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The CEN ORCHID Roadmap Standardising Information Across the Plant Engineering Supply Chain - Part 2: Implementation Guide

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Contents

Foreword

The production of this CEN Workshop Agreement CWA 16180-2. CEN ORCHID Roadmap: Implementation Guide was formally accepted at the CEN ORCHID Workshop's kick-off meeting on 7th May 2009 in Brussels.

The document has been developed through the collaboration of the key European groups active in plant and product lifecycle information management and standardisation in the oil & gas, process and power industry plant engineering supply chain. These groups are represented as partners in the CEN ORCHID WS project.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This CWA Part 2 CEN ORCHID Roadmap: Implementation Guide has been available on the CEN website for public comments during the period 19 April 2010 to 19 June 2010.

At the ORCHID open conference held on 19-20 May 2010 in Monheim, Germany this CWA Part 2: Implementation Guide was presented to the conference participants and was accepted. From various members of the CEN ORCHID WS and from some outside companies comments have been received that have been addressed.

This CWA Part 2 CEN ORCHID Roadmap: Implementation Guide has now been agreed by all 39 members of the CEN ORCHID WS project. These are:

Bayer Technology Services
SOASYS Limited
CC3P - Catalogues and Classifications in Public and Private Procurement
University of Groningen
CURE Maintenance Consultants
Pragmetica Knowledge Clout
Stichting ETIM Nederland
eCl@ss e.V.
University of Applied Science Aachen
Corena Deutschland GmbH
BGS Beratungsgesellschaft Software systemplanung AB
LSC Group
BGS Beratungsgesellschaft Software systemplanung AB
Royal DSM, CSHE&M, GMCC Process Control
Jacobs Engineering Group Inc.
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Indi Consulting Limited
PLM Consultancy GmbH
Siemens (ICAAMC)
Fluor BV
VTT Technical Research Centre of Finland
VCZ – Ver.d.deutschen Zentralheiz.wirt.e.V.
Paradine GmbH
Fluor BV
BGS Beratungsgesellschaft Software systemplanung AB
Endress+Hauser
PCA
Corena Deutschland GmbH
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Croon Elektrotechniek BV
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WCS Cataloguing Solutions
FernUniversität in Hagen
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Comments or suggestions from the users of the CEN Workshop Agreement are welcome and should be addressed to the CEN-CENELEC Management Centre.

Introduction

The European process industry needs standardised lifecycle information to more efficiently design, build, operate and maintain its plants. Resolving information “interoperability” issues across the supply chain is vital to reduce cost, improve productivity and enhance plant performance.

While companies have long acknowledged this business need, only limited progress has been made towards resolving information interoperability issues. The key reasons for this limited progress are:

- The complexity and volume of data and information in the process industry supply chain. A high level of precision is required for the data and information because of safety and construction implications.
- The large number of players and fragmentation in the supply chain – owner operators, EPCs, vendors and equipment manufacturers. Many of these companies are also in direct competition, and are therefore reluctant to share more than is absolutely necessary.
- A huge multiplicity of naming conventions and standards. The CWA Part 3. CEN ORCHID Roadmap: Standards Landscape has identified 35 information standards used in the process industry. This excludes the many individual company and proprietary standards.
- Plants and facilities still tend to be one-offs, with limited replication.

Figure 1 shows the complexity and large number of players and data/information in the process industry supply chain (as seen from a plant owner perspective).

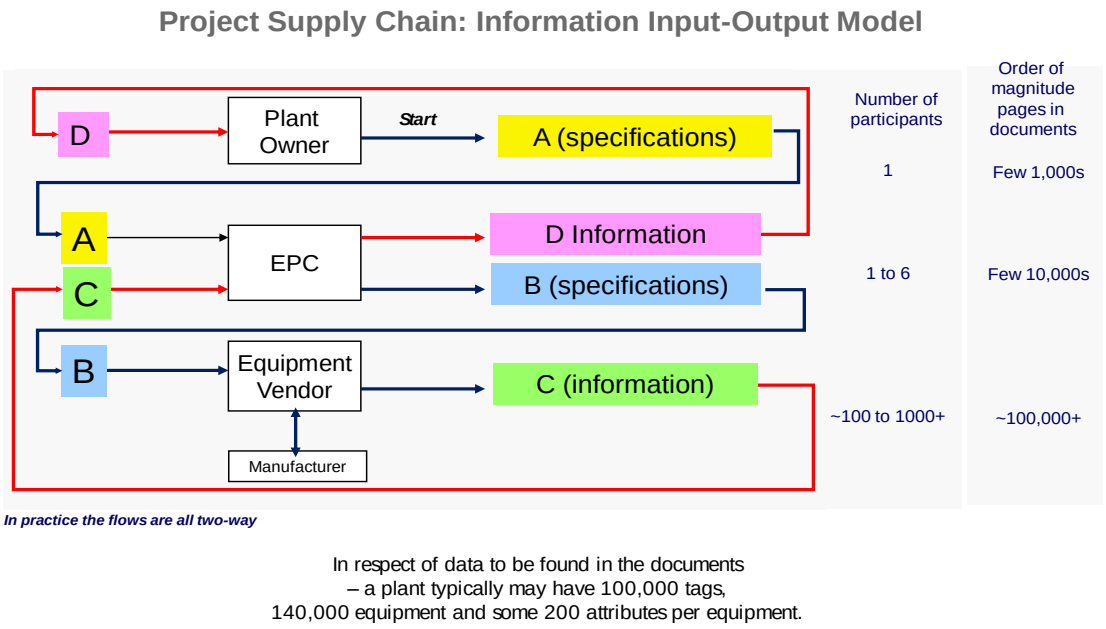

Figure 1 - Complexity in the Process Industry Supply Chain

Typically, each participant in the supply chain has developed its own standards, or used different industry standards to develop and deliver information. The challenge for the owner operator and intermediaries in the supply chain is how to integrate all this information consistently and with little or preferably no need for individuals to interpret and make connections. This issue of harmonising different standards for information is illustrated in **Figure 2**.

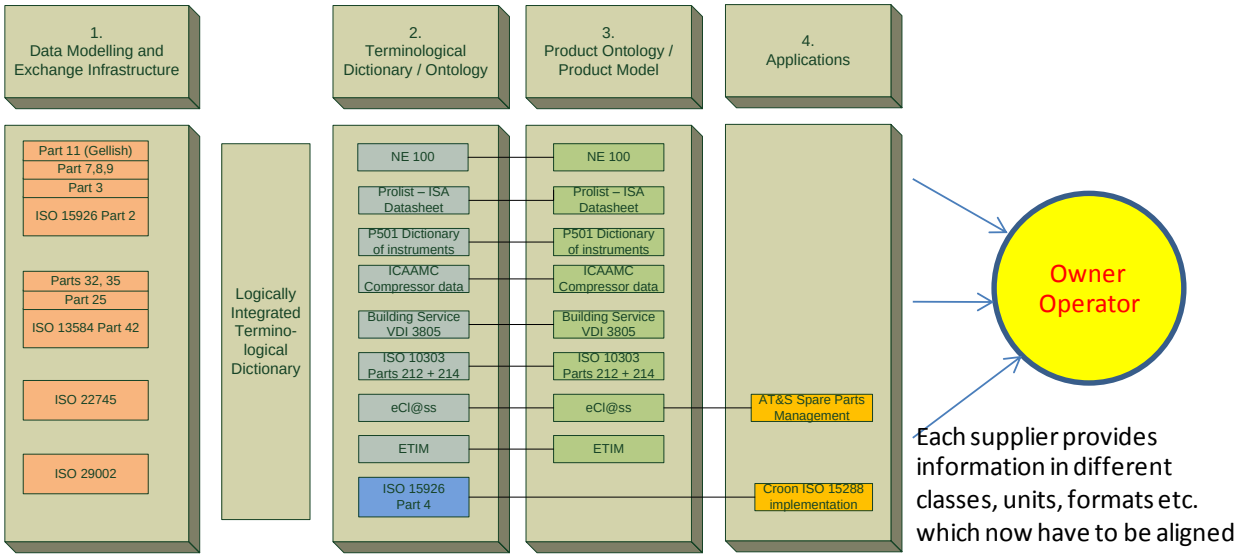

Figure 2 - Complexity of harmonising information delivered under multiple overlapping standards

The ORCHID Group (Orchestrating Industrial Data), which consists of companies across the process industry supply chain, has developed a Roadmap on the Standardisation and Sharing of Plant Lifecycle Information to help overcome these issues.

This accompanying guide document focuses on how European companies across the supply chain can simply and effectively implement the Roadmap to achieve competitive advantage.

1 Scope

1.1 General

This document is part of a family of standards consisting of

- CWA 16180-1. CEN ORCHID Roadmap: Direction and Framework
- CWA 16180-2. CEN ORCHID Roadmap: Implementation Guide (this document)
- CWA 16180-3. CEN ORCHID Roadmap: Standards Landscape

1.2 Scope of the whole family of standards

The scope of the CEN OPRCHID WS project is defined by:

- **Stakeholders**
- The process industry supply chain i.e.: plant owners, EPC contractors, equipment vendors, software vendors, standardisation consortia, trade associations
- Authorities, regulatory bodies

- **Standards**
- Standards that are relevant for the implementation of the Roadmap in practice.
- The standards landscape report lists those.

- **Timeframe**
- The timeframe covered by the Roadmap
    - Up till now covers from about 1994 – 2010
    - From 2010 – 2020

- **Not in scope**
- Real time DCS information
- Smart equipment
- Part of transition standards
- The business process used by supply chain participants to create and use information

1.3 Scope of this document

Within the scope of the whole family of standards the following topics are in scope of this document:

- Guidance for stakeholders from process industry of the actions required to solve the interoperability problem in the context of a plant engineering supply chain
- Introduction to successful example implementations of the principles for standardising and sharing plant life-cycle information.

The following topics are out of scope for this document:

- Normative definition of an implementation process for the principles and actions defined in this document
- Timing requirements on the process industry or any other industry segment with regard to the implementations and actions defined in this document

2 Normative References

This document makes normative reference to:

CWA 16180-1. CEN ORCHID Roadmap Standardising Information Across the Plant Engineering Supply Chain – Part 1: Direction and Framework

CWA 16180-3. CEN ORCHID Roadmap Standardising Information Across the Plant Engineering Supply Chain – Part 3: Standards Landscape

3 Definitions, symbols and abbreviations

The definitions, symbol and abbreviations used in this document are drawn from CWA 16180-1:2010.

4 The Implementation Guide

4.1 Purpose and Objective of the Implementation Guide

This Implementation Guide provides simple, practical guidance for companies on the standardisation and sharing of plant engineering lifecycle information. This will allow companies to overcome the information interoperability challenges outlined in Introduction of this document, and help the industry move towards the following vision:

"Companies in process industries shall be able to share and/or exchange electronically the information needed to design, build, operate and maintain process and power plants using internationally accepted standards"

The practical steps outlined in this document are based directly on the CEN ORCHID Roadmap Model on this topic, which is summarised in Section 4 of this document. The complete Roadmap (CWA 16180-1) is available from the CEN website.

As industry adopts the Roadmap concepts and ideas, companies and industry associations can work towards the development of robust wider normative standards in the future.

The Implementation Guide describes the activities that a company should and can do today in order to successfully exchange or share information with supply chain partners.

This document describes:

- Key Principles for Standardisation and Sharing of Plant Lifecycle Information
- Summary of the ORCHID Roadmap Model
- Process Overview: The steps companies need to take to improve information standardisation and sharing
- Practical examples of information standardisation and sharing in the process industry. These examples are linked to the ORCHID Roadmap Model
- Recommendations for the industry to progress information standardisation and sharing

4.2 Key Principles for Standardisation and Sharing of Plant Lifecycle Information

This ORCHID Roadmap focuses on three information processes that will contribute to resolving information interoperability issues:

A. Firstly, the processes that companies use internally to both generate and use engineering information, which should be aligned to standardised business processes, and used consistently across the involved organizations.

B. Secondly, the processes applied to classify product and plant engineering content. It is crucial that this information content is standardised both internally and externally.

C. Thirdly, the processes to exchange information internally and externally using a standard, common platform.

The following key principles have been identified to improve information standardisation and sharing, with a particular focus on processes B (content classification) and C (exchange) above.

Key principle 1: Agree and Document Core Internal Business Activities and Processes

A critical foundation step is for a company to codify and standardise its internal business activities and overall processes. This includes ensuring that all departments within the business understand and apply those activities and business processes consistently in their day-to-day work.

To understand what activities are required to be executed in the lifecycle management of a facility, ORCHID recommends the usage of the PISTEP Activity Model (see **Error! Reference source not found.**). This activity model also identifies the information types that are usually exchanged. This is a generic model and each organisation will need to decide on the extent and level of detail that will be used from this activity

model or further enhanced. Thus the PISTEP activity model should be interpreted as a reference to the organisation specific instantiation.

Figure 3 provides a high level view of PISTEP, however, there are more detailed activity levels below this (see Annex B). For the purposes of the ORCHID initiative, the PISTEP activity model is used in two contexts:

- Firstly to provide a common basis for companies in the supply chain to review their business processes
- Secondly to identify at a high level the key information types that are typically exchanged and these information types also provide a basis for companies to identify the relevant current standards as identified in the ORCHID Landscape of Standards.

These foundation steps are often undertaken by companies in preparation for implementing ERP systems, and are therefore widely used in many companies. Some companies are well advanced in this integration/standardisation of information internally, while others are just beginning the process.

(Sharing information between companies does NOT require sharing of business processes. While activities that are carried out in different companies are generally common, the end-to-end business processes that describe *how* those activities are conducted are often unique to an organisation. These are often proprietary, and a source of competitive advantage.)

