



**ORS**



# SAFETY CRITICAL ELEMENTS AND PERFORMANCE STANDARDS

**CAPABILITY STATEMENT**



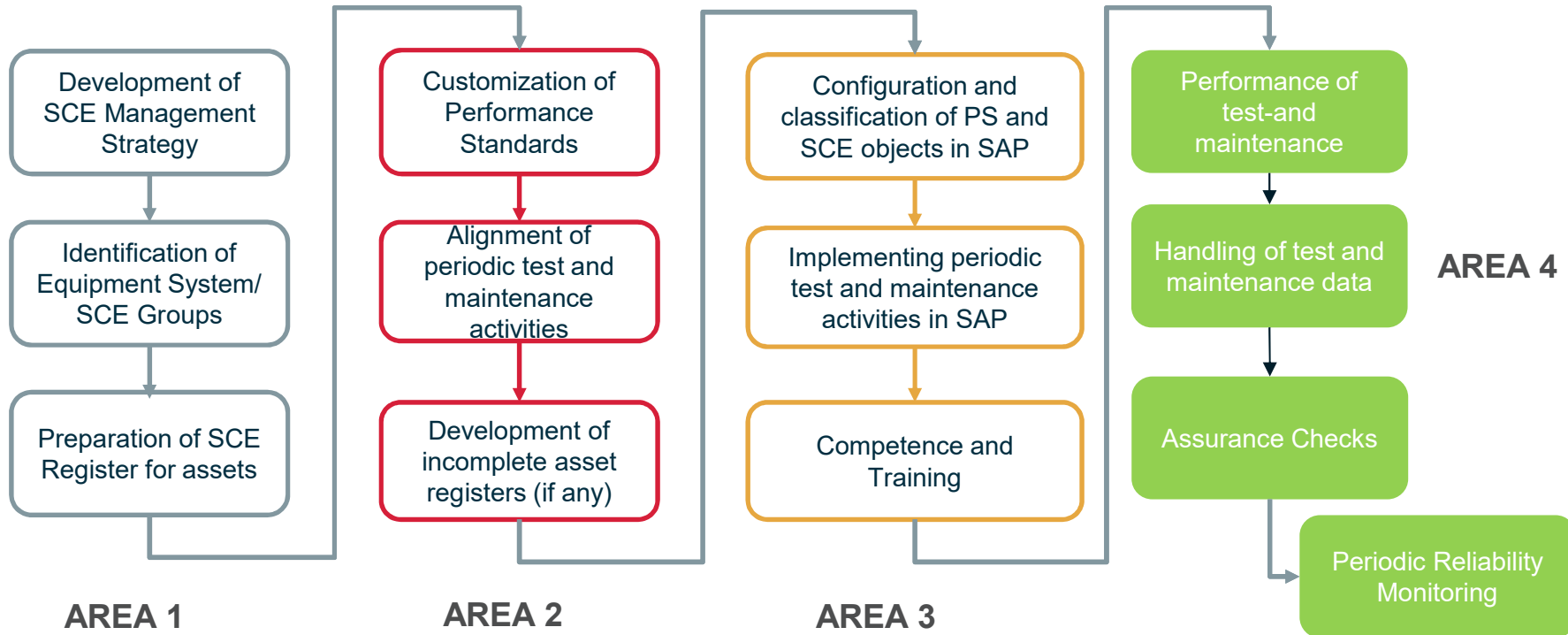
## SAFETY CRITICAL ELEMENTS AND PERFORMANCE STANDARDS

- Asset-owners generally provide a technical integrity framework which constitutes the basis for Asset Integrity Management;
- In addition to asset-owners/operators requirements Regulatory Bodies (such as HSE in UK, PSA in Norway etc.) have requirements for management of safety barriers and asset integrity;
- Safety Critical Elements (SCE) and Performance Standards (PS) are fundamental parts of Asset Integrity Management (AIM);
- Effective SCE Management requires specialist knowledge in the following areas:
  - Technical risk- and safety management
  - Asset data management

