

International Conference on Physical Protection
of Nuclear Material and Nuclear Facilities
13 – 17 November, 2017,
Vienna

**AN INTEGRATED APPROACH FOR DESIGN AND
IMPLEMENTATION OF PHYSICAL PROTECTION
SYSTEM ELEMENTS FOR NUCLEAR FACILITIES**



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Introduction

➤ **Nuclear Facilities (NF)**

- NF handles different process stages
- NF by design are distributed in nature
- Processes and systems in a NF are geographically & logically distributed

➤ **Physical Protection System (PPS)**

- PPS aims to prevent theft of NM, sabotage at NF
- Conventional PPS are independent & limited in information and resource sharing

➤ **Integrated PPS**

- In modern approach, PPS across various geographically separated sub-systems are integrated to provide the system functionality
- Common Operating Picture & Informed decision making

Objective of PPS

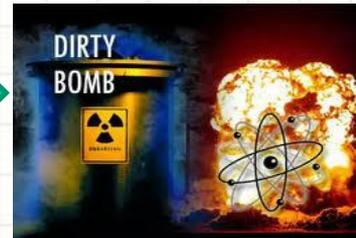
- Prevent **theft** of nuclear material and other radioactive material



Nuclear Material



Radioactive Material



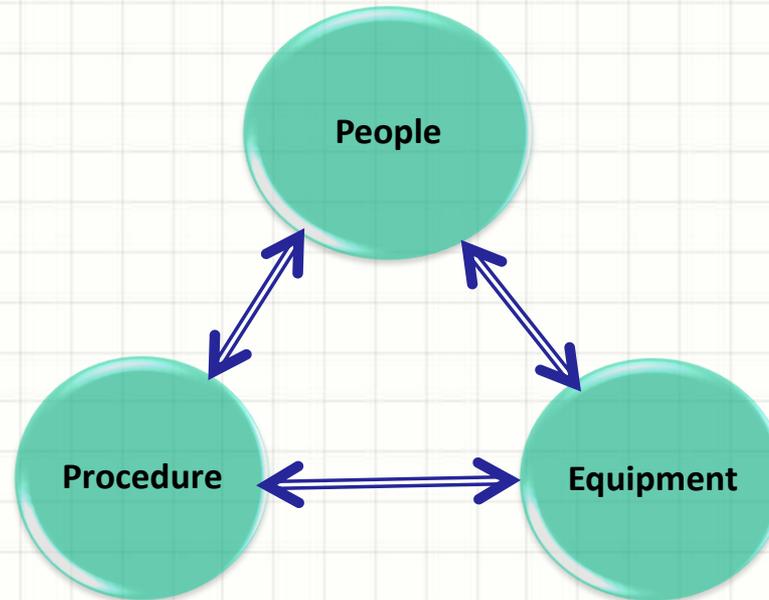
Radioactive Dispersal Device

- Prevent **sabotage** of NF resulting in radiological release



Physical Protection System (PPS)

Physical Protection System involves Integration of People, Procedures & Equipments, spread across a NF



- **People:** Need and Role based involvement is factored into the PPS for Integrated approach
- **Procedure:** SOP and its Interface with Process
- **Equipment:** Integration of PPS equipment (sensors, controls, barriers etc.)

PPS Functions

Protection (Detection & Analysis)

- Intrusion Sensing
- Alarm Communication
- Alarm Assessment
- Entry Control
- Contraband Detection



Prevention (Delay)

- Passive Barriers
- Active Barriers



Reaction (Response)

Guards & Response Forces

- Interruption:
- Communication
- Deployment
- Neutralization



Technology / Procedures / professional security staff

PPS Design Considerations

- Design of PPS needs Assessment at various Levels
 - Stakeholder related
 - Process related
 - PPS domain related
- Selection of PPS elements for NF is driven by
 - Facility Characterization
 - Threat Definition
 - Target Identification

