AIChE Benelux – May 31, 2012

Excellence in Turnaround Management

AIChE

May 31, 2012

Jos Vankevelaer

BASF
The Chemical Company

BASF – The Chemical Company

We create chemistry for a sustainable future

- Our chemicals are used in almost all industries
- We combine economic success, social responsibility and environmental protection.
- Sales 2011: €73,497 million
- EBIT 2011: €8,586 million
- Employees
  (as of December 31, 2011): 111,141
- In 2011, BASF filed for around 1,050 new patents worldwide
- 6 Verbund sites and around 370 production sites

Demographic challenges set the stage for the future of the chemical industry

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Nine billion people in 2050 but only one earth

Resources, Environment & Climate

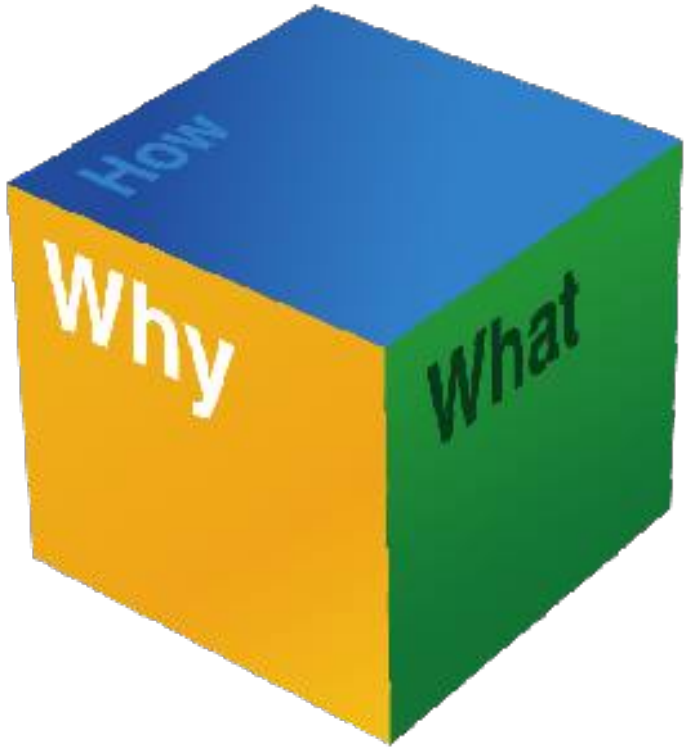
Food & Nutrition

Quality of life

Chemistry as enabler

Our purpose

We create chemistry
for a sustainable future



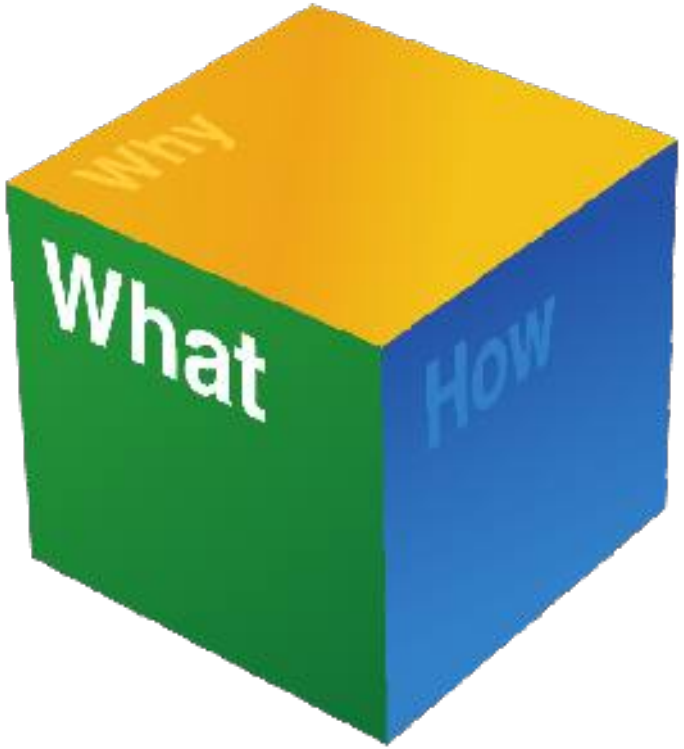
Our strategic principles

We add value as *one* company

We innovate to make our customers more successful

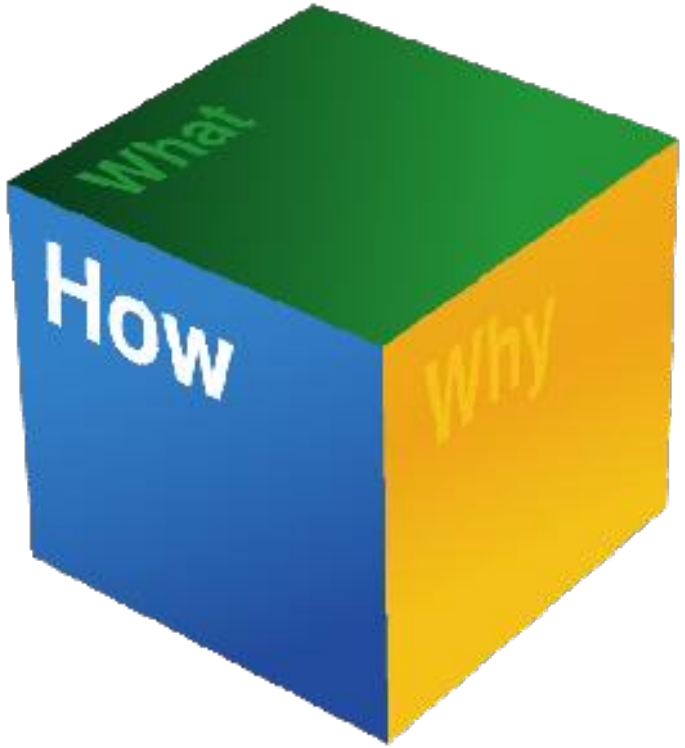
We drive sustainable solutions

We form the best team



Our values

- Creative
- Open
- Responsible
- Entrepreneurial



Organization of the BASF Group

- Six **business segments** contain 15 **divisions** which bear the operational responsibility and manage 70 global and regional business units
- These in turn develop strategies for 76 **strategic business units**
- **Regional divisions** contribute to the local development of BASF's business, help to exploit market potential and are responsible for optimizing the infrastructure for our businesses
- Three **central divisions**, five **corporate departments** and ten **Competence Centers** provide Group-wide services such as finance, investor relations, communications, human resources, research, engineering and site management

