Safety Critical Task Analysis

Oct 2023

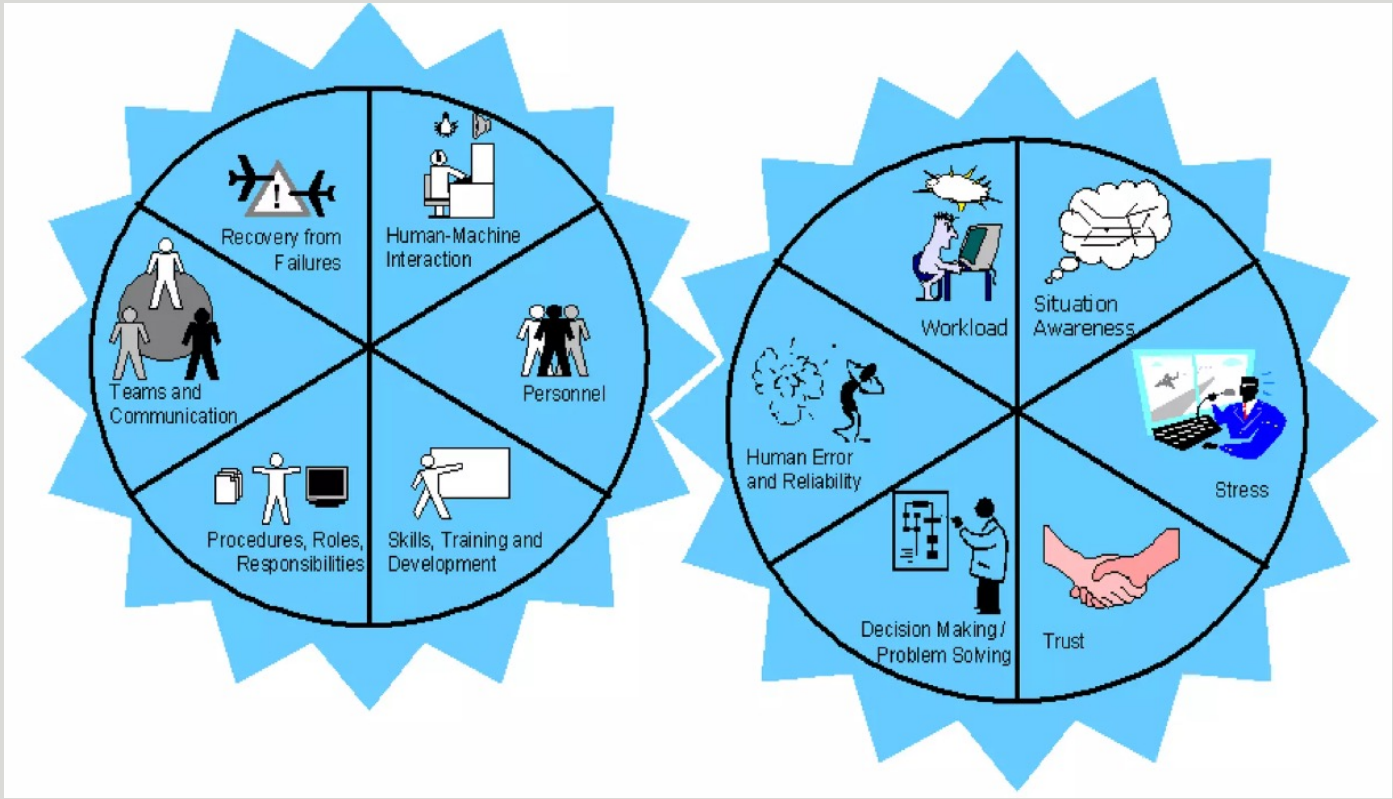
Safety Critical Task Analysis

Contents

Safety Critical Task Analysis

Human Factors Integration Plan (HFIP) consists of 10 key topics:

1. Managing Human Failures
2. Procedures
3. Training and Competence
4. Staffing
5. Organisational Change
6. Safety Critical Communications
7. Human Factors in Design
8. Fatigue and Shiftwork
9. Organisational Culture
10. Maintenance, Inspection and Testing



