HFC

HFC – forum for human factors in control

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RAPPORT

TITTEL

Human Factors in plant design, operations and maintenance resultater fra HFC forum, 19. til 20.oktober 2011, møte nr 14.

FORFATTER/REDAKTØR

Stig Ole Johnsen

OPPDRAGSGIVER(E)

HFC forum

RAPPORTNR.	GRADERING	OPPDRAGSGIVER	
SINTEF A21155	Åpen	Arne Jarl Ringstad/Statoil ASA	
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eRom civil/504017CRIOPUserGroup/0_2d92f		Stig Ole Johnsen	Lars Bodsberg
ARKIVKODE	DATO	GODKJENT AV (NAVN, STILLING, SIGN.)	
	18/11-2011	Arne Jarl Ringstad/Statoil ASA	

SAMMENDRAG

Denne rapporten dokumenterer presentasjoner, relevante artikler, agenda og deltakerliste fra HFC forum møtet den 19. til 20.oktober 2011 i Trondheim, møte nummer 14. De vedlagte presentasjonene er fra:

R. Boring	Human Factors (HF) in plant design, operations and maintenance
S. Hauge	Human Factors - fra kontrollrom til prosessanlegg
E. Lootz	Human Factors - fra kontrollrom til prosessanlegg
Gruppearbeid	Where and how can Human Factors contribute to better and safer plant operations outside the control room?
A.J. Ringstad	Human Factors tool (OTS) to monitor and improve safety
D. Lucas	HF and Operations: the next step after good ergonomic design
S. Antonsen	Sikkerhetskultur i designfasen ved utforming av prosessanlegg
T. Johnsen	HFs in virtual and augmented reality applications for plant operations
J.C. Rolfsen	Human factors in technical maintenance: experiences from aviation
Bedriftsbesøk	*Togledersentralen til JBV*

STIKKORD	NORSK	ENGELSK
GRUPPE 1	Menneskelige faktorer	Human factors
GRUPPE 2	ISO 11064	ISO 11064
EGENVALGTE	Sikkerhet	Safety

INNHOLDSFORTEGNELSE

1 Evaluering av møtet og innspill

1.1 Innledning

I denne rapporten gis en samlet oversikt over HFC møtet den 19.-20.oktober i Trondheim med presentasjoner, relevante fagartikler (”papers”), oppsummering av evaluering fra deltakerne og liste over alle deltakere.

I det nedenstående har vi oppsummert fra de evalueringene som deltakerne leverte inn.

1.2 Evalueringer

Vi fikk positive kommentarer på at vi gikk utenfor kontrollrommet, og inkluderte drift i hele anlegget. Dette møtet var bl.a. inspirert av http://www.aftenbladet.no/energi/olje/1364020/Miljoefarlig_tabbe_av_Statoil_.html.

Kommentarene vi får er generelt konstruktive og positive, med gode tilbakemeldinger på det faglige og sosiale utbytte. Generelt synes det som om de fleste er godt fornøyd med HFC møtene og formen som benyttes. Samlingen over to dager synes å passe, og vi fikk positive kommentarer mht å arrangere gruppearbeid, men gruppene burde ideelt ha vært på ca 8 deltakere.
Forumet er bredt med mange forskjellige deltakere, og utfordringen er å gi alle noe, både forskere, konsulenter og industrideltakere. Vi får derfor mange forskjellige innspill.

Tilbakemeldingene gikk i hovedsak ut på at programmet var vellykket og foredragene fikk gode tilbakemeldinger. Det var gode foredrag, god servering og interessante deltakere som gjør det mulig å få til konstruktive diskusjoner.

1.3 Formen på HFC møtene

Tilbakemeldingene er generelt positive til formen på møtene. Det ble påpekt at det var viktig med tid til debatter, og opphold mellom de forskjellige innleggene. Gruppearbeid er et bra tiltak.

1.4 Samarbeid med HFN i Sverige

HFN nettverket fra Sverige er aktive og inviterer HFC inn til sine seminarer og møter. Aktuelle møter i 2011 kan være seminaret :"Människan som operatör i säkerhetskritiska system", i Linköping, Sverige 24-25. november. "Key note speaker": Professor Torbjörn Åkerstedt, Stockholms universitet (Stressforskningsinstitutet). For ytterligere informasjon se http://www.humanfactorsnetwork.se/indexcoursesWork.html.

1.5 Tema og forelesere til de neste HFC møtene

Vi har i tidligere plannotat fra HFC forum, skissert følgende grove møteplan for HFC møtene, ref Tabell-1.

Tabell-1: Forslag til tema og forelesere i HFC forum

• HF i endringsprosesser, "Design for resilience", perspektiver som actor-network theory (ANT) i HF granskinger
• Inntog i det globale: Språk, kultur, tidsforskjell, HF i global setting.
• Fokus på HF i andre land, som USA og Sørøst Asia – erfaringer, muligheter og trusler

Av tema som ble trukket frem som spesielt interessante til neste møte, kan nevnes:

- Økt fokus på samspill "control-room" og samspill med omgivelsene og det de skal kontrollere.
- Inntog i det internasjonale driftsmiljøet, med samhandling med ekspertsentra og leverandører utenfor Norge – hvordan vil forskjellige regimer og forskjellig kultur påvirke den operasjonelle sikkerheten?
- Fokus på HF i andre land, som USA og Sørøst Asia – erfaringer, muligheter og trusler.
- HF i endringsprosesser, "Design for resilience", Human Factors design av arbeidsprosesser.
- Perspektiver som actor-network theory (ANT) i HF granskninger.
- Sammenlikning av Human Factors arbeid og standarder rammeverk i ulike bransjer som fly, kjernekraft eller helsevesen.
- Human Factors design av håndholdte enheter?
- Human Factors i styring av sikkerhetsbarrierer – hva er en barriere egentlig? Kan mennesket være en barriere. Begrepsavklaring og konseptavklaring knyttet til barrierestyring.
- Mental arbeidsbelastning og bemanning – fokus på metoder.
- Føreslår ein demonstrasjon, gjennomgang av tenkinga prinsippet frå Simone Colombo og Virthualis prosjektet. Virthualis var eit 5 årig FOU EU prosjekt som Statoil deltok i saman med nokre andre oljeselskap Det er snakk om HF i prosessanlegg og kommunikasjon mellom inne og uteoperatør, og responstid, frå alarm går på gasslekkasje til deteksjon og problemløysing er iverksatt. "Honeywell and Virthualis to Jointly Develop Innovative 3-D Simulation Solution for Safety Engineering and Operator Training." Link:https://www.honeywellprocess.com/en-US/news-and-events/Pages/PR_09282011_honeywellandvirthualistojointlydevelopinnovative3dsimulationsolution.aspx,
- Human Factors design av håndholdte enheter?
- La SIEMENS arrangere møtet (slik som ABB), enten på våren eller høsten 2012.

Av forelesere ble følgende nevnt (eller har vært trukket frem tidligere uten at de har fått plass):

- Ron Westrum - Two faces of resilience - requisite imagination & the human .issues.
- E. Hollnagel, R. Woods, J. Reason, C. Weick, K. Haukelied, Cato Bjørkli eller Frode Heldal.
- J.Frohm eller K.Gould - Automasjon eller lean production.
- M.Endsley (Situational awareness),
- G.R. Hockey fra Univ of Leeds, Mark Young.
- Fra miljøer som: Fraunhofer FKIE (Tyskland) eller MIT User Interface Design Group (USA).
- Interessant å utvide HF mot community of practice og praksisfellesskap som J.S.Brown, P.Duguide - eks. hvordan mobiliserer man et praksisfellesskap?

1.6 Kurs og forelesninger innen human factors

Ved UiS har de et kurstilbud innen MTO (Menneske, Teknologi, Organisasjon), se http://www.uis.no/kurs/evu/risikostyring_og_samfunnssikkerhet/mto-human-factors-videreutdanning-i-menneske-teknologi-organisasjon-article35526-6791.html

Ved NTNU arrangeres innføringskurs innen human factors, se:
videre.ntnu.no/link/nv12296

1.7 Menneskelige faktorer i vedlikeholdsstyring / Human Factors in maintenance

Universitetet i Stavanger arbeider med en bok om menneskelige faktorer i vedlikeholdsstyring, de som er interessert ta kontakt med Kenneth.A.Pettersen@uis.no, se nedenfor.

"We would also like to inform you on an ongoing effort at the University of Stavanger. The purpose is to produce a high quality book on human factors in maintenance, and if you are interested in contributing, please contact Kenneth Pettersen for details":

Kenneth.A.Pettersen@uis.no, Associate professor, Head of Centre: SEROS - Centre for risk management and societal safety, University of Stavanger, 4036 Stavanger, NORWAY, Tlf: +47 51831658, Mob: +47 97188965 at http://seros.uis.no

1.8 Kontakt opp mot Human Factors fagnettverket i Europa og USA

For de som er interessert i faglig kontakt opp mot Human Factor nettverket i Europa og USA viser vi til: *hfes-europe.org* – som er den europeiske Human Factors and Ergonomics Society. Beskrivelse: "*HFES - The Human Factors and Ergonomics Society, Europe Chapter, is organised to serve the needs of the human factors profession in Europe. Its purpose is to promote and advance through the interchange of knowledge and methodology in the behavioural, biological, and physical sciences, the understanding of the human factors involved in, and the application of that understanding to the design, acquisition, and use of hardware, software, and personnel aspects of tools, devices, machines, equipment, computers, vehicles, systems, and artificial environments of all kinds*." HFES er tilknyttet den internasjonale Human Factors and Ergonomics Society, Inc. Se *www.hfes.org*.

