USE OF CIGRE SURVEY TO IMPROVE CEPS REPORTING SYSTEM ABOUT FAILURES

WGA3-06 Tutorial
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CEPS, a.s.

Basic Data about CEPS, a.s.

CEPS, a.s. – the only one TSO company in CR

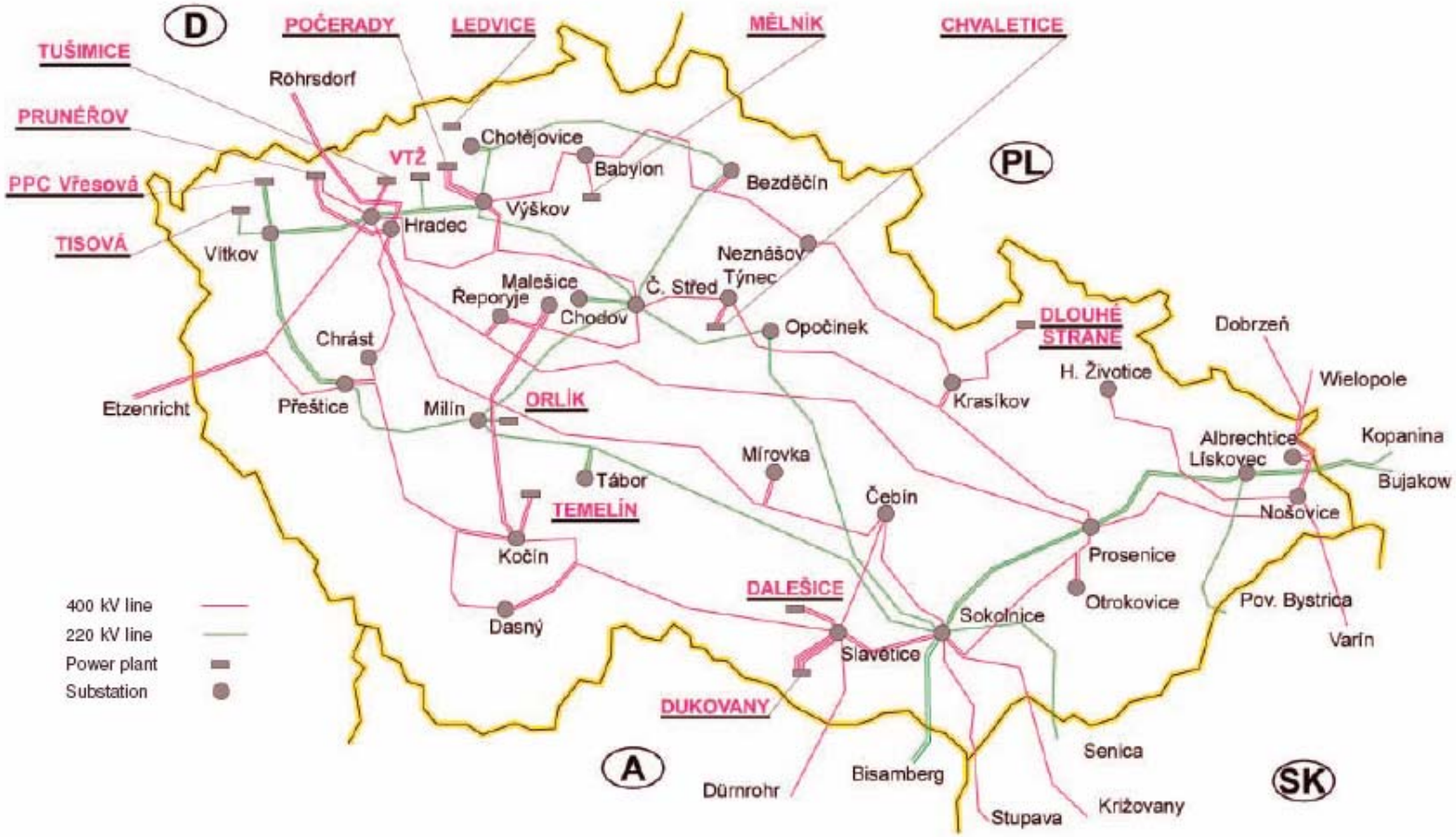
Foundation : 1998

Ownership :

- **Osinek, a.s. (National Property Fund) 51%**
- **Ministry of Finance 34%**
- **Ministry of Labour and Social Affairs 15%**

Number of employees : 430

Grid Structure



Transmission system of the Czech Republic

(situation as of 31.12.2004)

Equipment		Bohemia	Moravia	CR in total
400 kV line	(km)	1 914	987	2 901
of which double line	(km)	377	132	509
220 kV line	(km)	886	554	1 440
of which double line	(km)	249	229	478
110 kV line	(km)	45	60	105
of which double line	(km)	39	17	56
400 kV cross-frontier lines	(-)	4	6	10
220 kV cross-frontier lines	(-)	0	6	6
400 kV substations	(-)	16	8	24
220 kV substations	(-)	11	3	14
110 kV substations	(-)	1	1	2
400/220 kV transformers	(-)	2	2	4
400/110 kV transformers	(-)	27	14	41
220/110 kV transformers	(-)	14	6	20
Transformation capacity (MVA)		11 190	6 000	17 190

AM (Maintenance) Corporate environment

- HQ + 3 regional centers
- Main volume of maintenance (preventive as well as corrected) outsourced
- Small skilled teams able to provide diagnostic tasks – to keep the know-how within company
- Maintenance based upon EQ types rules (standards), outage plans coordinated by dispatch center
- In 2002 launched a project to improve asset management IT (grid, equipment, types, unplanned and planned events, maintenance planning and results inventory and statistics)
- Before, all technical data stored in xls/doc/mdb/paper

2002 project goal:

“Build an IT system for support of Asset Management allowing its technical and economical optimization”

Project history and future

History

- **2002 – II/2003 : analysis of initial state, benchmarking, theoretical model** (KPI's, weights of system components, lifetime modeling, reliability and costs evaluation, maintenance tasks and intervals optimization (CBM, RCM, RBM etc.), **selection of suitable IT tool**
- **II/2003 – II/2005 : creation and service of centralized "tailor made" technical information IT (B-SW) :** all inventories, equipment and grid history, maintenance planning and optimization, interconnection with currently existing expert systems and dispatch center outage planning IT, easy access to information from any point whithin company, evaluation of trends and statistics calculations
- **II/2005 : top management decision to buy SAP**
- **III/2005 – I/2006 – B-SW "transfer" to SAP**
- **I/2006 – ? – productive service of SAP R/3 PM module**

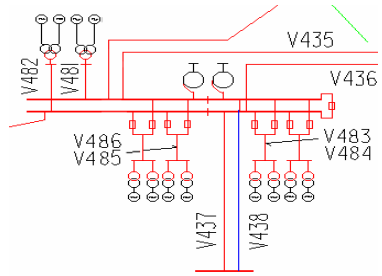
Future

- **SAP R/3 Data warehouse implementation (BIW, SEM)**
- **TID system for integrated collection and automatic expert evaluation of monitored parameters (data from SCADA, fault recorders, transformer and special monitoring systems**

First step: Structured terminology

Objects (Installation place)

Identification of a specific place where an equipment is to be installed in network (using single line diagram)

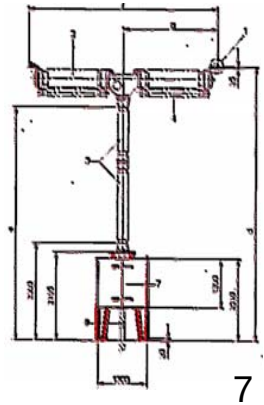


Components (Equipment)

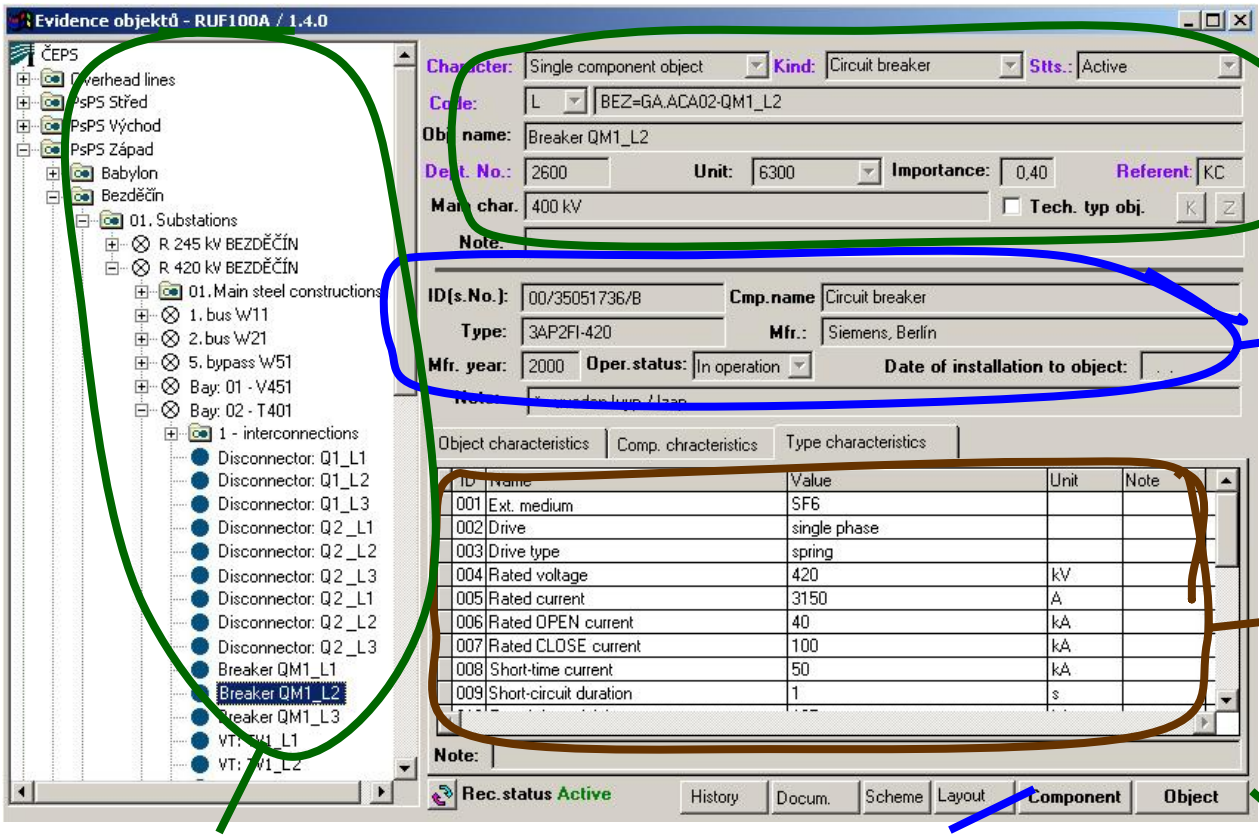
Identification of a specific equipment (using its serial number)