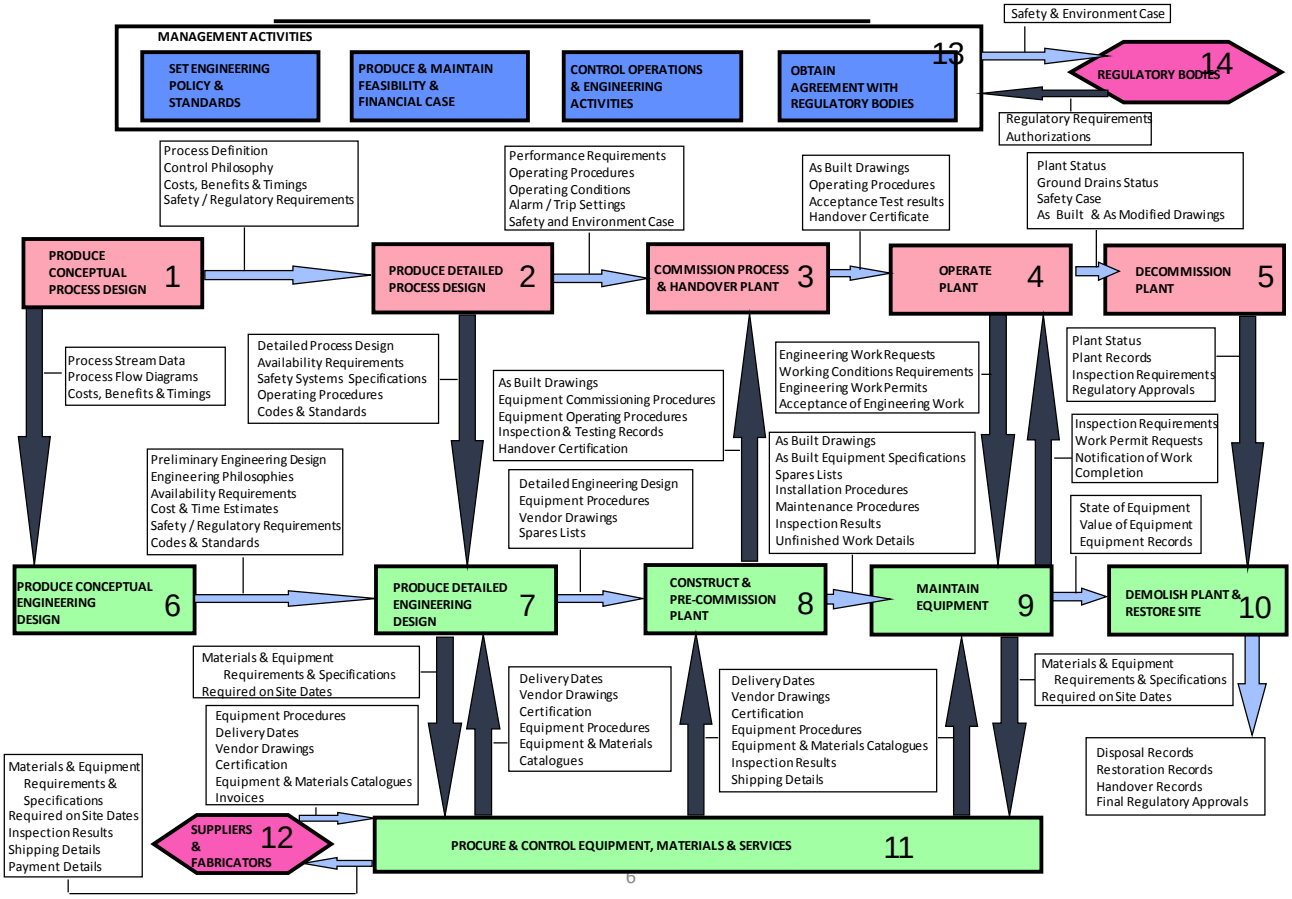

Figure 3 - PISTEP Process Industry Activity Model

Key Principle 2 - Always Use Internationally Accepted Standards Where They Exist

The next principle is that, where ever possible, companies must use internationally accepted standards. There are more that 50 standards (see CEN ORCHID Report on Standards Landscape in the Process Industry) in use in the process industry. It is therefore prudent for companies to use common standards and best practices in use rather than apply their own.

In cases where no standards exist or an existing standard has gaps, companies should first define the principles they will they will apply to augment standards, to bridge the gap to an existing standard. Subsequently, these additions should be passed on to standards organisations to help the industry progress towards common definitions.

In summary, companies will need to move from a multiplicity of naming conventions and formats for information to common and integrated classifications for information, based on internationally accepted standards.

Key Principle 3 - Agree on a Standardised Dictionary of Classes

It is often difficult enough to agree a common dictionary of terms *within* a company, let alone harmonise these with other companies. It is even harder still to harmonise the use of terms across the whole supply chain. Nonetheless, agreement on a common dictionary of classes is crucial to achieve information interoperability in the process industry, which relies on rigorous precision. For example, one company's definition of a pump must equate exactly to another company's definition of a pump e.g. it must be clear whether the pump being specified is a reciprocating pump or a centrifugal pump. In addition, the terms used for that reciprocating or centrifugal pump must be common to all parties involved in the exchange. When two engineers are sitting face-to-face, terminology differences are relatively easy to resolve. However, this is increasingly difficult now that data exchanges are almost always digital. Specification and definitions must be completely unambiguous if two or more applications are expected to use shared data accurately.

A useful guide for companies on how to develop a common dictionary of classes is shown below. Full details can be found in CWA 16180-3. CEN ORCHID Roadmap: Standards Landscape.

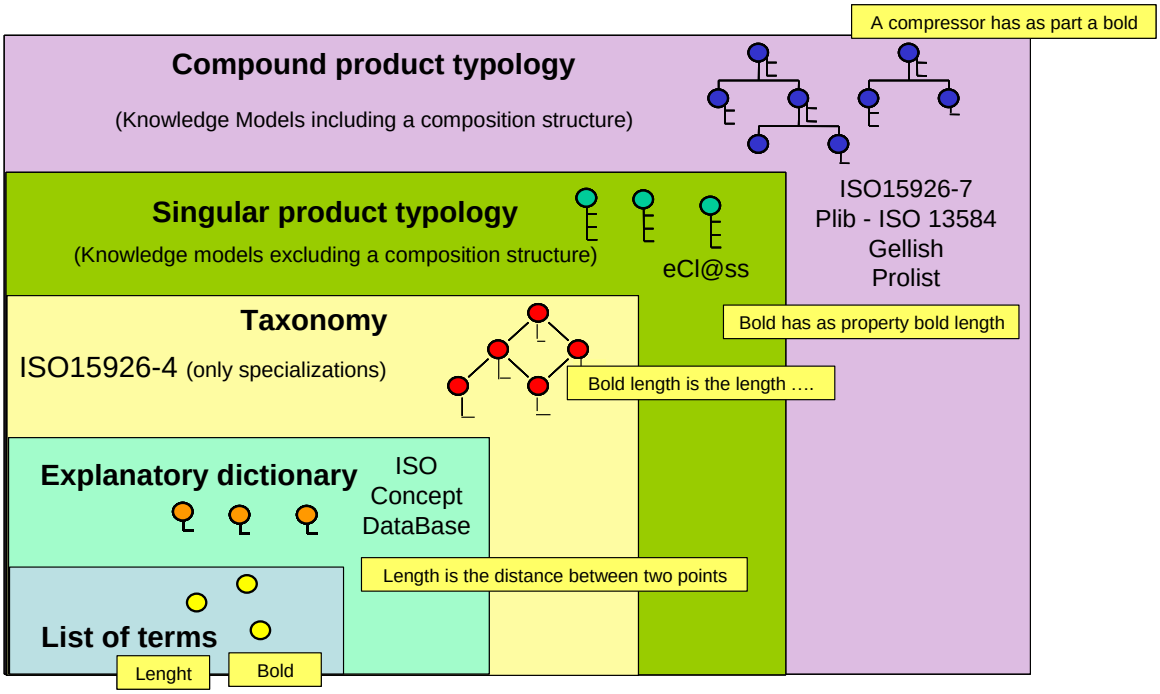

Figure 4 - Typology of Product Models

Companies need to determine the type of information exchange they wish to carry out, and then use Figure 4 to identify the elements that will be required for their dictionary.

Key Principle 4 - Agree Standardised Attribute Definitions

Once the dictionary of classes is agreed, the definitions of “attributes” linked to those classes must also be agreed. This means having common definitions for the properties of a class. For example, this will include definitions for the capacity, throughput or maximum operating temperature of a pump. The number and level of granularity of attributes will vary depending on the ultimate purpose of the information being exchanged to ensure that technical and business needs are met. Companies need to agree a practical (reasonable) level of granularity for attributes, which ensures that the information exchanged is clear and meets need, without being unnecessarily detailed.

Key Principle 5 - Agree on Units of Measure

There are great variations within companies and between companies, sectors, and even geographies in the way that units of measures are used (time, mass, length). This results in unnecessary complexity and errors in information being shares. For example, capacity for small pump may be measured in litres/minute, whereas a large capacity pump is measured in metres^3 per hour. In many cases, units of measure appear almost identical, but are actually quite different. For example, in the measurement of pressure, the use of absolute versus gauge is easy to misinterpret. It is therefore vital, that units of measure are standardised and agreed internally and externally.

The key to preventing misunderstanding is to provide clarity on what is requested/ communicated, and to use common definitions/units of measure in the information exchange process.

Key Principle 6 - Agree on the Collection of Attributes for the Class to be Used For Any Given Activity

Once the attribute definitions are agreed, companies also need to agree the collection of attributes for the class to be used during the exchange of information. This is important because it narrows the potential universe of attributes that can be applied to a class, based on the way the information will be used by a stakeholder.

Aggregation of these attributes should be based on the intersection of needs between stakeholders when sharing or exchanging information and not the union of needs across all stakeholders involved at some point in the supply chain.

If all stakeholders need to agree on all the attribute requirements per class of all other potential stakeholders, the combined list of properties becomes very large, cumbersome and unmanageable (potentially >1000 in a large project). Attempting to create one large universe of attributes per class across a project (as originally envisaged in the STEP approach in the 1990s) has, in practice, proved to be impractical for the process industry. It is therefore prudent to manage the attributes to be exchanged between relevant parties – initially between pairs of stakeholders. This would mean that the attributes per class being used between an owner operator and an EPC would be agreed between them, while the attributes per class being used between an EPC and a rotating equipment supplier would be agreed between themselves. Similarly, the attributes per class would be agreed between a rotating equipment supplier and an electrical motor manufacturer.

As also stated above, the key to preventing misunderstanding is to provide clarity on what is requested/communicated, and to use common definitions/units of measure in the information exchange process.

Key Principle 7 - Agree on Additional Attributes for Use by Stakeholders Across the Supply Chain

Once small groupings of attributes are agreed between stakeholders (see Key Principle 6 above), it is also important for all other stakeholders to agree on the additional attributes they may require for their specific activities. In the pump example, when owner operators define their needs for electrical drives, then electrical manufacturer stakeholders need to agree their incremental attribute requirements. Quite separately, steam turbine manufacturers will need to agree their incremental attributes. These sub-sets of attributes can be integrated as required, rather than creating an unnecessarily large number of attributes from the outset.

Once again, the number and level of granularity of attributes will vary depending on the ultimate purpose of the information being exchanged to ensure that technical and business needs are met. Stakeholders need to agree a practical (reasonable) level of granularity for attributes, which ensures that the information exchanged is clear and meets need, without being unnecessarily detailed.

As stated above the aggregation of these attributes should be based on the intersection of needs between stakeholders, not the union of needs across all stakeholders. In the longer term, once individual pairs of companies agree and standardise the attributes they need, the union of attributes can be developed step by step.

Key Principle 8 - Agree on a Standardised Delivery Envelope for Exchanging Information

After information content elements have been agreed, the information delivery envelope - or mechanism for exchange, or the “hand-shake” - must be agreed. For example, stakeholders need to decide whether they will both use XML for exchange or for example a common platform where the information is shared between the stakeholders.

It is important to note that from an ICT technology point of view there are no practical barriers for effective information exchange. Most IT systems in use today have adequate functionality to accommodate information exchange.

4.3 ORCHID Roadmap Model

As outlined in Section 2, this Implementation Guide is based on the ORCHID Roadmap Model (see Figure 5). A full version of the ORCHID Roadmap (CWA 16180-1) is available on the CEN website.

The structure for this model originates from the Carnegie Mellon University work on models for Information Technology. It has been applied here as a useful framework to explain levels of progression required to achieve information interoperability.

The Carnegie Mellon model normally has five levels, with the first being “un-managed”. The ORCHID Roadmap model drops this initial level, and uses four levels. These have been applied to:

- A company’s own internal work processes for lifecycle information
- A company’s processes for exchanging information with external parties

Progression within each level is assessed using the following five dimensions/criteria (see questions in Annex A :

- Business Processes
- Strategic Alignment
- People & Organization
- Plant Lifecycle Information
- ICT Technology & Infrastructure

NOTE: These dimensions need to be assessed on how they apply to management of information.