PPS Desirable Features

- Diversity
- Redundancy
- Confidentiality (Encryption)
- Balanced Protection
- Protection-in-Depth
- Graded Approach

Personnel Access Control



DFMD



Turnstile



CCTV



Flap Barriers



Tripod



Finger Scan System



Material Access Control & Perimeter Protection

Radiation Detector



Vehicle Access Control



Tyre killer



Boom Barrier



Bollards



Road Blocker

Radiation Detection at Borders & Ports



Cargo Monitoring



Container Monitoring



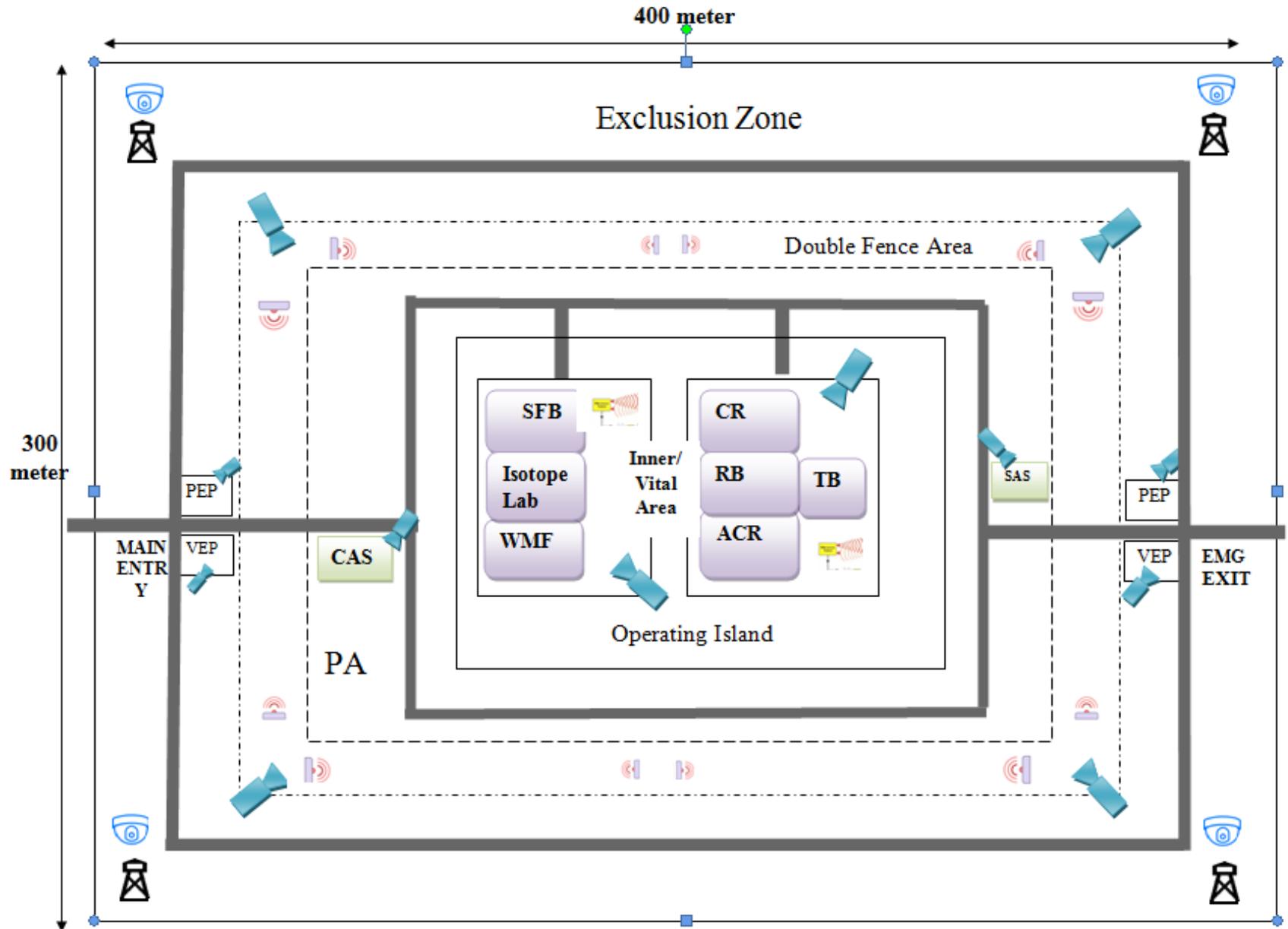
Integrated PPS Approach

Hypothetical Nuclear Facility (HNF)

To evolve an integrated approach to PPS design & implementation, a Hypothetical Nuclear Facility (HNF) is considered.

- A facility of approx. dimension- 400m x 300m
- Reconfigurable Facility for training and education purpose
- Facilities Located in HNF: Reactor Building, Control Room, Auxiliary Control Room, Turbine Building, Spent Fuel Bay, Waste Management Facility, and Isotope Lab besides Central Alarm Station & Secondary Alarm Station.
- HNF is equipped with integrated PPS

HNF Layout



HNF – PPS Details (1/2)

The various PPS elements considered at HNF include:

➤ **Perimeter Intrusion Detection System (PIDS)**

- Active IR sensors at double fence area.
- 8 No of E-Fence Zones with communication controller at outer fence of double fence area.

➤ **Access Control System (ACS)**

- 8 Nos. of RFID based readers with controllers & full height turnstile gates for access control), metal detector and a baggage scanner system at Personal Entry Portal (PEP).
- 10 Nos. of Biometric and RFID based readers with full height turnstile gate at various Inner & Vital area.
- 20 Door Monitoring Systems –normal & emergency doors.
- Boom Barrier, Bollard, Road Blocker & Tyre Killer at Vehicle Entry Portal (VEP).

HNF – PPS Details (2/2)

The various PPS elements considered at HNF include:

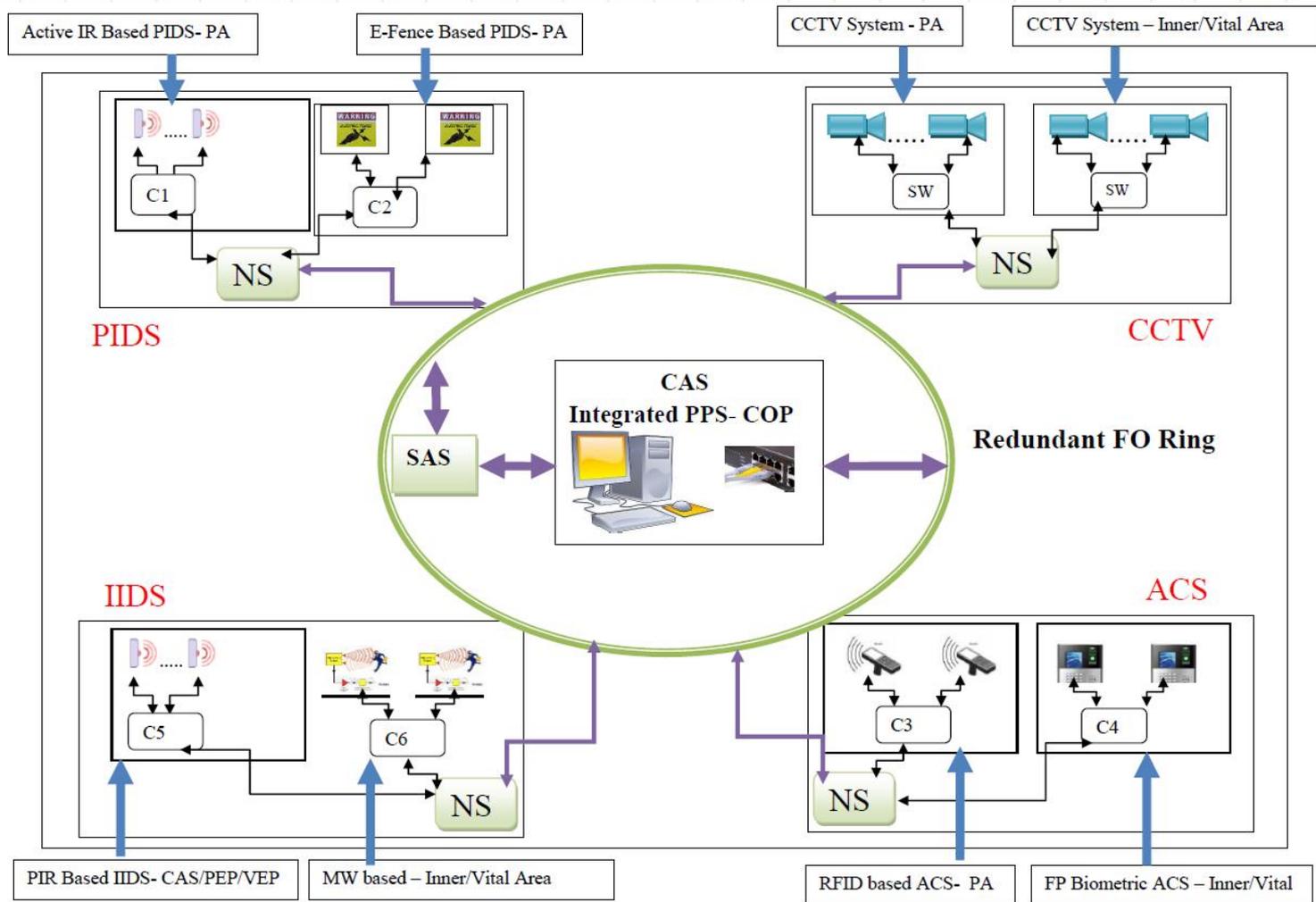
➤ **Intrusion Detection System (IDS)**

- 32 Nos. of Micro Wave based IDS sensors at Inner area, Vital Area, PEP, VEP and CAS.
- 16 Nos. of Passive IR sensors at Inner Area, Vital Area, PEP, VEP and CAS.