Types (Class)

Identification of equipment groups of the same design (using manufacturer's designation & specification)



Equipment population



Object data
Cigre :Rated U, Location, Service

Comp. data
Cigre: Manufacturing year

Type data
Cigre : Operating mech., Main insulation, Type of enclosure

Object tree

Component details

Object details

Events database

Object events:

- Unplanned outage
- Planned outage
- Service switch-off

Type events:

- Random failures
- Systematic failures (design, manufacturing, installation, ageing, etc.) see CIGRE questionnaire “Cause”

Components events:

- Major failure
- Minor failure
- Corrective maintenance
- Preventive maintenance (acc. to CEPS standard or extraordinary)
- Commissioning
- Disassembly
- Disposal

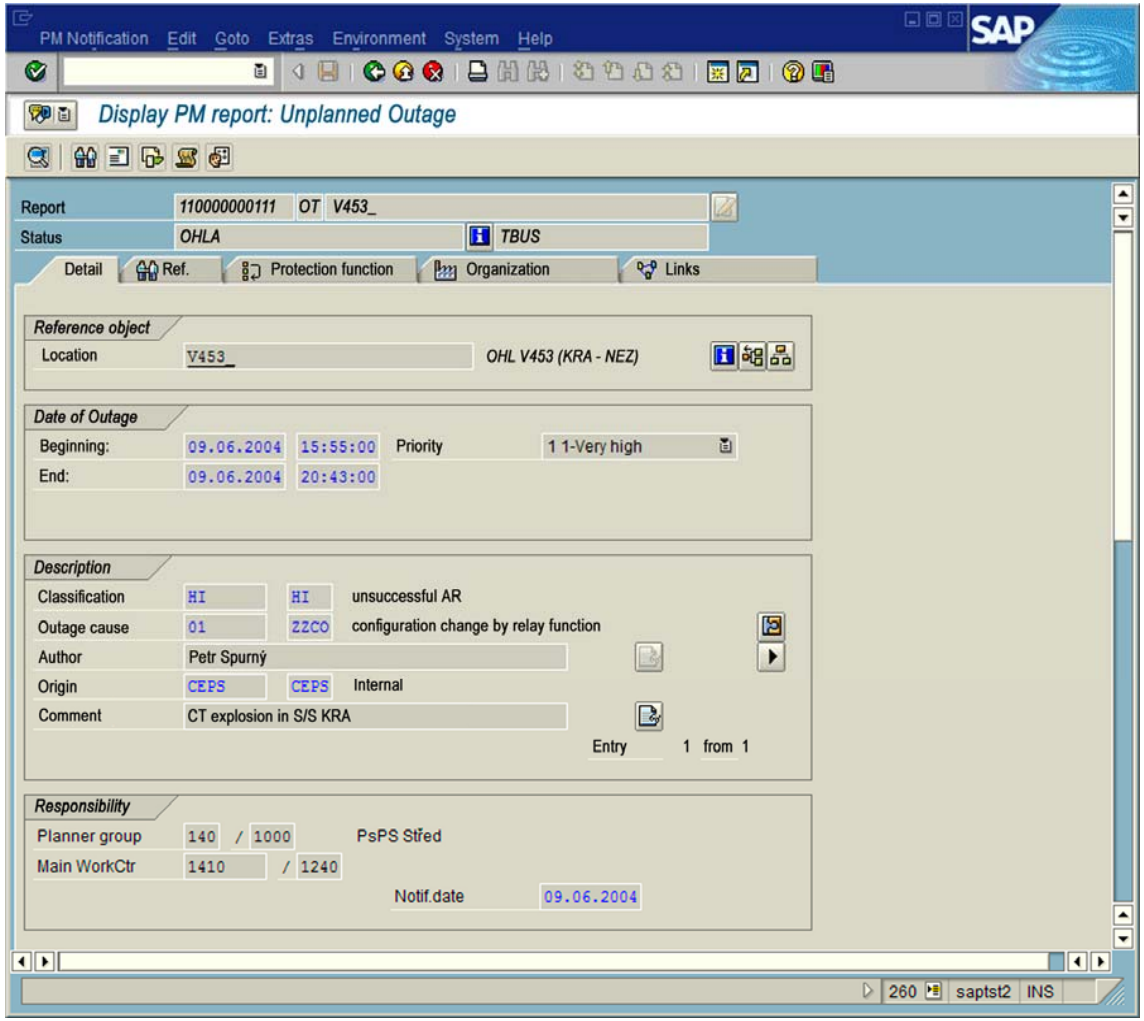
Links between different events has to be recorded to describe causes and consequences

Example of unplanned event

420 kV CT AOK (1996) explosion in 2004

- Normal service of OHL
- Two strokes into OHL conductor - 5-10 km distance, 10 kA, 2nd stroke at the end of single pole autoreclosing sequence