## INTEGRATED SCE MANAGEMENT SERVICES

- Keel Solution (**Keel**) and ORS Consulting (**ORS**) provide integrated services in the area of SCE Management.
- We offer our services as a complete package or in any of the following main areas:
  - **Area 1:** Development of Strategies and Guidelines for SCE Management Framework
  - **Area 2:** Development/Customization of SCE Registers and Performance Standards
  - **Area 3:** SAP Implementation and Configuration
  - **Area 4:** Start-up, Operations and Assurance activities
- Our integrated approach is presented in the next slide as **SCE Management Roadmap**

# HIGH-LEVEL ROADMAP FOR SCE MANAGEMENT



## WHAT IS A SAFETY CRITICAL ELEMENT?

- A SCE is classified as an equipment, structure or system whose failure could cause or contribute to a major accident, or whose purpose is to prevent or mitigate the effect of a major accident;
  - Examples include emergency shut down valves (ESDV), pressure safety valves (PSV) or similar.
- A systematic management of the identified SCEs is a continuous process, ensuring that the safety barriers are in place and effective, in alignment with the specific performance standards.

## DEVELOPMENT OF SCE REGISTERS

- During the design phase of the asset development projects, the asset owners classifies the components as safety-critical or production-critical. These components are SCE in the asset registry or master equipment list (MEL);
- The asset registry/MEL is implemented and classified in SAP. The components that are classified as SCE are governed strictly with regards to preventive and corrective maintenance activities.

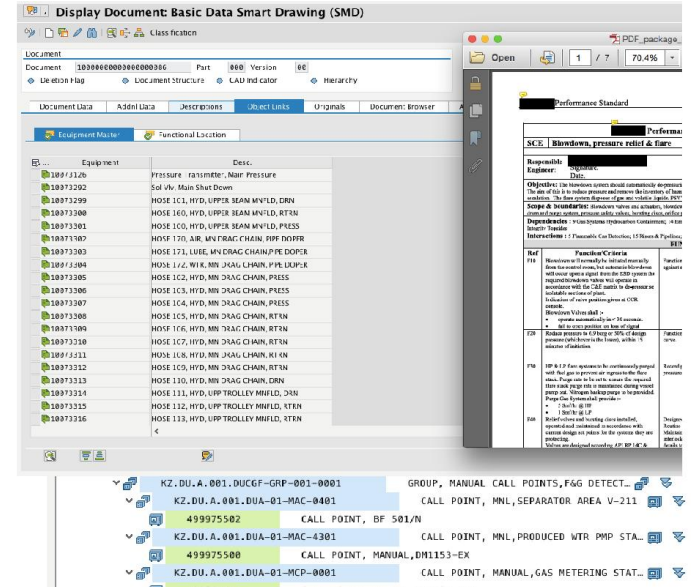
### Classification SCE Elements

The image shows two SAP screenshots. On the left is the 'Asset registry/MEL' table with columns for object category, class code, description, type, and object class. On the right is the 'Maintain Class Hierarchy' window showing a tree structure of classes. A red arrow points from the table to the hierarchy window.