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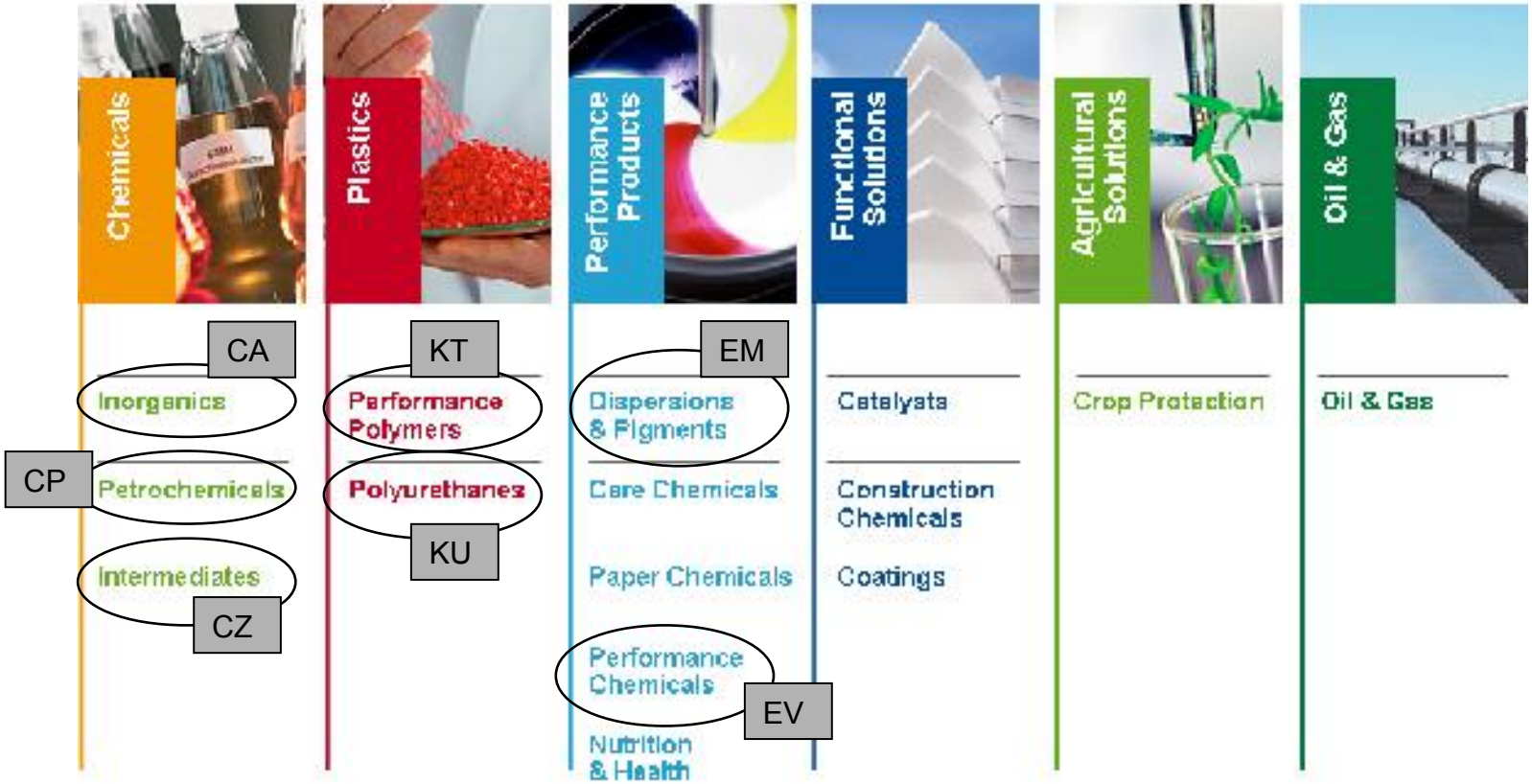

BASF Antwerpen

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BASF Antwerpen

600 ha

60 Installations

3.000 Own Personnel

2.000 Personnel (Partners & Contractors)

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Best Practices in Cracker TAR
BASF Antwerp - 2007

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Best Practices Overview

1. Clearly establish and communicate the TAR objectives.
2. Minimize the shutdown scope. Define and freeze the scope early.
3. Develop and work according to an overall TAR Project Schedule.
4. Define the budget based upon the frozen scope.
5. Develop and communicate a TAR-relevant EHS Plan.
6. Introduce an integrated TAR project organization with dedicated people.
7. Establish a clear documentation, communication and reporting strategy early.
8. Integrate TAR Infrastructure and Facilities.
9. Develop a TAR-specific contracting- and procurement strategy.
10. Integrate Operations, Maintenance, and Capital Project planning and execution.

1. Clearly establish and communicate the TAR objectives

Include all aspects: **EHS, Quality, Schedule and Costs => EHSQ€**

- Define and agree the TAR-Targets with the Business Unit (BU)
- Define the objectives in line with the TAR-Targets
- Clarify priorities with the BU (schedule ⇔ cost)
- Operational objectives => Importance of "QUALITY"
  - ✓ Safe operations
  - ✓ Mechanical reliability
  - ✓ Operational reliability
- Balance between company's financial goals and plant's operational needs
- Organizational effectiveness goals
  - ✓ High performance team in a synergistic work environment
  - ✓ Achieve true team work environment free from stress & organizational conflict
  - ✓ Integrated team, including key personnel of main contractors
  - ✓ Include "Team Building"

1. Clearly establish and communicate the TAR objectives

DOELSTELLINGEN STEAMCRACKER
UITBREIDING & TURNAROUND

VEILIGHEID, GEZONDHEID EN MILIEU

BUDGET

SCOPE

TERMIJN EN DUUR VAN DE SHUTDOWN

KWALITEIT

DIT ALLES IS SLECHTS BEREIKBAAR DOOR EEN GOEDE TEAMGEEST BIJ IEDERE MEDEWERKER!!!!

