guard response time = _____

Adversary Action (Tasks)	Probability of Detection	Time Delay (seconds)	Standard Deviation (± seconds)	Adversary Task Time Count Down
1. Enters the LNRI Limited Access Area through main personnel portal, P2, using stolen badge.				
2. Crosses the Limited Access Area and enters PTR				
3. Enters PTR Protected Area through P6				
4. Enters the reactor hall through door D60/1				
5. Penetrates door D90 into fresh fuel vault				
7. Acquires the fresh fuel				
8. Exits through shipping door D60/2				
9. Crosses protected area				
10.Climbs PTR fence				
11. Crosses LNRI Limited Access Area				
12. Climbs LNRI facility boundary wall				

Exercise 2 - EASI Analysis of Portal Entry (continued)

1. For this path:

   A. Where is the CDP? _____

   B. What is the Adversary Task Time after CDP? _____

   C. What is the probability of interruption given by EASI? P_I = _____

   D. What is the exit time? _____

2. If you upgrade the physical protection system by enclosing the fuel rods in a locked container within the vault, how does this change P_I?

   A. Where is the CDP? _____

   B. What is the Adversary Task Time after CDP? _____

   C. What is the probability of interruption given by EASI? P_I = _____

Application Considerations

1. Which adversary strategies can be analyzed using EASI?
   a) Theft only
   b) Sabotage only
   c) Both theft and sabotage
   d) Neither theft nor sabotage

2. How many paths can be analyzed at one time using the EASI model?
   a) Only a single path at a time
   b) Multiple paths at a time
   c) Both a and b

3. The main purpose in using EASI is to compute:
   a) Probability of interruption
   b) Probability of adversary success
   c) Probability of communication
   d) Probability of neutralization

4. The output of EASI is:
   a) Single path step probability
   b) Cumulative probabilities over the path
   c) Response force times
   d) Path access delays

5. The standard deviations used in an analysis tool should be obtained from:
   a) Experimental test data
   b) Practical experience
   c) Both a and b
   d) Neither a nor b

6. The output from EASI:
   a) Always includes the most vulnerable path
   b) Only includes the most vulnerable path
   c) May include the most vulnerable path
   d) Never includes the most vulnerable path

7. In the EASI model:
   a) Detection always follows delay
   b) Detection and delay are simultaneous
   c) Delay always follows detection
   d) Detection and delay are path dependent

8. What is the relationship between the probability of neutralization P_N and EASI?
   a) P_N is independent of EASI
   b) P_N X P_I = system effectiveness
   c) It is cumulative along the path
   d) Both a and b

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Subgroup 18S
Neutralization Analysis

Session Objectives

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

1. Identify the Response Force posture for the Institute
2. Define the Response Strategy and Rules of Engagement for the Response Forces
3. Determine the Order of Battle for each target set at the Institute
4. Analyze Response Force/Threat engagements to compute P_N at specific targets
5. Determine upgrades to increase Response Force effectiveness

Exercise 1 - Response Force Posture

The purpose of this subgroup exercise is to identify the Response Force Posture for the target set at the Institute. The participants will accomplish this by completing the table below, which will provide data needed to perform a neutralization analysis and evaluate the Response Force effectiveness. Completing the table will provide necessary data for a neutralization analysis. Use information from Subgroup 14S "*Response Force Subgroup*" and the *Exercise Data Book* to complete the table. Fill in the cells for the P10 patrol, LLEA City Police, and Offsite Military.

Adversary Strategy: Sabotage				**Response Force Strategy:**				
Response	**Numbers available (day/night)**	**Deploy numbers (day/night)**	**Weapons**	**Body Armor**	**Transport**	**Distance**	**Response time (vehicle)**	**Response time (foot)**
P1	2	0	Baton	N	---	---	---	---
CAS	1	0	Baton	N	---	---	---	---
P2	2	0	Baton	N	---	---	---	---
Institute entrance	1	0	Baton	N	---	---	---	---
P3	1	0	Baton	N	---	---	---	---
Vehicle gate	0	0	---	---	---	---	---	---
P4	0	0	---	---	---	---	---	---
Delivery gate	0	0	---	---	---	---	---	---
P5	0	0	---	---	---	---	---	---
PTR Entrance \ Vehicle Gate	0	0	---	---	---	---	---	---
P6	1	0	Baton	N	---	---	---	---
PTR R061	0	0	---	---	---	---	---	---
P8 PTR	0	0	---	---	---	---	---	---
Emergency Vehicle Gate	0	0	---	---	---	---	---	---
P9	1	0	Baton	N	---	---	---	---
Rad waste	1	0	Baton	N	---	---	---	---
P10	2	2	Baton	N	car	varies	146s	---
patrol	2	2	Baton	N	car	varies	146s	---
LLEA	4	4	HG/AR	N	car	varies	326s	---
City police	4	4	HG/AR	N	car	varies	326s	---
Offsite	10	10	AR	Y	truck	10 km	851s	---
Military	10	10	AR	Y	truck	10 km	851s	---