➤ **CCTV Surveillance e System:**

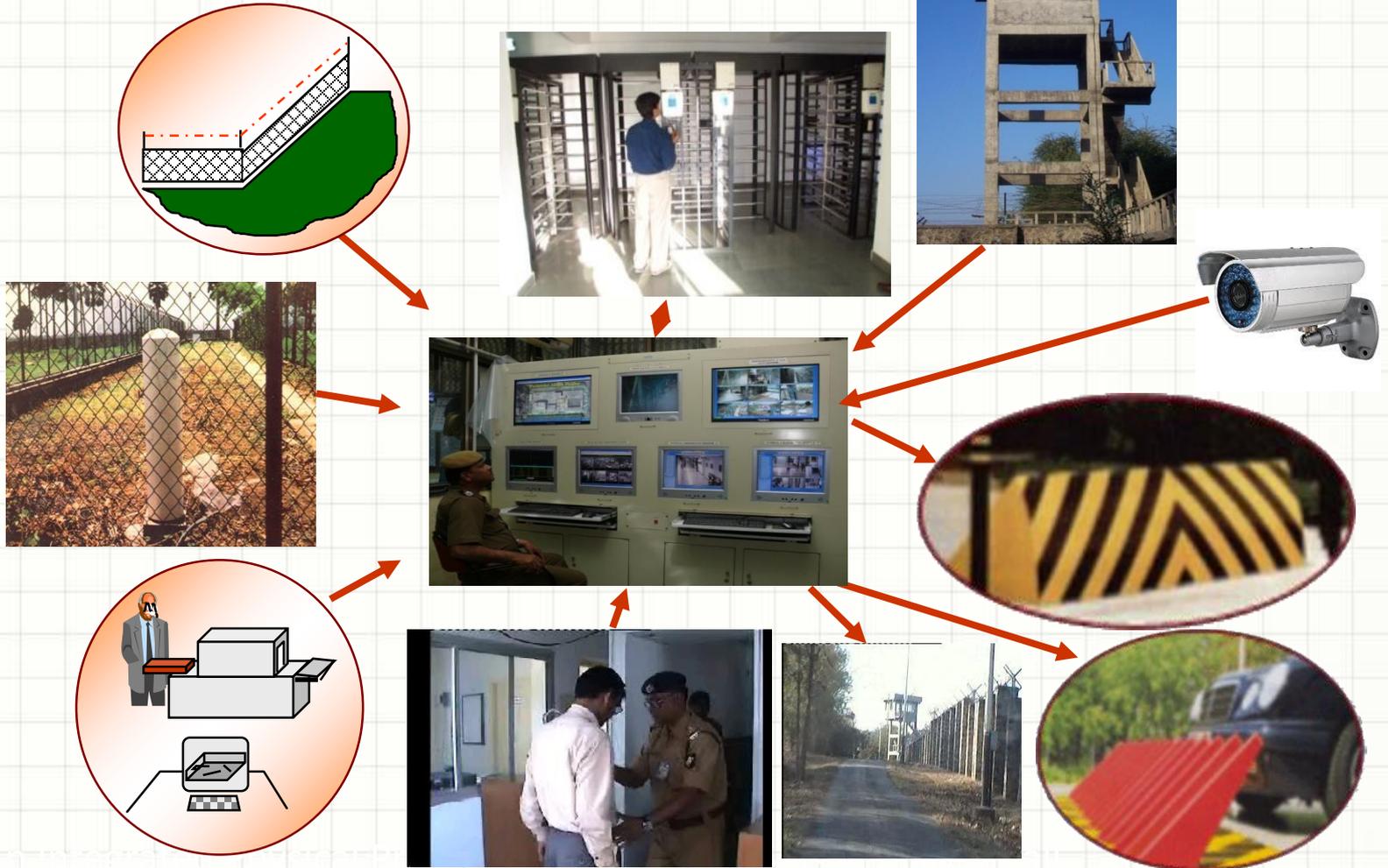
- 6 Nos. of Pan-Tilt-Zoom cameras at exclusion zone boundary.
- 24 Nos. of fixed bullet type camera for alarm assessment at double fence zone area.
- 20 Nos. of fixed dome type camera at PEP, VEP and CAS.
- 30 Nos. of fixed dome type camera at inner and vital area.