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Teambuilding

2. Minimize the shutdown scope. Define and freeze scope early.

Define the scope early, challenge & freeze the scope

- Set up criteria for scope generation.
- Execute a cold eyes scope challenge.
- Appoint a gatekeeper and develop a gate keeping procedure to restrict scope expansion after the freezing point.
- Include capital project work from the beginning.

Was only possible for maintenance scope!

Was not successful for project scope and plant changes!

Optimize the shutdown scope in order to minimize downtime & cost and to keep the scope manageable.

Maximize the scope to be executed during pre-SD/post-SD to minimize the SD scope.

Reduce the scope in an innovative way

Plan for Unexpected Scope

- Increased duration between two consecutive shutdowns leads to an increase of (unexpected) scope
  - Separate project crews on last minute scope issues
    - Flexible joints
  - Install a crash team to handle unexpected scope
    - Leaking cooling water heat exchangers in ethylene cooling circuit have been re-tubed

Separate project crews on last minute scope

3. Develop and work according to an overall TAR Project Schedule

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Start with a Milestone Plan

Milestone	Due Date
Kick-off Meeting	01/01/2010
Planning Organisation Chart	01/04/2010
Scope Challenge Finished	01/10/2010
Scope Freeze	01/11/2010
Confirm TAR Objectives	01/12/2010
Readiness Review #1	01/12/2010
Execution Organisation Chart	01/04/2011
Commission S Notification	01/06/2011
Readiness Review #2	01/08/2011
Detail Planning Finished	01/09/2011
Detail Execution Schedule Ready	01/10/2011
Start Shutdown	01/01/2012
Start SD work scope	15/01/2012
End of SD	01/03/2012
Final Review Meeting	01/04/2012
Project Closure	01/08/2012