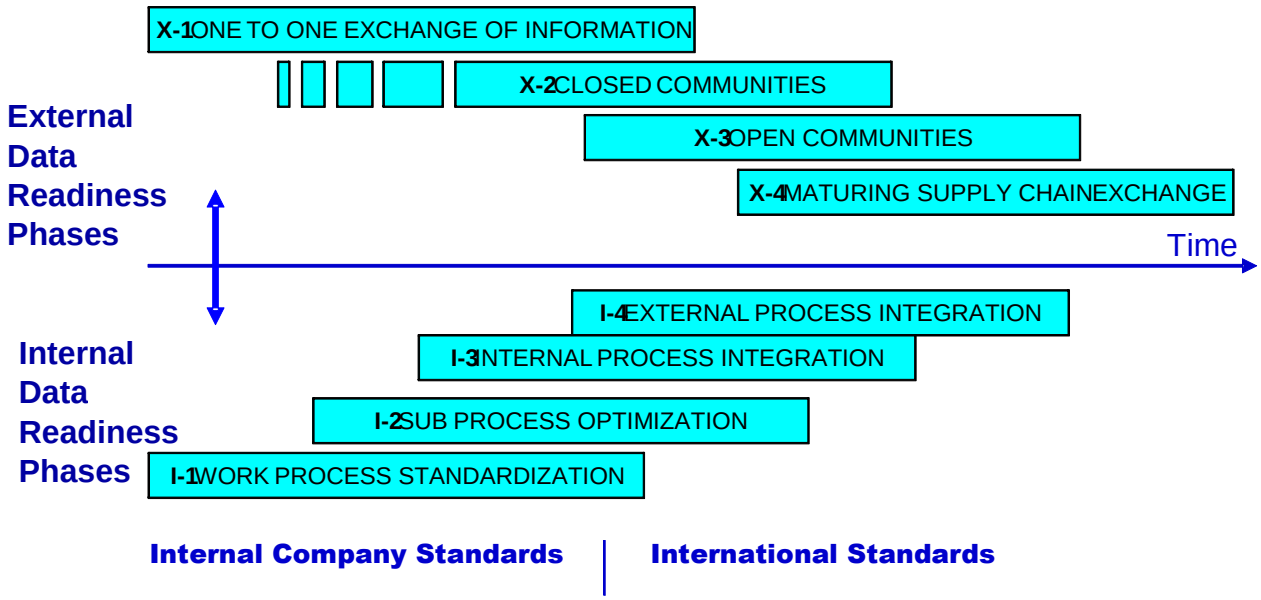

Figure 5 - ORCHID Roadmap Internal and External Phases

4.4 Implementation Guide: Overview of Key Steps

The ORCHID Implementation Guide for European process companies recommends four steps to improve information exchange capability:

Step 1: Understand the key principles for information standardisation and sharing

(See section 4.2)

Step 2: Understand where your business is on the ORCHID Roadmap Model

(See Figure 5)

This step is divided into two parts:

a. Firstly, understand which Roadmap Phase you are operating in:

Internal Phases

- I-1 = **Work Process Standardisation**- single repetitive processes within a certain group or discipline are standardised.
- I-2 = **Sub-Process Optimization** - higher efficiency is reached by removing non-value added steps in a process for a particular organisation.
- I-3 = **Internal Process Integration** - the isolated processes are integrated to a coherent whole.
- I-4 = **External Process Integration –** the process of exchange and sharing of information with external stakeholders is integrated within the internal processes.

External Phases

- X-1 = **One to One Exchange of Information** - the exchange of information with external stakeholders is structured and set-up on a case by case basis between two stakeholders.
- X-2 = **Closed Communities** - a group of organizations agree on a common, but limited set of generic definitions, and exchange information according to these rules.

- X-3 = **Open Communities** - a high level of integration and standardisation of the exchange of information is reached with those external stakeholders that are participating in the communities where a company operates in. International accepted and agreed standards become more and more important.
- X-4 = **Maturing Supply Chain Exchange** - many-to-many integration and a high degree of collaboration is implemented, based on internationally agreed standards.

b. Secondly, assess the company's progress or "maturity" within each of the above phases.

This is done by evaluating the company on the following five dimensions/criteria – see Annex A for further details of the questions that can be asked to make an assessment. These dimensions need to be assessed on how they apply to management of information.

- Business Processes
- Strategic Alignment
- People & Organization
- Plant Lifecycle Information
- ICT Technology & Infrastructure

This can be done by the company itself or with the expertise of information standardisation industry associations or by independent consultants working in this field.

It is in this context important to understand the relationship between the internal and external phases and the maturity levels. As Figure 5 shows, phases can and very often do overlap in time. At the same time it is true, that some activities associated with a certain phase are prerequisites to the following phase. The maturity level associated with a phase is the subset of requirements of this phase, which needs to be fulfilled before the next phase can reasonably be started.

NOTE: The ORCHID Roadmap model and these steps are a "guide" to help a company improve information standardisation and sharing internally and externally. It is important to note that the assessment of a company's phase/level on the Roadmap and maturity within that level are ultimately qualitative and subjective assessments, based on the knowledge and experience of those involved in the exercise.

In reality, the ORCHID Roadmap phases and the maturity dimensions are in fact part of a continuum. They are "guideposts" to enable companies develop and make meaningful progress. They should not be treated as having absolute boundaries.

Progression in the roadmap

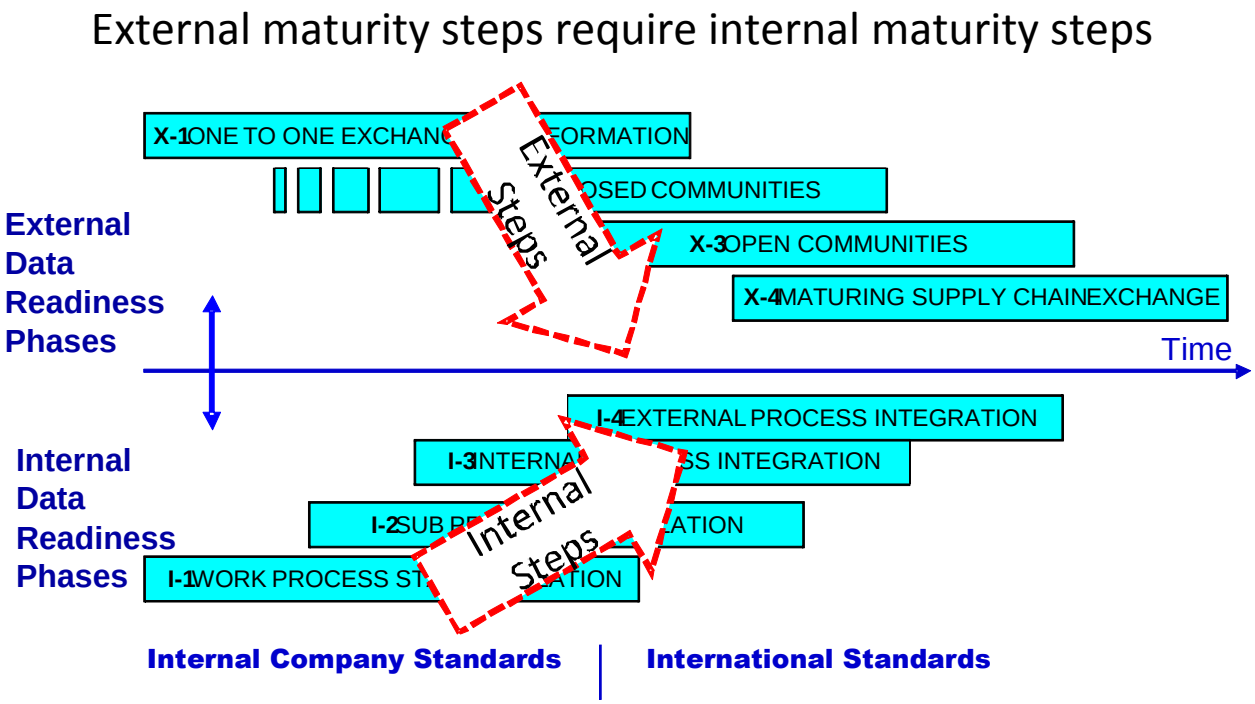

Figure 6 - Progressing up the maturity levels

A company where only a few departments have standardised work processes, will be at the beginning of I-1 band. As more and more work processes are standardised, then it will progressively move to the right in the I-1 band. Once a few more departments have standardised their processes, these departments can begin to optimise their processes across departments – this will mean that those departments in the company have moved into beginning of I-2 phase. This is how an organisation will move up in phases and therefore Maturity. The questions in Annex A help companies make a judgement on where they are in the context described above.

A company may be operating at one or more of these phases at any one time. However, the evidence for the success cases shows that if a company wishes to operate successfully in X-2, then it needs to have completed some aspects of I-1 and I-2 first as is indicated in Annex A.

Step 3: Establish realistic targets for where the company wants to be

Experience has shown that progression is a significant challenge because the information being exchanged is used in so many different company processes. To reach agreement, and change well established practices could take significant time and effort (internally and between parties).

Once companies have completed their evaluation, they can set targets for where they would like to be in the future. This means a. the levels of maturity within Roadmap phase and b. moving to other phases. The statements in Annex A should provide guidance on what the targets can be to achieve a specific level of maturity for each of the dimensions.

From a business point of view key considerations for setting targets are:

- New regulatory requirements
- Planned investment and expansion
- Competitor positioning
- New customer demands
- Globalisation strategies
- Time to market

Note that the target level can be different in different networks, which the company takes part in. Therefore the positioning of the industry domain and the partners in each collaboration network is a key consideration to be taken into account for setting the target. This can lead to the case that different business units inside a company will set different targets.

To help companies identify possible specific actions that they can take to improve their level of maturity for information exchange, some examples drawn from successful implementations are provided in Tables 1 & 2 below.

Table 1 - Actions to Drive Information Maturity Improvements within Each Internal Phase

Internal	Work Process Standardisation	Sub-Process Optimisation	Internal Process Integration	External Process Integration
Business Processes	Standardise processes across a department.	Standardise company-wide on best practice business processes.	Adopt a holistic approach on company-wide best practice business process standardisation. Optimise each process and interrelationships.	Agree and align the information to be exchanged, and the process for exchanging it.
Strategic alignment	Agree and align the information to be exchanged, and the process for exchanging it.	Complete standardisation and classification activities for the domain.	Complete cross company standardisation and classification activities.	Align classifications across the external interface and agree how to deal with exceptions.
People & organization	Develop staff skills and competencies required to implement processes.	Build capabilities for process ownership and change management within the sub-process.	Ensure overall process ownership, and implement cross process governance processes.	Clearly define roles and responsibilities for internal and external information management.
Plant lifecycle information	Define standards for one or more departments for information, document management.	Adopt international and internal standards at business unit level, including some classification norms. Agree formats for some interdepartmental information exchange.	Implement company-wide information quality management systems, and adoption of classification systems.	Publish internal rules for classifying information. Classify information according to internationally accepted standards.
ICT Technology and Infrastructure	Provide a secure personal computing infrastructure. Manage some work with IT systems securely.	Develop IT application governance structure per domain. Rationalise and standardise IT applications supporting standard business processes.	Establish a governing body for IT applications. Integrate IT applications between domains.	Provide secure connections to external parties. Adopt application connectors to external exchange standards.

Table 2 - Actions to Drive Information Maturity Improvements Within Each External Phase

	One to One Exchange of Information	Closed Communities	Open Communities	Maturing Supply Chain Exchange
BUSINESS PROCESSES	Accommodate/adjust processes and operations for identified interoperability barriers on a case by case basis.	Agree a common process model for participating companies. Connect this common structure to the entity specific process structure.	Agree a common process model and standard contracts for participating companies. Connect this common structure to the entity specific process structure for all exchanges.	Implement assurance model for consistency of processes used across the supply chain. Ensure automated processes are in place for exchanging information according to international (or de-facto) standards.
Strategic Alignment	Adopt policy and procedures to agree case by case information exchange.	Agree a shared vision and policies between participating companies to manage information exchange at a project level. Make incentive based information exchange contracts.	Agree a shared vision between participating companies to manage information exchange at a company level. Ensure standard contracts are in place.	Agree a shared strategic vision across the supply chain on the use of internationally agreed information standards. Ensure that work methods, procedures and contracts follow international standards.
People and Organisation	Ensure skills are available to identify, define and exchange information as agreed contractually.	Ensure relevant skills are available and mobilised to: - Connect common process models to internal processes. - Exchange information in closed communities.	Ensure relevant skills are available and mobilised to: - Connect common process models to internal processes. - - Exchange information in open communities.	Develop relevant knowledge and skills on internationally agreed information management standards, data quality and exchange processes.
Plant Lifecycle Information	Agree definition of handover points case by case.	Agree information standards to be used, and common, explicit definitions of handover points, and content for each exchange.	Use agreed lifecycle data standards to specify standardised handover points and standardised content across open communities.	Use available internationally agreed life cycle information standards to define and dynamically exchange all content. Ensure that explicit status information and provenance is available for all content.
ICT Infrastructure and Technology	Establish interoperability by mapping corresponding input and output files manually. Develop policy and infrastructure to automate future exchanges.	Use secure IT systems to automate mapping between input and output files using a meta-level structure. Inconsistencies resolved by manual interventions.	Use secure IT systems to automate mapping between input and output files using a meta-level structure. Inconsistencies resolved by manual interventions.	Use secure IT systems for automated exchange and/ or mapping between input and output files using: - A standardised meta-level structure - Internationally agreed standards Inconsistencies resolved automatically by validation mechanism.

Step 4: **Based on the targets, plan and implement improvement measures**

Once targets have been set, companies can plan and implement improvements. This can be achieved by:

- Adopting one or more of the Key Principles (see 4.2) as guide for standardisation. It is recommended to review all principles for potential usage before an implementation plan is defined.
- Moving to the target internal and external maturity level by fulfilling the recommended requirements derived from the tables in Annex A
- Creating an implementation team lead by the business and including thought leaders from the business.

- Defining and documenting the company specific business cases (this will be the input for any management decision)
- Learning from the best practices described in the information standardisation examples in section 5 of this document. These examples will help companies set specific improvement goals and identify activities to achieve them.

Please note, it is the rigour and extent of application of the Key Principles, combined with fulfilling of the maturity requirements, which improves maturity and therefore moves a company across a phase and up phases on the ORCHID Roadmap. Another main success factor is simplification, it is important for companies to keep it as simple as possible and try to avoid any unnecessary complexity.

5 Industry Examples and Success Stories {Informative}

The table below lists a number of known examples where companies have adopted standards. The ORCHID team have made an assessment on how this work related to the ORCHID Roadmap Phases.

Table 3 Successful examples of standards adoption, and mapping to ORCHID Roadmap

Nr	Company	Standards	From Phase	To Phase
1	Shell, DSM	STEPlib	I1	I3
2	Shell	EIS STEPlib, ISO15926-4	X1	X2
3	Siemens Energy and Oil	ISO13584, eCl@ss	I1 I2	I2 I3
4	BASF and Endress & Hauser	NE100, ISO 13584, IEC61987	X1	X2
5	Zeiss optical instruments	ISO13584, DIN property server	I1	I2
6	AT&S printed circuits	ISO13584, eCl@ss	I1	I2
7	Toshiba, JEMIMA	ISO13584-501	X1	X2
8	Alstom, Siemens, etc...	KKS	X1	X2
9	Croon TBI Techniek	STEPlib, ISO15926-4, Gellish	I2 X1	I3 X2
10	VdZ, Germany	VDI 3805	X1	X2
11	Renault France	ISO13584	X1	X2
12	Statoil Norway	POSCaesar lib	I1	I2
13	ECALS Japan	ECALS dictionary	X1	X2
14	NATO	NCS	X1	X2
15	NATO	ISO 22745	X2	X3

See below for details on how progress was achieved in seven of the above examples.