2 Agenda og deltakerliste

2.1 Agenda for HFC møtet

Vedlagt ligger justert agenda for HFC møtet, oppdatert med korrekte forelesere.

Dag 1	**Innlegg**	**Ansvar/Beskrivelse**
11:00-11:30	Registrering	HFC
11:00-12:00	Lunsj	Prinsen
12:00-12:30	Velkommen	Prinsen
12:30-13:15	Human Factors in plant design, operations and maintenance	Dr. R.Boring/Idaho
13:15-13:45	Diskusjon	
13:45-14:15	Human Factors - fra kontrollrom til prosessanlegg	S. Hauge/Sintef
14:15-14:45	Human Factors - fra kontrollrom til prosessanlegg	E. Lootz/Ptil
14:45-15:15	Diskusjon	
15:15-16:30	Workshop: "Where and how can Human Factors contribute to better and safer plant operations outside the control room?"	S.Hauge/PDF Forum
16:30-16:45	Pause	
16:45-17:15	Human Factors tool (OTS) to monitor and improve safety in operations and maintenance	A.J. Ringstad/Statoil
18:00	Middag i Studentersamfundet	
21:00	Ukerevy i Studentersamfundet	

Dag 2	**Innlegg**	
08:30-09:00	Kaffe	
09:00-09:45	Human Factors and the Conduct of Operations: the next step after good ergonomic design	Dr.D. Lucas/Rivington Human Factors Ltd
09:45-10:15	Diskusjon	
10:15-10:45	Sikkerhetskultur i designfasen ved utforming av prosessanlegg	S. Antonsen/Safetec
10:45-11:15	Diskusjon	
11:15-11:45	HFs in virtual and augmented reality applications for plant operation, maintenance and decommissioning	T. Johnsen/IFE
11:45-12:00	Diskusjon	
12:00-12:30	Human factors in technical maintenance: experiences from aviation	J.C. Rolfsen/DnV
12:30-12:45	Diskusjon	
12:45-13:00	Avslutning og oppsummering	HFC
13:00-14:00	Lunsj	
14:15-15:15	Besøke togledersentralen til JBV	Togdriftsleder/JBV
15:15-15:45	Buss til Værnes	

2.2 Påmeldte og deltakere

Nedenstående tabell lister opp påmeldte og deltakere i HFC møtet.

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HFC

Human Factors in Plant Design, Operations, and Maintenance

Dr. Ronald Laurids Boring

Mere informasjon:
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Human Factors in Plant Design, Operations, and Maintenance

Dr. Ronald LauridsBoring

Idaho National Laboratory

Today’s Talk

Introduction

Nuclear Energy and Human Factors

What Other Industries Can Learn from Nuclear Energy

What Nuclear Energy Can Learn for Other Industries

Research Snapshot

Introduction

Idaho National Laboratory (INL)

U.S. Department of Energy research laboratory in southeast Idaho

(about 2300km^2—a little smaller than Luxembourg)

Idaho National Laboratory (INL)

U.S. Department of Energy lead research laboratory in nuclear power

- Part of President Dwight Eisenhower's "Atoms for Peace" Initiative
- Birthplace of nuclear energy (and 52 reactors)
- Birthplace of nuclear navy
- Lead center for probabilistic modeling of power system and human reliability
- Headquarters for next-generation nuclear power development (so-called Gen IV reactors)
- Significant efforts in cybersecurity and renewable energy sources
- Currently 4,000 scientists and another 5,000 contract support staff

Presenter

Ronald Laurids Boring, PhD

Education

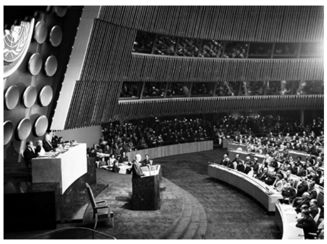
- BA (University of Montana) Psychology & German
- Fulbright Scholar (Universität Heidelberg) Social Psychology
- MA (New Mexico State University) Experimental Psychology
- PhD (Carleton University) Cognitive Science

Research Interests

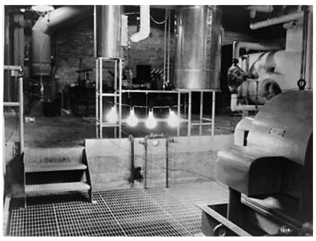
- Cognition, Perception, History and Systems, Human Factors, Human Reliability Analysis, Human-Computer Interaction, Safety-Critical Systems, Control Rooms

Nuclear Energy and Human Factors

History of Nuclear Energy



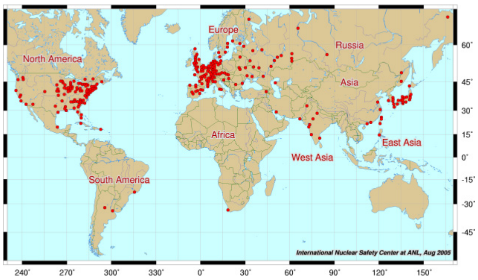
December 8, 1953: Atoms for Peace



December 20, 1951: EBR-1

December 2, 1957: Shippingport Power Station

Current State of Nuclear Energy



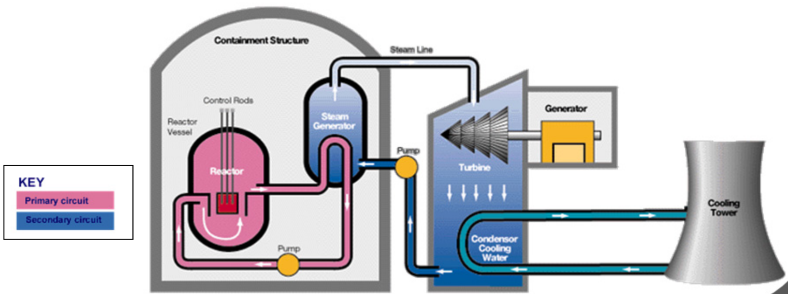
Current State of the Industry

- 439 operating plants worldwide (104 in US) = 16% worldwide energy (c. 22% in US)
- In 1980s, new plant completed worldwide an average of every 17 days (218 plants)
- 35 plants currently in construction worldwide
- 90 plants in early planning phase (34 in US) = a “nuclear renaissance”

How Nuclear Energy Works

Simple Concepts

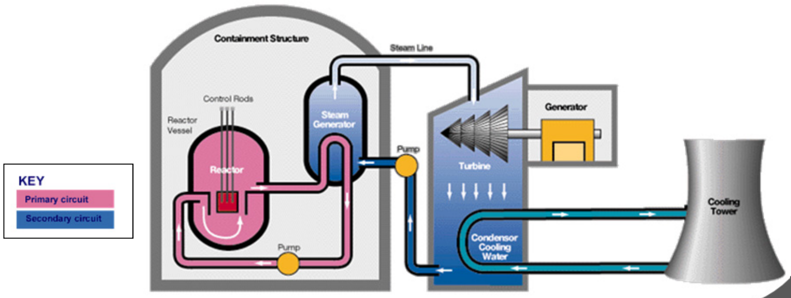
- Contained radioactive source produces heat
- Heat transferred to a secondary steam system to turn an electric generating turbine



What Control Room Operators Do

Reactor Operator (RO): Controls Radioactivity, Reactor Flow, and Reactor Temperature

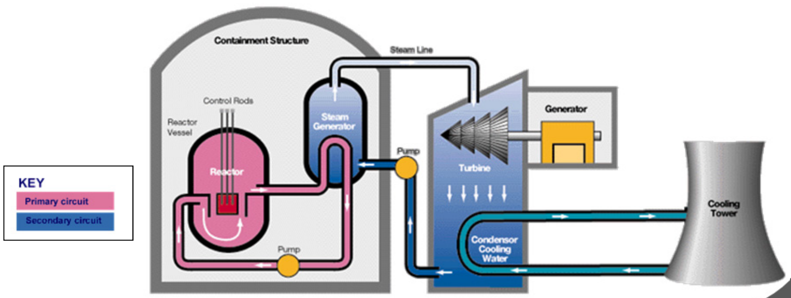
Turbine Operator (TO): Controls Steam Generation and Electricity Production



What Can Go Wrong

Thought of in Terms of Consequences

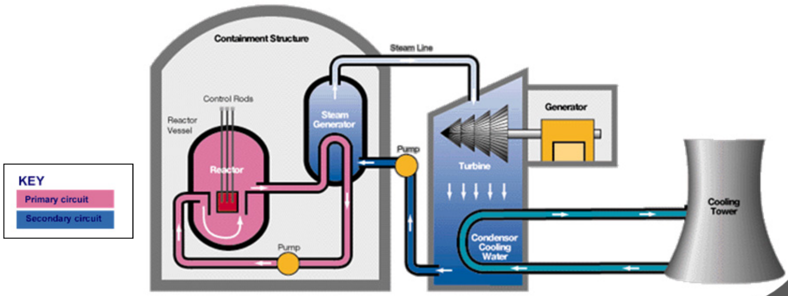
- Primary Damage: Release of Radioactivity
- Secondary Damage: Loss of Equipment and Plant Inoperability (= Financial Cost)



The RO's Worst Nightmares

Reactivity: Control Rods Stick and Keep Generating Heat

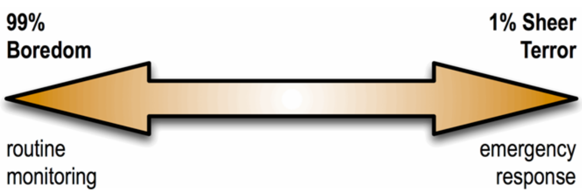
Flow: Can't Maintain Flow Pressure, Causing Reactor to Overheat (e.g., Meltdown)