Example of unplanned events inventory – Outage report

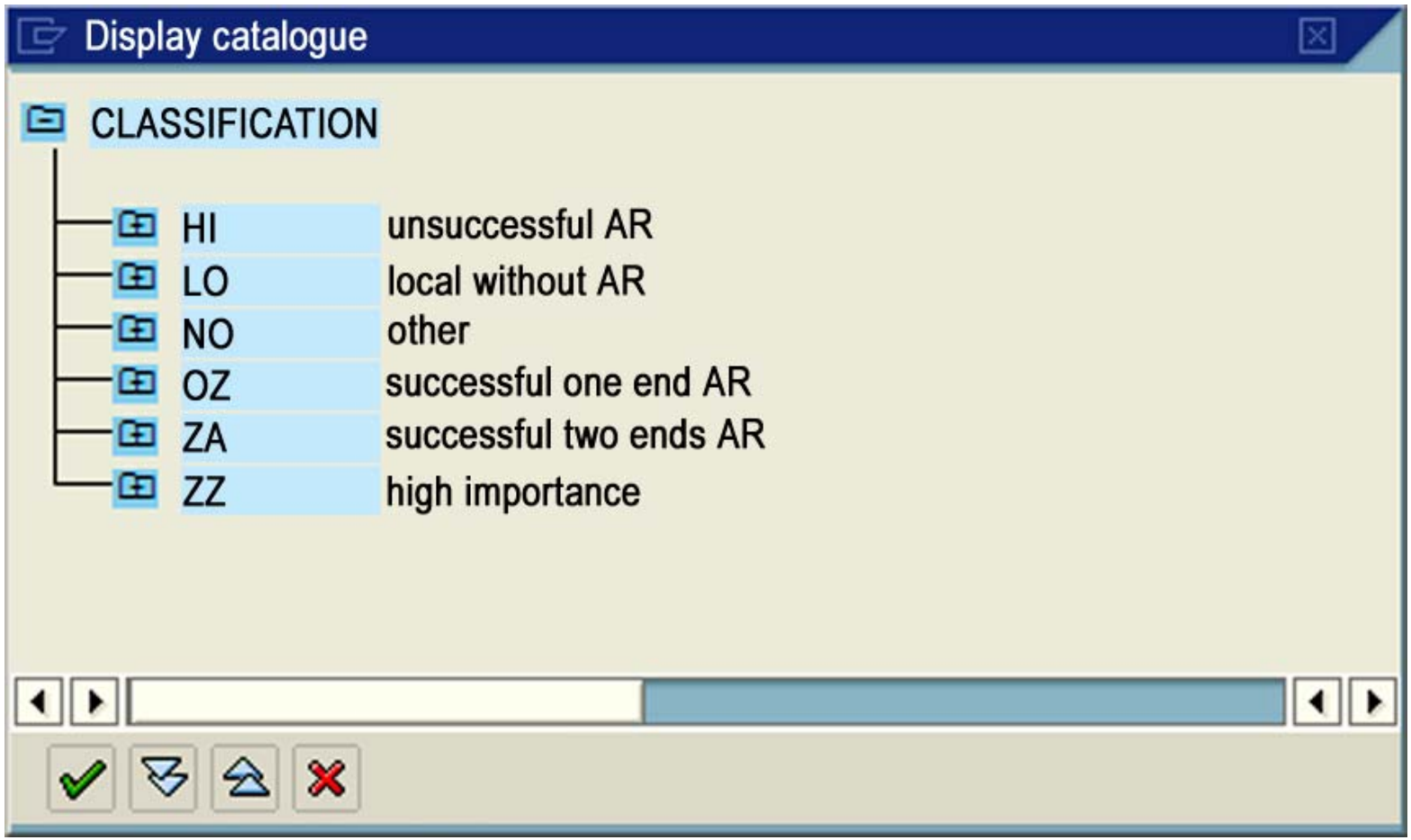


Dispatch center enters a record about the outage on the same day of the outage

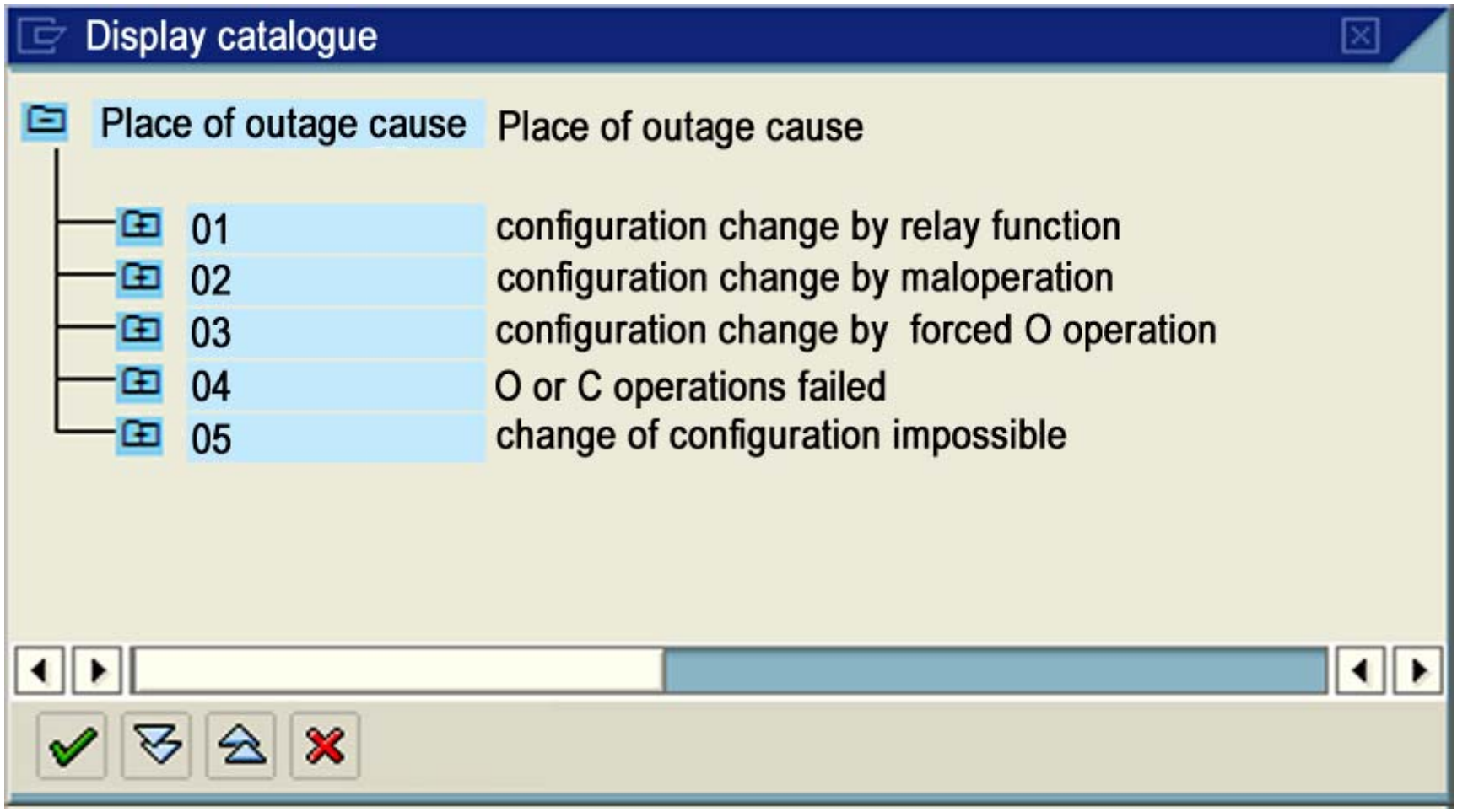
Categories:

- **Classification**
- **Outage Cause**
- **Origin**
- **Termination mode**

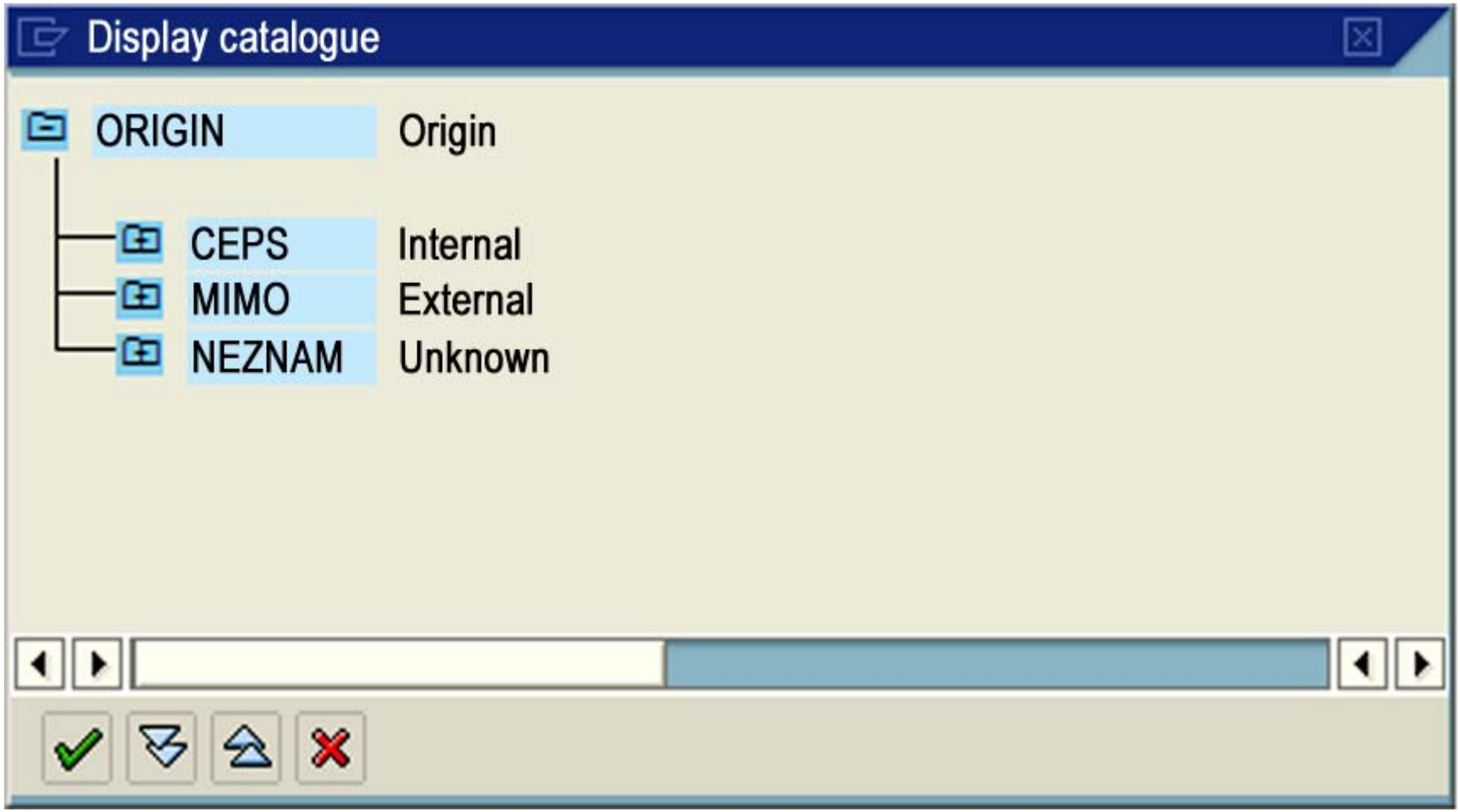
Example of unplanned events inventory – Outage classification



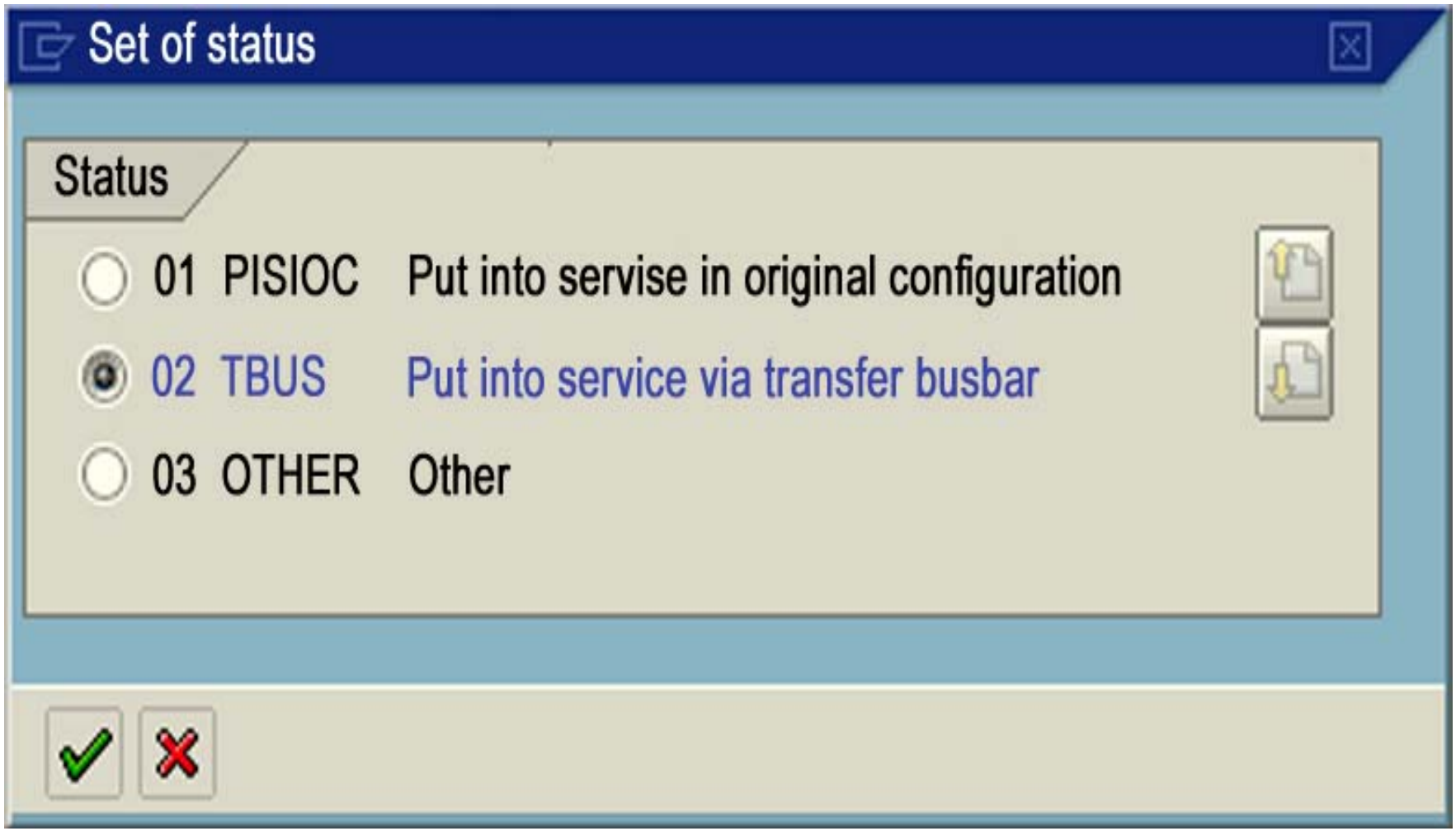
Example of unplanned events inventory – Outage cause



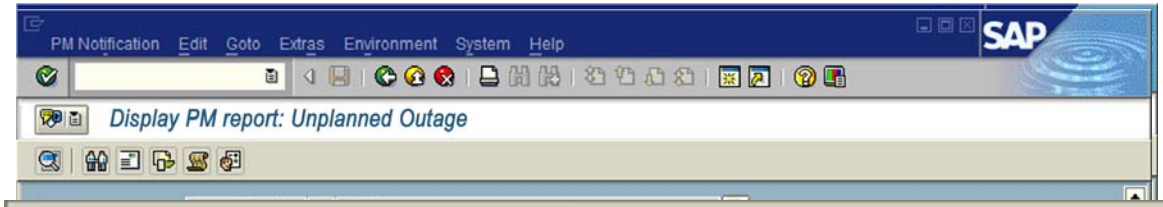
Example of unplanned events inventory – Outage origin



