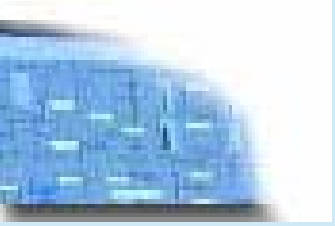
SINTEF

C R I O P

a scenario based risk analysis of control centres

http://www.criop.sintef.no



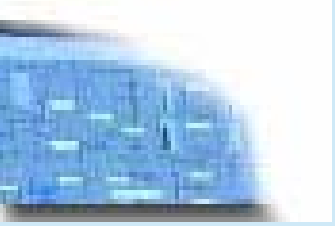
CRIOP - *Crisis Intervention Offshore Production*

CRIOP is a human factors (HF) based method to verify and validate the ability of a control centre to safely and efficiently handle all modes of operation. CRIOP is based on ISO 11064 – "Ergonomic design of control centres."

CRIOP goes thru checklists, potential accident scenarios and identifies critical actions in a Human-factor perspective.

CRIOP has been successfully applied to prevent accidents in the Norwegian oil industry for 15 years.

CRIOP identifies need for change early in the design phase. This is far less expensive than changes made later in the process.



CRIOP – interaction analysis

CRIOP analyses the interaction between operators and technical system thru checklists and during selected critical scenarios.

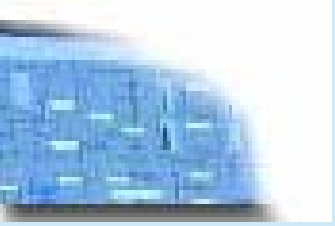
The aim is to prevent major accidents.

CRIOP is suitable both for the design phase and operations of new control rooms or modifications.

CRIOP is handling all modes of operations, including:

- Start up
- Normal operations
- Maintenance
- Revision maintenance
- Process disturbances
- Safety critical situations
- Shut down

CRIOP was originally made for offshore systems and offshore control-rooms. It may also be applied to other industries and other control-rooms systems such as nuclear power plants.



Areas of application

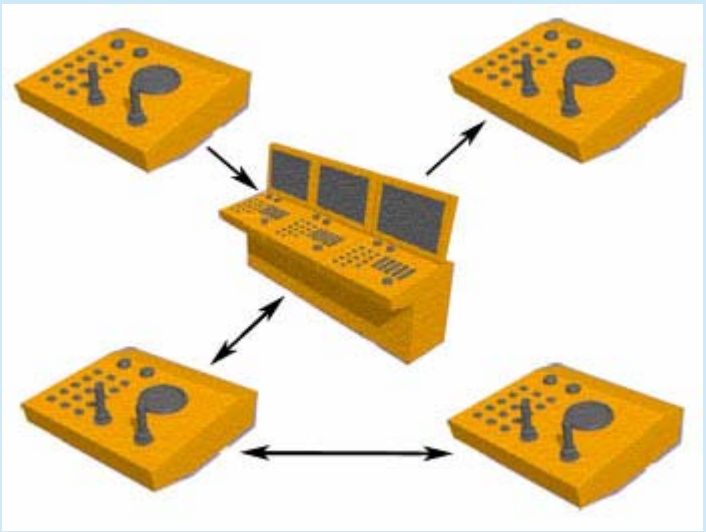
The present CRIOP methodology is customized for offshore and onshore control centers. Areas of application are:

- Central control rooms
- Control centers (used in e-Operations)
- Driller's cabins
- Cranes
- Emergency control-rooms (onshore / offshore)
- Cabins, e.g.

The methodology can also be used for other purposes, e.g.:

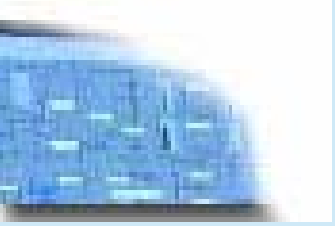
- The driving cabin of a train
- The command bridge of a boat

The "control room" can be a centralized room, a collection of distributed control rooms or a number of interconnected panels and cabins.



The scope of a full CRIOP analysis is between 2 to 5 days of effort. A detailed description can be found free of charge on the CRIOP-web pages: http://www.criop.sintef.no

Assistance for carrying out the CRIOP-analysis can be required see also http://www.criop.sintef.no.



CRIOP - a risk analysis method

Risk analysis is a proactive approach that enables us to identify and assess accident risks before they cause major loss.

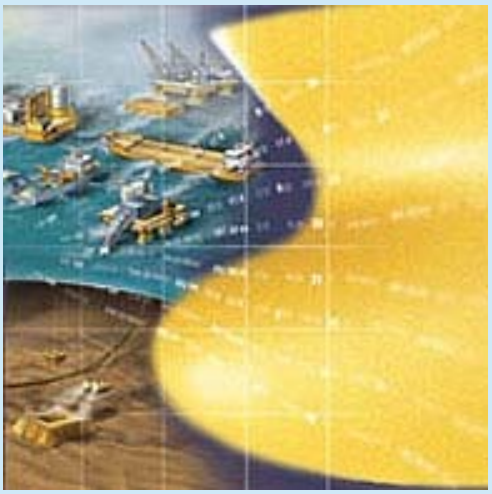
CRIOP is a planned method for identification and evaluation of accident risks in the control room. Performing risk analysis speeds up the learning process both for the operators and the managers of the system. Properly executed risk analysis of systems will reveal hazards corresponding to many years of accident experience from the same types of systems.