99% Boredom and 1% Sheer Terror

Most of the Time: Slow System that Must be Monitored and Sometimes Changed

Rarely: Something Goes Wrong that Requires Quick Response to Prevent Radioactive Release or Reactor Damage

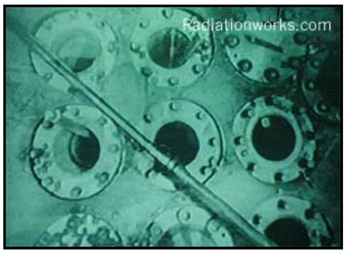


Some Things Are Better Left Unsaid
(The 1%)

SL-1 Reactor

January 3, 1961, Idaho Falls:

- Maintenance personnel were supposed to lift radioactive control rods about 9cm from neutralizing sheath; instead, lifted about 27 cm, causing vaporization of reactor core
- Control rods shot from reactor head, killing 3 plant personnel



Three Mile Island (TMI)

March 28, 1979, Londonberry Township, Pennsylvania:

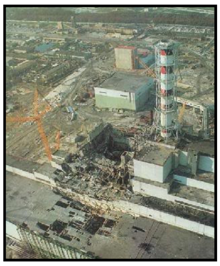
- Minor malfunction in the secondary cooling circuit caused the reactor to shut down automatically
- Relief valve failed to close, but instrumentation did not reveal this
- Much of the primary coolant drained away that the residual decay heat in the reactor core was not removed, causing meltdown and small release

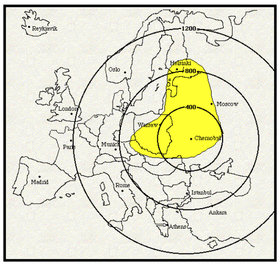


Chernobyl

April 26, 1986, Pripyat, Ukraine:

- A poorly planned test of the ability of the turbine to provide power for cooling during spindown was executed
- Key safety systems were disabled for the test, which actually shut down all core cooling, causing an uncontrolled nuclear reaction similar to a nuclear bomb





Davis Besse

February 16, 2002, Oak Harbor, Ohio:

- During refueling outage, inspection of vessel head penetration nozzles revealed that 3 control rod drive mechanism nozzles had through-wall axial cracking
- Cracking was caused by borated water that had leaked from reactor coolant system to vessel head due to poor maintenance
- Remaining thickness of vessel head found to be under 1 cm thick stainless steel cladding

H.B Robinson

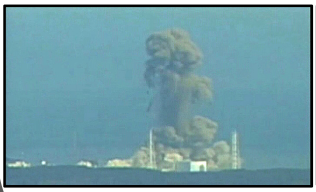
March 28, 2010, Hartsville, South Carolina:

- During normal operations, the plant sustained damage to two 4-kV buses and the unit auxiliary transformer when an arc flash occurred in a cable conduit and the bus supply circuit breaker failed to trip open on overcurrent
- During recovery activities, operators inappropriately re-energizing the faulted bus, causing additional damage to electrical switchgear and a second electrical fire

Fukushima Dai-Ichi

March11, 2011, Fukushima, Japan:

- Offshore earthquake followed by 12m tsunami wave damaged plant and disrupted offsight and backup power needed to cool reactor
- Crews lost all instrumentation and controls in control room
- Failed to restore power, resulting in hydrogen explosions and three reactor meltdowns and spent fuel leaks



Human Factors Affecting the Events

What Were Some HumanFactorsBehind These Events?

- Three Mile Island
- Chernobyl
- Davis Besse
- H. B Robinson
- Fukushima Dai-Ichi

None of the Events Were Caused by Human Factors, but All Events Were Complicated by Human Factors

Human Contributors to TMI

- Poor human factors
  - Valve indicator lights for pressurizer relief valve did not show true position of valve
- Limited training of personnel
  - Lack of integrated plant knowledge led to inability to interpret additional cues about what was happening to the plant
  - Too much emphasis placed on avoiding solid pressurizer
    - Led to securing safety injection
- Overreliance on limited set of indicators

Human Contributors to Chernobyl

TABLE I
THE MOST DANGEROUS VIOLATIONS OF OPERATING PROCEDURES AT CHERNOBYL-4*

	Violation	Motivation	Consequence
1	Reducing operational reactivity margin below permissible limit	Attempt to overcome xenon poisoning	Emergency protection system was ineffective
2	Power level below that specified in test program	Error in switching off local auto-control	Reactor difficult to control
3	All circulating pumps on with some exceeding authorized discharge	Meeting test requirements	Coolant temperature close to saturation
4	Blocking shutdown signal from both turbogenerators	To be able to repeat tests if necessary	Loss of automatic shutdown possibility
5	Blocking water level and steam pressure trips from drum-separator	To perform test despite unstable reactor	Protection system based on heat parameters lost
6	Switching off emergency core cooling system	To avoid spurious triggering of ECCS	Loss of possibility to reduce scale of accident

*From the Soviet Union summary of its report to the IAEA.

Human Contributors to Davis Besse

- Deferred maintenance
  - Upcoming plant outage, causing workarounds
- Workarounds
  - Indications of significant corrosion ignored
- Safety culture
  - Lack of questioning attitude and acceptance of status quo at plant

Human Contributors to H.B. Robinson

- The operating crew did not effectively manage resources to simultaneously handle the fire and plant transient
- Control room operators did not effectively monitor important control board indications and act promptly to control key plant parameters
- Previous simulator training conditioned the crewmembers with incorrect plant response

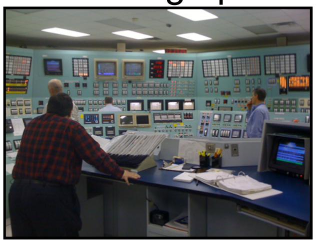
Human Contributors to Fukushima

- The plant was not designed to withstand a tsunami of that magnitude
  - Plant safety backup systems such as emergency generators were equally vulnerable
- Crew and first responders not well trained on emergency response
- Authorities slow to react to event
  - Failure to prioritize emergency response to plant in face of large scale damages in Japan

Accidents are the Exceptions

Plants are Designed to Be Safe

- Redundant hardware safety systems are quickly activated
- Operators have alarm systems and symptom oriented emergency operating procedures that guide them through plant upsets



In All Fairness—99% of the Time

What Operators Do Most of the Time

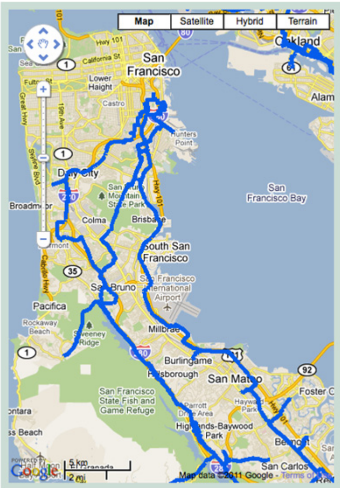
- Operators monitor and adjust the plant, making sure temperature, pressure, and flow stay in the safe range
  - Positive back and forth between monitoring and doing that maintains operator vigilance
  - New systems increase the automation, removing much of the “doing”
- Most plant upsets have hours/days available to fix the problem
  - Plants often continue to operate even when there’s an upset

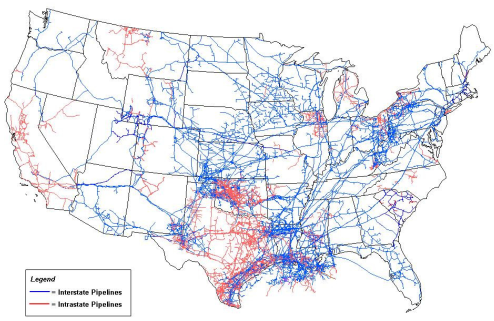
What Other Industries Can Learn from Nuclear

september 9, 2010
6:11pm
san bruno, california

- 30-inch (66cm) natural gas pipeline exploded
- 38 houses destroyed
- 6 people killed


CAL FIRE
CAL FIRE





Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System

gas pipelines: san francisco and u.s.

what is known

Pacific Gas and Electric Company®

- PG&E unaware of pipe specifics at san bruno
- PG&E ran higher than recommended pressure in pipes
- PG&E took over an hour to shut pipeline (alarm flood and control room command and control chaos)

Of Note

- gas pipelines regulated by US Department of Transportation
- ongoing investigation by National Transportation Safety Board
- new DOT guidelines for control rooms in effect august 2011
- PG&E undertaking control room upgrade

Pipeline Safety: Control Room Management/Human Factors

The Pipeline and Hazardous Materials Safety Administration (PHMSA) published the Control Room Management/Human Factors final rule in the **Federal Register** on December 3, 2009, which became effective on February 1, 2010. The final rule established an 18-month program development deadline of August 1, 2011.