Safety Critical Task Analysis

Human Error is not random Everyone can make an error no matter how experienced and motivated they are

Humans have natural vulnerabilities

Humans have limited capabilities:

- Become tired, bored & distracted
- Mis-hear
- Mis-understand

Human performance and error is influenced by our working environment

Safety Critical Task Analysis

Human Reliability Assessment

- Predict where human error might occur during a SCT
- Understand the consequences of human error at different stages during a task
- Determine whether existing controls are sufficient to protect against human error, or if additional controls are needed

The methodology for Human Reliability Assessment is called Safety Critical Task Analysis

Safety Critical Task Analysis

Safety Critical Task Analysis

The methodology for doing this is **Safety Critical Task Analysis** and the process is laid out below

01	02	03	04	05	06	07
Identify Safety Critical Tasks (SCTs)	**Screen SCTs**	**Hierarchical Task Analysis (HTA) incl Walk Through Talk Through**	**Human Error Analysis**	**Risk Reduction**	**SCTA Report**	**Action Management / Review**

This process follows the **Human Factors Roadmap** which is in the HSE'S Operational Delivery Guide (Inspecting Human Factors at COMAH establishments)

Safety Critical Task Analysis

Identifying Safety Critical Tasks (SCTs)?

Need to identify tasks based on their potential to contribute to a Major Accident Scenario

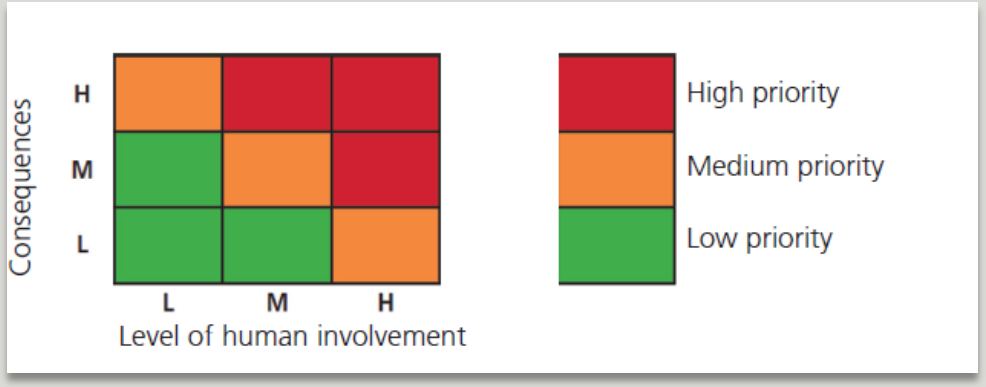
Identify the different types of task e.g., initiation, prevention and mitigation:

- Tasks with the potential to initiate an accident e.g., breaking containment
- Tasks Required to prevent and event sequence e.g., activation of an ESV
- Tasks that have the potential to escalate, such as poor maintenance of fire control systems or pressure alarms

Safety Critical Task Analysis

Screening Safety Critical Tasks

SCTA can be time-consuming so effort should be focused on Safety Critical Tasks, which are the tasks in which human performance could initiate or fail to mitigate a major accident



EI Guidance on Human Factors and Safety Critical Task Analysis

Consequences of failure	Score	Guidance
High (H)	3	A human failure could result directly in a MAH or SI
Medium (M)	2	A human failure could escalate to a MAH or SI if other barriers are judged to be at risk of failure
Low (L)	1	A human failure should not lead directly or indirectly to a MAH or SI

Level of human involvement	Score	Guidance
High (H)	3	Task involves **extensive or complex** human interactions with safety critical equipment or processes
Medium (M)	2	Task involves **limited or simple** human interactions with safety critical equipment or processes
Low (L)	1	Task involves **minimal** human interactions with safety critical equipment or processes

Screen the tasks to prioritise them, then place them on a Safety Critical Task Register

Safety Critical Task Analysis

Task Walkthrough

Weld Inspection using Automated Ultrasonic Testing

This should be done by a multidisciplinary group:

- An Operational Manager describing the process
- A Frontline Operator describing their role, the equipment they use, their working environment and any challenges that they face
- A Safety representative looking at the hazards
- A Human Factors Specialist looking at psychological theory and types of human error

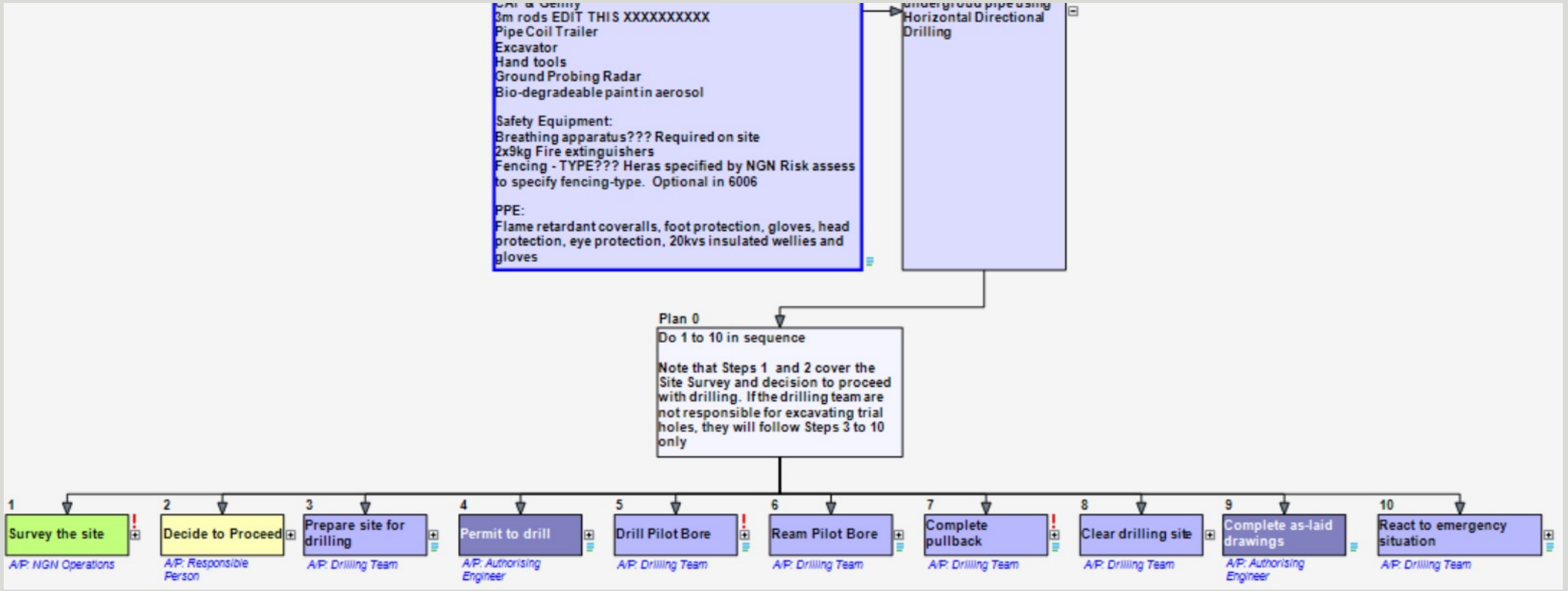
Safety Critical Task Analysis

SCTA Workshop

- Useful when there are many organizational and discipline interfaces
- Ensure to create a safe space where operators can speak openly.
- It creates an opportunity for people to come together and learn from eachother e.g., management see pressures on front line, front line see difficulties or delays in repairing or replacing equipment.
- Invite people who have knowledge of planning, managing and performing the task, and the hazards surrounding it, but avoid large groups
- This can be a tiring process to make sure to break it up with regular breaks
- Useful to use introductory slides to explain the HF approach and SCTA process to the group

Safety Critical Task Analysis

Hierarchical Task Analysis



Hierarchical Task Analysis is used to break down the task into all its component steps. It allows us to map the flow of the task before moving on to the human failure analysis

Safety Critical Task Analysis

Human Error Analysis

What error might occur, what are the consequences, are there opportunities for recovery?