OBJECT CATEGORY	SAP NO	SAP NO CLASS	SAP NO	SAP NO TYPE	OBJECT CLASS	OBJECT DESCRIPTION
ELECTRICAL	0001	0001	0001	0001	0001	0001
ELECTRICAL	0002	0002	0002	0002	0002	0002
ELECTRICAL	0003	0003	0003	0003	0003	0003
ELECTRICAL	0004	0004	0004	0004	0004	0004
ELECTRICAL	0005	0005	0005	0005	0005	0005
ELECTRICAL	0006	0006	0006	0006	0006	0006
ELECTRICAL	0007	0007	0007	0007	0007	0007
ELECTRICAL	0008	0008	0008	0008	0008	0008
ELECTRICAL	0009	0009	0009	0009	0009	0009
ELECTRICAL	0010	0010	0010	0010	0010	0010
ELECTRICAL	0011	0011	0011	0011	0011	0011
ELECTRICAL	0012	0012	0012	0012	0012	0012
ELECTRICAL	0013	0013	0013	0013	0013	0013
ELECTRICAL	0014	0014	0014	0014	0014	0014
ELECTRICAL	0015	0015	0015	0015	0015	0015
ELECTRICAL	0016	0016	0016	0016	0016	0016
ELECTRICAL	0017	0017	0017	0017	0017	0017
ELECTRICAL	0018	0018	0018	0018	0018	0018
ELECTRICAL	0019	0019	0019	0019	0019	0019
ELECTRICAL	0020	0020	0020	0020	0020	0020
ELECTRICAL	0021	0021	0021	0021	0021	0021
ELECTRICAL	0022	0022	0022	0022	0022	0022
ELECTRICAL	0023	0023	0023	0023	0023	0023
ELECTRICAL	0024	0024	0024	0024	0024	0024
ELECTRICAL	0025	0025	0025	0025	0025	0025
ELECTRICAL	0026	0026	0026	0026	0026	0026
ELECTRICAL	0027	0027	0027	0027	0027	0027
ELECTRICAL	0028	0028	0028	0028	0028	0028
ELECTRICAL	0029	0029	0029	0029	0029	0029
ELECTRICAL	0030	0030	0030	0030	0030	0030
ELECTRICAL	0031	0031	0031	0031	0031	0031
ELECTRICAL	0032	0032	0032	0032	0032	0032
ELECTRICAL	0033	0033	0033	0033	0033	0033
ELECTRICAL	0034	0034	0034	0034	0034	0034
ELECTRICAL	0035	0035	0035	0035	0035	0035
ELECTRICAL	0036	0036	0036	0036	0036	0036
ELECTRICAL	0037	0037	0037	0037	0037	0037
ELECTRICAL	0038	0038	0038	0038	0038	0038
ELECTRICAL	0039	0039	0039	0039	0039	0039
ELECTRICAL	0040	0040	0040	0040	0040	0040
ELECTRICAL	0041	0041	0041	0041	0041	0041
ELECTRICAL	0042	0042	0042	0042	0042	0042
ELECTRICAL	0043	0043	0043	0043	0043	0043
ELECTRICAL	0044	0044	0044	0044	0044	0044
ELECTRICAL	0045	0045	0045	0045	0045	0045
ELECTRICAL	0046	0046	0046	0046	0046	0046
ELECTRICAL	0047	0047	0047	0047	0047	0047
ELECTRICAL	0048	0048	0048	0048	0048	0048
ELECTRICAL	0049	0049	0049	0049	0049	0049
ELECTRICAL	0050	0050	0050	0050	0050	0050
ELECTRICAL	0051	0051	0051	0051	0051	0051
ELECTRICAL	0052	0052	0052	0052	0052	0052
ELECTRICAL	0053	0053	0053	0053	0053	0053
ELECTRICAL	0054	0054	0054	0054	0054	0054
ELECTRICAL	0055	0055	0055	0055	0055	0055
ELECTRICAL	0056	0056	0056	0056	0056	0056
ELECTRICAL	0057	0057	0057	0057	0057	0057
ELECTRICAL	0058	0058	0058	0058	0058	0058
ELECTRICAL	0059	0059	0059	0059	0059	0059
ELECTRICAL	0060	0060	0060	0060	0060	0060
ELECTRICAL	0061	0061	0061	0061	0061	0061
ELECTRICAL	0062	0062	0062	0062	0062	0062
ELECTRICAL	0063	0063	0063	0063	0063	0063
ELECTRICAL	0064	0064	0064	0064	0064	0064
ELECTRICAL	0065	0065	0065	0065	0065	0065
ELECTRICAL	0066	0066	0066	0066	0066	0066
ELECTRICAL	0067	0067	0067	0067	0067	0067
ELECTRICAL	0068	0068	0068	0068	0068	0068
ELECTRICAL	0069	0069	0069	0069	0069	0069
ELECTRICAL	0070	0070	0070	0070	0070	0070
ELECTRICAL	0071	0071	0071	0071	0071	0071
ELECTRICAL	0072	0072	0072	0072	0072	0072
ELECTRICAL	0073	0073	0073	0073	0073	0073
ELECTRICAL	0074	0074	0074	0074	0074	0074
ELECTRICAL	0075	0075	0075	0075	0075	0075
ELECTRICAL	0076	0076	0076	0076	0076	0076
ELECTRICAL	0077	0077	0077	0077	0077	0077
ELECTRICAL	0078	0078	0078	0078	0078	0078
ELECTRICAL	0079	0079	0079	0079	0079	0079
ELECTRICAL	0080	0080	0080	0080	0080	0080
ELECTRICAL	0081	0081	0081	0081	0081	0081
ELECTRICAL	0082	0082	0082	0082	0082	0082
ELECTRICAL	0083	0083	0083	0083	0083	0083
ELECTRICAL	0084	0084	0084	0084	0084	0084
ELECTRICAL	0085	0085	0085	0085	0085	0085
ELECTRICAL	0086	0086	0086	0086	0086	0086
ELECTRICAL	0087	0087	0087	0087	0087	0087
ELECTRICAL	0088	0088	0088	0088	0088	0088
ELECTRICAL	0089	0089	0089	0089	0089	0089
ELECTRICAL	0090	0090	0090	0090	0090	0090
ELECTRICAL	0091	0091	0091	0091	0091	0091
ELECTRICAL	0092	0092	0092	0092	0092	0092
ELECTRICAL	0093	0093	0093	0093	0093	0093
ELECTRICAL	0094	0094	0094	0094	0094	0094
ELECTRICAL	0095	0095	0095	0095	0095	0095
ELECTRICAL	0096	0096	0096	0096	0096	0096
ELECTRICAL	0097	0097	0097	0097	0097	0097
ELECTRICAL	0098	0098	0098	0098	0098	0098
ELECTRICAL	0099	0099	0099	0099	0099	0099
ELECTRICAL	0100	0100	0100	0100	0100	0100