New Regulations (74 FR 63310)

- **address human factors and other aspects of control room management** for certain pipelines where controllers use supervisory control and data acquisition (SCADA) systems
- pipeline operators must implement methods to **reduce the risk associated with controller fatigue**
- operators must define the roles and responsibilities of controllers and **provide controllers with the necessary information**, training, and processes to fulfill these responsibilities
- operators must also manage alarms, assure control room considerations are taken into account when changing pipeline equipment or configurations, and review reportable incidents or accidents to determine whether control room actions contributed to the event

These Regulations Mirror Nuclear

- Requirement to build control room training simulator
- Requirement to consider controller fatigue
- Requirement to develop data historian for logging controller actions
- Requirement to report incidents
- Requirement to improve alarm delivery system
- Requirement to develop and use operating procedures in control room
- Implicit requirement to develop overview display systems for better command and control

Briefly Noted: Offshore Oil

April 20, 2010, Macondo Prospect:

- Deepwater Horizon Accident

BSEE
Bureau of Safety and Environmental Enforcement

On October 1, 2011, new U.S. Government agency established

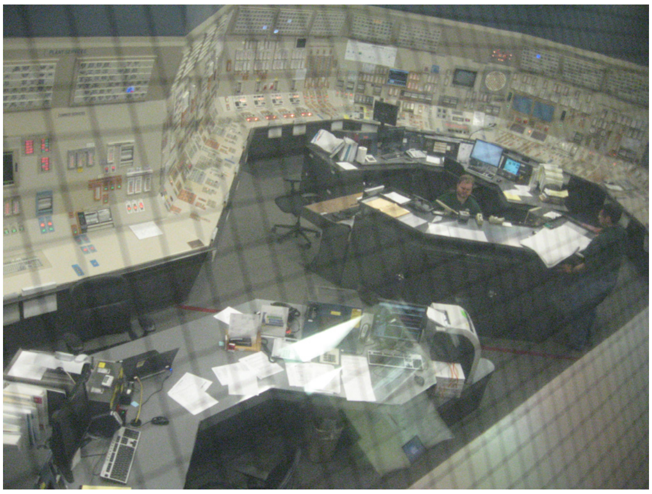
- BSEE modeled after U.S. Nuclear Regulatory Commission

Strengths of U.S. Nuclear Industry

- Strong, empowered regulatory agency (U.S. Nuclear Regulatory Commission)
- Human factors considerations pervade
  - Good training
  - Good procedures
  - Good alarms and instrumentation
- Safety emphasis of plant
  - Risk-informed decision making
  - Use of probabilistic risk assessment (PRA)
  - Use of human reliability analysis (HRA)

What the Nuclear Industry Can Learn from Others

What's the Matter with This?

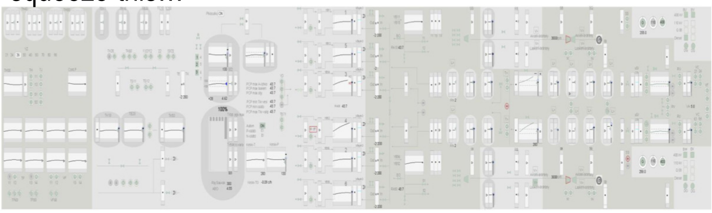


Weaknesses of U.S. Nuclear Industry

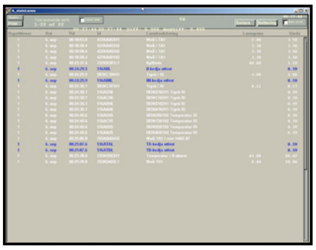
- Regulations
  - Current nuclear power plant control rooms use technology from the 1960s
    - Analog instrumentation and controls
    - Nuclear specific
    - Difficult to maintain and repair
  - Regulatory framework makes plants hesitant to upgrade
    - Change in control room = change in operating license
    - Will a new control room require years of regulatory review?
    - Buying like-for-like replacements rather than improving

the problem space

squeeze this…



and this…



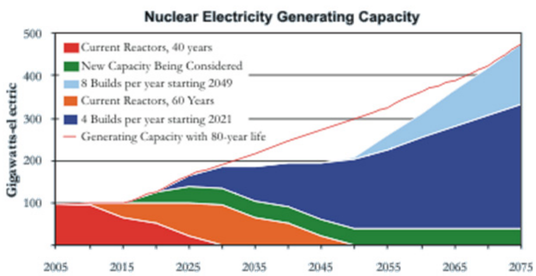
…into this

how do we get there?

Research Snapshot

Light Water Reactor Sustainability (LWRS)

- LWRS is a research and development program sponsored by the US Department of Energy (DOE), performed in close collaboration with industry programs
  - Provide technical foundations for licensing and managing the long-term, safe and economical operation of current nuclear power plants



LWRS Goals

Improve:

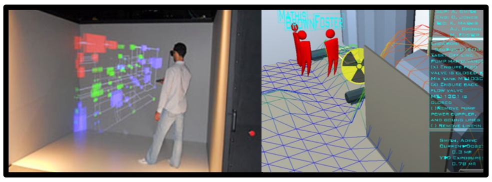
- Use of technology at plants
  - Conduct relevant research to see what lessons learned from other industries can be applied to nuclear domain
  - Help industry and regulator with control room upgrades
  - Establish relevant technologies for maintenance
- Use of HRA and PRA
  - Develop better methods for predicting risk
  - Develop better methods for using risk
  - HRA for design

Improving Technology Use in Nuclear

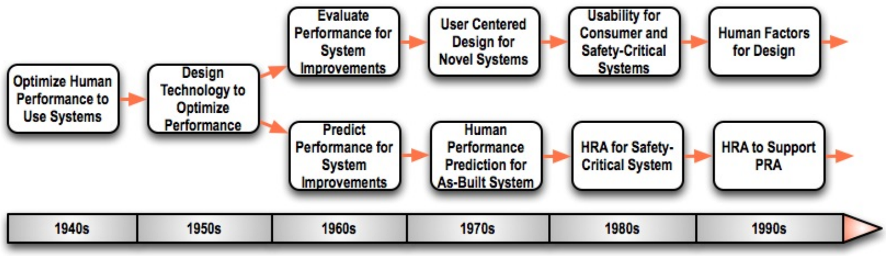
Adapt Technologies from Other Domains

- To control room modernization

- To plant maintenance



Bridging Human Factors and HRA



Design and Human Performance

Traditional Human Factors Engineering

- Involved in design and testing of new technologies to be used by humans
  - Much emphasis on usability (e.g., Nielsen), enjoyment (e.g., Norman), and safety (e.g., Palanque)

Traditional Human Reliability Analysis

- Involved in assessment and modeling of designs in the context of a larger system safety
  - HRA often used in predictive analysis, including a safety review of a designed system
  - HRA rarely used in an iterative way as part of the system design process

Two Ways to Look at Humans

Human Factors

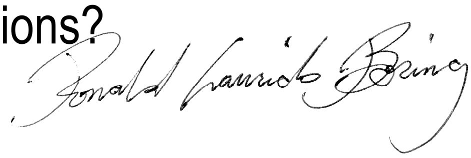
- **Diagnose:** How do we improve the design of the system to complement the capabilities of the human?

Human Reliability

- **Predict:** How do we decrease the human contribution to the overall system risk?

Development of new HRA approaches to be used as part of design

Questions?



HFC

Human Factors – moving from control room issues to the process plant

Stein Hauge, SINTEF Society and Technology
Bodil Mostue, SINTEF Society and Technology
Trond Kongsvik, Studio Apertura

Mere informasjon:
http://www.ptil.no/nyheter/rnnp-2010-store-utfordringer-paa-viktige-omraader-article7805-24.html

The report is documented as chapter 9 in the RNNP report, found at:
http://www.ptil.no/risikonivaa-rnnp/rapporter-fra-risikonivaa-i-norsk-petroleumsvirksomhet-rnnp-2010-article7778-20.html

Human Factors – moving from control room issues to the process plant

"Causal factors and measures relating to hydrocarbon leaks on the Norwegian Continental Shelf"

Stein Hauge, SINTEF Society and Technology
Bodil Mostue, SINTEF Society and Technology
Trond Kongsvik, Studio Apertura

HFC Forum – 19th October 2011

Main purpose of study

To describe key challenges for the petroleum industry in order to reduce the number of HC leaks and give recommendations concerning future work in this area.

The study included:

- A review and re-analysis of selected HC leak investigation reports for the period 2002-2009 (out of some130 investigation reports, 42 were chosen)
- A review of relevant Norwegian and international papers, reports and publications

Main challenges identified for the industry

1. ***Design factors as a major cause***
   The petroleum industry should put effort into avoiding poor or defective design solutions. The industry should also have a more proactive attitude towards modifying or rebuilding poor technical solutions rather than accepting and adapting to them

2. *Formulation of more specific measures*
   The petroleum industry has a significant improvement potential with respect to developing more specific risk reducing measures

3. *Learning from previous events*
   The industry has a significant improvement potential with respect to ensure learning from previous events and in a systematic and effective manner apply information from event databases and other sources in their work to avoid HC leaks

4. *Improved risk assessment and analyses*
   The industry should apply risk assessment and risk analyses more effectively in order to avoid HC leaks.

Measures and recommendations from investigation report – some examples

- A general observation is that the specified measures often are of a general nature and needs further processing to be implemented. For example:
  - *"Management must take ownership of the handover quality"*
  - *"It must be ensured that solutions selected in design are suitable for all project phases"*
  - *"Lessees and operators should review their platform specific emergency plans to reduce further injuries or accidents when an incident occurs."*
  - *"Increased focus on risk during routine operations is required"*
  - *"Effectuate a stricter practice with respect to following the established isolation plan"*

- Several possible explanations to this:
  - *Challenging to identify good and concrete measures*
  - *Measures are further processed and concretized later*
  - *The amount of resources used during investigations are limited*
  - *The composition, the competency and the authority of the team that specifies the measures*

Measures and recommendations – improvement areas

- Examine more closely how and in which forums good and goal-oriented measures can be specified
  - Broadly composed groups that come together after the investigations have been conducted?
  - A larger industry forum where operators, contractors, vendors and engineering companies come together and go through relevant investigation reports?
- Is a more structured and methodical approach for coming up with good measures called for?
- To which degree are we able to evaluate and enunciate the actual effect of already implemented measures – how to promote a more transparent regime – and how to motivate for further identification of risk reducing measures?