Shell example 1: - Business Process Improvement I2 to I3 on the Roadmap

Background: In the mid 1990s Shell started standardising and optimising its business processes with the roll out of SAP – it was therefore moving from I-1 to I-2. Simultaneously, there was a recognition that the information used in these processes needed to be standardised. Further progress was made to integrate internal process and the move from I-2 to I-3 started. The Information standardisation that is the subject of the ORCHID project was implemented by standardising its SAP definitions by harmonising them using STEP-Lib (the precursor of ISO15926-4) for product classifications and attributes.

In this information standardisation example, Shell has progressed from ORCHID Roadmap level *I-2 Sub-process Optimisation* to *I-3 Internal Process Integration* on the Roadmap.

Specific actions included:

- As part of the business process improvement programme to implement ERP, Shell identified a dictionary/library for classification (in this case STEP-Lib, which is in the public domain)
- When classes were required, these were selected from STEP-Lib, wherever possible
- When a class was *not* available, STEP-Lib rules were applied, and augmented by Shell's own pragmatic rules
- Based on the above, Shell created a common internal dictionary of standard classes for use by all businesses
- When an ISO dictionary becomes available, the intention is to migrate the classes in the dictionary to that standard dictionary
- Key benefits: faster, more accurate implementation and efficiency gains through use of common standards

Shell Example 2 – Engineering Information Specifications X1 to X2 on the roadmap

Background: Like most Owner Operators, Shell works with EPC contractors and suppliers to deliver its projects. To enable contractors and suppliers to deliver information electronically, Shell has successfully developed its Engineering Information Specifications (EIS) for the handover of engineering information with EPC contractors. This makes use of STEP-Lib and ISO15926-4

In this exercise, Shell has progressed from ORCHID Roadmap level X1 –One to One Exchange of Information to X2 - Closed Communities.

Specific actions included:

- Agreement between different Shell businesses on standard classes, attributes, units of measure, and equipment models
- Incorporation of these standards into a range of Shell business processes for engineering, maintenance and procurement
- The standard classes, attributes, units of measure, and equipment models are shared with partners in the supply chain via EPC contractors. This means that more companies in the supply chain work to common standards when they exchange information with Shell. Work is ongoing to drive further improvements.

Key benefits: improved efficiency of information exchange across Shell's supply chain, which results in reduced errors and "rework"

Croon Elektrotechniek B.V., TBI Techniek Example – Exchanig information with partners X1 to X2

As an EPC contractor, Croon Elektrotechniek B.V. frequently faces interoperability problems in projects between project partners. For projects in the area of infrastructure and the shipbuilding industry Croon has successfully adopted the Gellish methodology combined with the usages of the ISO 15926-4 Reference Data Library to capture and exchange project information explicitly. As the scope of information exchange goes beyond the Oil and Gas area Croon have also defined "private" classes within their Reference Data Library.

In this exercise, Croon has progressed from ORCHID Roadmap level X1 –One to One Exchange of Information to X2 - Closed Communities.

Specific actions included:

- Harmonise terms for infrastructure and shipbuilding by reference to ISO15926-4 and agree a project common, neutral dictionary .
- Select and configure IT systems that can handle the usage of a Data Reference Library and an object oriented approach like Gellish.
- Select an exchange protocol and procedures that only allow exchange of information that is compliant with the agreed common RDL.

Key benefits: improved efficiency of information exchange within projects, reduced errors and "rework" and longer term for use during maintenance. The contract requires the project partners to provide maintenance for 10 years after project completion.

It is worthwhile noting that the approach adopted stretches the organisation since staff have to get used to this new way of working.

THTH Example - Modelling of Collaboration Processes (X1 to X2)

The THTH companies have carried out proof-of-concept work for moving from X-1 to X-2.

The specific actions included:

- modelling of collaboration processes
- specification of interchange data: dictionary, classification, data sets, hierarchy
- implementation of standard infrastructure software

The work has utilised the XMpLant specification, and the dictionary items are linked to ISO 15926-4 where possible.

A Power Plant Industry Example (Alstom, Siemens, and others) – X1 to X2

In the past when planning, constructing and operating a power plant different, non compatible systems for classifying of equipment and sections of plants were typically adopted.

Action: Introducing a common classification system KKS by the power industry.

Key benefits: Unambiguous identification of plants, sections of plants and items of equipment in any type of power station according to task, type and location. It is used by all engineering disciplines for planning, licensing, construction, operation and maintenance

Key Benefits: It eliminates cost caused by delivering wrong material and related re-work.

The NATO Classification System (NCS) – X1 to X2

The principal objectives of the NATO Codification System are:

- To facilitate interoperability between user nations
- To increase the effectiveness of user nations logistics systems.
- To facilitate data handling.
- To minimise logistics costs of user nations.
- To increase efficiency in user nations logistics operations.

It classifies each spare part (or "Item of Supply" - IoS) uniquely.

Operational advantages:

- Enhanced opportunities for standardisation, by recording and revealing the unique characteristics of Items of Supply in user nations supply systems, allowing parts from a number of weapons systems to be used efficiently and effectively.
- The NCS provides access to the full range of information on all Items of Supply in the inventories of user nations. This allows users to pool resources and share the burden in regard to the acquisition of spare parts and the maintenance of common equipment. During operational deployment the NCS also facilitates minimisation of the supply requirement in terms of spares and consumables.
- An accurate description of the IoS permits users to readily identify spares and or substitute Items of Supply which meet the requirement for a given weapon system thus reducing downtime and supporting force multiplication.
- The use of a common supply language understood by all users simplifies the technical dialogue between participating nations and other users.
- The use of computer technology allows the recording, processing and transmittal of IoS identification data and related management support data in an efficient and user friendly manner.

Economic advantages:

- The database allows the designer and project manager to screen for parts which are already stocked in the supply system and which could be utilised rather than producing a new IoS concept. This practice reduces the variety of Items of Supply to be managed and eliminates unnecessary costs for identification, storage and other related supply functions. Nearly 50 % of the components used in the design of new equipment are already codified in the NATO inventory.
- Improved determination of materiel requirements and budgeting through greater knowledge of Items of Supply in stock.
- Effective co-ordination in procurement by enabling the elimination of concurrent acquisition and disposal of the same IoS, consolidating orders from several users to benefit from price reductions on bulk purchases and having visibility of several potential sources of supply.
- Effective use of assets by enabling supply support interchange between linked organisations and between nations.
- Reduction of national and NATO inventories, warehouse space, data maintenance and personnel through the elimination of duplication of an IoS.
- Improved surplus and excess materiel disposal operations through the uniform identification of each Item of Supply, including the prevention of erroneous disposal.

The NCS standard is very successful and but its maintenance cost is high. That is why NATO is interested in moving to an international standard. They intend to use the Open Technical Dictionary (OTD) on basis of ISO 22745 as developed by ECCMA under TC184/SC4. The OTD definitions are used successfully in South Africa and in Oman for information cleansing.

VdZ Germany

The German VdZ Group has developed the VDI 3108 standard for classification / product modelling of HVAC equipment. Many installation companies in Germany successfully use the standard. VDI 3805 'Product data exchange in the building services' is a German standard for the Building Services product industry and planners of Building Services plants. It is documented in the guideline VDI 3805 Part 1 – 100 of 'VDI Verein Deutscher Ingenieure'

The guideline defines an EDP data model and an exchange format for Building Services equipment to be used for the transfer of product catalogue data from manufacturers into independent software applications for layout, calculation, CAD, design, planning and management.

This standard substitutes the existing diverse and insufficient manufacturer-depending data formats and software solutions.

The standard's purpose is to enable product selection and automatic layout as well as calculation and optimization of Building Services plant models including components from different manufacturers.

An important element of VDI 3805 is the exchange of product properties together with algorithmic and geometrical data. The properties used in VDI 3805 are standardized properties defined in DIN property server (ISO 13584).

VDI 3805 is practically used by HVAC-planners and engineers and integrated in related software products.

Planners read in VDI 3805 data files to their CAE-system. From the whole product-catalogue they can quickly select single products and integrate them into the CAE-plant-model. Planners can be sure that the selected product variant exists.

The data files contain machine-readable layout algorithms. The HVAC systems will be designed with layout programs of the manufacturers.

Based on manufacturer's parameters the planner's CAE-system can calculate complete Building Services plant models containing components from different manufacturers.

The CAE-system is able to check adjacent connections, to execute interference checks, to display the 3D geometry with realistic colours and surfaces and to integrate the geometry into drawings. In addition, it can fill out bills of services and bills of material with VDI 3805 data.

Embedded in BIM (Building Information Model like IFC), VDI 3805 data of selected products can be exchanged to other CAE-systems, FM-applications (Facility Management) and to commercial systems.

VDI 3805 Website: http://www.vdi3805.eu
Downloadable documents: http://www.vdi3805.eu/fileadmin/user_upload/downloads/VdZ_VDI3805_01.04.09_e.pdf

Other Process Industry Examples

Siemens Energy and Oil

Siemens Energy and Oil classification has used ISO13584 and eCl@ss to structure all its product information in catalogues and SAP as a result of which the number of product classifications has gone down tremendously.

BASF and Endress+Hauser

The companies BASF and Endress & Hauser successfully make use in engineering of the NE100 from PROLIST for procuring instrumentation devices and integrating the information into the engineering design.

Zeiss Optical Instruments

Zeiss optical instruments has improved its product catalogue efficiency by building standard product classifications of optical instruments making use of ISO 13584 for the structure and of the DIN property server for attributes.

AT&S Printed Circuits

The company AT&S has significantly improved its spare part position by using eClass to standardise on the part codes.

Toshiba JEMIMA

The Toshiba Company in the context of the Japanese Jemima group of instrumentation suppliers has created a common instrumentation catalogue ISO 13584-501 portal based on ISO13584. This portal is used successfully by instrumentation suppliers and plant owners for standardised product data.

Renault France

Renault has set-up a joint equipment catalogue project with some 200 equipment suppliers to standardise on the way automotive equipment is specified and purchased. In the pilot project non-automotive materials are tested out first. The catalogue employs ISO 13584 as basis for the standard catalogue.

Statoil

Statoil has successfully adopted the PoscCaesar definitions for oil and gas daily reporting.

ECALS

For a number of years the association ECALS in Japan has operated a common product model catalogue portal for electronic equipment using a PLIB type model and IEC 61360. Many companies make use of this portal. A desire exists to move the portal to full international standard.

6 Potential Opportunities for Future Work

6.1 Actions by individual companies

Companies can adopt best practices from within their sector to improve maturity. It is also important to note, that they may be able to identify best practices from other sectors, or indeed pioneer their own best practices.

Learning from the same sector

Companies in the same industry sector share the same priorities and constraints, and therefore tend to do things in broadly the same way. Therefore, taking best practices developed in one company to another in the same sector would only require the identification and removal of the company specific practices and taking the practices that are “generic” within that sector.

There may be slight variations between sub-sectors or broadly similar industries. For instance oil and gas and chemicals are both part of the process sector. Both have safety as a major issue and therefore safety procedures are of highest priority. In both sub-sectors there are risks to personnel lives, but the nature of the danger is different. In the oil and gas it is fire and explosions, while in the chemicals industry, toxicity plays an increasing role. In the nuclear industry it is both of these and electromagnetic radiation. So while the details may vary, general guidelines can be standardised on industry as well as international levels. Safety standards are good examples of this.

As an example, an industry best practice has been developed in the Netherlands to identify critical document types that need to be kept as “As Built”. This helps companies prepare for future regulation on HSSE and also provides guidance to regulators on relevant HSSE issues. This best practice will be shared to benefit industry across Europe.

Learning from different sectors

Different industries tend to have different priorities and constraints, which shape their respective best practices. That said, some business processes are more generic than others. For instance, accounting, human resources, and administration, procedures are virtually the same across all industry sectors.

Some like training and personnel development the general principles are broadly similar across all industry sectors even so the content may vary. In other cases such as configuration management, the general principles are the same, but the emphasis and detail may vary. So where it is in the Aerospace & Defence, automotive or the process sector, there is a need for change and version management, but the work flow and the approval cycles can vary significantly not only in different industries, but even in the same company depending on the type of product.

In the automotive industry, PLM software is widely used to manage information of all parts and components in a car. However, the process industry relies on the less efficient method of individual suppliers provide a range of products managed by different software packages with different configurations.

In short there is huge scope for cross-learning between industries. The above actions are best carried out by companies coming together in National and International associations.

Pioneering new practices where no experiences currently exist

Best practice is generally grown in an evolutionary process. Only when completely new technology is invented are completely new practices developed. Therefore the creation of new practices is generally a matter of refining and extending established ones. To this end it is necessary that procedures can be captured, analysed, described and communicated. Knowledge capture can play a big role in this.

Therefore, the key innovation in this area would be building a foundation for modelling knowledge. Once we have an effective way to model knowledge, we can go forward and build tools to capture and analyse it and from there build tools to create new practices much like we create a CAD or spreadsheet model today.

The crucial point is consistency within an organisation, and compliance with existing standards wherever possible. Once this is in place, mapping to other standards becomes easier.

Wherever possible, companies must converge on standards not diverge.

6.2 Recommendations

Standards development bodies (CEN and ISO, and other industry groups) need to review the ORCHID Technical Landscape of Standards to consolidate them. This is critical to overcome fragmentation at the highest level.

Rather than develop or create their own standards to deliver a specific solution, organisations or solution providers should adopt and consolidate existing standards where possible to prevent further proliferation of standards.

While small closed communities can continue to build their own standards, and operate them effectively, this does not contribute to the overall integration that is required by owner operators in the process industries.

A key action is for Industry and standards bodies to come together and create a common logical Dictionary – the background to this is discussed in *CWA 16180-3.*

Without industry acceptance of a common dictionary, there is unlikely to be integration in any sort of sensible timeframe. In fact, this may be a root cause of why only limited progress has been made over the last 15 years.

The end game must be to have a common process industry dictionary of terms and significantly fewer information standards, adopted by more companies.

Annex A
Information maturity levels, implementation phases, and requirements
{Normative}

A.1 General

This framework serves as reference to measure the maturity of an organization with regard to information exchange along a plant engineering supply chain. At the same time every organization wishing to improve its maturity can derive the necessary actions from this framework.

