Best Practice of Acceptance Test for Physical Protection System of Nuclear Facilities

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Introduction

- ACCEPTANCE TEST OF PHYSICAL PROTECTION SYSTEM IN THE BACKGROUND OF NUCLEAR SECURITY
- ANALYSIS OF NECESSITY
- CASE STUDY: PHYSICAL PROTECTION SYSTEM ACCEPTANCE TEST IN COE
- DEFICIENCIES AND PROSPECTS

Introduction

- ACCEPTANCE TEST OF PHYSICAL PROTECTION SYSTEM IN THE BACKGROUND OF NUCLEAR SECURITY
  - Definition and status of acceptance tests
  - Prerequisites of Acceptance test
- ANALYSIS OF NECESSITY
- CASE STUDY: PHYSICAL PROTECTION SYSTEM ACCEPTANCE TEST IN COE
- DEFICIENCIES AND PROSPECTS

Definition

The nuclear facilities's physical protection project of **construction, alteration or extension**, after the **design, construction and commissioning** of the project meet certain conditions, a series of **site compliance testing** works shall be carried out by the facility owner in conjunction with the relevant State departments, including the quality of the physical protection system, the installation and commissioning of the equipment, the connectivity of the system and functional integrity, etc.

Realation withe relevant works

Project overall acceptance

Effectiveness assessment

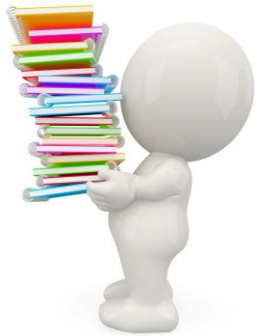
Site acceptance test

- Does not involve project funds audit, business review, project progress, etc;
- Only concerns about the function of PPS itself;
- The test results and analysis reports can be used as supporting material;
- Shall be carried out only after completion of all subprojects.

- The acceptance test requires a 100%-by-test of all systems and all equipment;
- Based on the performance or base on criteria。

Legislation and criterion

Legislation and criterion



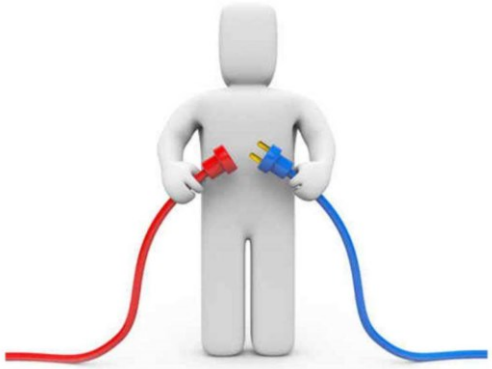
- **Existing Legalized Systems**
  - **The decision of State Council Decree No. 412**
  - **<The Security Regulations of Nuclear Power Plant>**

- **Upcoming Legalized Systems：**
  - *<Regulation of Acceptance for Nuclear Facilities Physical Protection System> and relevant guidences and manuals.*

- **Referable Legalized Systems**
  - Technical specification for security system（GB 50348）
  - Acceptance regulation for security system（GA 308）

Prerequisites of Acceptance test

- Prior to the acceptance test, the physical protection project shall meet：
  - Preliminary design shall pass the examination；
  - After the joint-commissioning of the system, the PPS shall run for at least one month and the trail report shall be submitted；
  - Establish the management system of operation and maintenance；
  - Technical training；
  - The completion material of concealed works；
  - Jointly set up a special acceptance test committee.