# POTENTIAL AREAS OF CONCERN WHEN DEVELOPING THE SCE REGISTERS:

- Incomplete asset registers or MEL as a basis (*critical SCEs missing from the list*);
- The philosophy and methodology behind the classification of safety critical-and production-critical element are not made sufficiently clear (*with incorrect classification as a result*);
- Highly conservative SCE classification (*resulting in too many SCEs – a significant cause of distraction*).



# HOW TO DEAL WITH INCOMPLETE ASSET REGISTERS?

- Due to increased industry regulations and documentation requirements, maintaining large industrial installation has become a challenge;
- Experience show that asset registers may be incomplete, missing critical components, potentially forming a part of a safety barrier;
- In order to complete the asset registers;
- We conduct on-site data collection on new- and existing assets;
- We use an advanced cloud-based multiuser asset data modeling tool (**KeelBuilder**) to enrich, structure and complete the asset registers, when requested by our Clients.

The screenshot displays a software interface with several components:

- File Explorer:** Shows a tree view of files under 'Plant: DUNGA FIELD'. Files include 'KZ-DUWGA-PRO-LAY-050-00001-01: PST-01\_IN...', 'KZ-DUWGA-PRO-LAY-050-00001-02: PST-01\_IN...', 'KZ-DUWGA-PRO-LAY-050-00001-03: PST-01\_IN...', 'KZ-DUWGA-STR-LAY-033-00101: WELL CLEAN...', 'KZ-DUWGA-TNII-DWG-033-00101: WELL CLEAN...', 'KZ-DUCGF-PIP-LAY-081-00204: PIPING GENER...', 'KZ-DUCGF-PIP-LAY-081-00205: PIPING GENER...', 'KZ-DUPFG-PIP-ISO-001-00001: GTU FIRE EXTI...', and 'KZ-DUPFG-PIP-ISO-001-00011: GTU FIRE EXTI...'.
- File Viewer:** Displays a technical drawing titled '250-KZ-DUCGF-PIP-LAY-081-00204\_A\_003.PDF'. The drawing shows a circular vessel with piping and a handwritten note '250mm diameter'.
- Material Specification Table:** Titled 'Standard Material Specifications' and 'ASTM Specifications'. It lists various parts and their corresponding material grades.