Exercise 2 - Rules of Engagement

The purpose of this subgroup exercise is to identify the Rules of Engagement that the Response Force will use against an adversary strategy of sabotage at the Institute. The participant will accomplish this by completing the table below, which will provide data needed to perform a neutralization analysis and evaluate the Response Force effectiveness. The participant will need to use information from the *Exercise Data Book* to complete the table.

TARGET: PTR REACTOR FACILITY				
Adversary Strategy: *SABOTAGE*		**Response Force Strategy:**		**Denial**
Response	**Strategy**	**Objective**	**Tactic**	**Escalation of Force Technique**
Target posts	Denial	Delay	No engagement	Physical presence
Other posts	Denial	Delay	No engagement	Physical presence
P10 Patrol	Denial	Backup	No engagement	Physical presence
LLEA	Denial	Delay	Engage on necessity	Deadly force
Offsite Military	Denial	neutralize	Engage on necessity	Deadly force

Strategies:
- Deterrence
- Denial
- Containment
- Pursuit
- Recapture/Recovery

Objectives:
- Neutralize
- Interrupt
- Delay
- Observe
- Arrest
- Backup

Tactics:
- Engage at will
- Engage on command
- Engage on necessity
- Coordinated engagement
- No engagement

Techniques:
- Deadly force
- Physical force
- Physical restraint
- Verbal coercion
- Physical presence
- Other

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Exercise 3 -- Order of Battle

The purpose of this subgroup exercise is to determine the Response Force Order of Battle against an adversary strategy of sabotage at the Institute. The participant will accomplish this by completing the table below, which is necessary to perform a neutralization analysis and evaluate the Response Force effectiveness. The participant will need to use information from the *Exercise Data Book* to complete the table. Consider the P10 Patrol, LLEA Patrol, and Offsite Military Tactical Teams in the temporal order in which they might engage the adversary under the Rules of Engagement developed in Exercises 1 and 2. Fill in the Response Force Strategy for the 3rd response.

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Target: PTR Reactor Facility				
Adversary Strategy: Sabotage **Response Force (3rd) Strategy: ____Containment_____**				
Response	**Location**	**Numbers (day/night)**	**Weapons**	**Times**
1st (P10)	**On Site**	2	Baton	146s
		2	Baton	146s
2nd (LLEA)	**Off Site**	4	HG + 1 AR per Car	326s
		4	HG + 1 AR per Car	326s
3rd (Offsite Military)	**Off Site**	10	AR	851s
		10	AR	851s

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Exercise 4 -- Neutralization Analysis

The purpose of this subgroup exercise is to **compute the probability of neutralization for the Response Force for a sabotage target at the Institute.** The participants will accomplish this by inserting the data requested below into the *Markov Chain Neutralization Estimation* computer program. The adversary numbers and weapons should be taken from the 5S Threat Definition exercise 2. The adversary task time is the value computed in Exercise 1 of *17S Path Analysis Subgroup*. Other necessary information is from the Order of Battle data from the previous exercise. Use the drop-down boxes and the spin buttons to select the correct input values on the computer menu.