Example of unplanned events inventory – Mode of outage termination



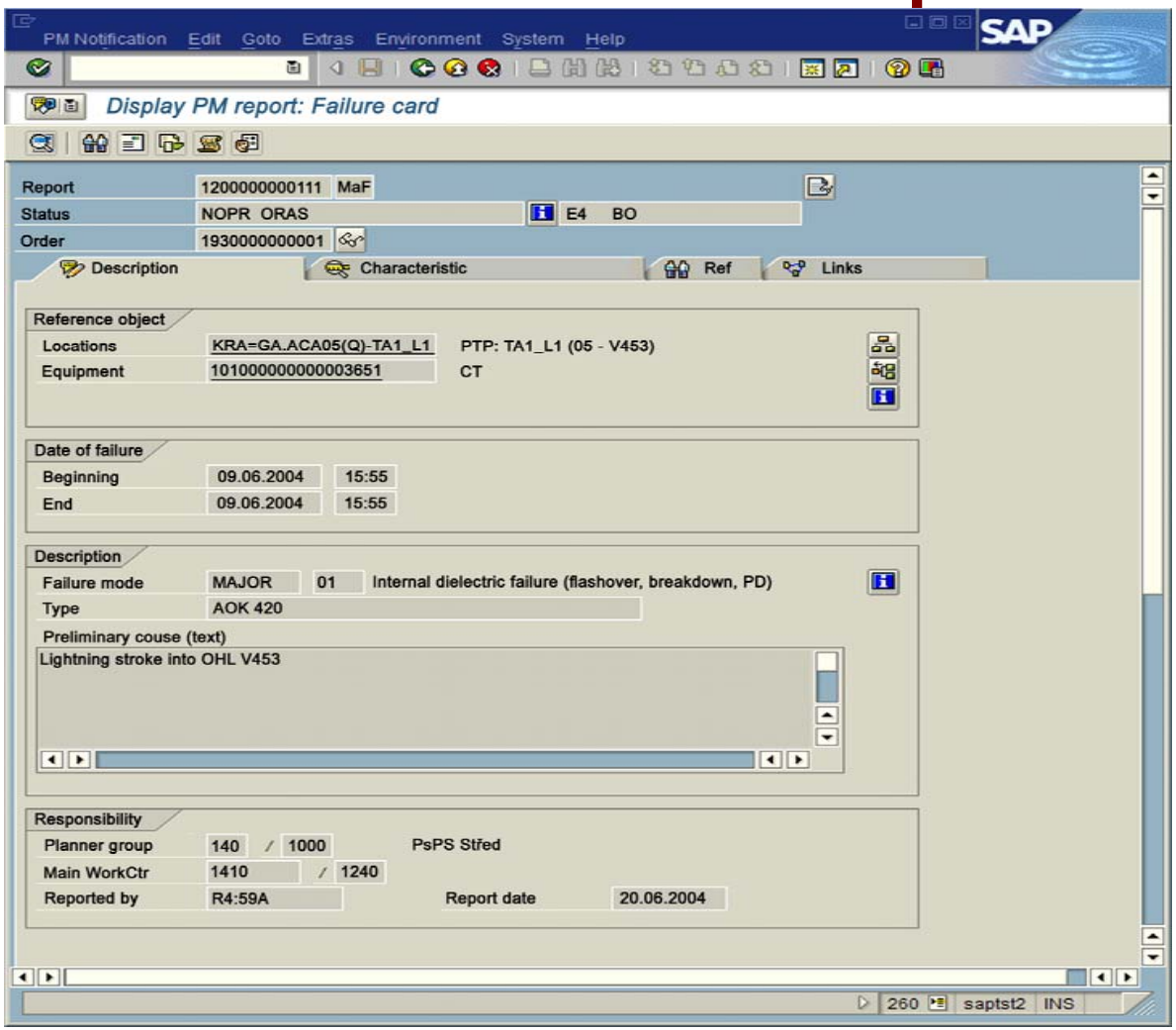
Example of unplanned events inventory – Outage link to failure report



Links

REPORT	TYPE	STATUS	EQUIPMENT TYPE
120000000074	MaF	PŘZA ZPHL	AOK 420

Example of unplanned events inventory – Failure report

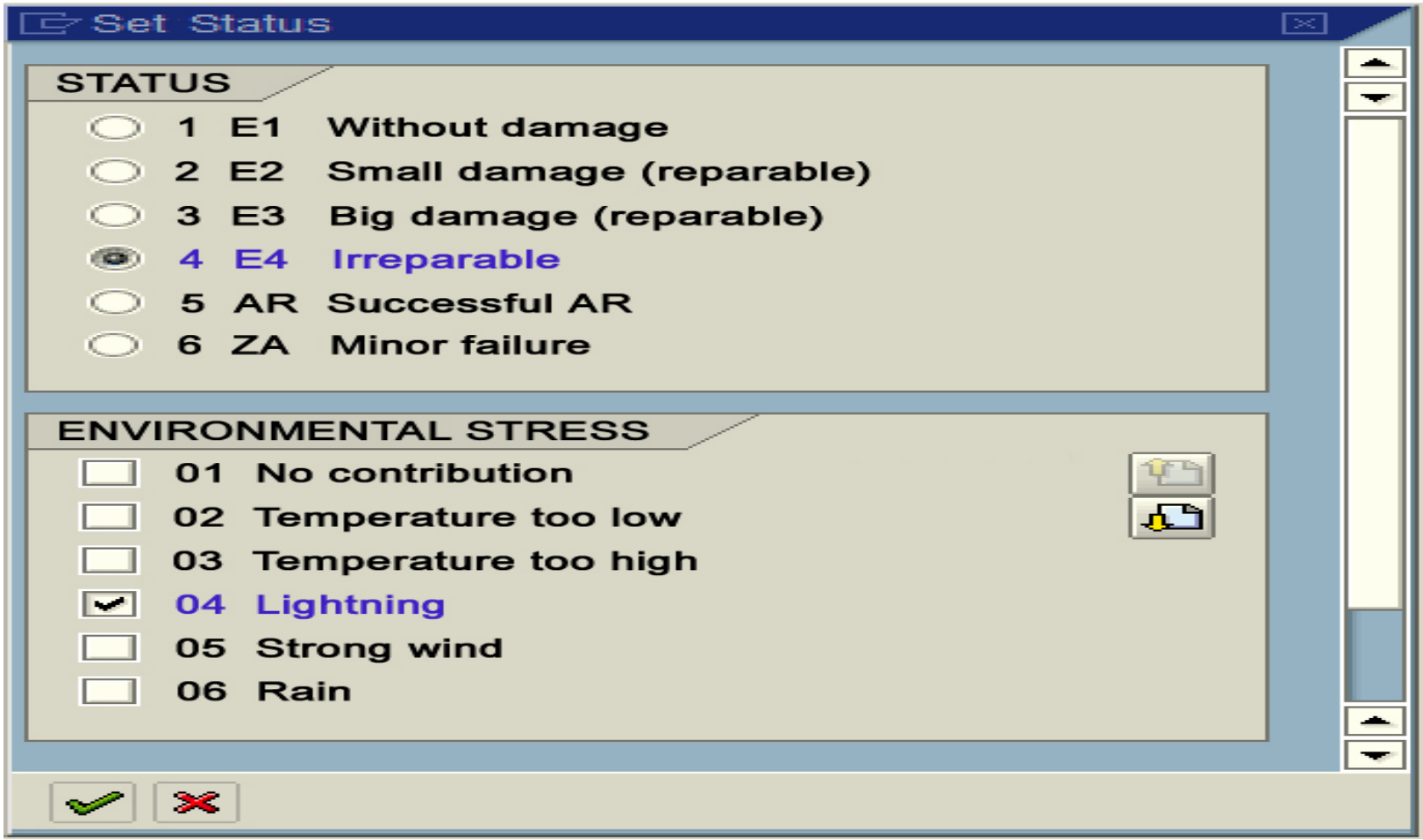


Regional center enters a record about basic information about the failure within one week

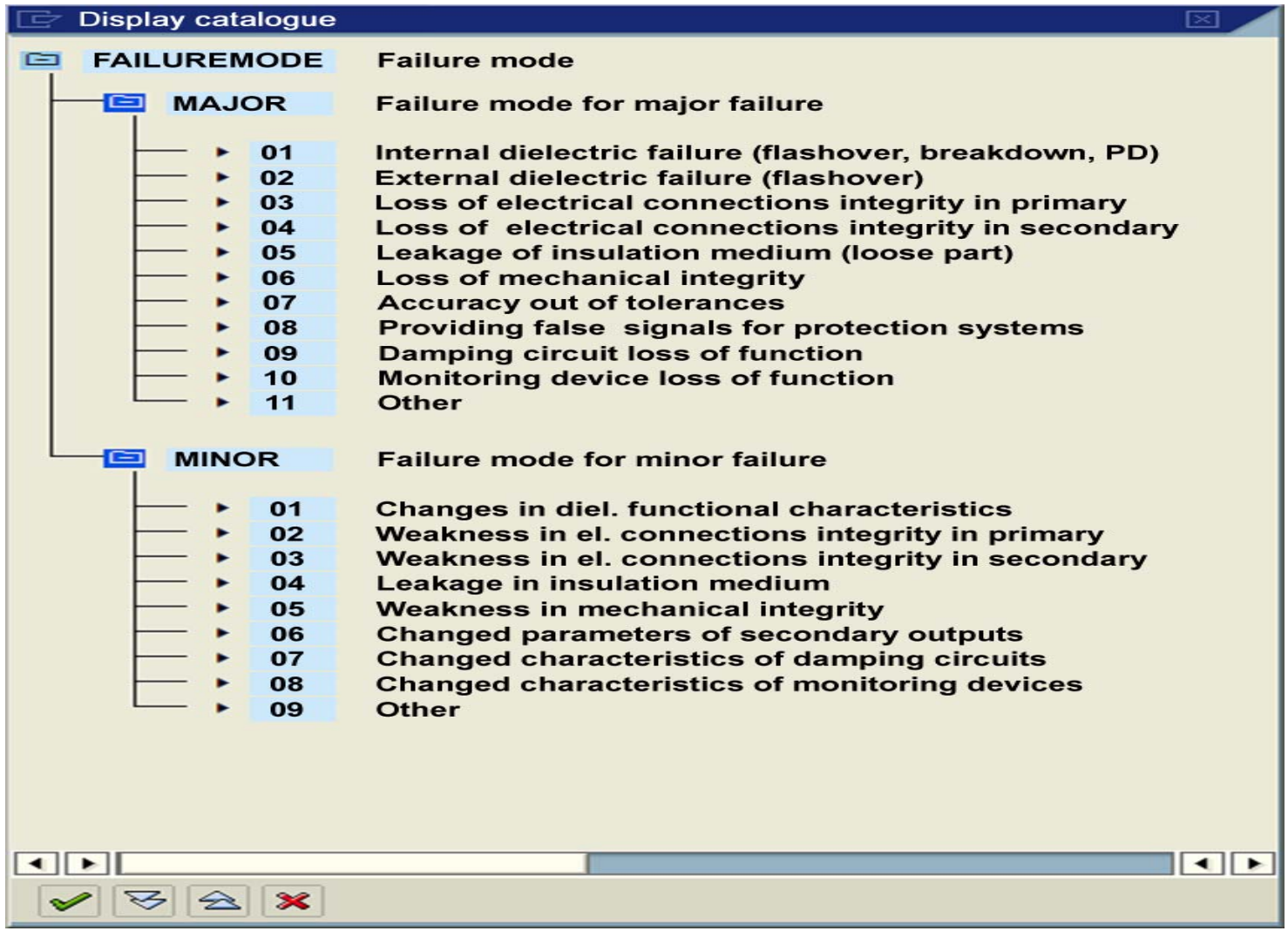
Description :