HNF- Integrated PPS

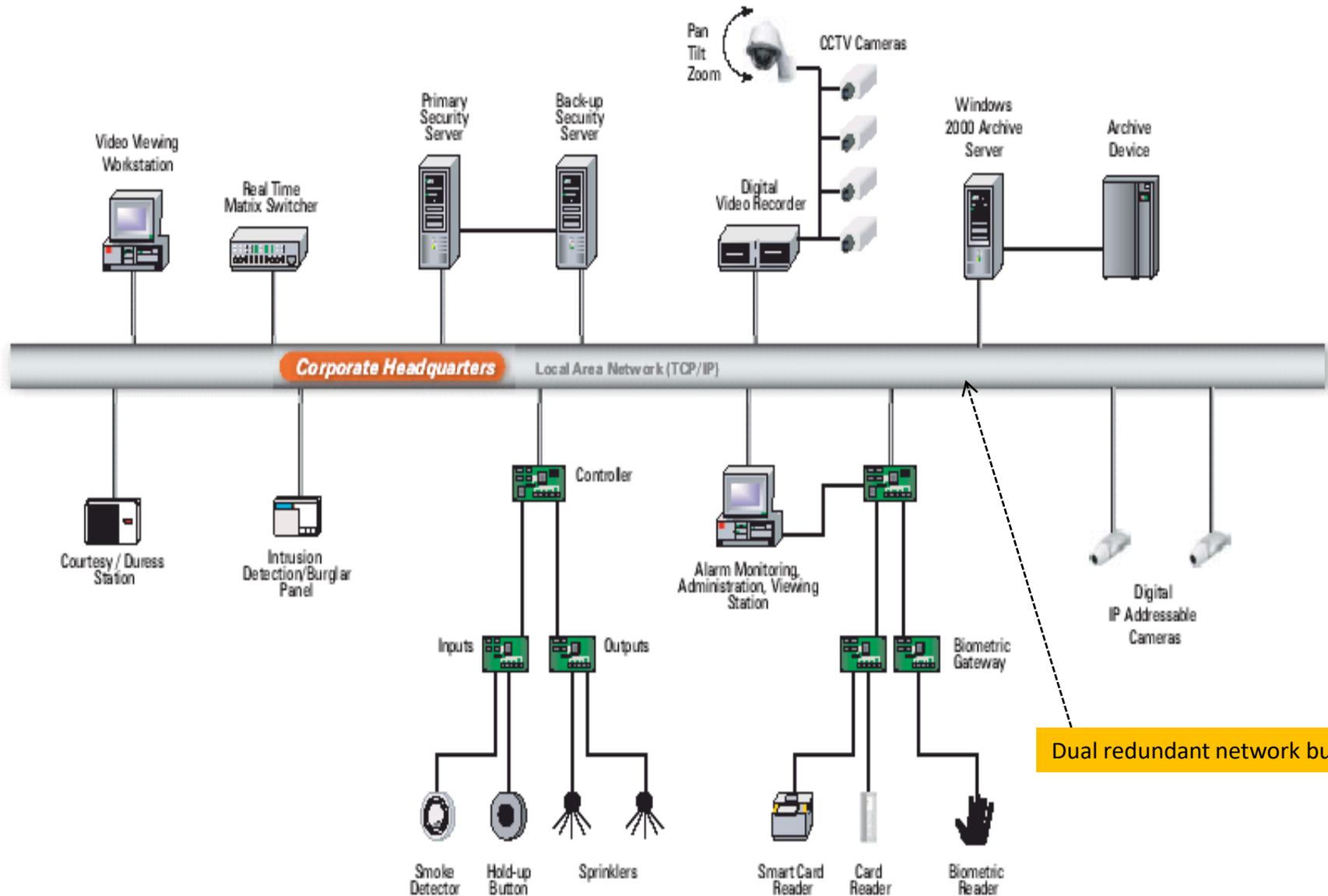


Integrated Physical Protection System Approach

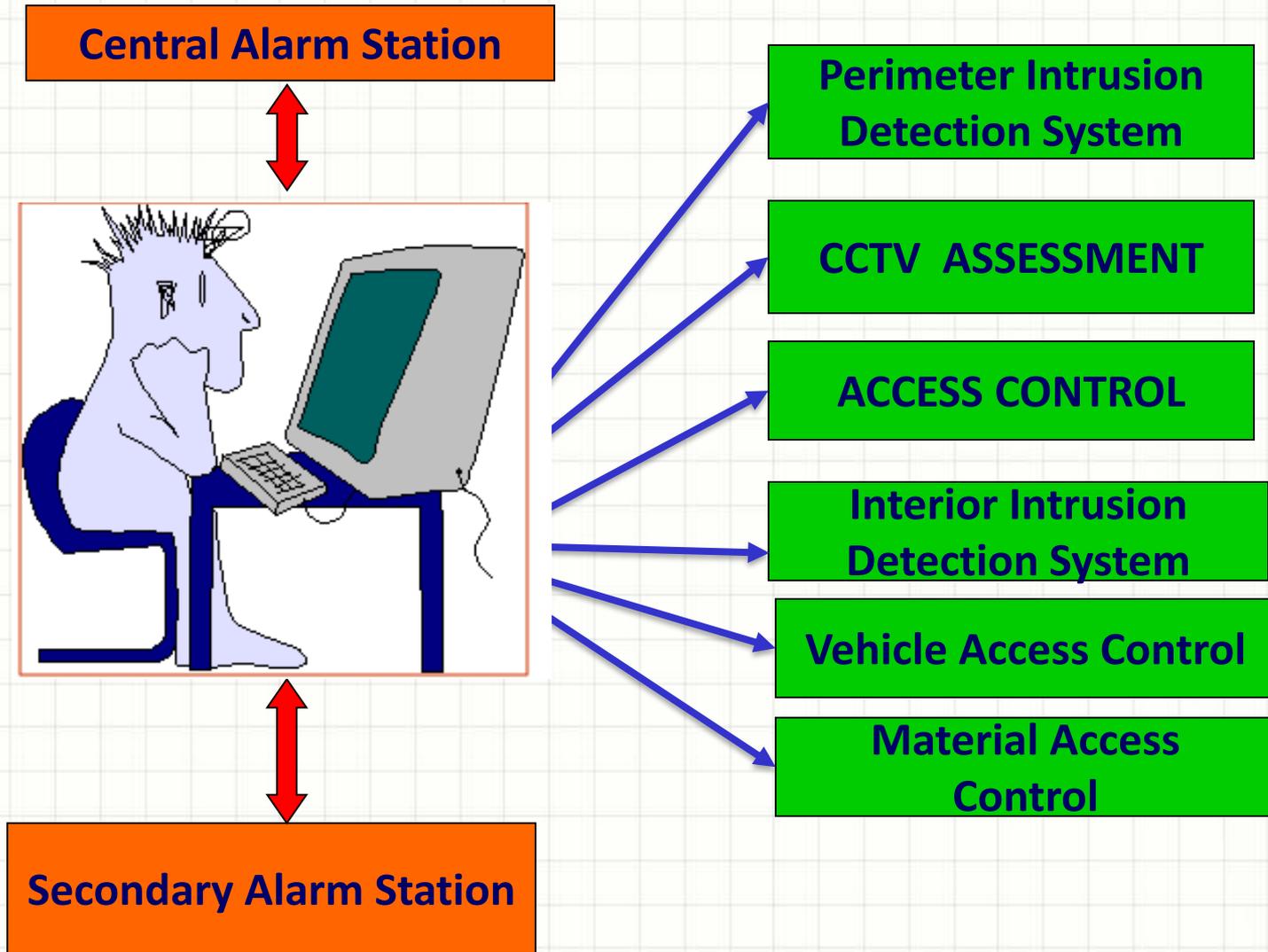
Typical IPPS



Integrated Networked System (PPS)



Common Operating Picture (COP)



Advantage of Integrated PPS Approach

- Enhanced site supervision and an improved probability of detection
- Centralized video & surveillance management system driving the COP
- Reconfigurable automated interaction within the PPS elements
- Centralized and graded access control policies for visitors, staff and vehicles
- Better understanding & accreditation of systems
- Centralized vehicle and person screening
- Better management of false and nuisance alarms
- Centralized incident and response management
- Better managed coordination for event management and disaster recovery
- Centralized platform to carry out scenario based simulation studies
- Efficiently introducing redundancy and diversity

Conclusion

- Integrated Physical Protection System is gaining importance as it addresses complex and dynamic changes in security scenario.
- Integrated PPS provides—
 - Common Operating Picture for effective & efficient security
 - Informed decision making
 - Centralized data repository for PPS elements
 - Better understanding of the systems & sub-systems

During the risk and threat assessment phases of developing an IPPS, you frequently discover areas of vulnerability that can be remedied and practices that can be improved.
- Easy to use, easy to scale, quick to analysis and easy to reconfigure systems to fit the desired responses.

All People & Nuclear Facility needs to be safe and secure.

Thank You