3. Develop and work according to an overall TAR Project Schedule

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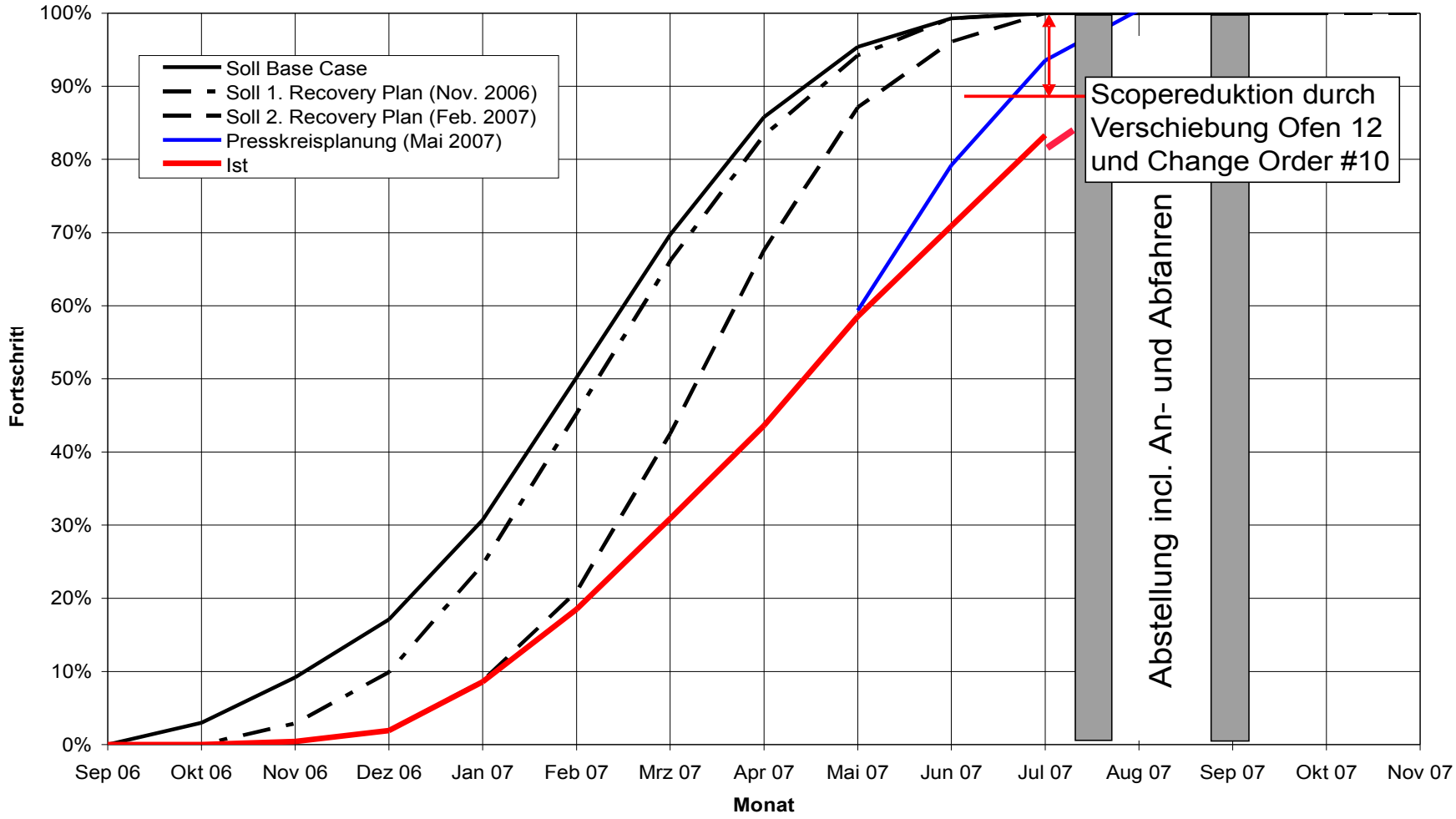
Turnaround Process Matrix

- Define the Concepts and Deliverables for each of the Processes described in the Turnaround Process Matrix
- Describe these Concepts in your Project Execution Plan
- Develop a Plan to develop these Concepts
  Who? **Milestone?**
- Develop a Plan to develop the Deliverables (e.g. Procedures)
  Who? **Milestone?**

Integrate this information in the overall TAR Project Schedule (MS-Project)

- Develop your SD-Procedures (procedures for the execution phase) in time!
- Bundle the SD-Procedures, including the SD-relevant EHS-procedures, which are relevant for all supervisors, also the contractor supervisors, in a **Shutdown Manual!**
- **Communicate them in time and stick to them!**

Delay in schedule



Scope expansion too late & pre-SD scope not ready

- Project restart was not expected; re-start of engineering took too much time!
- Not enough experienced personnel available
- Huge delays in purchase and delivery of materials and equipment
- Enormous cost pressure on Contractor: errors in engineering, estimation errors and increased fabrication and construction costs
- Contractor's countermeasures to guarantee the milestones in the project time schedule were not sufficient
- Discussions in steering committee did not generate the necessary measures
- 5 – 10% of the pre-SD piping scope and even a higher % of the tracing and insulation was not ready before start of the shutdown
  => delayed start of tie-ins and delayed pre-commissioning and re-commissioning
  All resulted in an enormous increase of „not-planned" SD-scope!