Part No.	Part Name	Carbon Steel		Alloy Steel		ASTM Specifications			Stainless
		A105	A350	A191	A350	A105	A350	A191	
1	Body	A105	A350	F5	F11	F22	F304	F304L	F316
2	Stem	A105	A350	F5	F11	F22	F304	F304L	F316
3	Stem	A105	A350	F5	F11	F22	F304	F304L	F316
4	Gland	A276-410		A276-304	A276-304L	A276			
5	Seal Ring	A276-410-316		304 + 316	304 + 316L	316L			
6	Bottom Bolt (S)	A193-B7	A320-L1	A193-B7E	A193-B7				
7	Gasket	304-316		304-316					
8	Gland	A276-410		A276-304					
9	Flange	A105		F11					
10	Flange Flange	A105		F11					
11	Seal Bolt	A193-B7	A320-L1	A193-B7E					
12	Gland Bolt Nut	A193-B7	A320-L1	A193-B7E					
13	Gland Bolt Nut	A193-B7	A320-L1	A193-B7E					
14	Stem	A276-410		A276-304					
15	Stem Washer	A276-410		A276-304					



## WHAT IS PERFORMANCE STANDARD?

- A performance standard is typically defined as a set of requirements that constitute the basis for assurance tasks for safety critical elements during design- and operations;
- This performance is required in order to manage the major accident hazards;
- Asset owners may have a set of generic performance standards available;
- The generic performance standards reflect the applicable standards and Corporate (Company) requirements, but not necessarily the local regulations or other operational considerations in different business units.

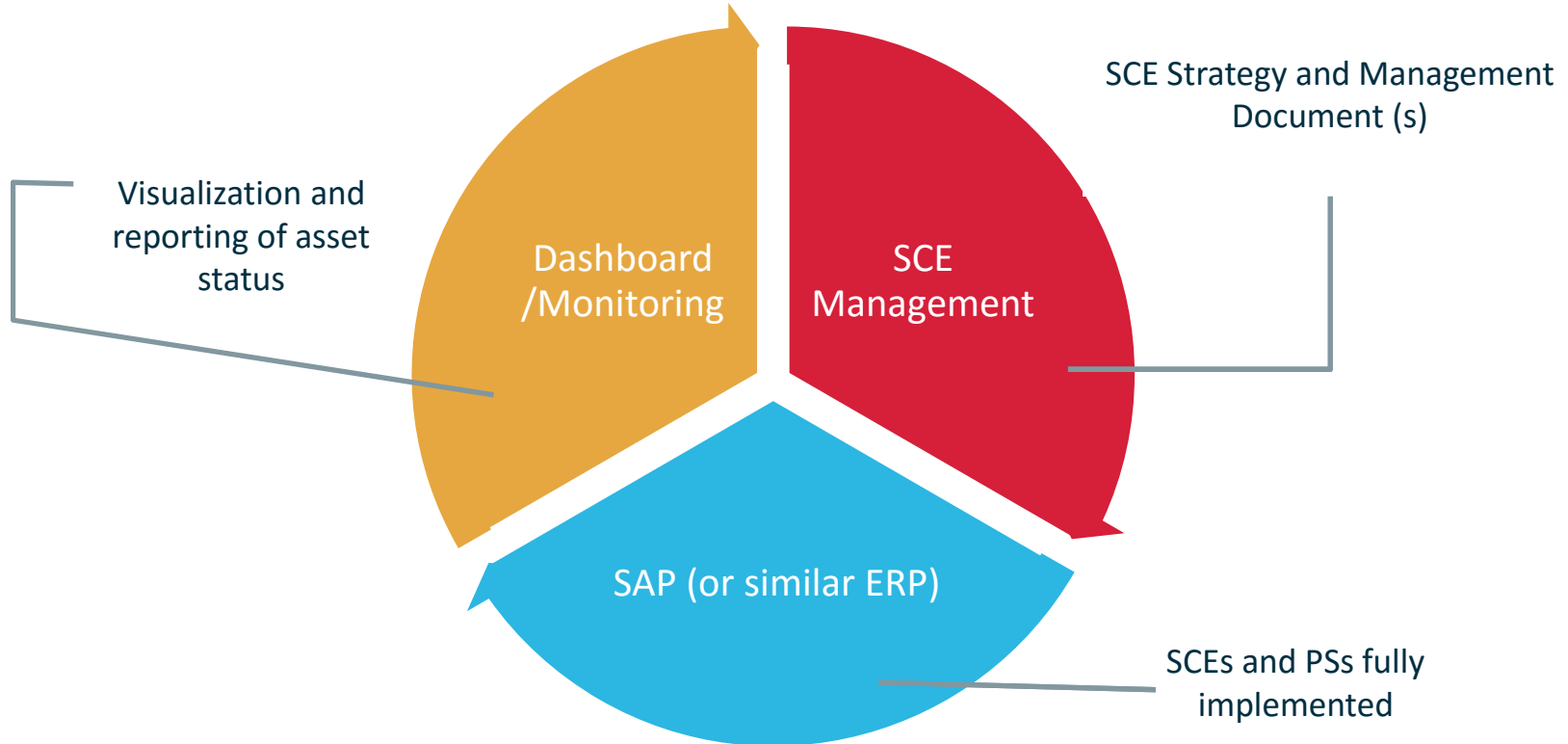
## WHAT DOES A PERFORMANCE STANDARD CONTAIN?