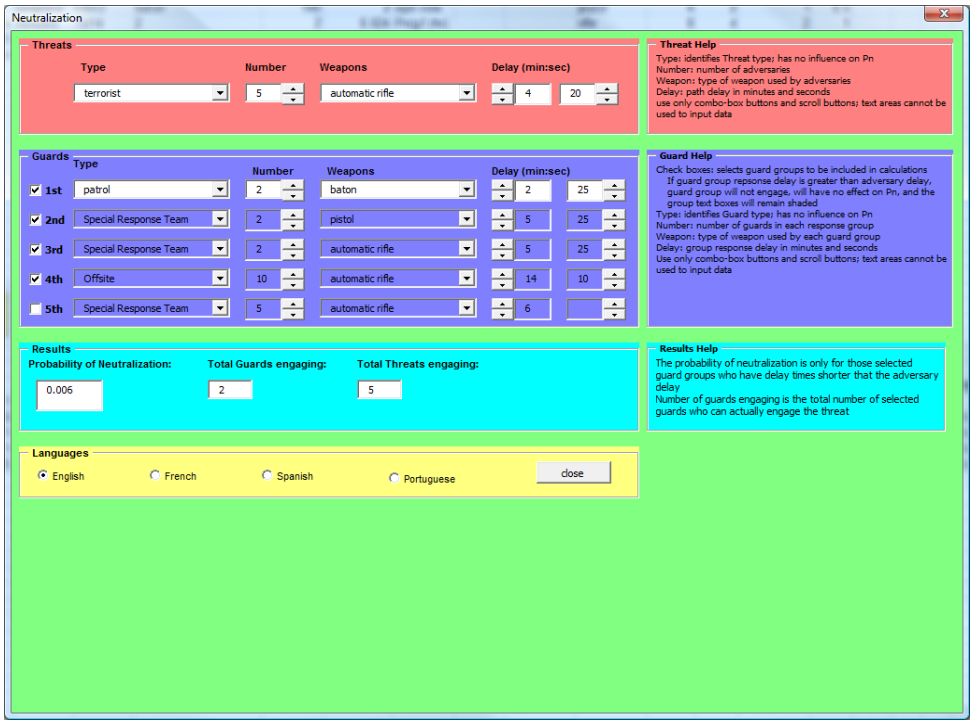
Target: PTR Reactor Facility

Adversary Strategy:_____Sabotage_____ Response Force Strategy: _____Denial_____

Adversary Numbers: ____5 (use data from DBT developed in Threat Definition Subgroup)

Adversary Weapons: Automatic Rifles (use data from DBT developed in Threat Definition Subgroup)

Adversary Task Time: ___146 seconds_____



Exercise 5 -- Response Force Upgrades

The purpose of this subgroup exercise is to investigate the effectiveness of potential Response Force upgrades and determine how to implement them. Use the P_N code to answer the questions below.

1. What is the computed P_N from Exercise 4? _**.006**____

2. How can P_N be improved?

Add at least 65 seconds delay at the reactor core. This will just permit the LLEA Patrols to arrive. P_N = 0.227.

OR

Decrease the response time of the Military Offsite Team to at most 4 minutes and 20 seconds. P_N = 0.988.

3. How can the improvements be accomplished?

Add a barrier system to the reactor core.

OR

Consider relocating the special response team to decrease deployment time. Work on procedures to decrease the response force preparation time.

4. Perform a sensitivity analysis to determine the minimum number of guards, their weapons, and their maximum response time to meet the P_N design requirement.

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Subgroup 20

Insider Analysis

Session Objectives

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

1. Apply the insider PPS design evaluation technique to the PTR hypothetical facility.
2. Use, to a limited degree, the forms and processes outlined in the Insider Analysis lecture.
3. Suggest solutions to reduce the vulnerability to the insider threat of theft of special nuclear materials.