- **Status : type of the failure and environment contribution**
- **Failure mode**

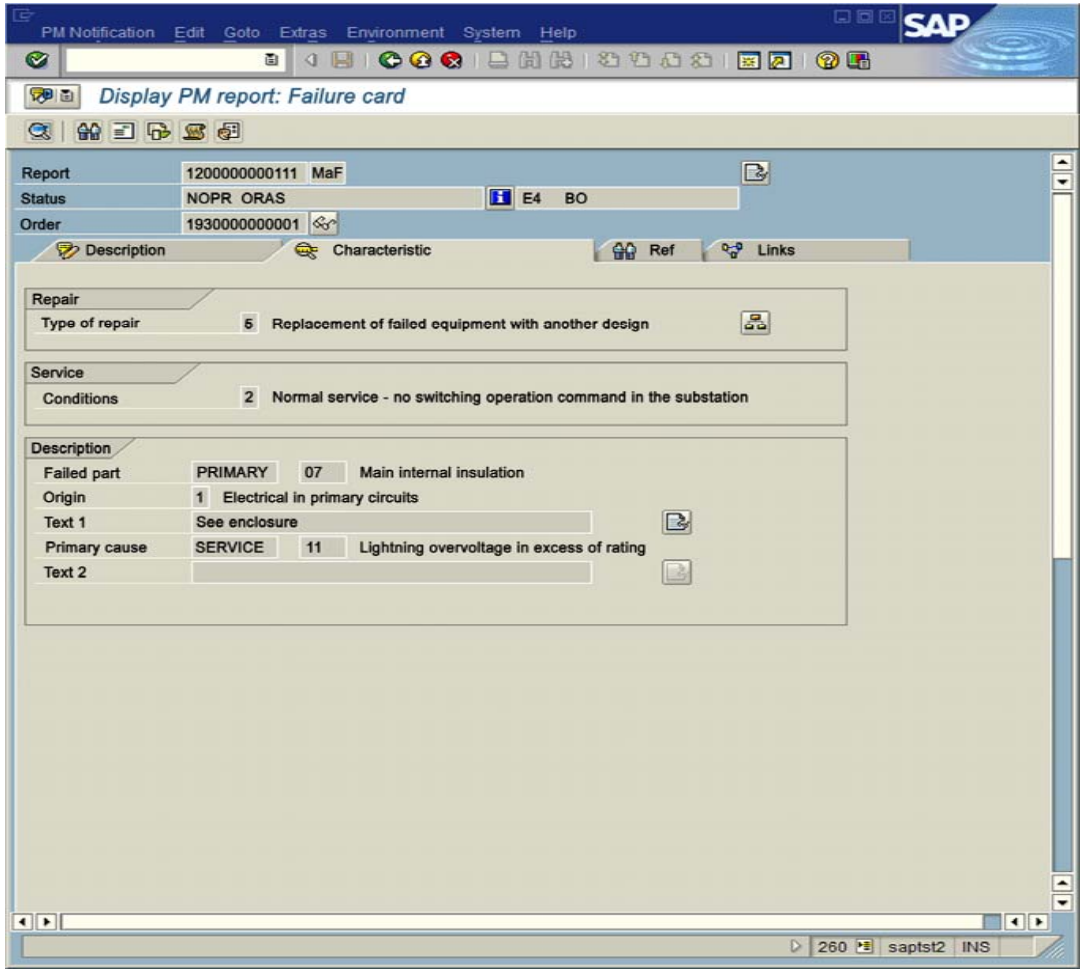
Example of unplanned events inventory – Type of the failure and environment contribution



Example of unplanned events inventory – Failure mode



Example of unplanned events inventory – Failure characteristics

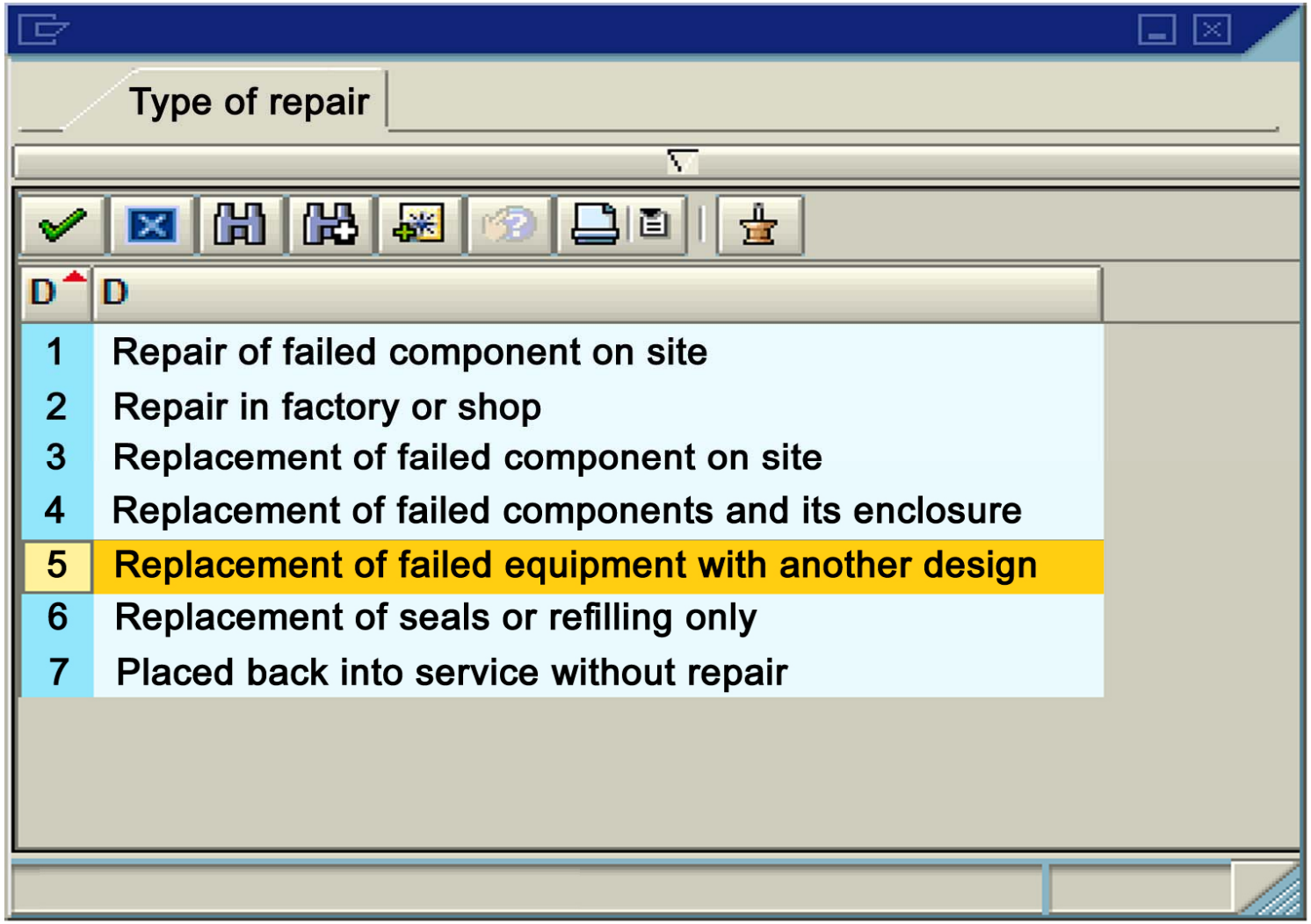


Regional center enters a record about the failure details when they are known

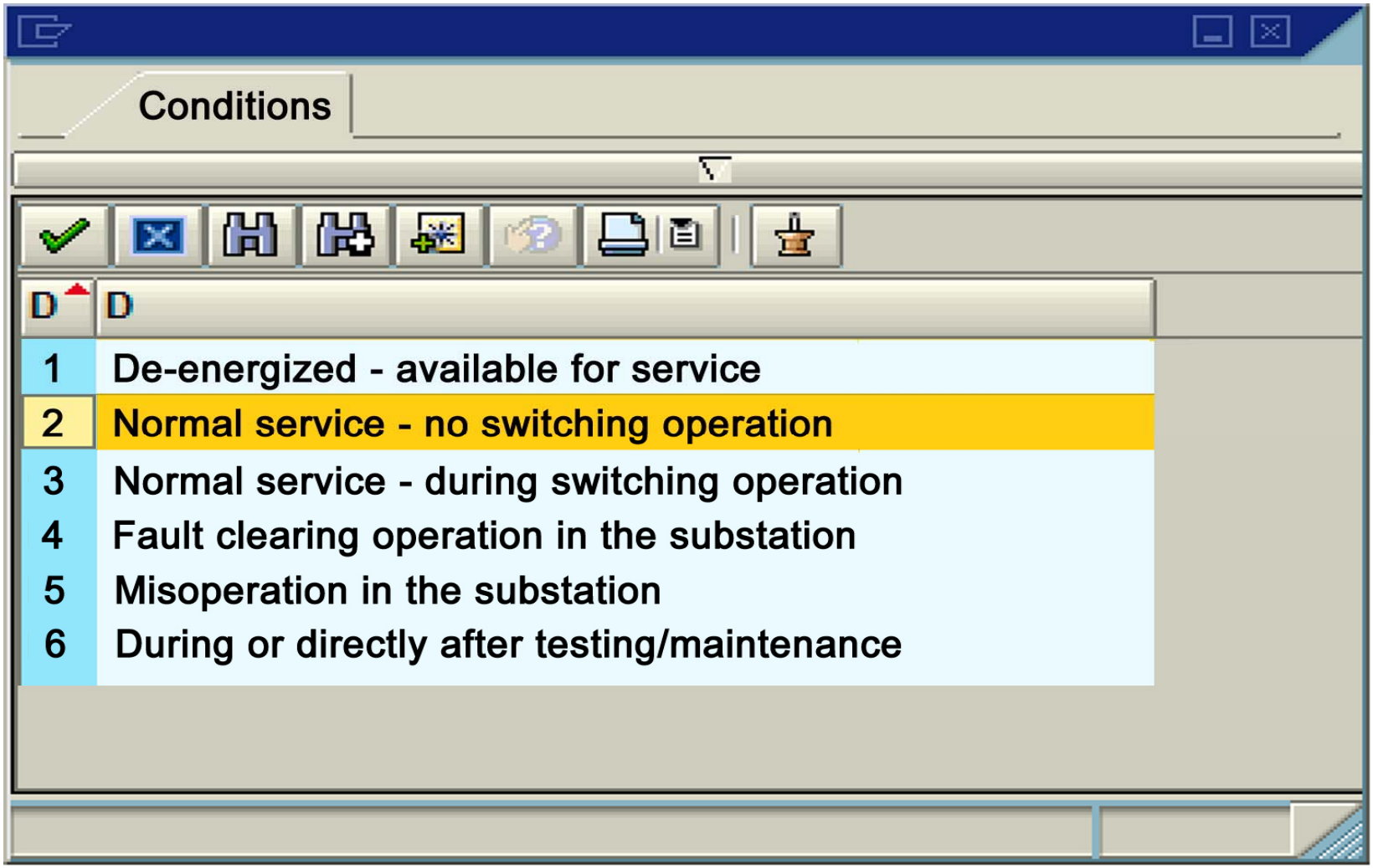
Failure characteristic:

- **Type of the repair**
- **Service condition**
- **Failed part**
- **Origin**
- **Primary cause**

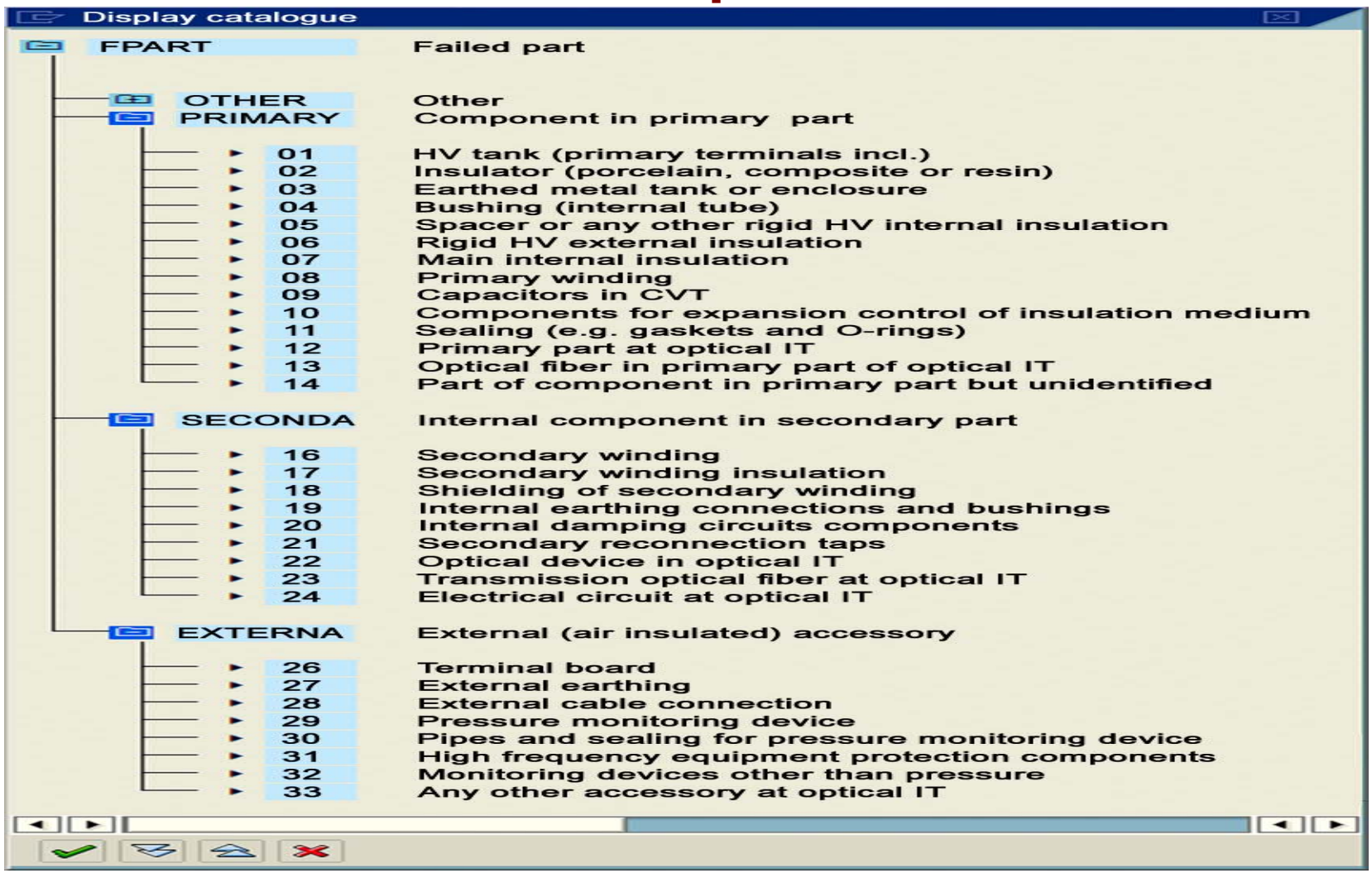
Example of unplanned events inventory – Type of the repair



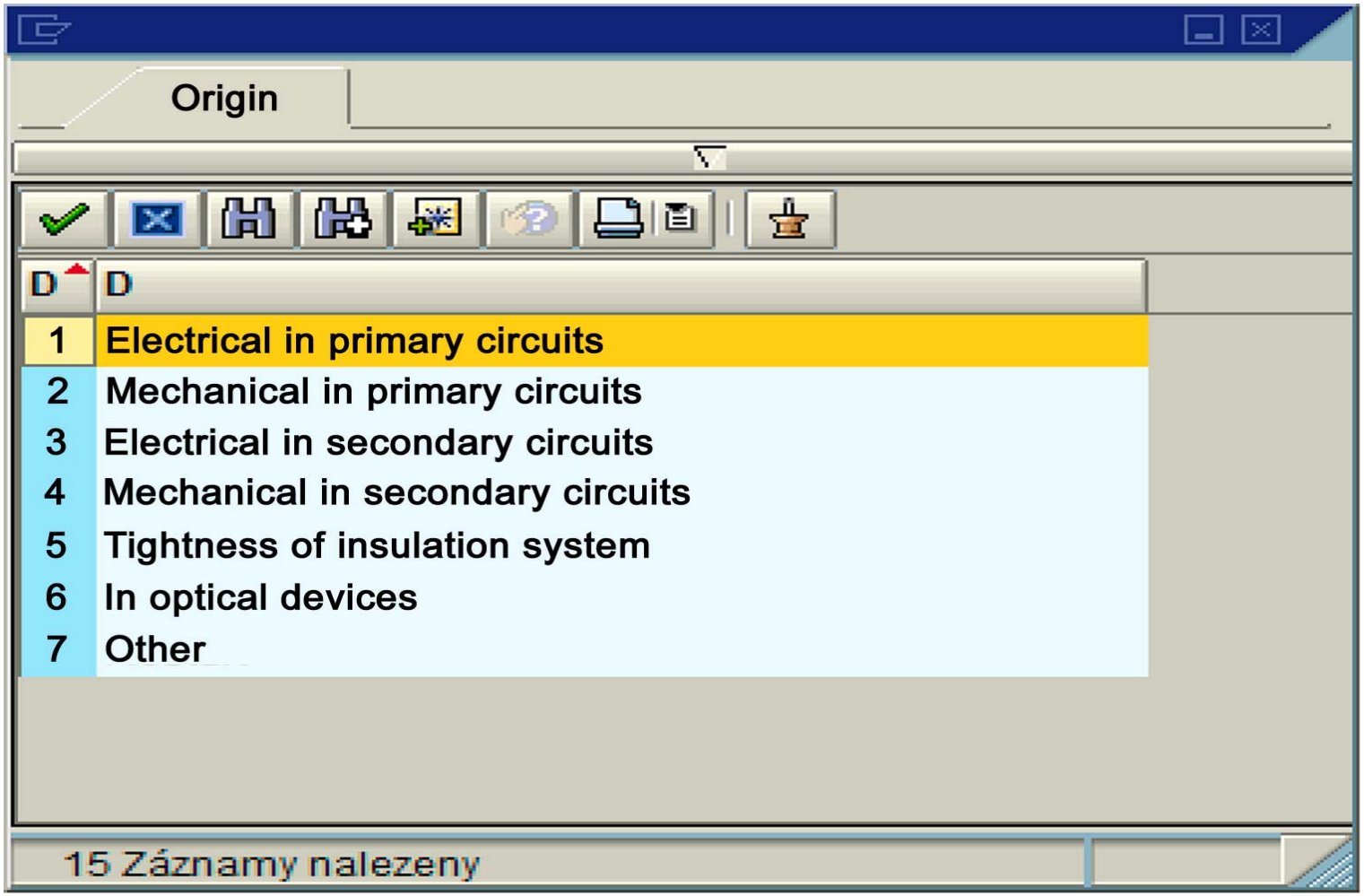
Example of unplanned events inventory – Service conditions