ID	Description	Agent/Person	Warnings	Comments	Activity Type	Failure Modes
1.2.5	Excavate to 250mm below the proposed depth of the main or service	Dig Team	Falure to excavate to this depth may obsure sight of a change in the direction of the service, resulting in a collison during drilling	Utilities must be exposed fully so that changes in direction or adjacent services and structures can be seen. This should include the full pipe circumference plus an additional 250mm below	Actions	ACT4 Action too little/much

Error Description	Error Type	Consequences	Consequence Type	Existing Risk Control Measures / Recovery
Fail to excavate to 250mm below the proposed depth of the main or service	Mistake	Strike gas pipe and subsequent LoC during drilling	Possible MAH (2nd order)	Requirement and SW1 Section 6.1.8

Focus on the steps with the greater risk, consider the types of error that might occur, and their consequence
This allows error prevention strategies to be developed for the parts of the task that pose the biggest risk

Safety Critical Task Analysis

Performance Influencing Factor (PIF) Analysis

Description		Consequence Type	Existing Risk Control Measures / Recovery
Excavate to 250mm below the proposed depth of the main or service	ing	Possible MAH (2nd order)	Requirement and SW1 Section 6.1.8

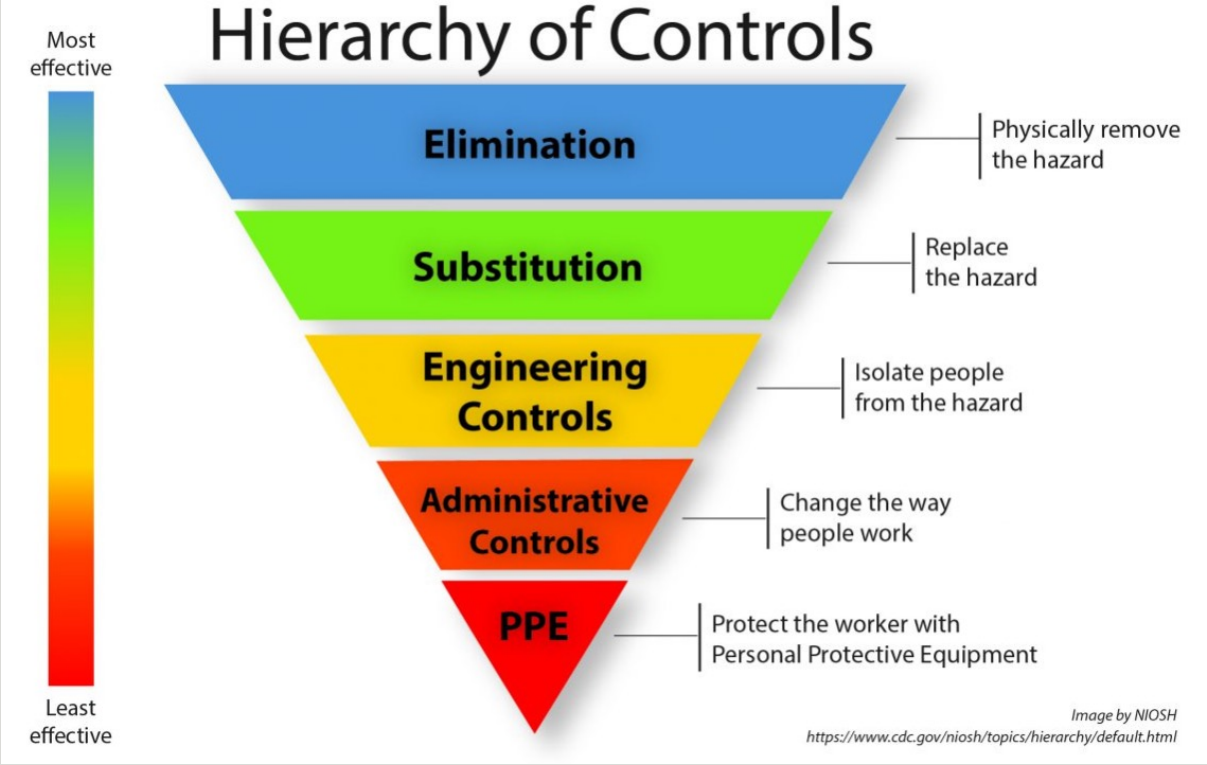
Performance Influencing Factors
-ve EXPERIENCE: Not all DSPs are aware of the need to excavate to this extent -ve COMMUNICATION: Findings of previous incidents where services were not fully exposed, have not been well communicated to those involved in HDD +ve PROCEDURE INADEQUATE: In NGN WP 6006 the depth of excavation is specified for lateral crossings but not for other underground services