The framework is presented below as two sets of tables. These two sets correspond with the internal and external Maturity Levels as outlined in this document.

Each table in these two sets corresponds with one of the key dimensions in which information exchange maturity can be assessed. These key dimensions are:

- Business Processes
- Strategic Alignment
- People & Organization
- Plant Lifecycle Data
- ICT Technology & Infrastructures

Within each key dimensions certain topics (or sub-dimensions) have been identified, to provide additional granularity.

The columns in all tables correspond with the implementation phases (See Section 4.5 for details). The table cells contain one requirement for every pair of implementation phase and topic. An implementation phase is successfully finished, if the answers to all requirements in the corresponding table columns are positive. From requirements with a non-positive answer the actions required for a successful phase closure can be derived.

The Relationship Between Phases and Maturity Levels

While an organization can execute activities belonging to more than one phase in parallel, it can only be on one internal and one external maturity level at any given point in time. In addition, the maturity levels are not connected with the successful closure of an implementation phase. Rather the maturity levels identify the minimum set of requirements, which must be fulfilled during an implementation phase, before the following implementation phase may start.

This difference between implementation phases and maturity levels explains the use of colours in the tables:

red	Requirements for maturity level I-1 or X-1
orange	Requirements for maturity level I-2 or X-2
yellow	Requirements for maturity level I-3 or X-3
green	Requirements for maturity level I-4 or X-4

A.2 Internal Information Maturity Level

A.2.1 Business Processes

Business Processes	**work process standardisation (1)**	**sub-process optimisation (2)**	**internal process integration (3)**	**external process integration (4)**
definition of work methods & procedures	work methods & procedures are documented and maintained	local & discipline work methods & procedures are documented and maintained	business processes are integrated across the company	company processes are integrated into supply chain processes
implementation of work methods & procedures	work methods & procedures are implemented	local & discipline work methods & procedures are implemented	change management processes inside the company are CMII or equivalent compatible	CMII compatible change management processes are implemented including the involvement of external stakeholders
standardisation of work methods & procedures	work methods & procedures are standardised	local & discipline work methods & procedures are standardized	work methods & procedures are standardized across the company	work methods & procedures are standardized across the company involving integration with external stakeholders
certificates		quality certificates (ISO 9000 / 14000) are acquired		collective agreements or certificates over the supply chain are acquired
best practices	best practices are used to improve work methods & procedures and to define performance targets	best practices are used to eliminate non value added activities from local business processes and to define performance targets for such processes	methodology in place to improve business processes based on (standardized) corporate and industry best practices and to define performance processes for such business processes	methodology in place to improve business processes across the supply chain based on (standardized) corporate and industry best practices
engineering methodology & approach	modular design approach is part of engineering methodology	modular design approach is in place on local business unit level	modular design approach is company wide in place	modular design approach includes external design partners
	concurrent engineering way of working is considered when defining division of work	concurrent engineering set-up involving several disciplines is implemented	concurrent engineering set-up across discipline and business unit boundaries is implemented	concurrent engineering set-up across discipline, business unit and company boundaries is implemented

A.2.2 Strategic Alignment

Strategic Alignment	**work process standardisation (1)**	**sub-process optimisation (2)**	**internal process integration (3)**	**external process integration (4)**
vision & strategy	lifecycle information management vision and strategy is defined and agreed	lifecycle information management vision and strategy is implemented on business unit level	lifecycle information management vision and strategy is implemented on corporate level	lifecycle information management vision and strategy is implemented in the integration with partners, suppliers, customers and any other external stakeholders
policy	policy is defined to enable that lifecycle information management issues will be included in work methods and procedures	policy is in place that lifecycle information management issues are considered in work methods and procedures of a business unit	policy is in place that lifecycle information management issues are considered in corporate methods and procedures	policy is in place that lifecycle information management issues are considered in the integration with partners, suppliers, customers and any other external stakeholders
implementation of policies	work processes are executed according to local rules and guidelines	processes, work methods and procedures are executed throughout a business unit according local defined policies	processes, work methods and procedures are executed according corporate policies across the company	processes, work methods and procedures are executed according corporate policies when integrating with partners, suppliers, customers and any other external stakeholders
benchmarking	lifecycle information management vision and strategy is benchmarked	lifecycle information management vision and strategy is benchmarked on business unit level	lifecycle information management vision and strategy is benchmarked on corporate level	lifecycle information management vision and strategy is benchmarked on corporate level including the integration with partners, suppliers, customers and any other external stakeholders

A.2.3 People & Organisation

People & Organisation	**work process standardisation (1)**	**sub-process optimisation (2)**	**internal process integration (3)**	**external process integration (4)**
organisational ability to change	staff are able to work according defined procedures	regular improvement of work practices on business unit level is in place	corporate improvement initiatives take place regularly	corporate initiatives for improving the integration with external stakeholders take place regularly
job skills	staff have the required skills to execute personal tasks	staff is available with the skills to act as the local business unit "champion" for key business and engineering applications	staff is available with the skills to sponsor "championship" for key multi-disciplinary corporate business and engineering applications	staff is available with the skills to sponsor "championship" for key multi-disciplinary corporate business and engineering applications including integration with external stakeholders
interpersonal	staff have the skills and motivation to work according to corporate or industry best practices	staff have the skills and motivation to participate in improvement programmes on business unit level	staff have the skills and motivation to participate in multi-disciplinary teams and improvement programmes	staff have the skills and motivation to participate in multi-disciplinary, multi-enterprise teams and improvement programmes

A.2.4 Plant Lifecycle Information

Plant lifecycle information	**work process standardisation (1)**	**sub-process optimisation (2)**	**internal process integration (3)**	**external process integration (4)**
information (documents & data) management	documents are registered and electronically available (if needed in scanned format)	information management procedures are in place and used within local business units	information management procedures according quality management and configuration management standards and best practices are in place and supported electronically company wide	information management procedures according quality management and configuration management standards and best practices are implememted company wide to support the company's role in contact with external stakeholders
information access	Roles and responsibilities are defined according division and scope of work	access to information according defined roles and responsibilities is implemented on local business unit level	access to information according defined roles and responsibilities is implemented company wide	access to information according defined roles and responsibilities is implemented company wide including external stakeholders
structuring of information	information is classified and structured according specific rules that are different throughout the company	information is classified and structured according business unit specific rules	information is classified and structured according company specific rules and standards	information is classified and structured according international accepted rules and standards
equipment properties & material standards	business unit standards, company standards and/or internationally accepted standards for equipment properties and material are used	a fixed and documented set of either business unit standards, company standards and/or internationally accepted standards for equipment properties and material is used in a business unit	a fixed and documented set of either company standards and/or internationally accepted standards for equipment properties and material is used across the company	a fixed and documented set of internationally accepted standards for equipment properties and material is used across the company
data format	data format for exchange and sharing of plant information is standardized on business unit standards, company standards, or internationally accepted standards	data format for exchange and sharing of plant information is standardized on business unit level on either a business unit standard, company standard, or an internationally accepted standard	data format for exchange and sharing of plant information is standardized across the company on either a company standard or an internationally accepted standard	data format for exchange and sharing of plant information is standardized across the company on an internationally accepted standard
product classification / modelling	at least one standard for classification / modelling of products is used	one common standard for classification / modelling of products is used within a business unit	company standard for classification / modelling of products is used	company standard for classification / modelling of products is used that supports sharing of information with external stakeholders according internationally accepted standards

A.2.5 ICT Technology & Infrastructure

ICT Technology & Infrastructure	work process standardisation (1)	sub-process optimisation (2)	internal process integration (3)	external process integration (4)
infrastructure	ICT Infrastructure and support is available e.g. desktop, server, e-mail, backup and restore facility, virus protection, network with sufficient bandwidth, internet connection			ICT Infrastructure and support is available including encrypted data transfer and network connections to external stakeholders with sufficient bandwith
security	personal work data are secured	business process data are secured	company and corporate data are secured fulfilling company guidelines and regulatory requirements	company and corporate data are secured including data shared with external stakeholders fulfilling company guidelines and regulatory requirements
information management applications	all relevant plant lifecycle information at work level is managed by information management applications such as CAD, PLM, MRO and ERP systems	all relevant plant lifecycle information, standards, procedures and rules for a particular business unit are managed and supported by information management applications	all relevant plant lifecycle information, standards, procedures and rules for a company are managed and supported by information management applications during the complete lifetime of a plant	all relevant plant lifecycle information, standards, procedures, rules and including information to be shared with external stakeholders are managed and supported by information management applications during the complete lifetime of a plant

A.3 External Information Maturity Level

A.3.1 Business Processes

Business Processes	**One - to - One exchange of information (1)**	**closed communities (2)**	**open communities (3)**	**maturing supply chain exchange (4)**
contract	information is exchanged according mutually agreed business processes in the contract	information is exchanged according standard business processes according community guide-lines	information is exchanged according standardised contractual business processes for the communities the company operates in	information is exchanged according internationally standardised contractual business processes for the supply chain the company operates in
regulatory	safety and environmental information is exchanged on a case by case basis with authorities	safety and environmental information is exchanged with authorities according agreed procedures within the community	safety and environmental information is exchanged with authorities according to agreed procedures for the communities the company operates in	safety and environmental information are exchanged according to globaly accepted standard procedures in the supply chain

A.3.2 Strategic Alignment

Strategic Alignment	**One - to - One exchange of information (1)**	**closed communities (2)**	**open communities (3)**	**maturing supply chain exchange (4)**
policy	policy is in place that exchange of information with a contractual partner will be included in work methods, procedures and contracts	policy is in place that exchange and sharing of information with contractual partners will be included in work methods, procedures and contracts according agreed guidelines and requirements of the community the company operates in	policy is in place that exchange and sharing of information with contractual partners will be included in work methods, procedures and contracts according guidelines and standards agreed by the communities where the company operates in	policy is in place that exchange and sharing of information with contractual partners in the supply chain will be included in work methods, procedures and contracts according internationally accepted guidelines and standards for that supply chain.
implementation policy	contract incentives are implemented that support strategy for information exchange with contractual partners	contract incentives are implemented that support strategy for information exchange and sharing with community members	contract incentives are implemented that support strategy for information exchange and sharing with communities where the company operates in	contract incentives are implemented that support strategy for information exchange and sharing for the supply chain where the company operates in

A.3.3 People & Organisation

People & Organisation	One - to - One exchange of information (1)	closed communities (2)	open communities (3)	maturing supply chain exchange (4)
skills & resources	Either the organisation's staff have the skills or the organisation has access to skills in order to exchange information with contractual partners	Either the organisation's staff have the skills or the organisation has access to skills necessary to exchange or share information with contractual partners according guidelines and standards agreed in the community	Either the organisation's staff have the skills or the organisation has access to skills necessary to exchange and share information with contractual partners according guidelines and standards agreed by the communities where the company operates in	Staff has the skills necessary to exchange and share information with contractual partners in the supply chain where the company operates in, according international guidelines and standards agreed in the supply chain

A.3.4 Plant Lifecycle Information

Plant Life Cycle Information	One - to - One exchange of information (1)	closed communities (2)	open communities (3)	maturing supply chain exchange (4)
standards	The contract between the two parties does contain clauses specifying the information to exchange as well as the delivery format and/or information standards	A fixed and documented set of information standards and specifications is used according agreed community guidelines and requirements	The company is able to exchange information according guidelines of the communities where the company is operating in	The company is able to exchange information with the supply chain partners according internationally accepted standards agreed in the supply chain.

A.3.5 ICT Technology & Infrastructure

ICT Technology & Infrastructure	**One - to - One exchange of information (1)**	**closed communities (2)**	**open communities (3)**	**maturing supply chain exchange (4)**
policy & planning & contracts	a company policy is in place to ensure the required ICT infrastructure is specified in contracts and any access to information is controlled and managed	policy is in place to ensure ICT systems to be used in a community are specified, managed and any access is controlled	policy is in place to ensure ICT systems to be used in inter community exchange are specified, managed and any access is controlled	policy is in place to ensure ICT systems to be used in the mature supply chain are specified, managed and any access is controlled
information management applications	any information to be exchanged with or received from an external stakeholder is managed by information management applications	any information exchanged, received or shared with community members is managed by information management applications	any information exchanged, received or shared within the communities where the company operates in, is managed by information management applications	any information exchanged or shared within the supply chain is managed by information management applications

Annex B
All levels of PISTEP Model {Informative}

For the purposes of the ORCHID initiative, the PISTEP activity model is used in two contexts. Firstly to provide a common basis for companies in the supply chain to review their business processes –refer to Key Principle 1. Secondly to identify at a high level the key information types that are exchanged and these provide a basis for companies to identify the relevant current standards as identified in the ORCHID Landscape of Standards

Reference: The Plant engineering activity model used in ORCHID was developed in the 1990's by PISTEP in the UK. Below the then acknowledgement is listed and the main activity chart. The detailed activity level charts are included in the implementation guide. The usage of the activity model will be further discussed in the guide as well.

PROCESS PLANT ENGINEERING ACTIVITY MODEL

The information in this presentation is subject to change without notice.