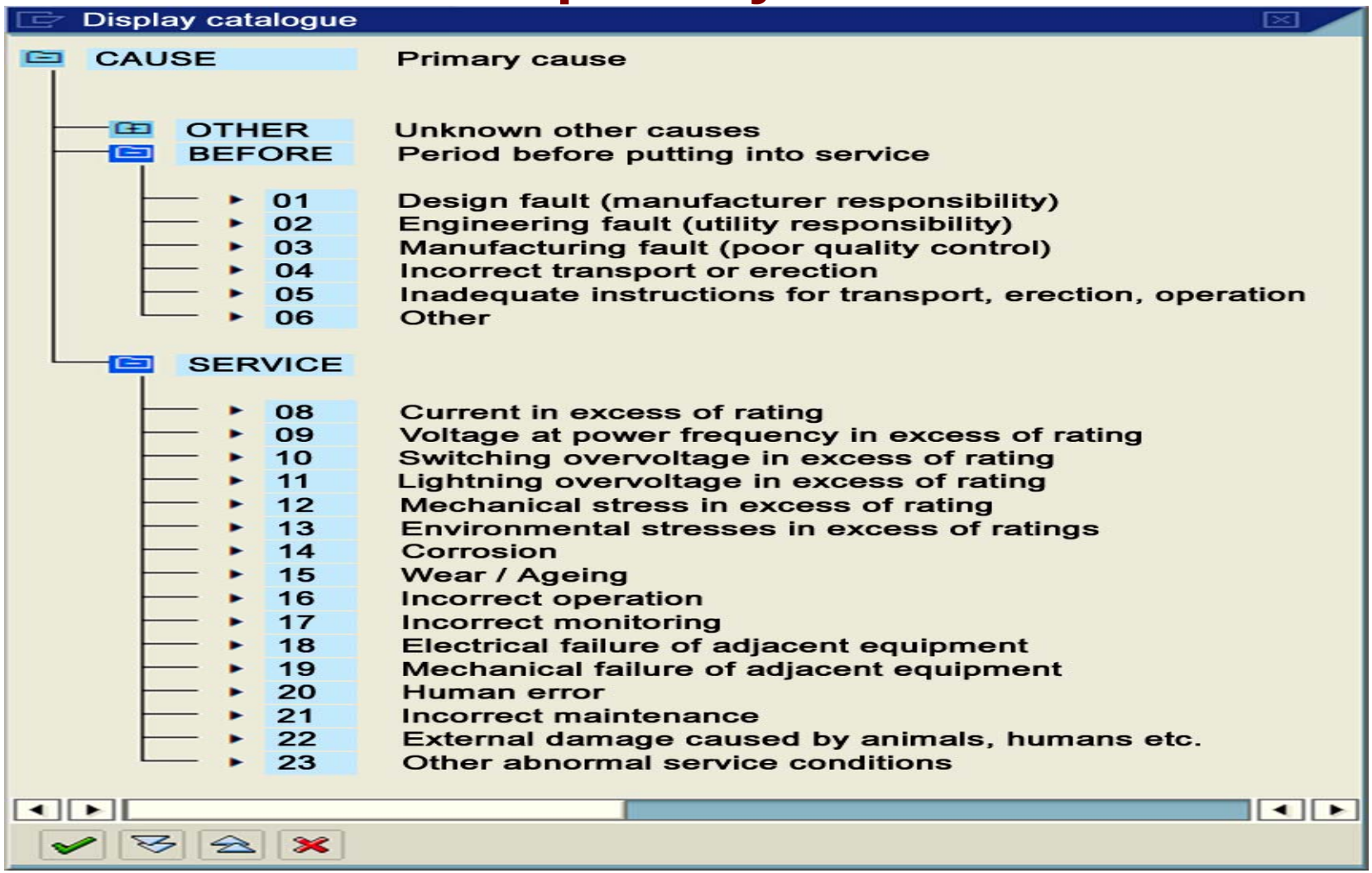
Example of unplanned events inventory – Failed part



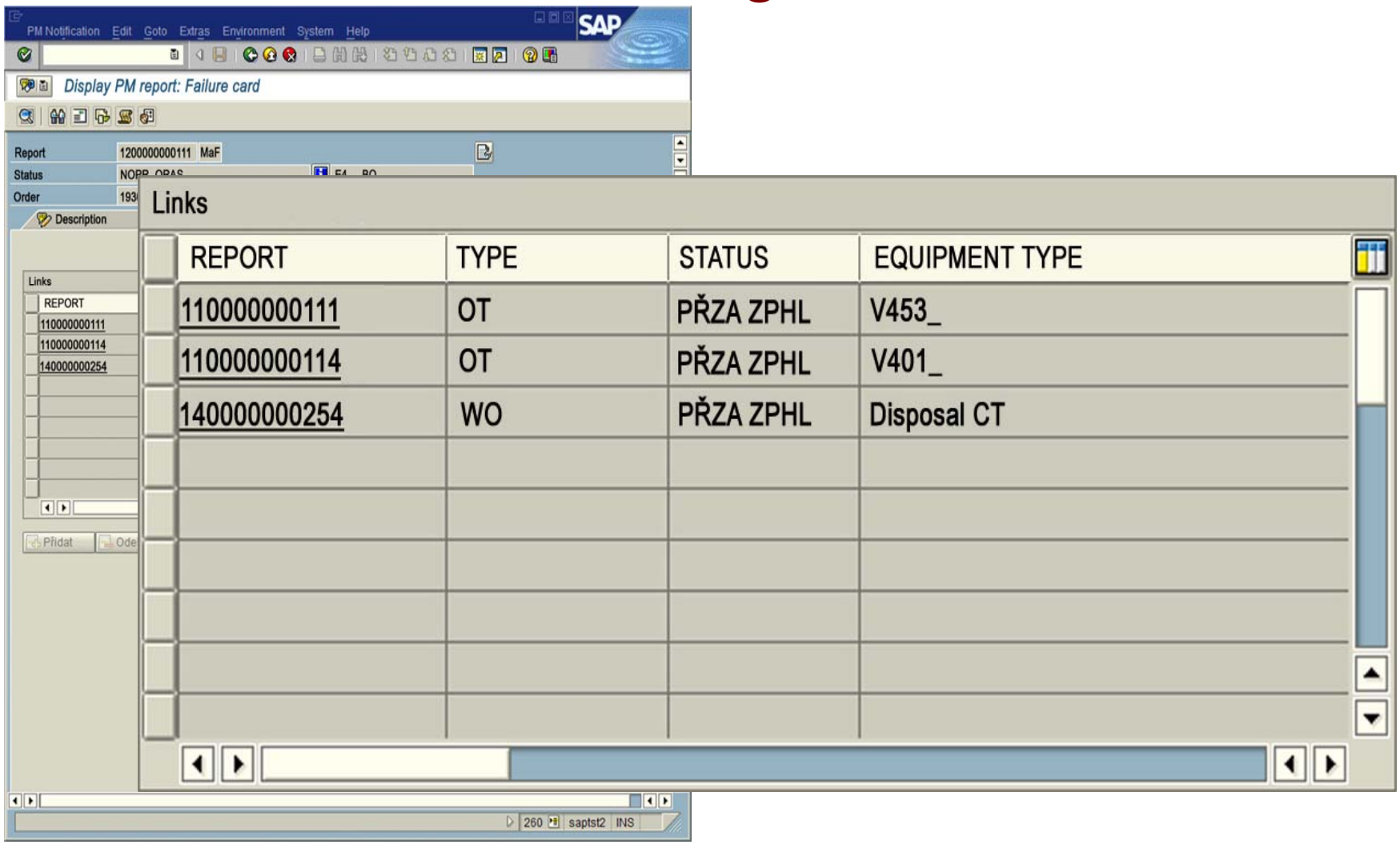
Example of unplanned events inventory – Failure origin



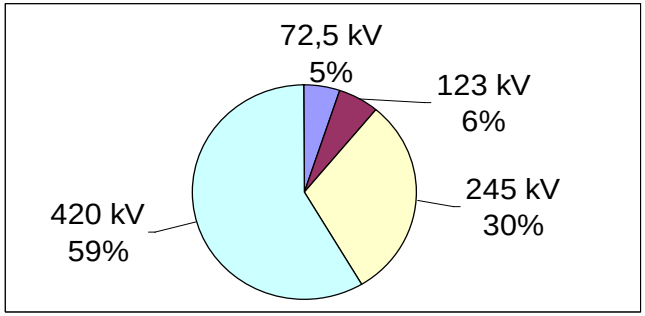
Example of unplanned events inventory – Failure primary cause

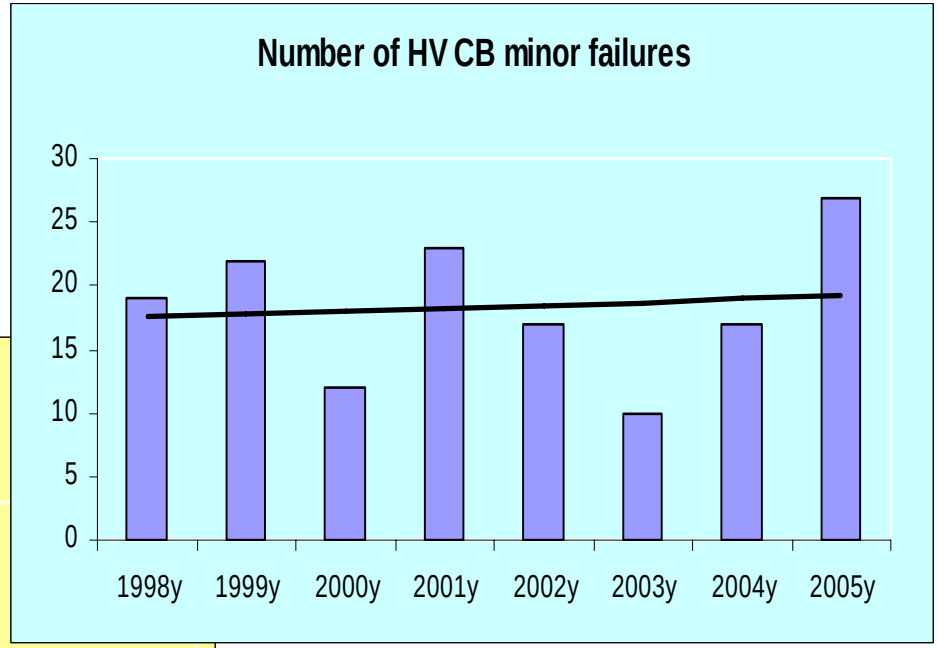


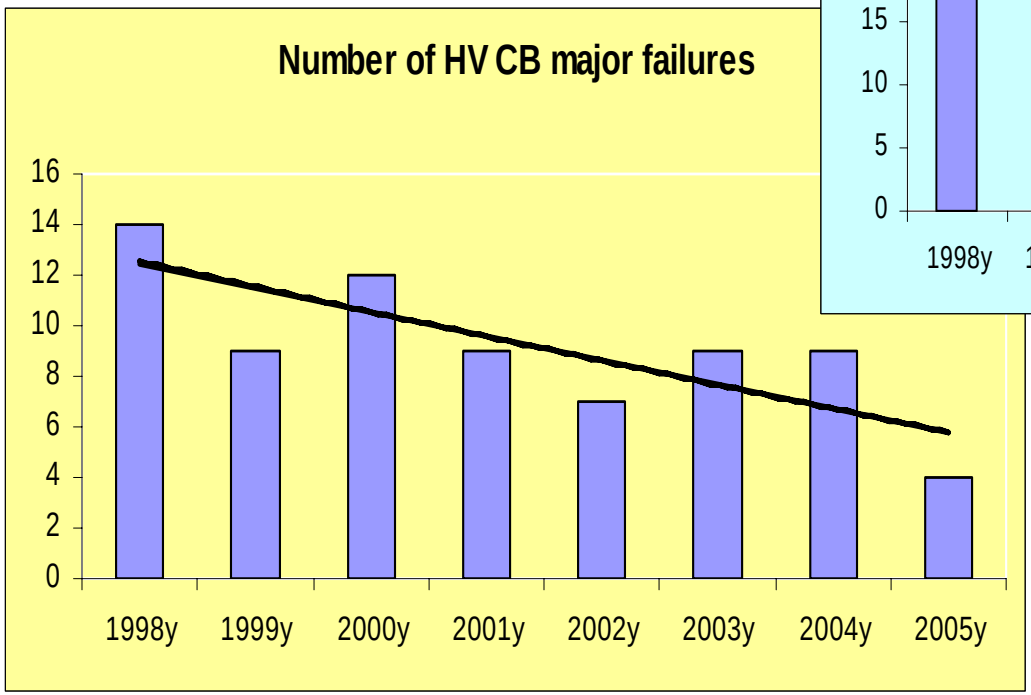
Example of unplanned events inventory – Failure links to outage and work order