Main challenges for the industry

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Learning from previous events – challenges for the industry

- How can we improve on using event databases such as SYNERGI more proactively instead of in retrospective?
  - *"Well-organized and well used incident reporting systems [...] are already beginning to grow so large that it is not possible to see the wood for trees." (Hale, 2002).*
- How can we better utilize already existing meeting places (HSE-meetings, SJA-meetings, technical network meetings, etc.)?
- **And the great question**: how can we improve the industry's collective memory and its ability for more effective experience transfer?

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   The industry should apply risk assessment and risk analyses more effectively in order to avoid HC leaks.

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Risk assessments and analyses

- Being aware of and understanding the associated risk factors is an important prerequisite for safe operation
- A number of tools and analyses methods are applied today (HAZID, HAZOP, QRA/TRA, SJA, HRA methods, etc.)
- These analysis range from more qualitative discussions prior to a specific work operation (type SJA) to large quantitative analyses with the purpose of presenting the "complete" risk picture (type TRA)

Risk assessments and analyses – challenges for the industry

- There are challenges related to :
  Communication (of result, recommendations and assumptions)
  Understanding (of content, method and scope of the analyses)
  Ownership and responsibilities (involvement in analyses)
- How can existing analyses better "interact"? Is it possible to identify clearer links between QRA/TRA and operational type of analyses of type SJA ?
  - How can the large analyses such as QRA/TRA be performed in order to better support the risk evaluations performed during operations?
  - Concerning SJA etc.: Do the considerations that are performed prior to the work operations include sufficient consideration of major hazard risks?
- How can future risk analyses better address (everyday) operational issue?

Main challenges for the industry

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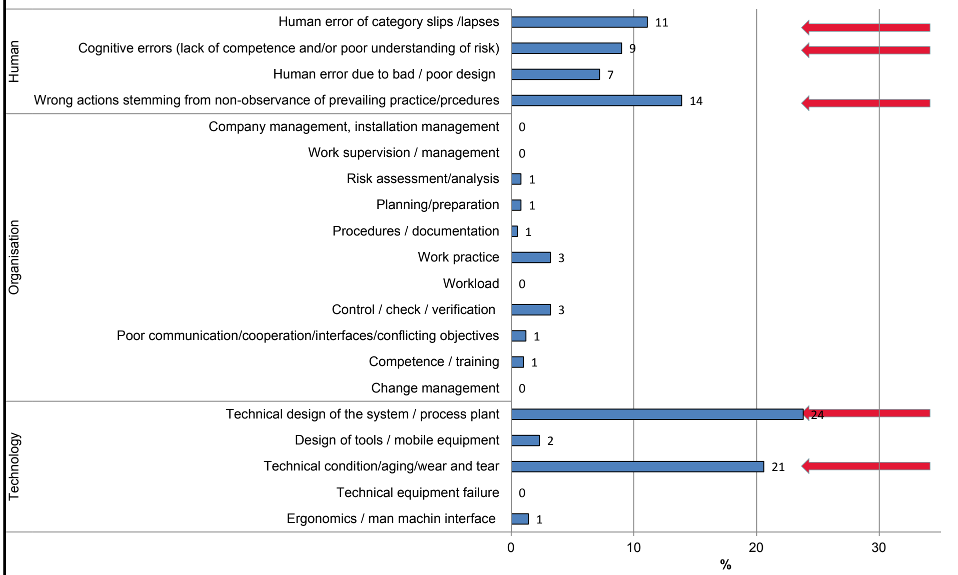
   The industry should apply risk assessment and risk analyses more effectively in order to avoid HC leaks.

"Causal factors and measures relating to hydrocarbon leaks on the Norwegian Continental Shelf"

Some more detailed result from the study related to:

- Distribution of direct/triggering causes
- Distribution of underlying causes
- Distribution of recommended measures
- Correspondence between causal factors and measures
- Phases where the HC leaks occurred

Distribution of direct / triggering causes



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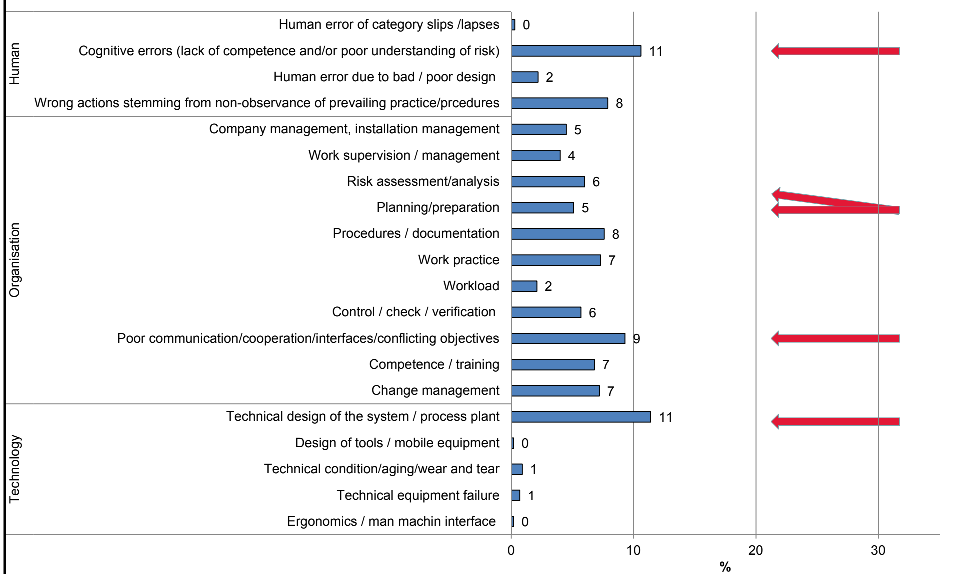
Distribution of underlying causes



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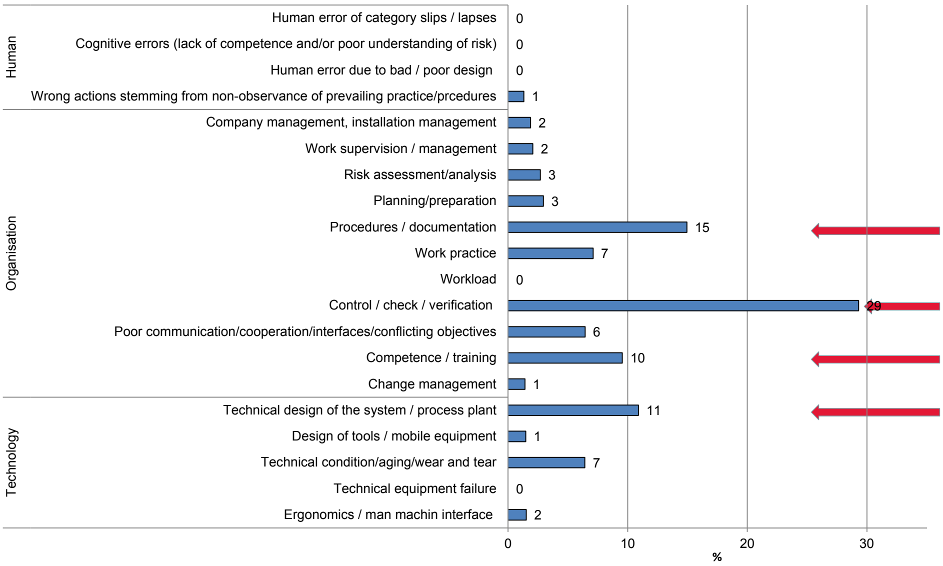
Recommended measures from the investigation reports



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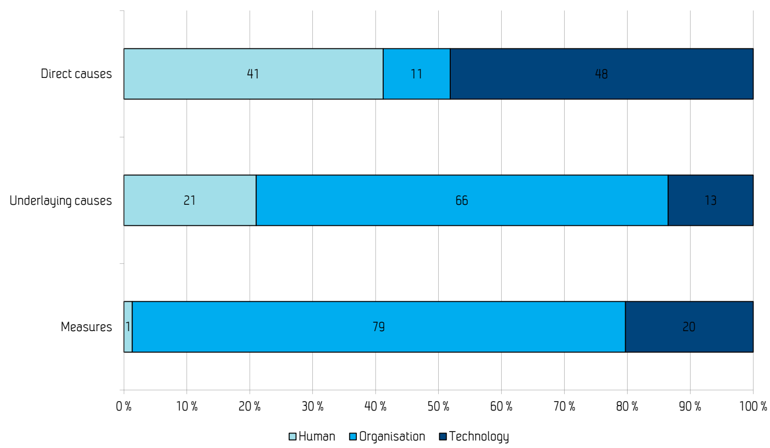
How do identified causes and measures correspond?