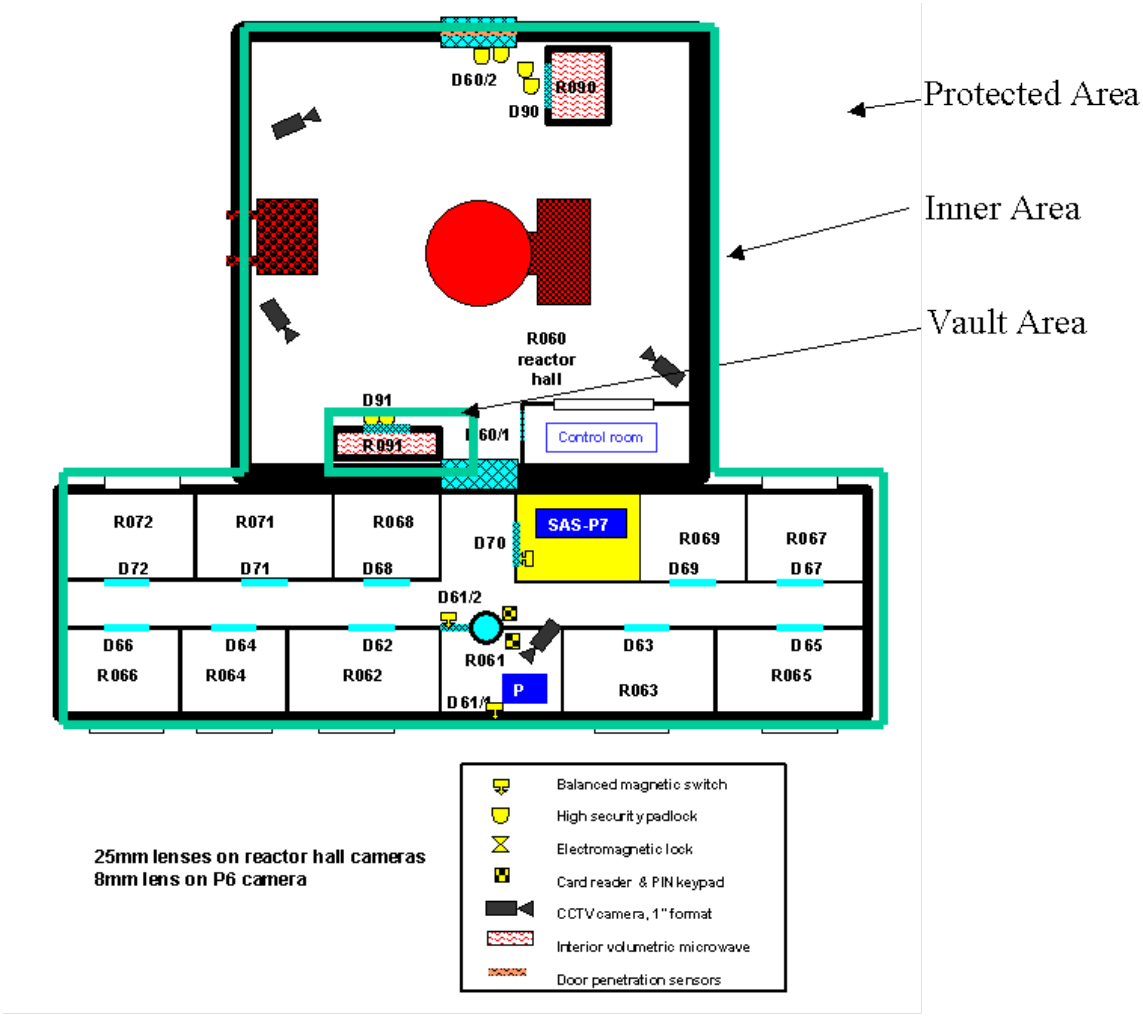
Session Instructions

In the next exercises, participants will consider theft by an insider adversary. The analysis will be conducted using the forms and procedures shown in Section 20, Insider Analysis.

In the analysis, consider only the Pu experiments in R091 as targets. The adversary has succeeded if the assemblies are removed from the Protected Area (PA).

Exercise 1: Identify Path Elements in the Layers of Protection

The physical areas for the PTR Research Reactor Building are outlined in the figure below. Using the Exercise Data Book for the hypothetical facility, identify the path elements between these physical areas leading to the target and add them to the ASD shown below.



Insider Adversary Sequence Diagram

Protected Area

Inner Area

Target Enclosure – Vault R091

Target – Pu Experiments

Exercise 2 – Define the Insider ~~Threat~~Access Levels

It is important to identify all the potential insiders by ~~personnel~~ access type and not as individuals. Any personnel type is a potential insider. The table below lists the types and number of personnel that work at the PTR Research Reactor.

~~Personnel~~ Access Type	Number (Total) Day	Number (Total) Night
Plant Manager	1	0
Guards ~~(1 x 4 shifts) + 1~~	~~5~~2	1
Scientists	6	0
Operators	10	0
Maintenance	6	0
Clerk	4	0
Total	32	1

The PTR is operated 8 hours per day, 5 days per week. During nights and weekends the Inner Area (IA) is locked. The vaults are alarmed using volumetric microwave sensors.