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Figure 7 - Acknowledgement PISTEP

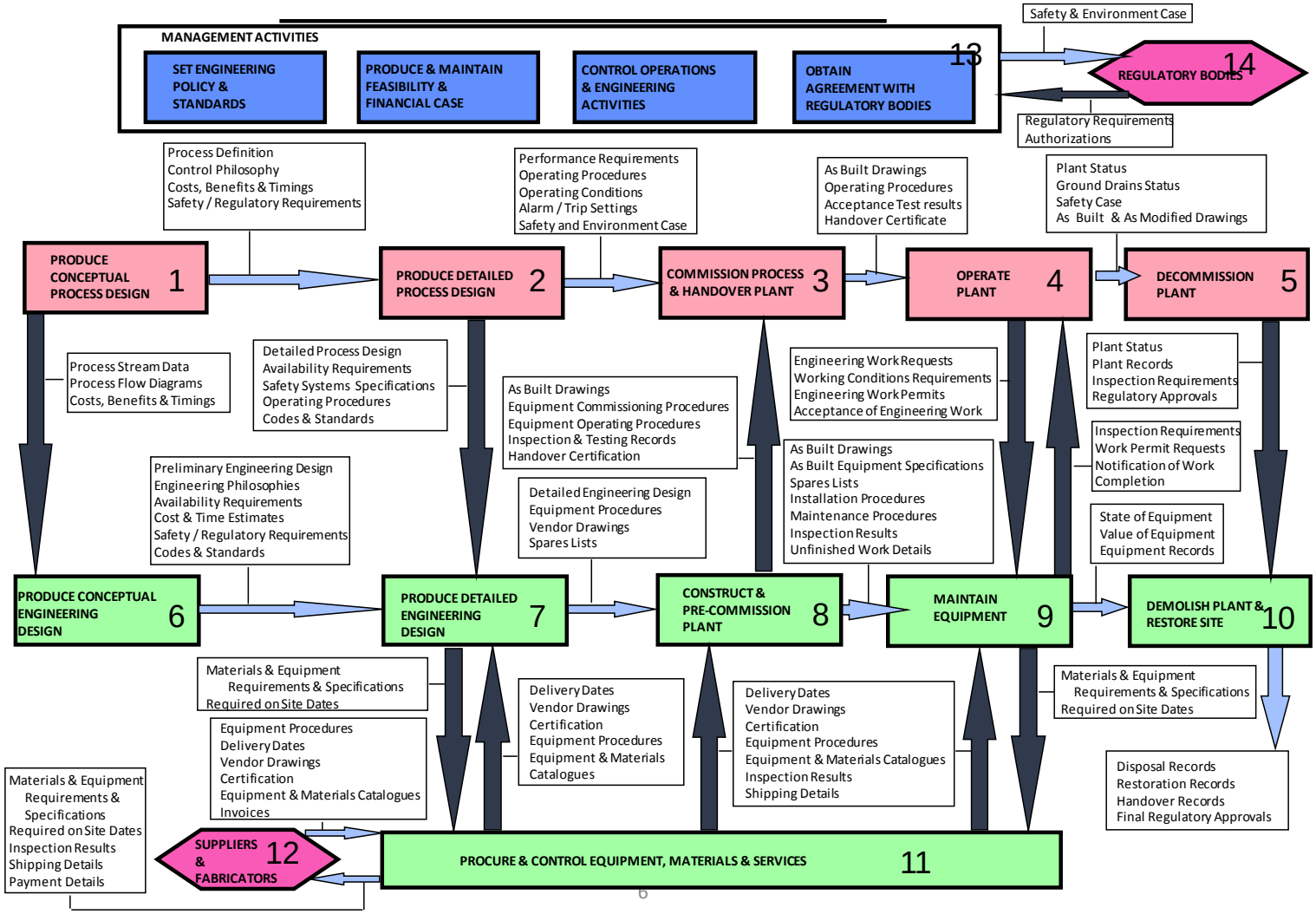

Figure 8 - Overview about the Process Plant Engineering Activity Model of PISTEP

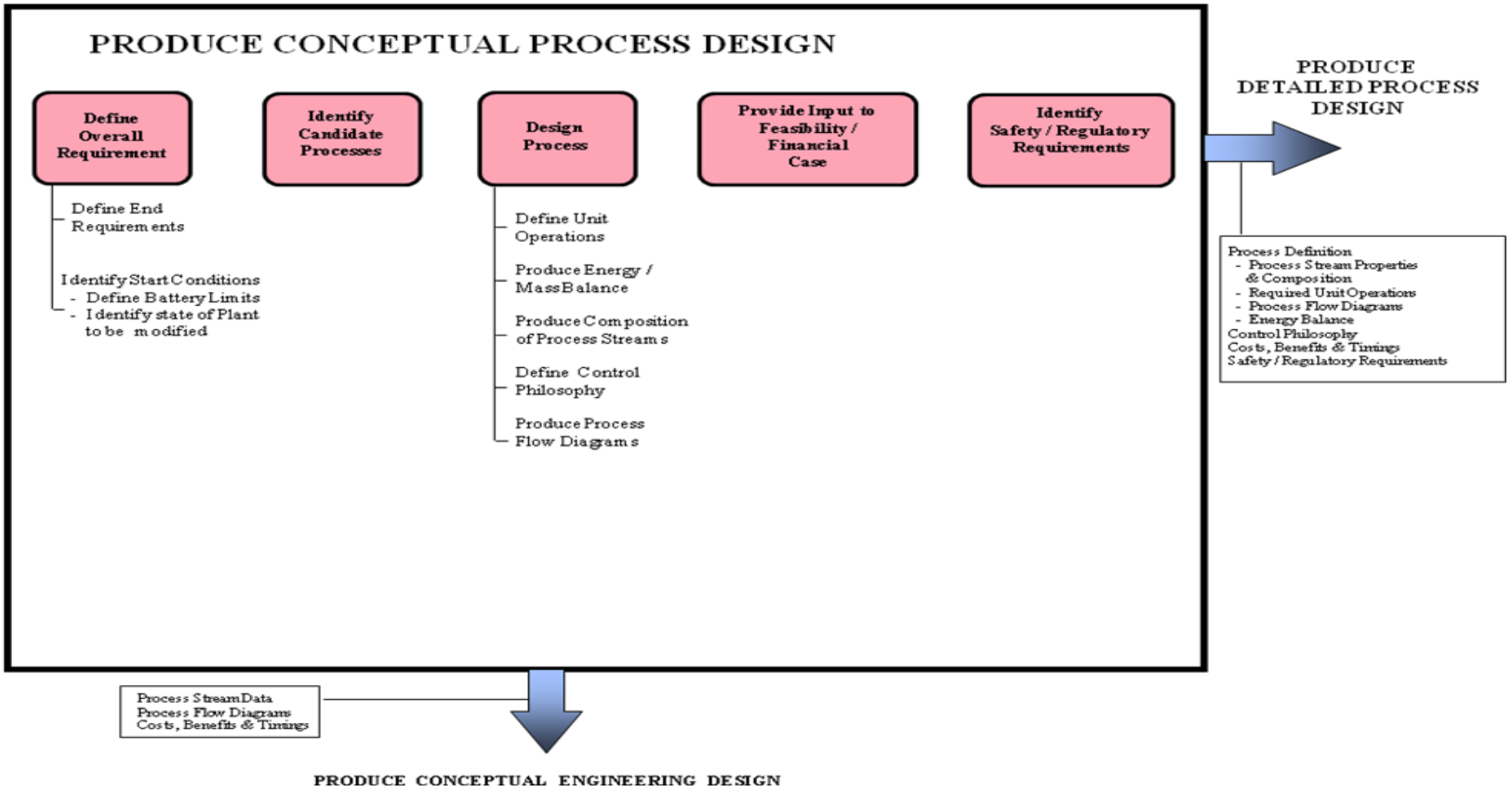

Figure 9 - Breakdown of phase "Produce Conceptual Process Design"

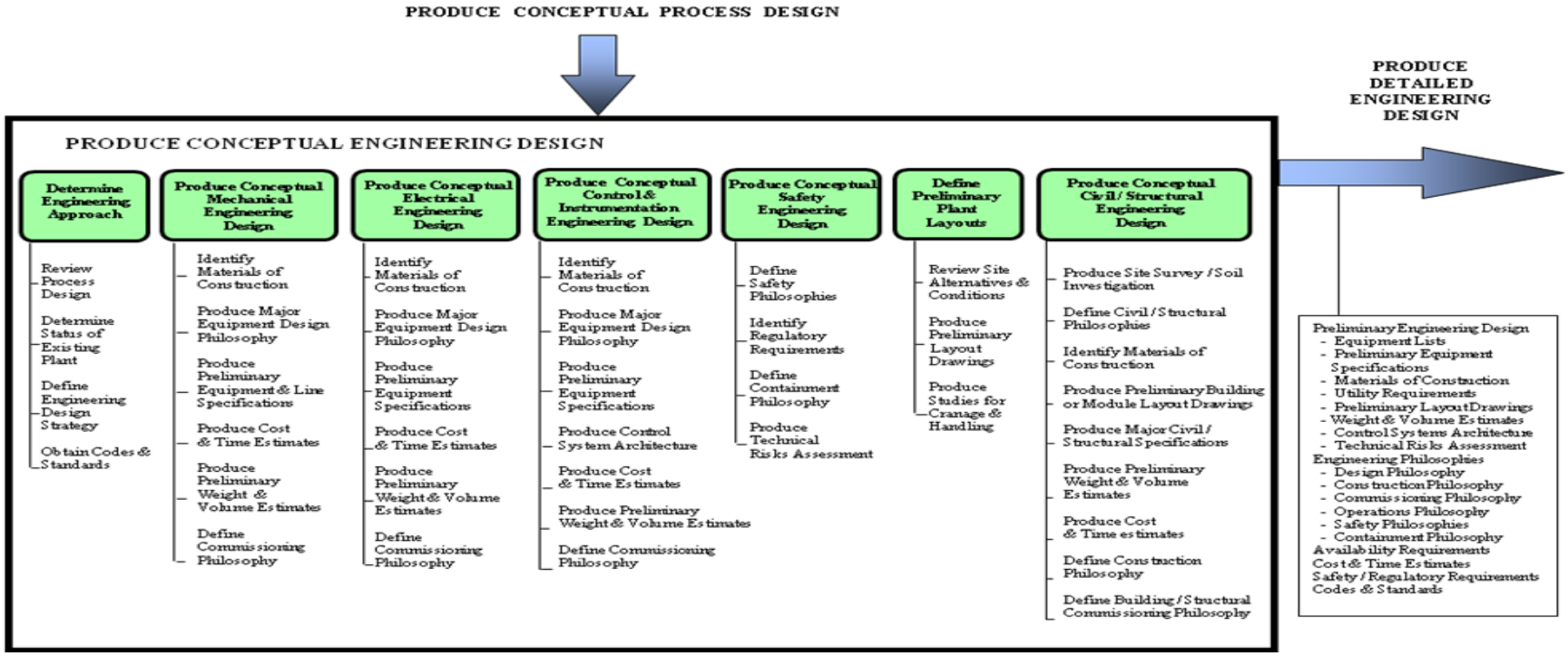

Figure 10 - Breakdown of the phase "Produce Conceptual Engineering Design"

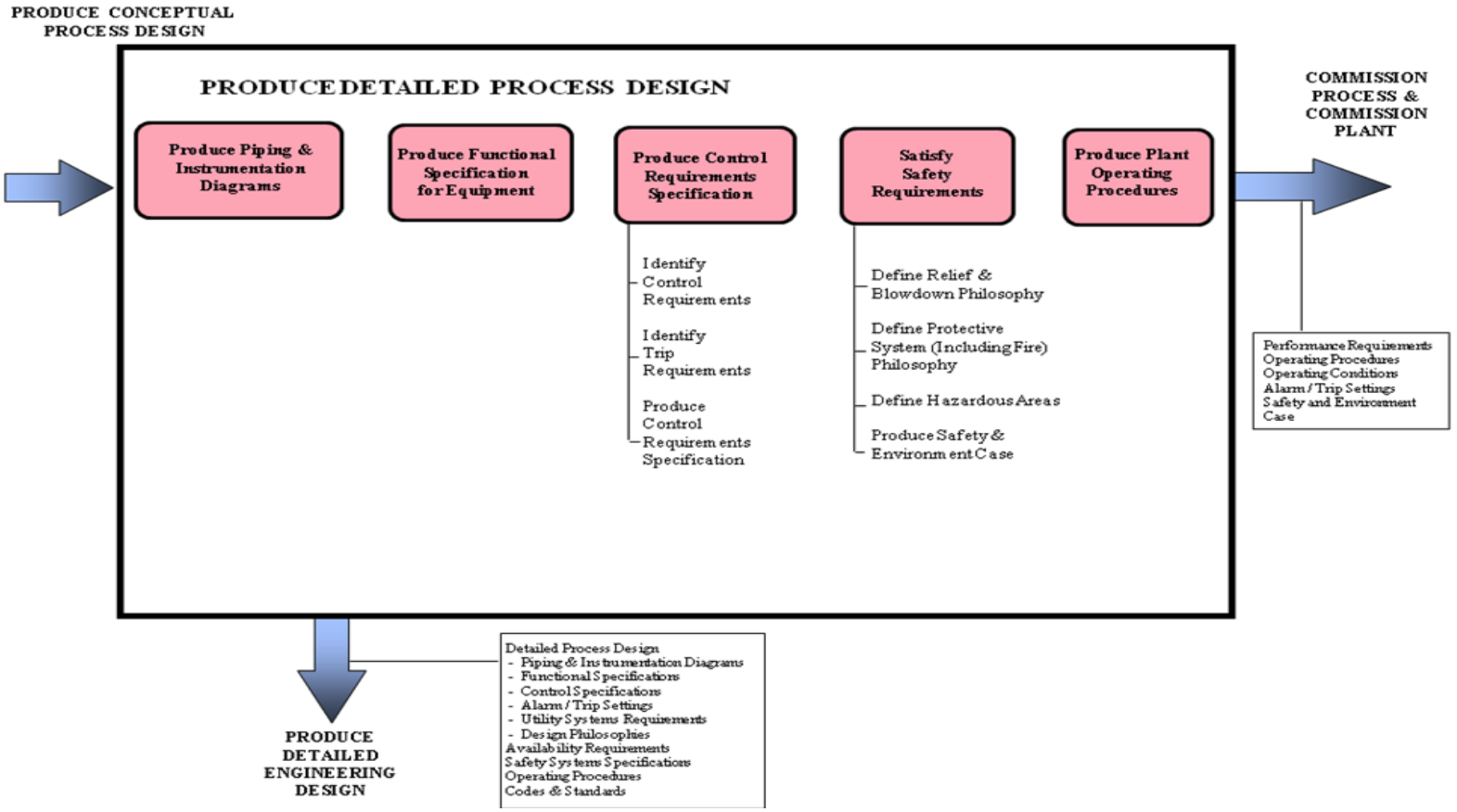

Figure 11 - Breakdown of the phase "Produce Detailed Process Design"