CRIOP measures the risk in terms of consequences of human errors.

SHE-legislation (Safety, Health and Environment) tends to replace prescriptive requirements with goal-oriented requirements.

Compliance with such requirements often has to be documented through risk analyses.

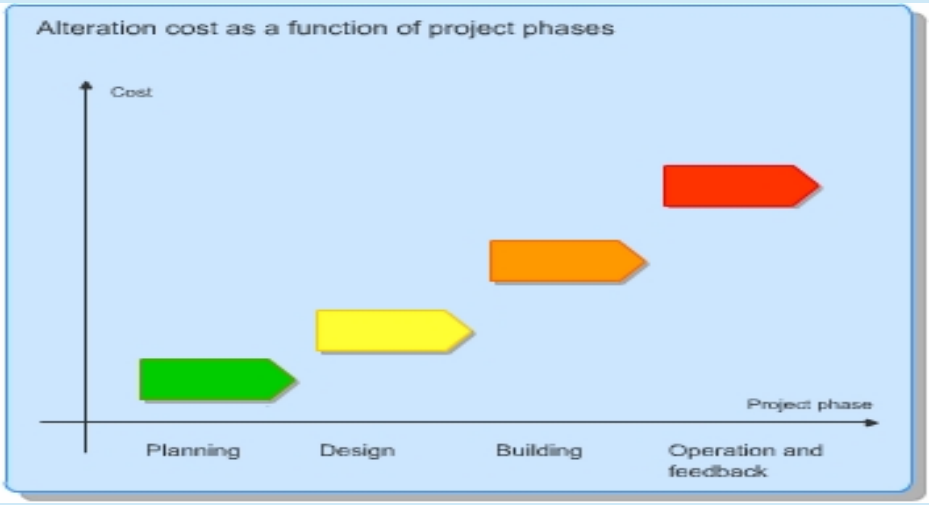
CRIOP identifies missing compliance with these goal-oriented requirements already in the design phase of a project.
This is done through the use of checklists and scenario analysis,



Minimizing the cost of changes and modifications

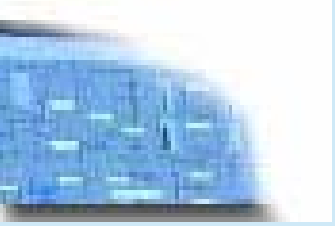
The cost of changes increases significantly through the phases in the design process.
Experience shows that the cost of a change increases exponentially between each phase:

1000-	*10 000 $*	*in the analysis phase*
10 000-	*100 000$*	*in the design phase*
100 000-	*1 000 000$*	*in the build phase*
1 000 000-	*10 000 000$*	*in the operations phase*



The customer should decide which of the phases they want to carry out a CRIOP analysis. The major operators in Norway have decided to use CRIOP in the design phase, the build phase and in the operations phase, after 1 years of operation experience.

The CRIOP methodology identifies problems early in the design process and thus is reducing the risk for costly changes at a later stage in the project.



How to carry out a CRIOP analysis

A Criop analysis consists of two main parts.

The first part is a review of the plant's control centre. This includes a checklist review, based on best practices, standards and regulations.

The second part of the CRIOP analysis is a scenario-based risk analysis. This allows us to investigate possible future accidents in detail. The scenario analysis starts by selecting key scenarios. Then studying the operators' interventions to control disturbances that may lead to major hazards or accidents.

The CRIOP process consists of four work tasks:

- Prepare and organize the CRIOP analysis
- General Analysis / Checklist review
- Scenario Analysis
- Implementation and follow up of actions

Areas that are checked:

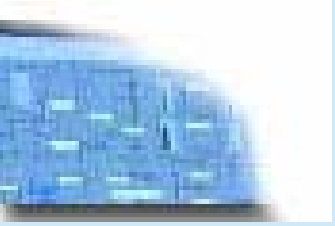
- Layout
- Working environment
- Control- and safety systems, man-machine interfaces
- Job Organisation
- Procedures and work description
- Training and competence
- e-Operations, remote operations

CRIOP is used in verification and validation of the control-room.

When used in the design phase the focus is on the control-room arrangements and the man-machine interfaces.

When used in preparing start-up the focus will be on emergency preparedness, organization, operators training and working procedures.

When choosing a scenario for the CRIOP analysis, a relevant scenario is selected based on experience or future trends.



CRIOP – developed by Hydro, Saga, Elf and SINTEF

SINTEF is the largest independent research organization in Scandinavia (www.sintef.no). Turnover 2005 was USD 260 Mill.

SINTEF generates new knowledge and solutions for our customers, based on research and development in technology, the natural sciences, medicine and the social sciences. The vision of SINTEF is:

Technology for a better society.

The CRIOP method was published in 1990. The method has been developed based on experiences of accidents and best practices, for use during the design of new offshore installations. CRIOP was a result of a cooperation between SINTEF and the Norwegian oil and gas industry with special support from Norsk Hydro, Saga and Elf.

CRIOP went trough a major revision in 2003 initiated by Norsk Hydro. This included new regulations, technical developments, new standards such as ISO 11064, remote operations/e-Operations, and user experiences from the Norwegian oil industry.

SINTEF is a non-profit organization and wish to improve control room safety and plant safety through offering the CRIOP method free of charge from their web pages. Please contact SINTEF for further assistance:

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