Stick to the developed TAR-Project Schedule

- Ensure **pre-SD scope to be ready before start of SD**
- **Contingency plan in case the pre-SD scope should not be ready**
  => Develop the necessary “contingency” procedures in advance

Pre-Shutdown Construction of Furnaces and Aluminium Plate Exchangers

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Pre-Shutdown Erection of new C3-Splitter

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4. Define the Budget based upon the frozen Scope

- Target to be agreed with the Business Unit
- Accuracy of the budget to be increased when scope gets detailed
- Bottom-up verification required
- Changes of budget can be approved in the Steering Committee

5. Develop and communicate the TAR-relevant EHS Plan & EHS Manual in time

Based on Best Practices and Lessons Learned from TARs in the past and TAR EHS audits

EHS Best Practices

EHS Concept → **EHS Plan** → **EHS Manual**

Starting from a check list that clarifies which EHS aspects have to be considered to be developed in a concept or a procedure

Bundle of developed EHS procedures

Contains the EHS procedures for the TAR execution phase (Shutdown)

6. Introduce an integrated TAR project organization with dedicated people

- **Divide the TAR-organisation among dedicated key people from all major disciplines:** TAR-project director, TAR-manager, EHS-Manager, Controller, Material Manager & TAR-Coordinators from production, mechanical (incl. scaffolding & insulation) and E&I
  - Operations in the lead
  - Capital project organization to be integrated
  - Install crash team to handle unexpected scope or execution problems