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Design and human factors issues related to HC leaks

- A large number of the HC leaks on the NCS are related to errors and unfortunate actions during interaction between operators and the technical equipment
- In previous classification schemes, most of these leaks have been classified as "*human intervention causing an immediate leak or a latent failures (which again causes a leak)*". For the period 2005-2009 between 60 and 80% are classified as such (RNNP, 2010)
- **But - what is due to man and what is due to design?**

Some example events

During leak-testing after replacement of a hydraulic control to a manifold valve, the valve opened inadvertently and instantaneously. This caused a strong pressure wave and rupture of a 2" pressure-equalisation line with a resulting gas leakage rate of 26 kg/s. The subsequent investigation pointed out that in the commissioning phase it had been revealed that several of the valves functioned opposite of what they were intended to do, and this was caused by a failure in how the hydraulic control to the actuator was designed. In order to correct this, the solenoid valve was modified (i.e. it was laterally reversed). As said in the investigation report, "It was easier to laterally reverse the solenoid valve than rebuilding the connector between the hydraulic control and the valve actuator". The report further states: "The event was primarily caused by the fact that the solenoid valve was laterally reversed without this being reflected properly in spare parts and documentation. This failure was therefore a latent threat"

During leak-testing of a wellhead valve, a pressure equalisation line was over pressurised and a gasket blew out. The pump used during the leakage test had pressure class 5000 psi and was connected to a system with a significantly lower pressure class. This, in combination with an erroneously closed valve caused overpressure of the low pressure system and a gasket blew out.

After a completed drilling operation, drilling personnel should bleed off remaining gas in the drill pipe to the test separator. However, the operator opened the wrong valve such that gas from the drill pipe was sent to flare, from where it was routed to atmosphere instead of the test separator. The valve which was mal-opened was poorly marked and it was the last barrier against open air.

Some main conclusions from the HC leak study related to design and human factor issues (1)

- Our study indicates that between 30 - 40 % of the hydrocarbon leaks can be related to unfortunate design features
- Unfortunate design features strengthen the effect of "lack of competency" issues
- A stronger focus on a design that facilitates safe and efficient work performance may have hindered many of these leaks
- There seem to be a lack/underrepresentation of specific technical measures

Some main conclusions from the HC leak study related to design and human factor issues (2)

- There are also several examples that the problems are "known" in operation, but instead of modifying the process plant, quick fixes such as writing a new procedure or adapting the work practices are introduced. This is clearly related to costs, however a greater will from the industry to rebuild or modify poor or deficient technical solutions rather than adapting to them can sometimes be wished for
- There is a potential to expand the use of human factor assessments and analyses to field equipment and work places designed for operational and maintenance work – both in design and during operation

Some questions for discussion – workshop themes

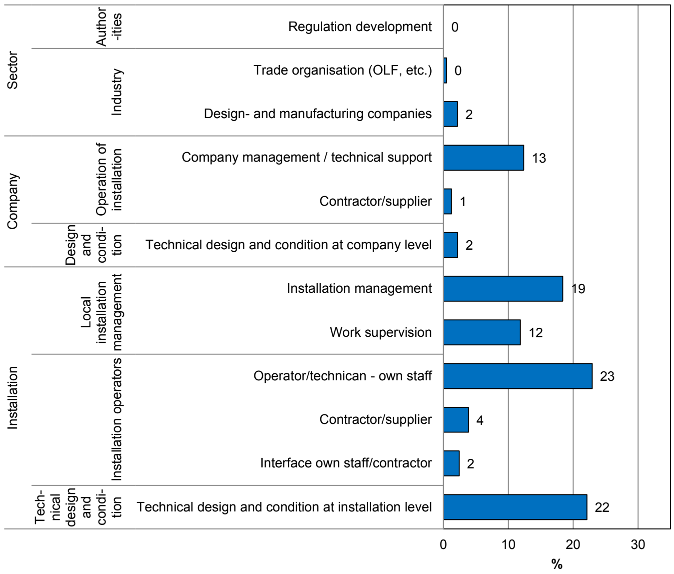
1. How can Human Factor related methods be applied **during design** in order to reduce the likelihood of HC leaks?
   - through contracts?
   - analyses performed during design?
   - Other ways/measures?

2. How can Human Factors related methods be applied more actively **during operation** in order to reveal potential poor/deficient design (of the process plant) that can result in HC leaks?

3. Is there a trend/tendency of thinking that "design related issues is basically a problem solved - now we have to focus on management, communication, organisational resilience, etc." (ref. e.g. main conclusions from President Commission report Deepwater Horizon)?

EXTRAS

Who is affected by the recommended measures?



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In which operational phase do the leaks occur?

Leaks	Start-up	Shut down/ blowdown	Normal operation	Maintenance/ testing	Modifications	Sum
Number	8	7	15	5	2	37
Share [%]	22	19	40	14	5	100%

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HFC

Hydrocarbon Leaks on the NCS

in Trends in Risk Level in the Petroleum Activity (RNNP)

Elisabeth Lootz
Petroleum Safety Authority Norway (PSA) and
Stein Hauge Sintef

Mere informasjon:
http://www.ptil.no/nyheter/rnnp-2010-store-utfordringer-paa-viktige-omraader-article7805-24.html

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Hydrocarbon Leaks on the NCS

in Trends in Risk Level in the Petroleum Activity (RNNP)

HFC 19.10.2011
Elisabeth Lootz
Petroleum Safety Authority Norway (PSA) and
Stein Hauge Sintef

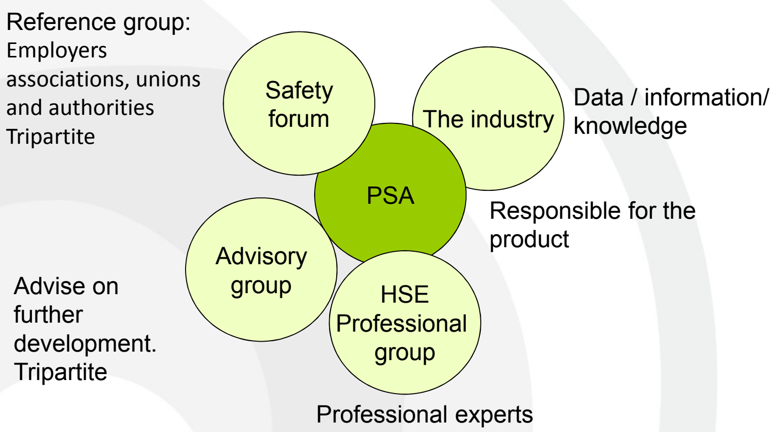
Petroleum Safety Authority - PSA

- PSA shall establish the premises for and follow up that the participants in the petroleum activity maintain a high standard on health, environment, safety and emergency preparedness, and thereby also contribute to create the highest possible values for society.
- The PSA is charged with the authority to:
  - Work out regulations pertaining HS&E in the petroleum industry
  - Supervise the industry's compliance with the regulatory framework
  - Maintain an overview of the overall safety level at any time

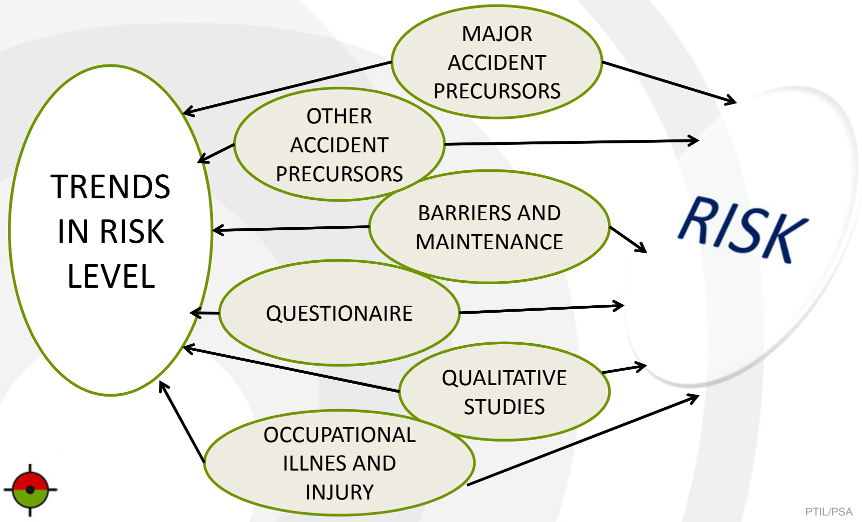
Trends in risk level in the petroleum activity (RNNP) – annual report

The Trends in Risk Level report aims to pinpoint critical HSE areas and identify causes to incidents and accidents in order to prevent their reoccurrence

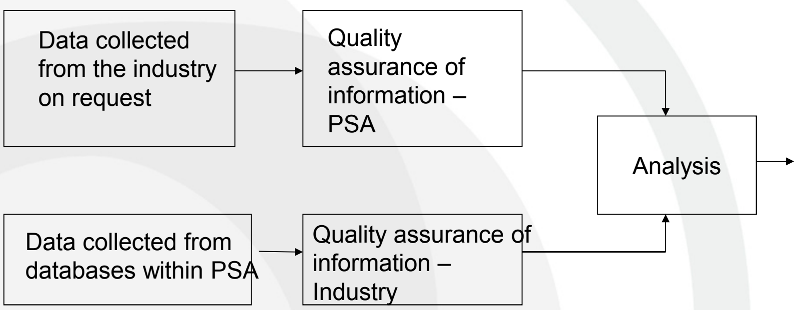
Participants and contributors



Trends in risk level
Methodology



Collecting data
Quantitative information



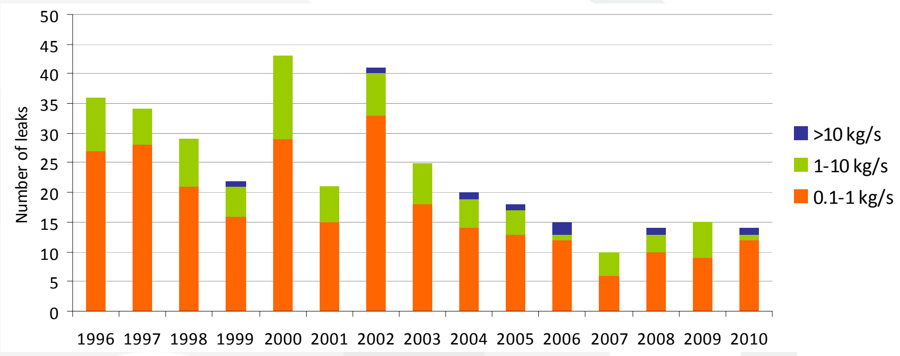
Accident precursors / indicators

- Non-ignited hydrocarbon releases
- Ignited hydrocarbon releases
- Loss of well control
- Fire/ explosion – non process fluids
- Vessel on collision course
- Drifting objects
- Collision with filed related vessel, shuttle tanker
- Structural damage, stability, anchoring, dynamic pos failure
- Releases from subsea production systems, pipelines, risers
- Damage to subsea production systems
- Helicopter
- Man over board
- Serious injury – personnel
- Occupational illness
- Total power failure
- Diving accident
- H2S emission
- Falling object