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- ACCEPTANCE TEST OF PHYSICAL PROTECTION SYSTEM IN THE BACKGROUND OF NUCLEAR SECURITY
- ANALYSIS OF NECESSITY
  - The Final Pass of Construction Management
  - The last opportunity to compensate for the lack of design
  - Last chance to check equipment defects
  - Final Window to Clarify the Responsibilities
- CASE STUDY: PHYSICAL PROTECTION SYSTEM ACCEPTANCE TEST IN COE
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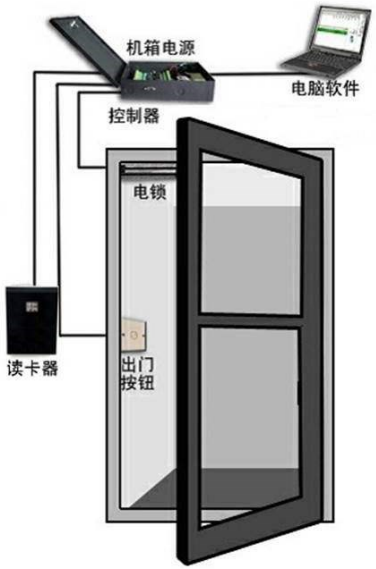
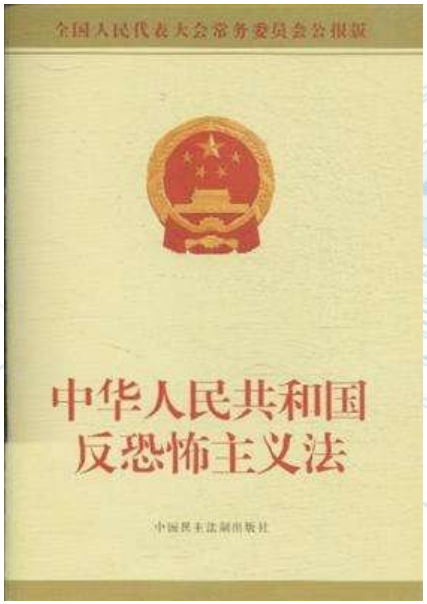
ANALYSIS OF NECESSITY

- **The Final Pass of Construction Management：**
  - **The resources allocated are limited, and time often limited**
  - **Low reliability and high failure rate;**
  - **Modification of each defect before the operation should always be the principle and the bottom line of the project management;**
  - **Use the residual resources of the project to maximize the protection of their own interests.**

ANALYSIS OF NECESSITY

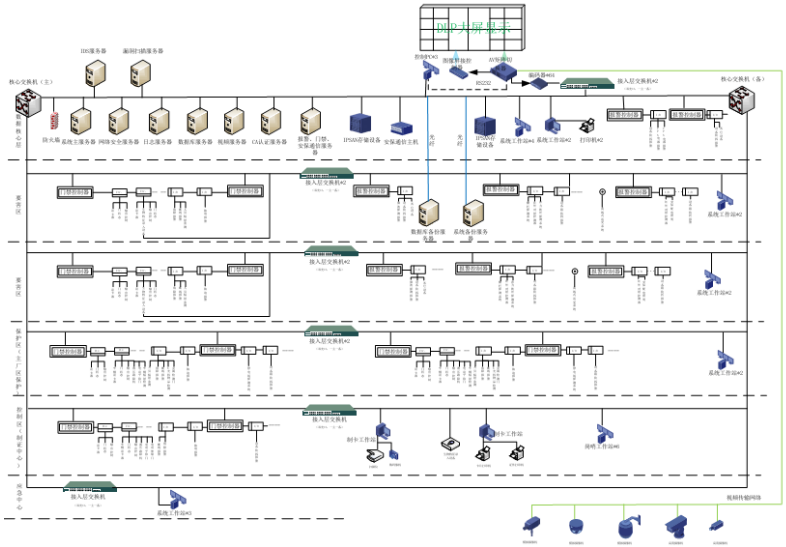
- **The last opportunity to compensate for the lack of design:**
  - **Update of regulations and standards**
  - **Change of threat situation**





ANALYSIS OF NECESSITY

- **Last chance to check equipment defects：**
  - **Environmental adaptation**
  - **Electromagnetic compatibility**
  - **Equipment compatibility**
  - **System expansion**



ANALYSIS OF NECESSITY

- Final Window to Clarify the Responsibilities：
  - The design,construction,general contract,subcontract,vendors and other units;
  - The finance, the project, the security, the maintenance and other different departments.