- A performance standard normally contains the following information about a safety critical element:
  - Functional requirements;
  - Availability and reliability requirements;
  - Required utilities;
  - Roles and interfaces;
  - Survivability requirements.
- Assigning correct and auditable performance requirements is of paramount importance in order to carry out assurance and verification activities during Operational phase;
- Assurance and verification activities ensures that SCE meet their PS

## PERFORMANCE STANDARDS: GENERIC OR ASSET-SPECIFIC?

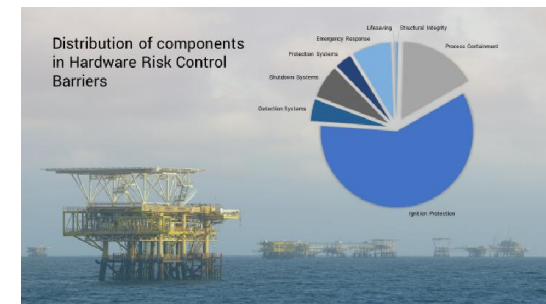
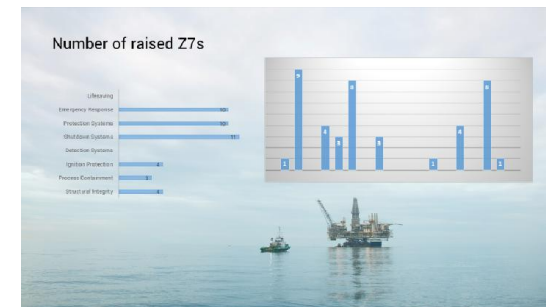
- Project- or asset-specific performance standards are developed during the design phase, and are based on the generic performance standards;
- The asset-specific performance standards reflect the design of installations, local rules and regulations as well multiple other considerations from asset operations standpoint;
- Possible areas of concern:
  - Performance standards from the design phase are too generic (*limited/no use in connection with test and maintenance*);
  - Performance standards are not validated (*containing wrong, misleading or contradictory information*);
  - Performance standards developed without taking the Operations input into consideration (*does not fit to the Organization or the existing test and maintenance system*).

## WHAT TOOLS ARE REQUIRED FOR SCE MANAGEMENT?



## VISUALIZATION OF FACILITIES STATUS

- By having a configured SAP system with high quality data the Asset Organisation gets a real snapshot of the condition of their assets;
- Typically, dashboards and other visual indicators are created and made available both through company intranet and at various office/plant locations;
- External tools & software are also available to provide visualization of SCE / facilities status;



## SUMMARY OF OUR SCE MANAGEMENT SERVICES:

- Identification and assessment of major accident hazards;
- Development of SCE Management strategies and guidance documents;
- Classification- and Development of SCE Registers based on Master Equipment List / Asset Register;
- Further development of incomplete asset registers
- Development of generic and/or asset-specific performance standards;
- Independent 3<sup>rd</sup> party validation of performance standards;
- Full implementation of SCE Register and performance standards in SAP;
- Customization of maintenance- and test procedures
- Assurance tasks for SCEs (during Operational phase);
- Competence and training modules for asset organization.

## SOME OF OUR CLIENTS





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