Example of equipment analyses



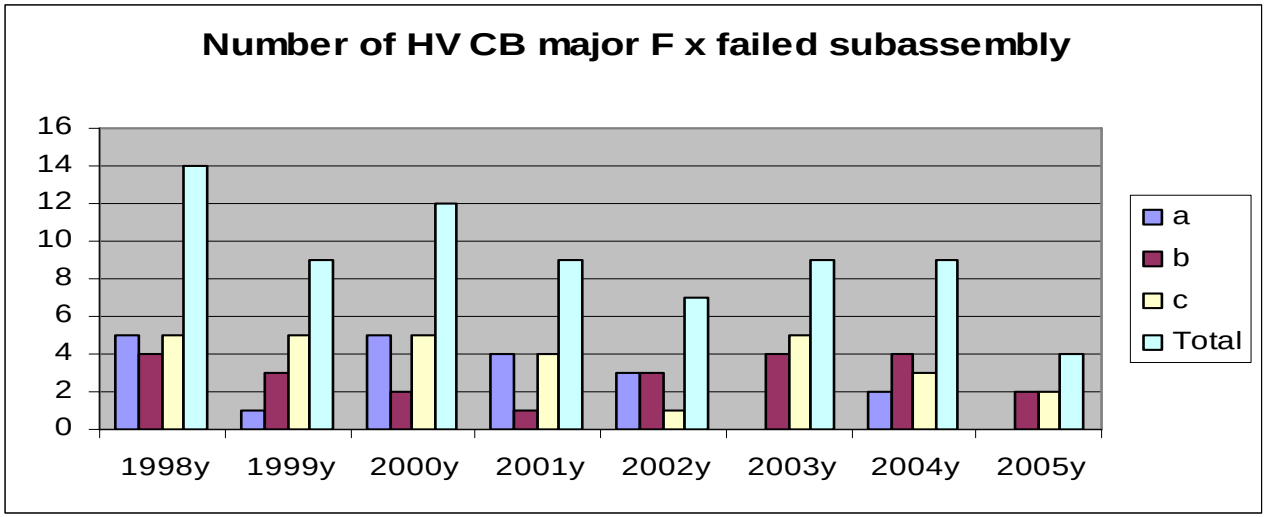


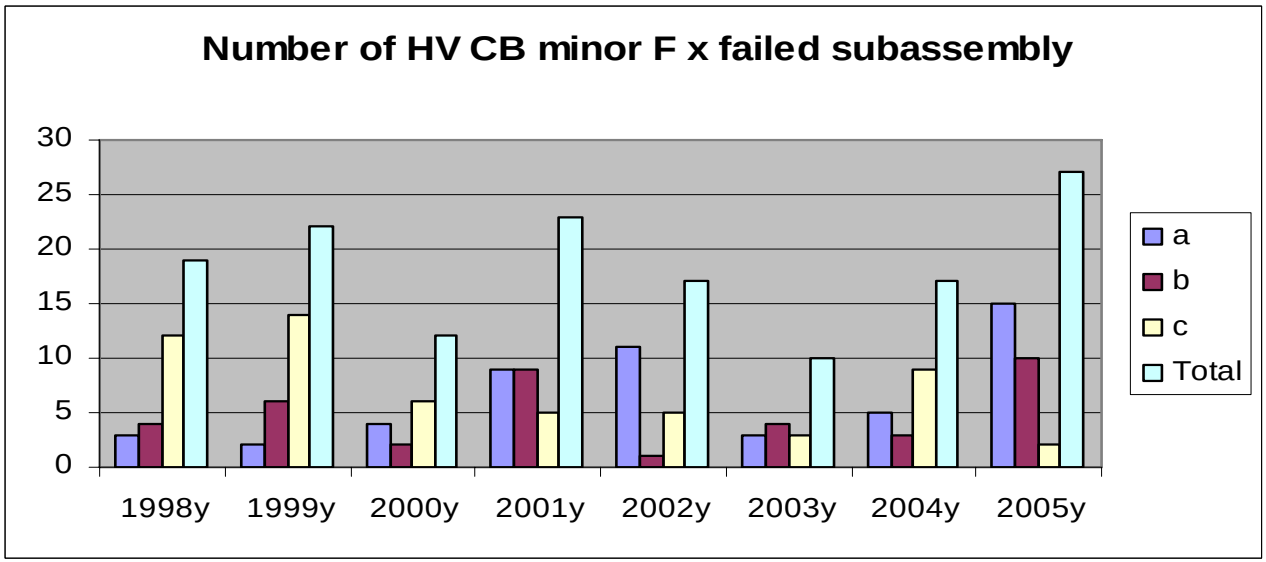


class 1 to 4 :

308 live tank CBs

Example of equipment analyses





a – Comp. in primary circuit

b – Comp. in control, auxiliary or monitor. circuit

c – Comp. in operating mechanism

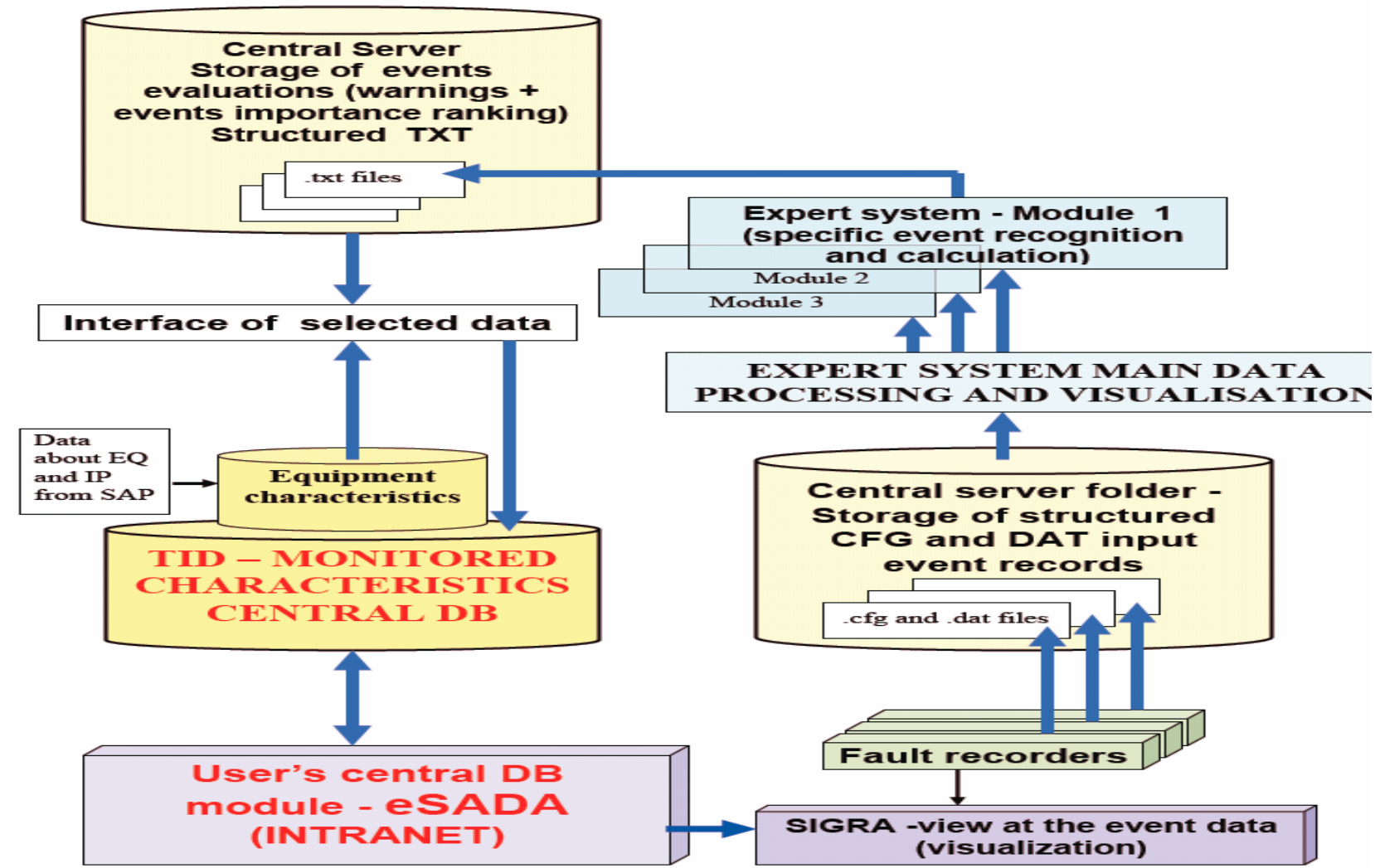
Conclusion

- Structured data collection allows analysis of equipment history
- Automation (match codes) can bring high added value to the data collection process by making it as simple as possible to the personnel
- Using the history of unplanned and planned events, the equipment condition can be evaluated to support AM decision making process
- The system can be used to justify decisions of equipment refurbishment, replace or changing maintenance intervals and tasks, allowing flexible long-term work planning

Future challenges

- Automatic collection of monitored data (SCADA, fault recorders, transformer monitors, etc.)
- Interconnection to expert systems
  - to evaluate automatically monitored data
  - to deliver recommendations about maintenance rules changes
- Interconnection to economical system to evaluate corporate risk of AM decisions

Future challenge – Example : Data from fault recorders



The whole system than will look like a nice, organized city