Black: Major accident potential

PTIL/PSA

Number of hydrocarbon releases exceeding 0.1 kg/s, 1996-2010



PTIL/PSA

Background – RNNP 2010

- PSA have in 2010 initiated a study on Hydrocarbon Leaks based on data from 2002-2010
- The study was conducted by an interdisciplinary research group from SINTEF (Stein Hauge and Bodil Mostue) and Studio Apertura (Trond Kongsvik)

The study's main objective is to describe challenges that the petroleum industry face in it's effort to reduce the number of hydrocarbon leaks

- Identify critical human, technical and organizational causes (and improve our understanding of the interplay between causes) to hydrocarbon leaks on the Norwegian Continental Shelf based on incident investigations (43 reports), research literature and other available data sources
- Identify what the industry perceive as the most important measures to reduce to hydrocarbon leaks
- Assess the correspondence between the causes identified and recommended / implemented measures

Four areas for improvement have been identified with regard to the reduction of hydrocarbon leaks

1. The adoption of a more offensive approach to designing or re-designing technical solutions where these are deficient, rather than accepting and adapting to them.
2. Appropriate learning and experience transfer and the systematic and efficient use of information from event databases, investigations, indicators and other sources relevant to preventive work.
3. Definition of precise and concrete measures to be taken in the wake of investigations, an area in which there is substantial room for improvement.
4. The implementation and application of risk assessments and analyses of the risk of hydrocarbon leaks.

Industry initiatives to reduce leakages

- Employers' organization OLF established Hydrocarbon leaks project/network 2002
- Aim to identify and recommendations for risk reducing measures for operators at the NCS
- Improve learning across the industry nationally and internationally
- Holistic approach; technical, organizational and human measures
- Interpretational uncertainty about ‘redesign’? Rebuilding the process plant? Modifications? Or smaller adjustments?

HFC

Workshop

"Where and how can Human Factors contribute to better and safer plant operations outside the control room?"

Mere informasjon:
http://www.aftenbladet.no/energi/olje/1364020/Miljoefarlig_tabbe_av_Statoil_.html

Some questions for discussion – workshop themes

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Tomorrow's human factors standards today

"Where and how can Human Factors contribute to better and safer plant operations outside the control room?"

Jörgen Frohm, MSc, PhD
Adam Balfour
19-20 Oct, HFC forum Trondheim

Workshop Questions

"Where and how can Human Factors contribute to better and safer plant operations outside the control room?"

- **Q.** List up areas where HF can contribute ***in*** CCR today (e.g. Competence, layout, procedures, HMI ++). Use this as a basis for handling other questions
- **Q.** List up physical areas/locations outside CCR where HF can contribute and state how / what the contribution is.
- **Q.** List up products/systems/services outside the CCR that can contribute to better and safer plant operations. How can HF make these products better?
- **Q.** List up HF methods/analyses/approaches / standards that can be used outside the CCR.

 2

Design for support by automation

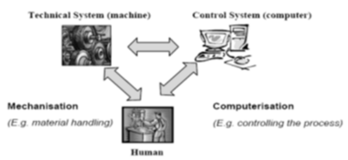


Figure 5-1: Separation of functions into mechanisation and computerisation

A central question in the design of automation is how to optimize task allocation (TA) between the technology and its users.

- **Q**. How can HF contribute to allocation between technology and users?

 3

Questions: Levels of automation

Despite technological advances to develop automated production processes that can perform functions more efficiently, reliably or accurately or at a lower cost than human operators, automation has still not replaced humans in the production systems.

- **Q.** How can we design production systems that take advantage of the interaction between humans and automation/technology?
- **Q.** How can we avoid to focus on automation solutions for the easiest tasks and leave the rest to the operator as described in the left-over allocation approach?
- **Q.** How can we design automation systems that not only maintain situational awareness, but also improve it.
- **Q.** How to we handle the out-of-the-loop performance problems with increased level of automation?

Levels of automation

- **Q.** Do we need more clever /advanced automation, or just learn to cope what we have?
- **Q.** What are advantages and disadvantages of increasing level of automation (LoA)
- **Q.** Is there a need for different design solutions at different levels of decision-making, where the purpose of automation and decision support may vary? Q. How can we ensure that the users/humans are not replaced by automation?
- **Q.** How can we ensure that the users/humans stay in control of the processes that they have responsibility for?

Levels of automation

With increased level of automation, the main responsibilities for the users have shifted from conducting the task to supervising/monitoring the performance of the task.

- **Q.** How do we handle the change-of-roles when users become responsible for the tasks, without conducting the tasks?
- **Q.** How do we cope with the sudden shift in mental workload due to the out-of-the-loop and loss of situation awareness?
  - E.g. "The ironies of Automation"

Advantages with increased Level of Automation

Research has found that the main advantages with increasing the level of automation in production systems are:

- Increased efficiency
- Improved quality
- Increased competitiveness
- Cost cuts
- Improved productivity
- Operating with lower maning
- Possibilities for increased volume capacity
- Improved working environment

Disadvantages with Increased LoA

- Research has found that small and medium sized companies invest in automation based on the benefits of increased automation
- Major companies on the other hand who already have implemented an high level of automation have realized that the increased level of automation has disadvantages
  - Loss of Control
  - Loss of important information exchange needed for uphold tacit working skills and knowledge
  - Increased complexity can lead to longer downtime and larger difficulties in diagnosing the failure
  - Increased need for competence in handling and monitoring the production process as for maintain production disturbances.

Background Information

- "Levels of Automation in Production Systems - *How to design for a suitable level of automation"* Dr. Jörgen Frohm, PhD Thesis
- The thesis can be downloaded from:
  - *http://www.hfs.no/wp-content/uploads/2010/04/PhD-thesis-Frohm.pdf*
- *Questions comments can be sent to jorgen@hfs.no*

Operational Safety Condition Monitoring operational safety barriers

Arne Jarl Ringstad & Snorre Sklet

Mere informasjon:

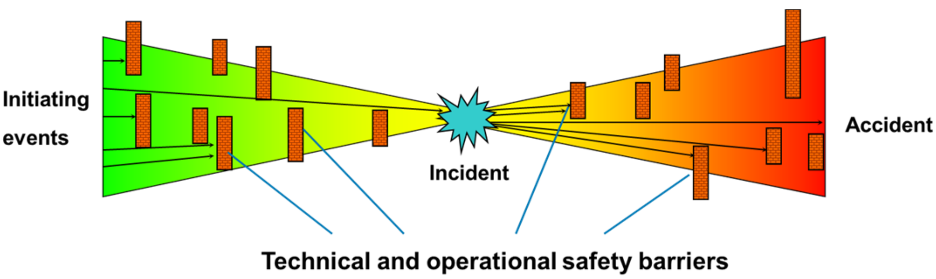
Statoil

Operational Safety Condition

Monitoring operational safety barriers

Arne Jarl Ringstad & Snorre Sklet

The original question



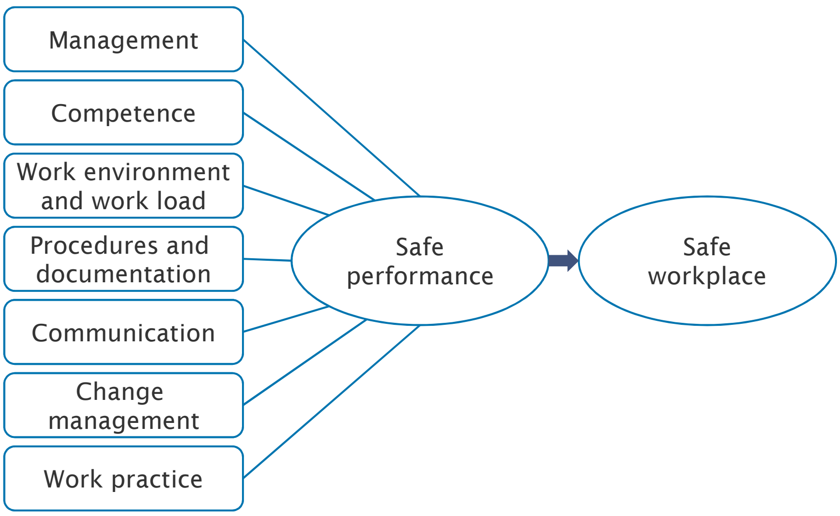
Statoil has a system used to monitor and improve the integrity of technical safety barriers – can we use the same approach wrt operational barriers?