- **The organization should fit to the complexity and kind of work**

Organization should fit to the complexity and kind of the work

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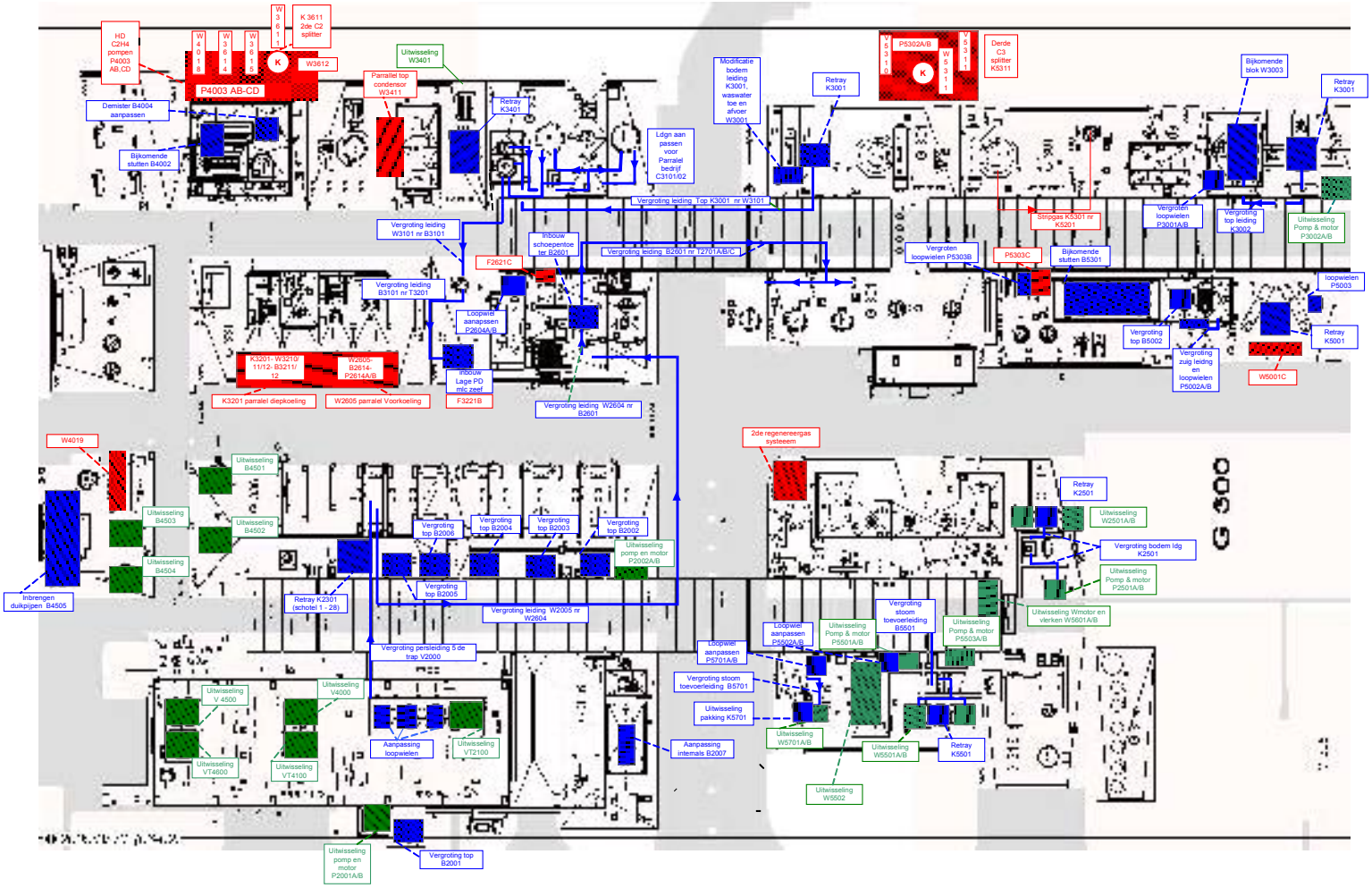