POSITIVE PIFs	NEGATIVE PIFs
Useable procedures	Poor safety culture
Optimal conditions (heat, lighting, noise)	Time pressure
Clear signage	Lack of clear instruction
Good safety culture	Fatigue

PIFs influence the likelihood of failure; negative PIFs make failure more likely, positive PIFs optimise performance

Safety Critical Task Analysis

Protecting Against Human Error

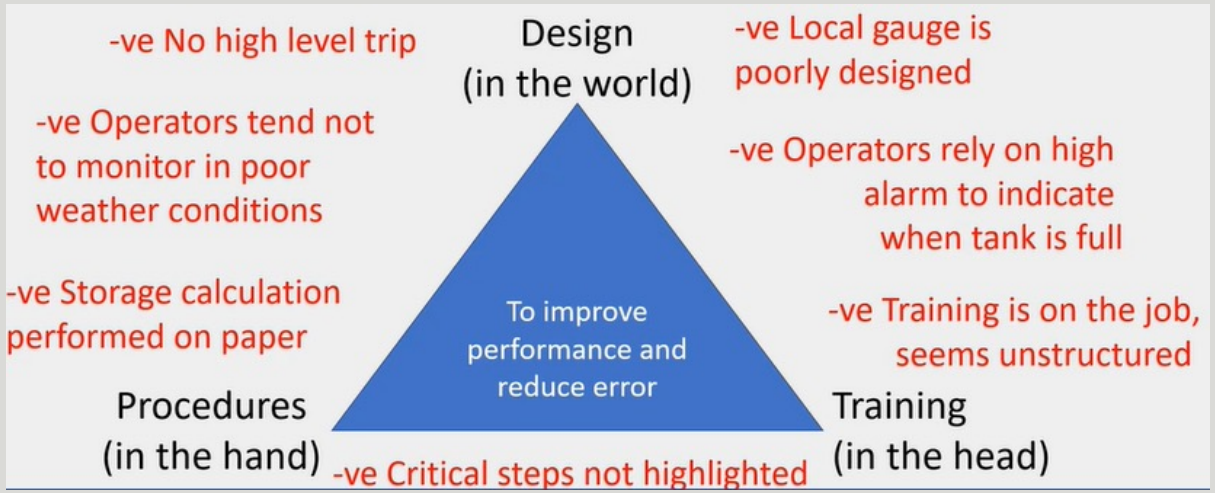


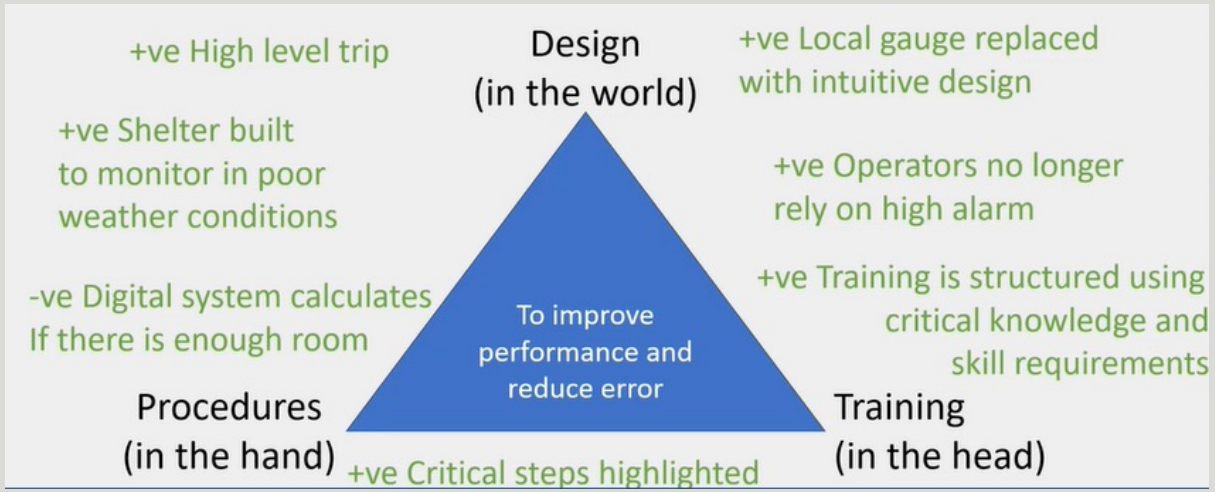
- Can the hazard be removed?
- Can human contribution be removed?
- Can the consequence of human failure be prevented or mitigated?
- Can human performance be assured (interlocks, logic controllers)?
- Can PIFS be optimised?

Energy Institute Guidance on Human Factors SCTA

SCTA and how it is used by our members

Protecting Against Human Error - Address Negative PIFs





To control and reduce human error, we need to address the Organisation, Environment and Individual stressors that negatively influence human performance

Change the risk profile of the task

Safety Critical Task Analysis

Protecting Against Human Error – Introduce new Control Measures

Improvements (HoC / PIFs)
A4. TRAINING For all DLOs and DSPs to ensure required level of knowledge exists across the teams involved in HDD A5. PROCEDURE UPDATE - NGN 6006 should specify depth of excavation as is done in SW1 P33 A2. STEP-BY-STEP WI: Include checking that excavation is 250mm below the depth of he Item is a WI item

Ideally, **well-designed automated systems** and engineered controls to be adopted over softer measures such as procedures and training.

E.G., emergency shutdown systems (ESD) which shut down entire process system and include detection, emergency stops, automated valves and deluge.

Typical outcomes include:

- Hardware modification
- Provision of written instructions
- Design of information systems interfaces
- Task specific training and competency assessment