CAT-A Defects

CAT-B Defects

CAT-C Defects

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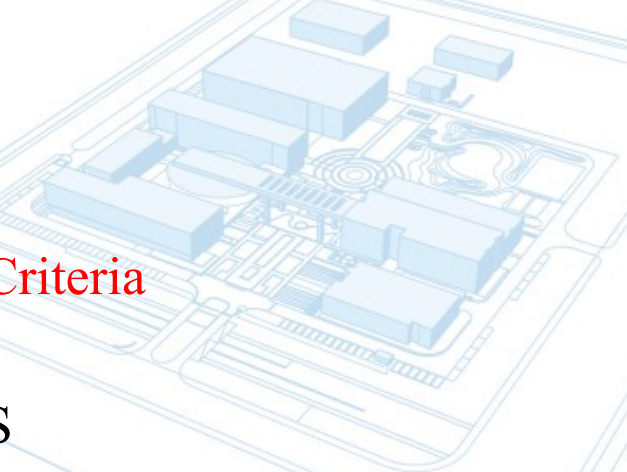
- CASE STUDY: PHYSICAL PROTECTION SYSTEM ACCEPTANCE TEST IN COE
  - Organazation framework
  - Acceptance Test Plan
  - Acceptance Test Protocols and Criteria
  - Testing Results
- DEFICIENCIES AND PROSPECTS



Case study--Organazation framework

Acceptance Test Committee

Test director

facility-project departments

facility-security departments

Test Engineer

construction unit

system integrators

security

equipment vendors

operation

Case study--Acceptance Test Plan

3.Formal Acceptance Test

2. Optimization and Rectification

1.Pre-acceptance test

Case study--Acceptance Test Protocols and Criteria

Test protocols and criterion are based on the national or regional regulations and standards as well as the examined and revised design document. They are compiled by the acceptance test work team and approved by the Committee

Failures need to stop the test：

- Violate the design or regulation；
- Influences the follow-up test；
- Could be rectified quickly;
- Reason unknow.

Failures can continute the test：

- Basicly meet the design and regulation；
- Reason known and not influence the follow-up test；
- Can't be rectified quickly.

Case study--Acceptance Test Protocols and Criteria

1.Intrusion detection systems

1.1 **Choice of type:** suitable for surface topography, weather, working environment;

1.2 **Installation:** stable installation of detector; no exposed wiring; the voltage and current meet criteria of electrical and fire regulations; with independent alarm signal of tamper, shortcut and open circuit.

1.3 **Maintenance:** with extendable function; storage of key spare parts; have regular testing operating procedures and equipment for regular maintenance; proper training.

1.4 **Performance:** the ability to prevent crawling, walking, running, jumping, bridging, spoofing, and other forms of intrusion; consistent detection probability through all time.

Case study--Acceptance Test Protocols and Criteria

入侵探测报警系统整合与显示

要求编号	要求内容
1	图形用户界面应当具有将所有报警点整合在一起的能力，将所有入侵和周界探测，以及 CCTV 整合为一体。系统应当允许操作员从中央警报站控制和维护场地安保系统。
2	出入口控制系统界面应当安装在工作站或与图形用户界面整合在一起
3	应当显示系统所有传感器 / 组成部分并通告状态变化
4	AC&D 系统应当显示报警的类型、优先顺序和地点
5	在控制站的
5a	文字
5b	图示地图
5c	必要时进行
5d	应当提供直
5e	图标应当有全＝绿色…
6	图形用户界面应当显示传感器的状态。这些传感器的状态列在下面：
6a	报警＝引发状况出现异常的通告
6b	安全＝表示回到标准报警的正常状况
6c	篡改＝引发传感器外壳和 / 或线路受到危害的通告
6d	出入＝表示在标准报警的状况下，某一处有人出入
6e	故障＝引发传感器线路出现问题的通告
7	应当通过以下方式为控制站所收到的每一次报警，以及对报警系统或任何相关组成部分所作的维护活动保存记录。
8	应当备有一台事件打印机，用来编写连续的事件记录或打印审核报告。
9	服务器应当将系统所有的事件记录在数据库里
10	应当允许操作员记录、检索并自订打印几乎是无限的系统事件报告，包括事件内容、日期、时间、用户行动 / 反应等。

Case study--Acceptance Test Protocols and Criteria

There is a model of tension detection device test table.