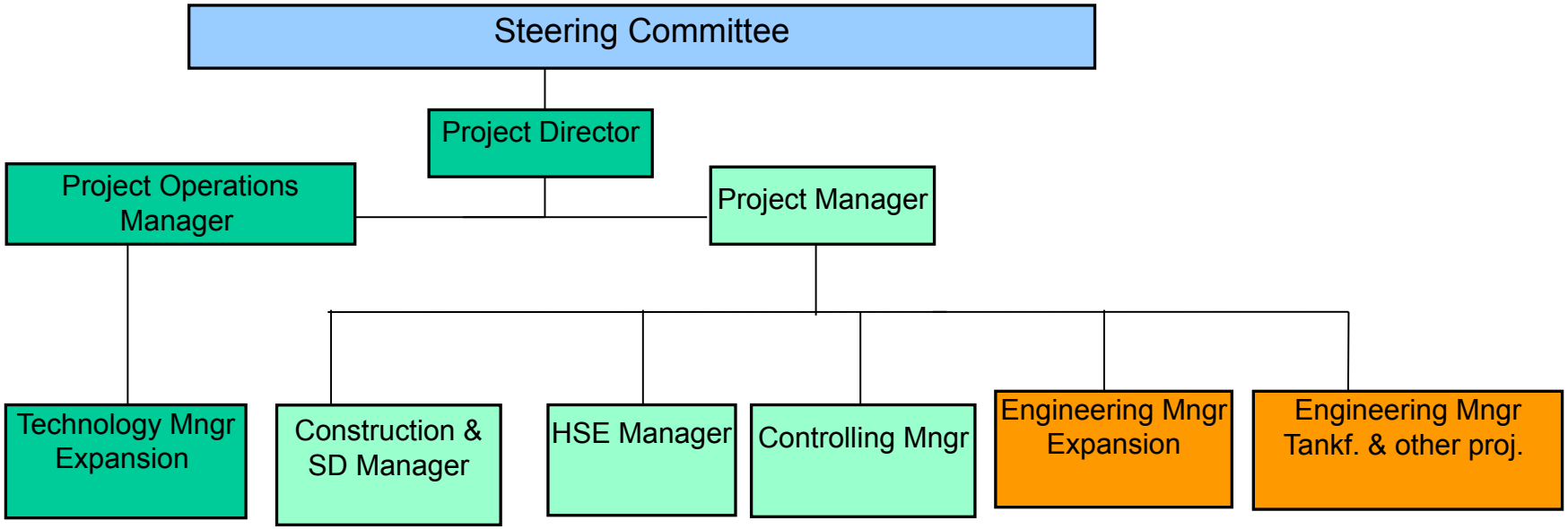


Organization should fit to the complexity and kind of the work



Construction driven project!
Specific plant knowledge is important!