Emergency Shutdown Valve

Safety Critical Task Analysis

SCTA Report

- A record of the SCTA process, including the date of the walkthrough and workshop, and a list of the workshop attendees
- A summary of the task
- A list of the Major Accident Hazards surrounding the task
- A record of the Human Failure and PIF analyses for the parts of the tasks with MAH risk
- A list of recommendations for additional controls to protect against human error
- A list of actions with scheduled completion dates

Safety Critical Task Analysis

Challenges

- SCTA can be Resource intensive
- Reluctance to change procedures ; replacing traditional work procedures with step-by-step instructions
- Tendency to look at training and procedures and not at introducing new engineered controls
- Allowing time to implement changes while pressing on with analyses:
    - New equipment
    - New procedures and sign off
    - Training and competency in new equipment and procedures

Safety Critical Task Analysis

Summary

- We are addressing Human Reliability through SCTA of Safety Critical Tasks
- SCTA enables us to predict the points in a task where errors might occur and to consider their consequence
- Our aim is to create conditions where human error is less likely
- Where human error can't be removed, our aim is to create systems which are tolerant of human error
- Preferred to remove the human element from safety critical part of the task
- If the human must be involved, SCTA helps us to develop risk informed, usable procedures which take account of human reliability, and to introduce equipment which better suits the task and operator's capabilities
- Don't underestimate the resources required and the time needed to implement changes identified in the workshop
- Done correctly, SCTA enables Owners to protect against Human Error, and to manage the issue of Human Reliability in Safety Critical Tasks.