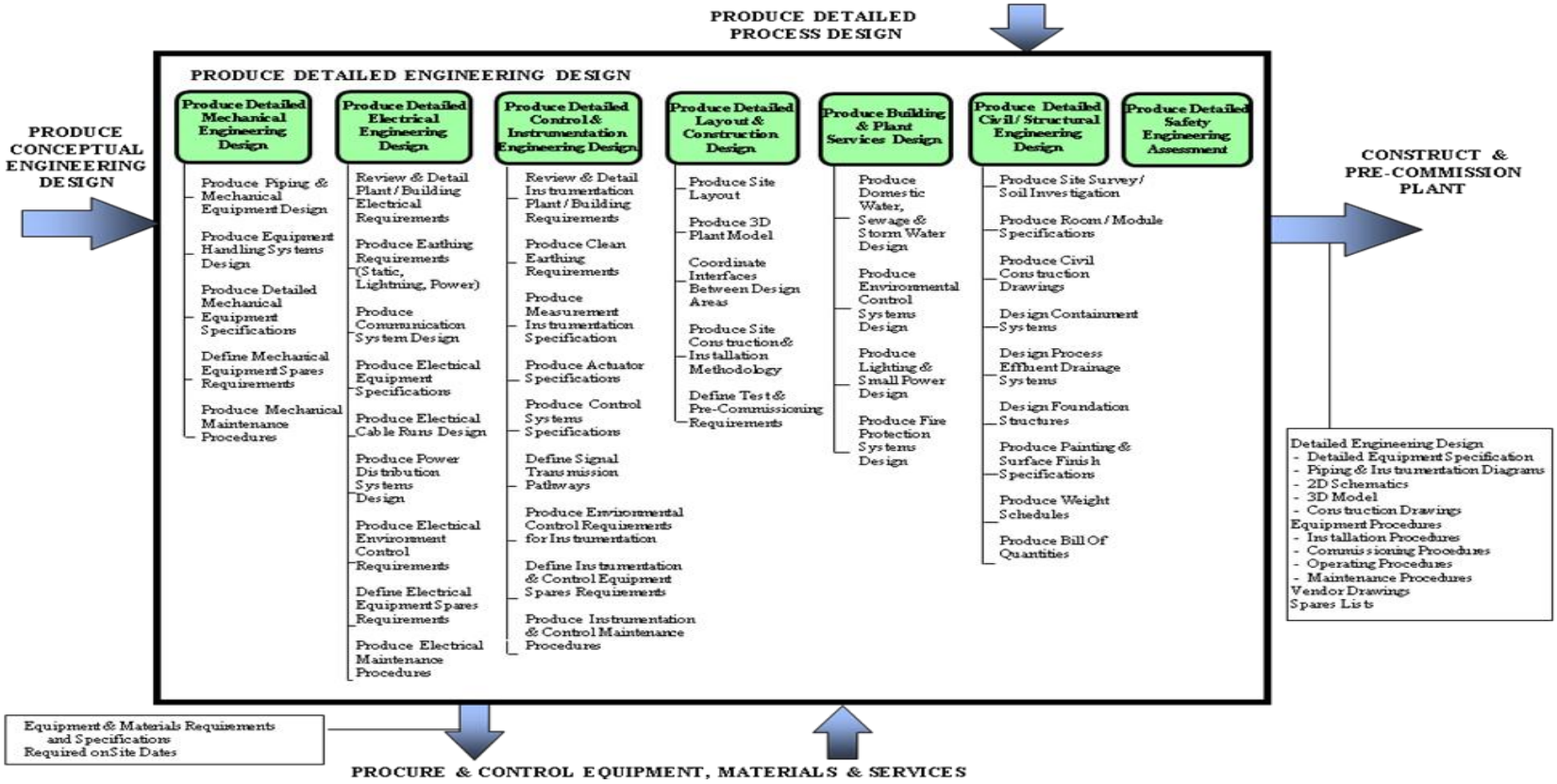

Figure 12 - Breakdown of the phase "Produce Detailed Engineering Design"

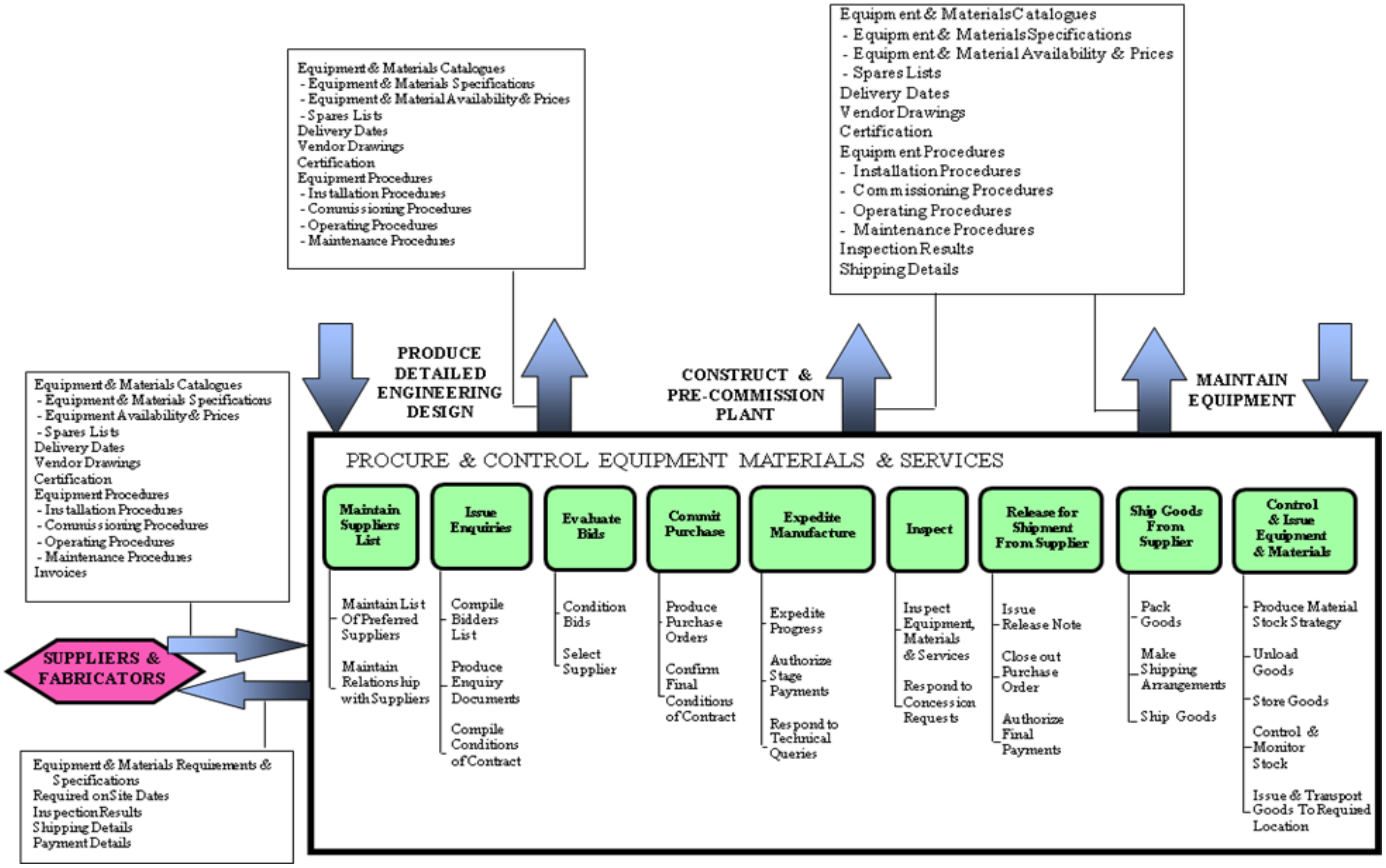

Figure 13 - Breakdown of the phase "Procure & Control Equipment Materials & Services"

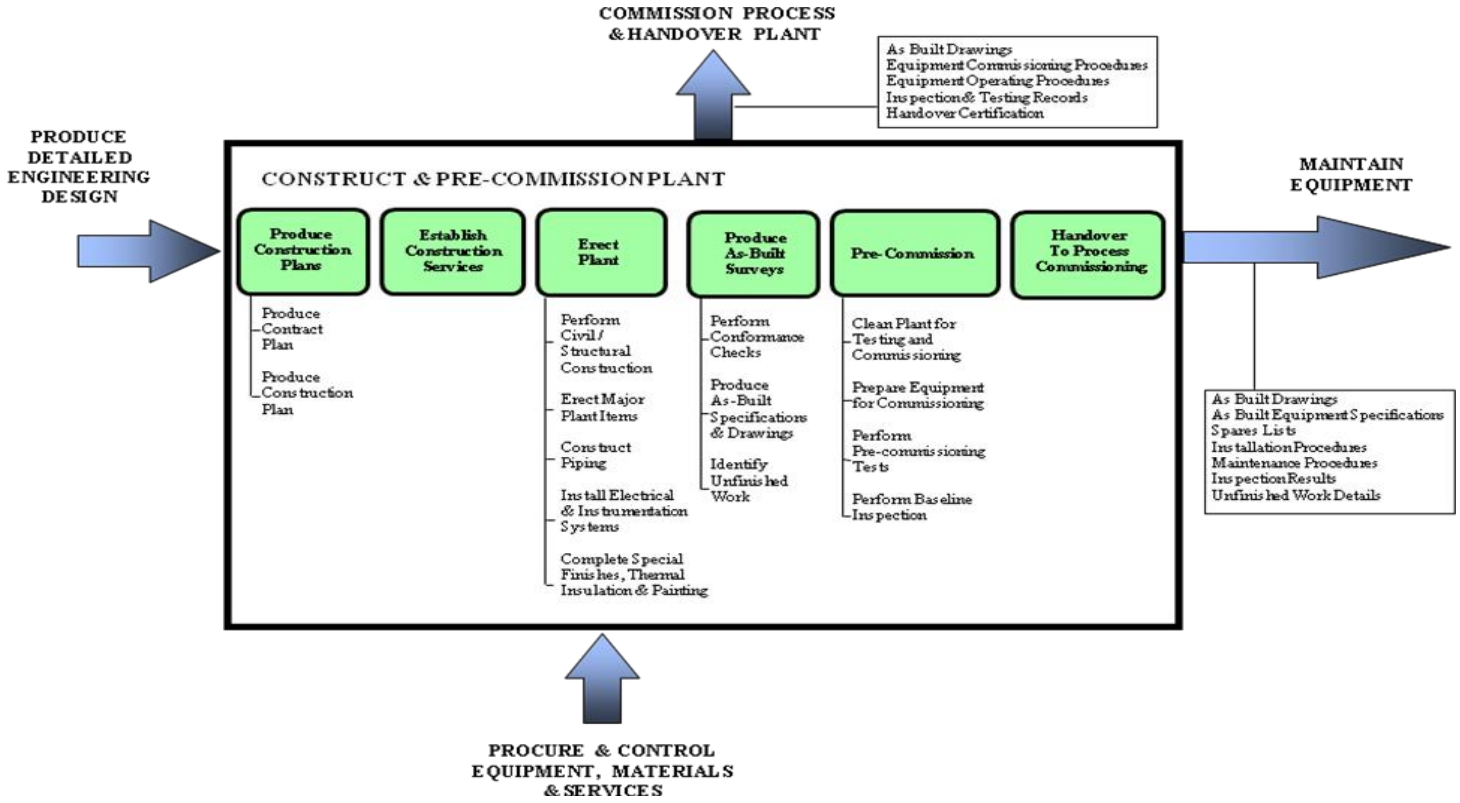

Figure 14 - Breakdown of the phase "Construct & Pre-Commission Plant"

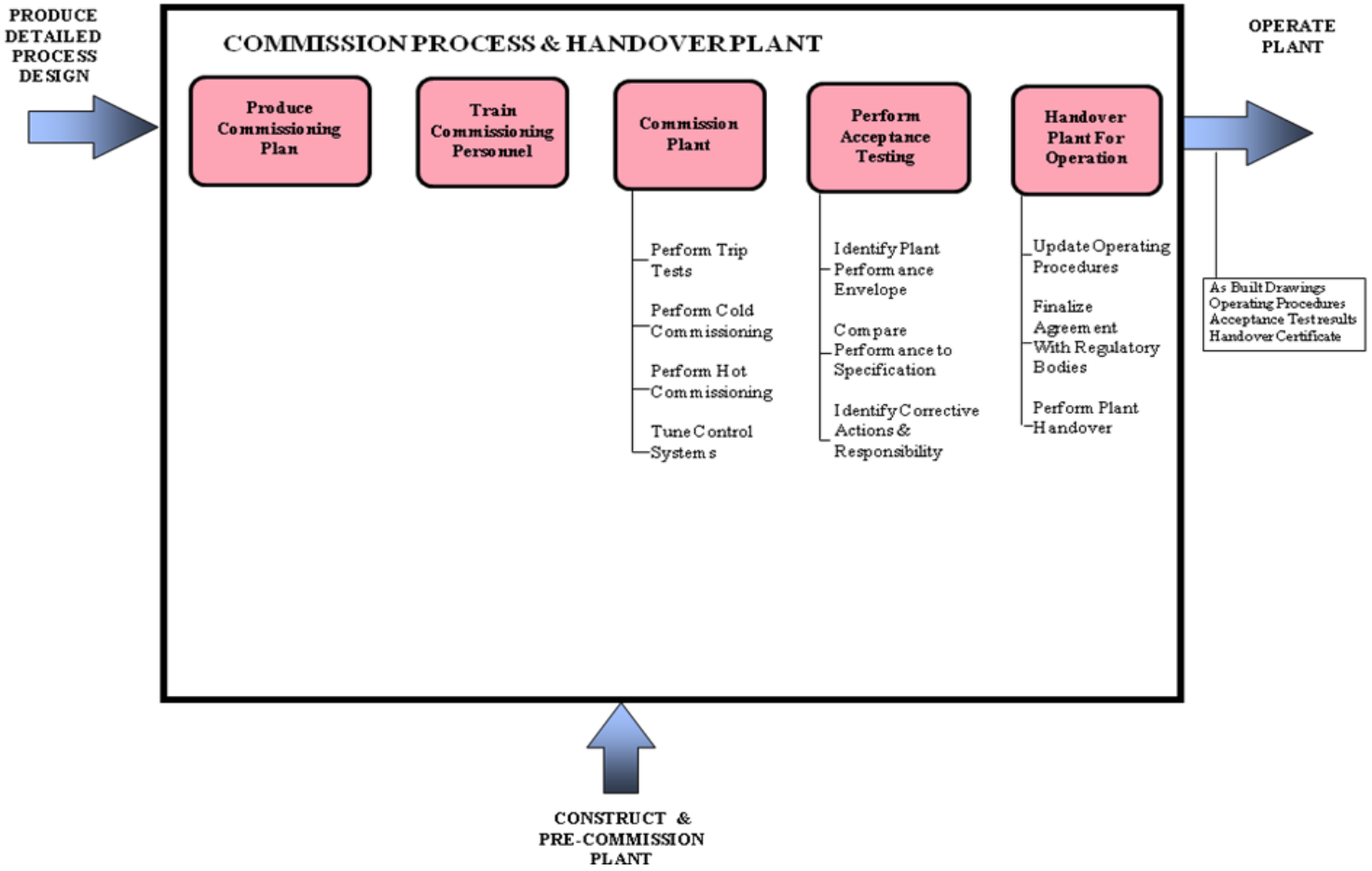

Figure 15 - Breakdown of the phase "Commission Process & Handover Plant"