For each of ~~the potential insider~~insider access types listed, characterize their attributes in the following table. Consider the path elements from Exercise 1 and the PTR operational information given in the paragraph above. ~~This information is not in the PTR facility description.~~ You will have to use your experience and judgment to complete this and the following exercises. Consider only paths that use stealth and deceit to get to the material or vital area.

Question: Is there a distinction between reactor maintenance personnel and reactor maintenance personnel access requirements that should be reflected? If so, how?

_____

_____

_____

_____

Attribute	Plant Manager	Guards	Scientists	Operators	Maintenance	Clerk
Access to ~~vaults and facility inner areas (IA)~~material or vital areas						
Keys/combinations/access control lists held or easily acquired						
Special authority or job privileges						
Special skills or knowledge						
Any other relevant details						

~~Exercise 3: Data-Based Grouping of Potential Insiders~~

~~Using the data developed in Exercise 2, decide if any of the Facility Personnel types can be grouped together for the remaining analyses.~~

Exercise 43: Develop Scenario

Using the insider attributes from Exercise 2, define defeat strategies which the insider adversary might use to remove the material through the P6 personnel portal path element. Use a "brainstorming" process for this step to define several strategies for each insider ~~group~~access type. Give each strategy a short name such as "Cut", "Deactivate", or "Normal Entry." Use the table below to document your results.

Evaluate the effectiveness of the P6 Personnel Portal in detecting the ~~insider group~~malicious insider based on access types using each of the strategies from the brainstorming process. Use the following qualitative terms to describe the effectiveness: **Very High, High, Medium, Medium-Low,** and **Low**.

Path Element: P6 Personnel Portal			
Insider ~~Group~~Access Type	**Insider Strategy**	**Effectiveness (P_D)**	**Comments**

Exercise ~~5~~4: Summarize and Analyze Results

Assume that the adversary will use the weakest path for the system; that is, the strategy that results in the lowest probability of detection, P_D. The next step is to condense the PPS effectiveness worksheets into a table of PPS layer effectiveness.

Assume the adversary will use the best (for him) strategy at each layer. Choose the strategy with the lowest effectiveness (P_D) and enter it into the table below. The effectiveness has already been evaluated for removing the target from the vault area and the protected area. Additional space has been provided if you used different groups in Exercise 3.

	Effectiveness (P_D)		
Insider ~~Group~~Access Type	**Remove from Vault Area (R091)**	**Remove from Inner Area (IA)**	**Remove from Protected Area (PA)**
Plant Manager	Medium		Medium
Guards	High		Medium-Low
Scientists	Medium		Medium
Operators	Medium-Low		Medium-Low
Maintenance	High		Medium-Low
Clerk	Very High		High

Using this table of implied probability of detection (P_D), put ~~quantitative~~ qualitative values in the table for Effectiveness (P_D). Change the values if necessary.

Qualitative Effectiveness	Probability of Detection
Very High	**0.8**
High	**0.7**
Medium	**0.5**
Medium-Low	**0.3**
Low	**0.1**

Substituting the values into the Protection Measure Effectiveness Table and using the method of combining independent, sequential probabilities of detection, determine the insider class that has the greatest chance of success and thus is the greatest risk to the PTR.

Combined $P_D = 1- [(1-P_1)(1-P_2)(1-P_3)]$

Potential Adversary	Remove from R091	Remove from IA	Remove from PA	Combined P_D
Plant Manager	0.5		0.5	
Guards	0.7		0.3	
Scientists	0.5		0.5	
Operators	0.3		0.3	
Maintenance	0.7		0.3	
Clerk	0.8		0.7	

Exercise ~~6~~5: Suggested Solutions

This exercise helps identify the insider who presents the greatest risk of success if stealing Pu from the Storage Vault in the PTR (R091). What solutions would you suggest to improve this situation? Remember that when one improvement is made, the situation will change and perhaps another insider will present the greatest risk of success and another path will become the most vulnerable.

Insider with greatest risk of success: _____

Improvement(s):

_____

_____

_____

_____

How does ~~this~~ each suggested improvement change your analysis on the previous page?

_____

_____

_____

_____

How well do the suggested improvement(s) work for both operational conditions (night and day)?

_____

_____

_____

_____

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