Tension Detection Device Test Table Equipment No. & location of Field distribution box : ___	Region: Room No./Detecting Area: Date/Test engineer: Temp: Wind Speed: Precipitation: Other

No.	Testing Item	Location of Testing point	
1	Wiring and Quality of Installation		□Pas
2	Space of Tension Wire		Avg. Max □Pas
3	Length of detecting area		Lengt □Pas
4	Dead zone in detecting area		□Pas
5	Preload of tension wire	No: Distance from sensor: ***Repetition could be made as needed to different wire in a same area.***	Prelo □Pas
6	Alarm test	No: Distance from sensor: ***Repetition could be made as needed to different wire in a same area.***	Linkage camera: □Pass □basically pass □fail
7	FAR		Linkage camera: □Pass □basically pass □fail
8	Alarm of tamper		Linkage camera: □Pass □basically pass □fail
9	Alarm of short cut		Linkage camera: □Pass □basically pass □fail
10	Alarm of power off		Linkage camera: □Pass □basically pass □fail
11	Alarm of communication lost		Linkage camera: □Pass □basically pass □fail
12	Maintaining document		□Pass □basically pass □fail
13	Maintaining equipment		□Pass □basically pass □fail

Case study--Test results

- **There are 217 sets of equipment and 3255 items to be tested in Mock facility of COE project.**
- **There are 157 sets of equipment and 1884 items to be tested in Real facility of COE project.**
- **As for the statistics of data, test qualification rate(Ks) = (number of passed testing items + 0.6 * number of basically passed testing items) / number of total testing items.**

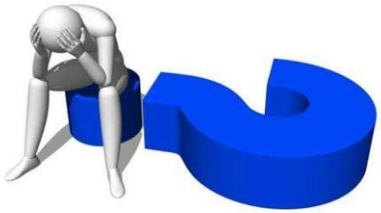
Case study--Test results

The defects and problems found by the acceptance test mainly includes：

1.The design principle of system/equipment doesn't match the principle of Nuclear security

2.Breakdown/failure of security system/equipment

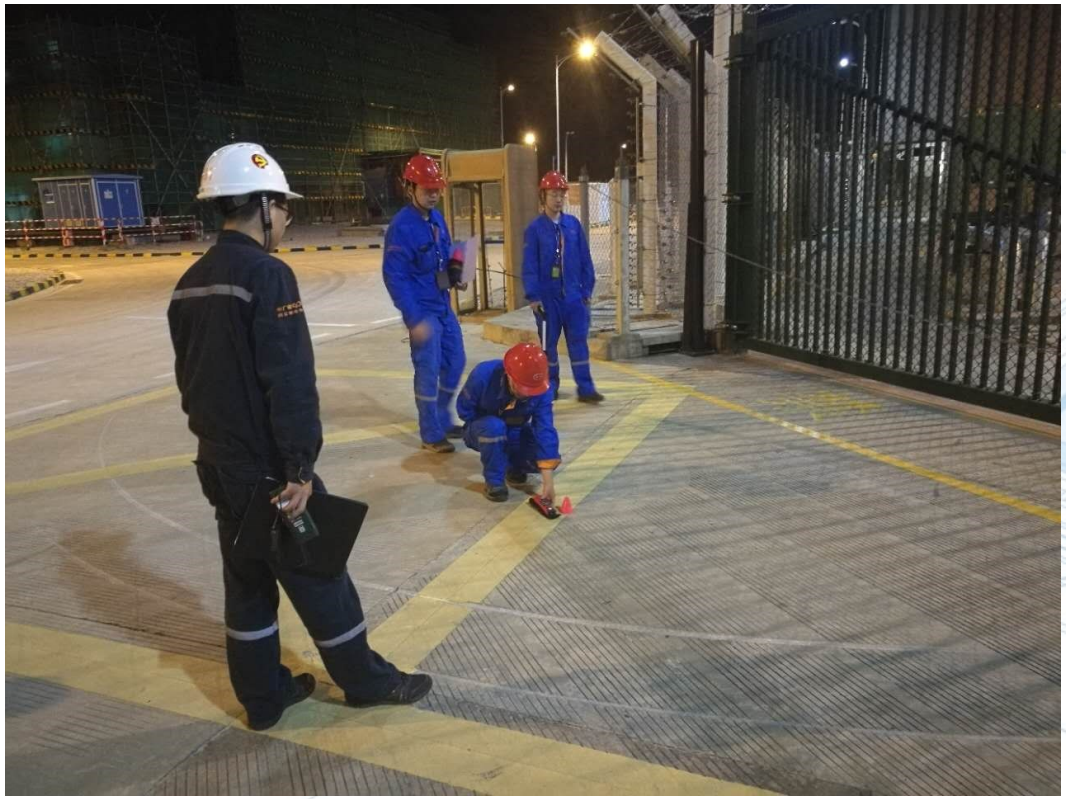
3. Other external factors.