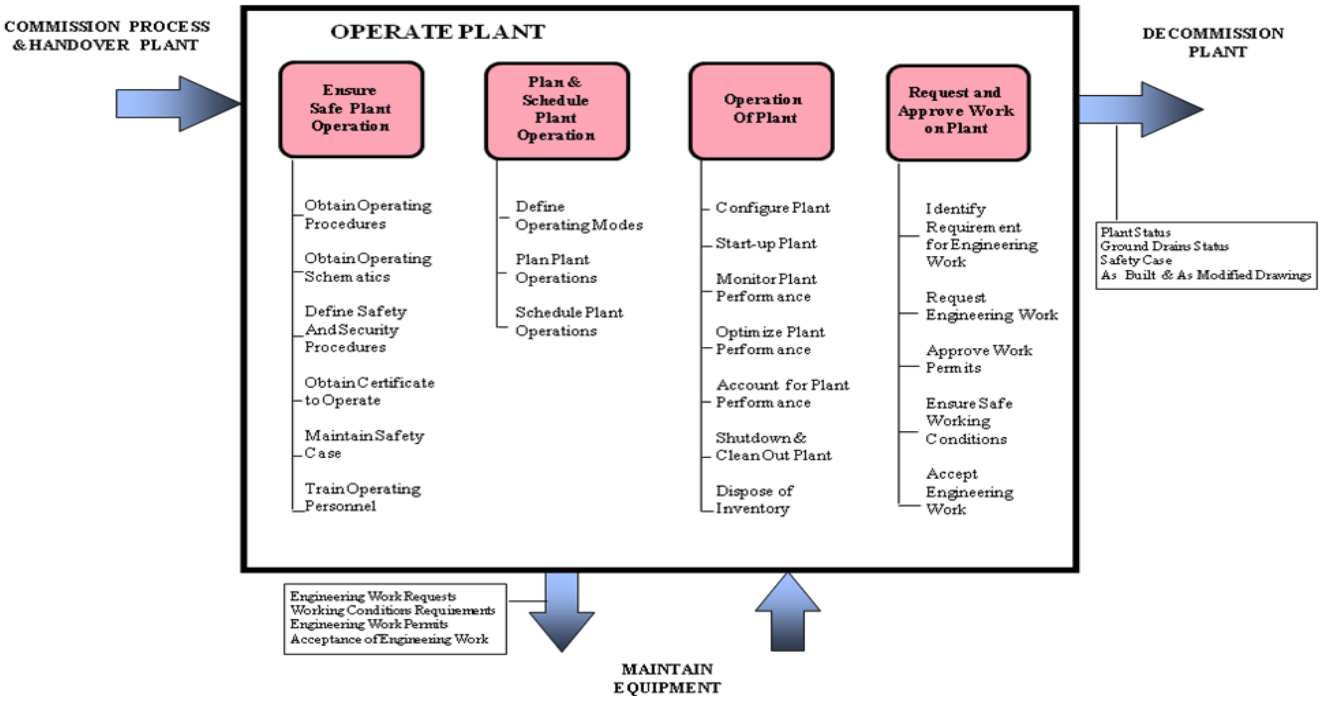

Figure 16 - Breakdown of the phase "Operate Plant"

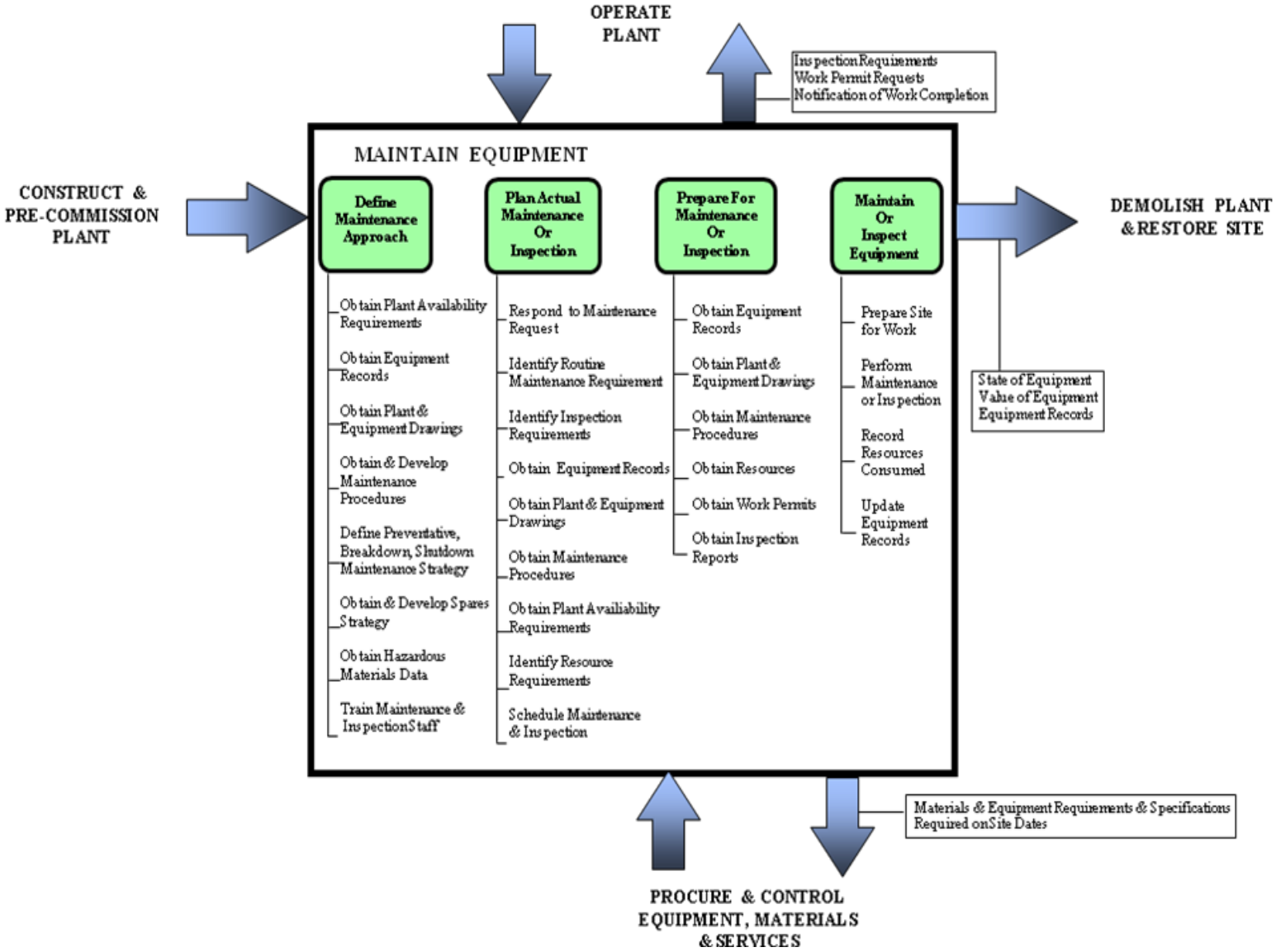

Figure 17 - Breakdown of the phase "Maintain Equipment"

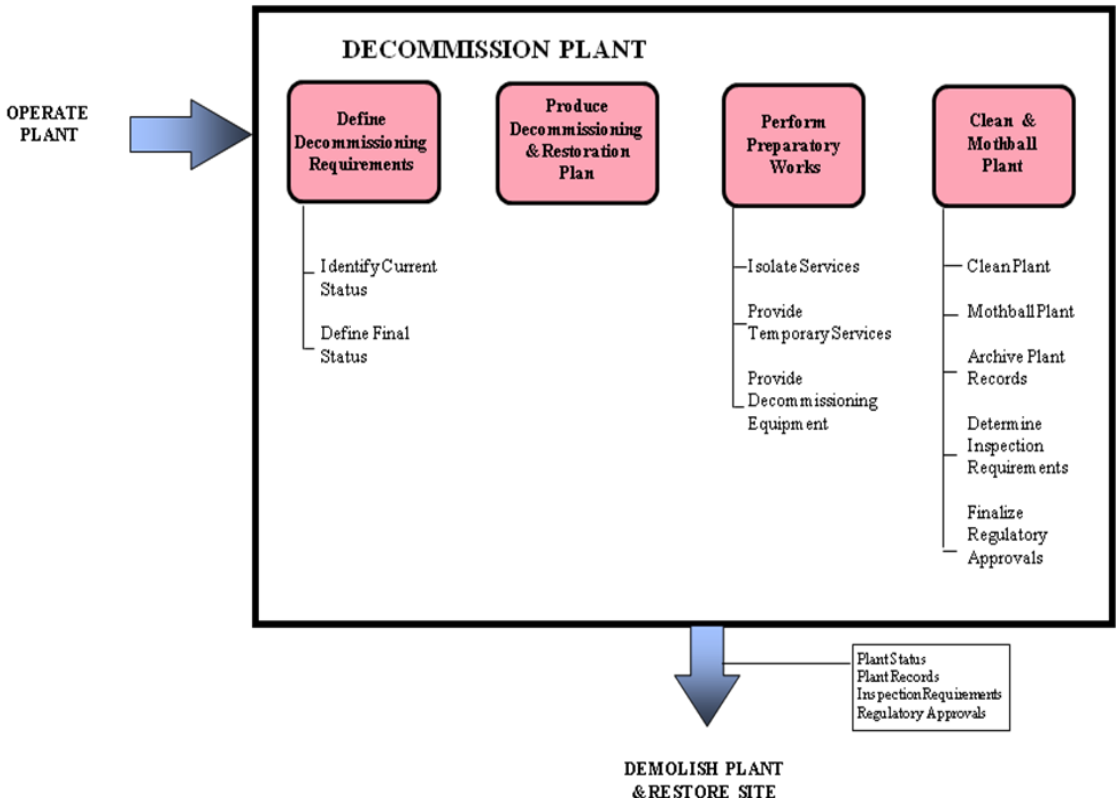

Figure 18 - Breakdown of the phase "Decommission Plant"

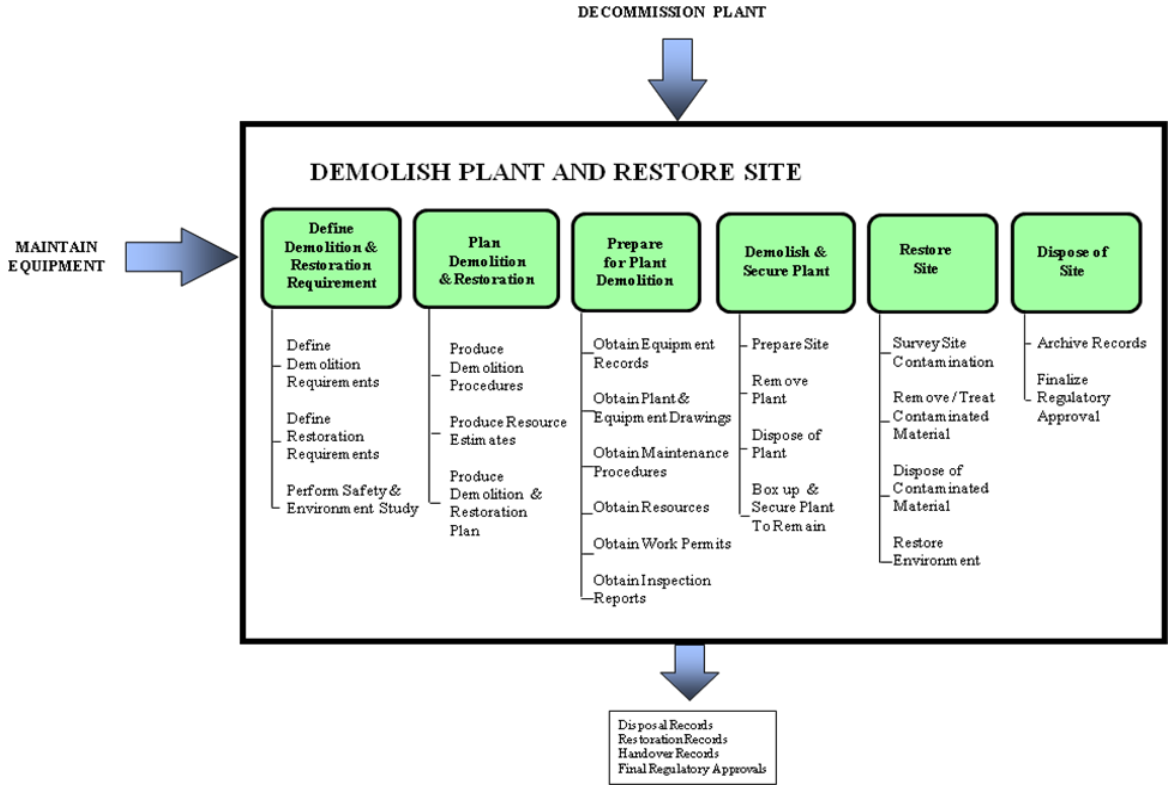

Figure 19 - Breakdown of the phase "Demolish Plant and Restore Site"

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