7. Establish a clear documentation, communication and reporting strategy early

- Fix the documentation systems early with focus on re-usability for the next turnaround
- Document the scope on P&Ids
- Develop job cards with pictures
- Have a communication plan in place

Individual Monthly Report TAR
To be started at an early stage of the TAR-Project

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Highlights:

Status September 30, 2007:

- **September:** **177028 man-hours,** **1 LTI-incidents**
- **Cumulative:** **405204 man-hours,** **2 LTI-incident**

– **Planning / work preparation:**
- Shutdown project started on July 1, 2007.
- Stop CGC: August 17, 2007
- Re-scheduled date for restart of CGC: October 22, 2007
  Further delay of 12 days due to several problems:
  - Clearing of several systems (up to 2 days delay),
  - Problems with release of work permits, especially hot work permits,
  - Labour force problems, e.g. unsufficient qualified welders,
  - Underestimation of tie-in work due to unsufficient work preparation,
  - Temporary banning of Safe Rad equipment for NDT of welds due to radiation incident,
  - High number of punch items during mechanical completion of main systems.
- Further overshoot of budget expected due to delay of restart.

– **Concerns:**
- The restart can be further delayed due to the high number of punch items and late hand-over of main systems. Especially the large amount of remaining cold insulation can cause further delay.
- The amount of punch items may increase the risk for leakages during start-up.
- Further delay will increase the cost of the turnaround.
- High amount of remaining scaffolding due to late completion of shutdown and pre-shutdown scope (esp. insulation) impacts the mobility in the plant during start-up.
- Delay in insulation can cause start-up difficulties.

(Report Sep 2007 - Highlights)

8. Integrate TAR Infrastructure and Facilities

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Infrastructure

9. Develop a TAR-specific Contracting & Procurement Strategy

- Include major contractors at an early state of planning
- Contracting concept should be related to the actual market situation
  - ✓ Know your local and regional contractor market well
  - ✓ Make company profiles and collect recent field experiences and feedback
  - ✓ Get some powerful contractors on board: contractors with the ability to act fast and to build up extra resources fast
  - ✓ Get enough players on board; limit the "no show-up" risk
  - ✓ Do not allow a contractor to "over-eat" himself; limit the span of control
  - ✓ Use of well-known qualified long term contractors, e.g. in-house contractor

How to Minimize Impact of Shortages of Skilled Staff and Crafts

- Know how many skilled people every contractor can mobilize
  Availability of skilled technical workers is declining in Western Europe
- Split the work scope according to the different areas so that it can be allocated to a number of contractors
- Require a robust organization versus a high number of executors
- Have a well-structured owner's organization
  - Separate planning and supervision for separate jobs, e.g. re-trays, equipment modifications, exchange of catalyst, chemical and industrial cleaning and rotating equipment
  - Quality should be handled in a similar way as safety
- Motivate the employees

Motivate the Employees, also Contractors'

10. Integrate operations, maintenance, and Capital Project planning and execution.

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Integrate operations, maintenance, inspections & capital projects in one planning based on 'proven', 'best in class' systems:

- Use one method, one permit system and one organization for de-commissioning, execution of shutdown and re-commissioning
- Planning system should be proven, available in time and all people should be well-trained on how to use it
- Guarantee the planning to be complete in time and qualitatively good
  - ✓ Scope should be very detailed
  - ✓ Turnaround management tool should be proven and available in time
  - ✓ Check and input of work preparation in turnaround tool to be done by well-trained owner's planners

Tie-ins: include project work from the beginning

- Project scope should be handled in the same way as maintenance scope
- Tie-ins should get enough priority due to their impact on the critical path of the shutdown; tie-in engineering is for LSTK-contractor no priority
  Delay in tie-in engineering delays optimization of tie-ins and also the detailed scoping of the tie-ins, which is influenced by the way of execution.
  The resulting planning has impact on the material ordering.
- Elaborate and communicate the work procedures in time with all executing contractors
- Integrate contractor in time in the SD-organization to minimize impact on planning and scheduling due to lack of knowledge on the tool

Execution of Tie-ins

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Solid Planning of PLT-Project Activities

Replacement of equipment and re-trays

Industrial Cleaning

Rotating Equipment

Questions ?