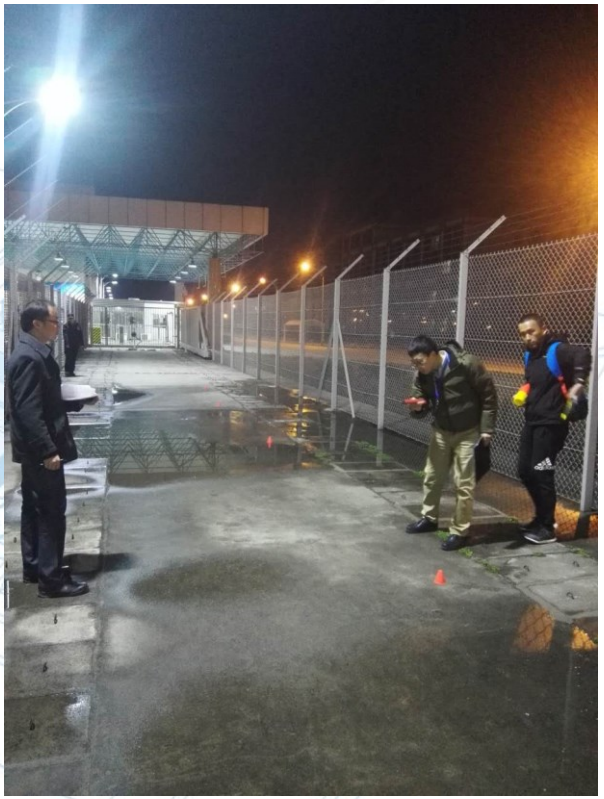


Case study--Test results

For the convenience of the testing engineer and the management of the site equipment, improving the standardization level of the acceptance test, SNSTC designed and manufactured a pair of portable kit for the site acceptance test

Case stu nd manuals





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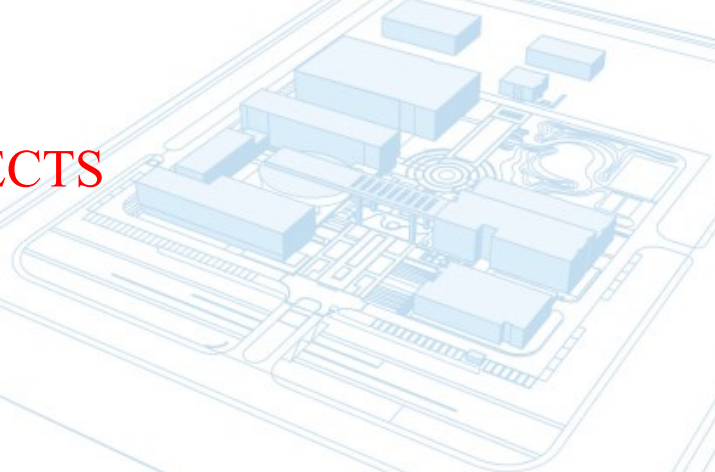


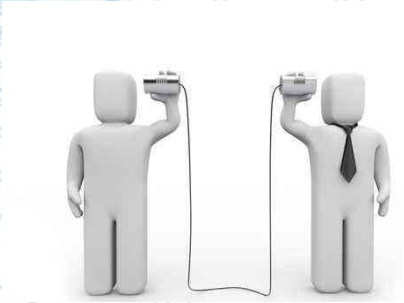
Quantitative analysis of determent

Natural Surveillance

Natural Access Control

Territorial Reinforcement

CPTED stands for Crime Prevention Through Environmental Design, focuses on the physical design of fencing, lighting, plantings - to identify areas or elements that may have the potential to attract crime.



◆ DEFICIENCIES AND PROSPECTS

Legislation and criteria	• **shortage of direct legal basis for owners** • **lack specific technical documents**
Performance assurance	• **nuclear security practitioners** • **facility's relevant procedures**
Professional team	• **uneconomical and unrealistic** • **independent, operational and reliable members**
Test for delay and response	• **subsystems share the same platform** • **stress test under specific circumstances**