Statoil

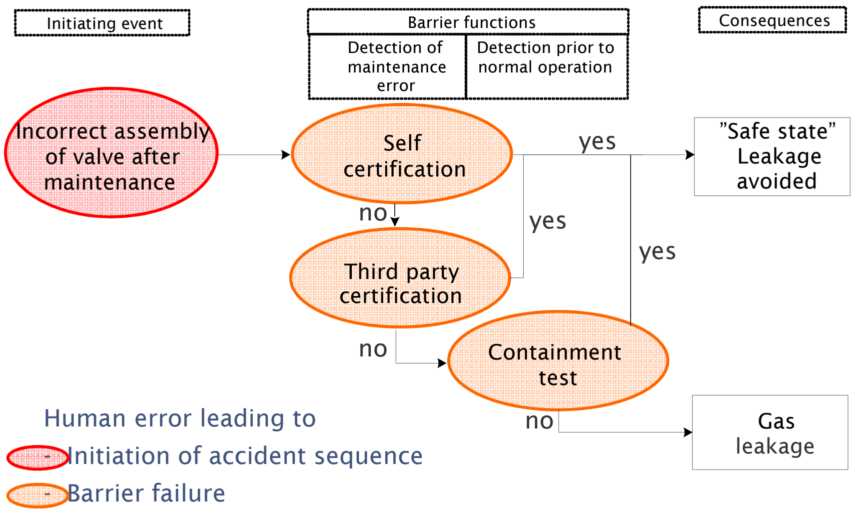
Operational safety barrier defined

An operational safety barrier is a personal (e.g. competence) or environmental (e.g. workplace design) factor that increases the probability of correct and safe work performance and (consequently) guards against human error and unsafe behavior

Operational safety barriers (OTS structure)



Task analysis – identifying safety critical behavior



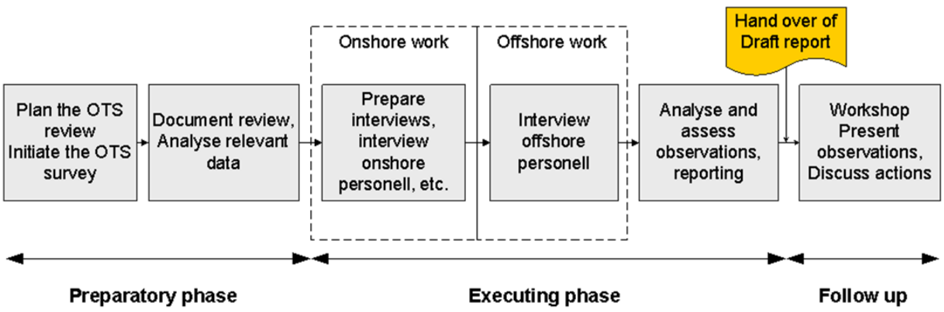
Statoil

Performance requirements and checkpoints

- Observations per checkpoint based on different sources (+ / -)
  - Findings are classified as red, yellow or green
- Grades (A – F) with arguments for all performance requirements

A1.1	**Planning of maintenance on hydrocarbon systems shall be done according to relevant requirements in governing documents**			
Ref.	**Checkpoint**	**References to requirements**		
A1.1.1	Are work packages developed for all shutdown jobs? - Are work orders (WO) included? - Do they contain comprehensive descriptions? - Do they contain all necessary information? - Are before and after activities included?	OM04.01.08.02.02	K	22839
		OM04.01.08.02.02	M	12311
		OM04.01.08.02.02	I	11014
A1.1.2	Is P&ID checked against the Master P&ID before it is used for preparing the isolation plan?	OM05.07.01.01.04	K	19019
A1.1.3	Is a documentation package (isolation plan) created that contains: - Updated P&ID with all points in the isolation plan clearly marked - Checklists - Valve and blinding lists -Hose connections marked off on the P&ID - Clear numbering - Color and symbols used on the P&ID	OM05.07.01.01.04	K	19019
		OM05.07.01.01.04	K	19020
		OM05.07.01.01.04	K	19021
A1.1.4	Are simplified treatment used for work on hydrocarbon systems? - For what kind of jobs? - Are the standardised form used?	OM05.07.01.01	K	19009
A1.1.5	Is the isolation plan verified and signed? - Is the roles segregated?	OM05.07.01.01.05	K	19022
		OM05.07.01.01.05	K	24670

Steps in an OTS



Statoil

Are we monitoring the important barriers?

OTS vs Chief Counsel's report on DWH

OTS – Operational barriers	DWH – Main non-tech causes
Management/leadership	Leadership
Communication	Communication
Procedures	Procedures
Competence	Employees (competence)
Work environment (incl HMI) and work load	Technology (HMI)
Change management	Risk / change management
Work practice	Operator – contractor relationship

Statoil

The Report to the President after DWH

On Institute of Nuclear Power Operations (INPO)'s Plant Performance Assessments (PPA)).

"These exercises figuratively deconstruct and reconstruct the plants, looking into all aspects of operations, maintenance and engineering. The inspection teams evaluate processes and behaviors that cross organisational boundaries such as safety culture, self-assessment, corrective action, operating experience, human performance and training."

HFC

Human Factors and the 'conduct of operations': The Next step after good ergonomic design

Dr Deborah Lucas
Rivington Human Factors Ltd

Mere informasjon:
IAEA guidance on conduct of operations - http://www-pub.iaea.org/MTCD/publications/PDF/Pub1339_web.pdf

Office of Rail Regulation – Guidance on Competence Management Systems at http://www.rail-reg.gov.uk/server/show/ConWebDoc.9915

HSE video on tanker spill - http://www.hse.gov.uk/humanfactors/resources/case-studies/gasoline-spillage.htm

HSE human factors - http://www.hse.gov.uk/humanfactors/

You're four times
It's hard to
more likely to
concentrate on two things
have a crash when you're
at the same time
on a mobile phone

HUMAN FACTORS AND THE 'CONDUCT OF OPERATIONS':

THE NEXT STEP AFTER GOOD ERGONOMIC DESIGN

Dr Deborah Lucas
Rivington Human Factors Ltd

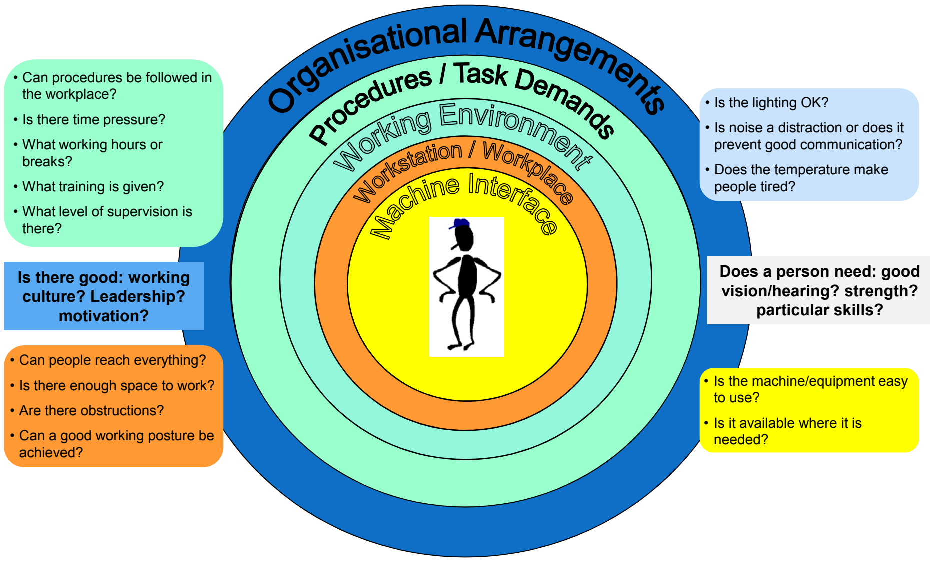
Rivington
HUMAN FACTORS LTD

Plan

- Who I am
- Lessons about human factors in major accidents: Is good ergonomic design enough?
- High Reliability Organisations and Resilience
- 'Conduct of Operations'

Dr Deborah Lucas

- Ex-HSE human factors principal inspector
- 15 years in onshore chemical, rail, nuclear divisions of HSE
- Evidence to rail public inquiries after Southall and Ladbroke Grove
- Adviser to investigation board after Buncefield
- Inspected high hazard sites and reviewed many safety cases
- Recently left Lloyd's Register and set up own consultancy – Rivington Human Factors Ltd

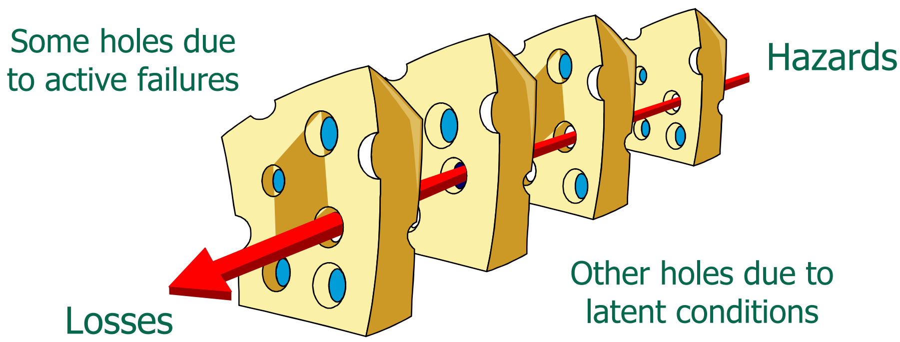


LESSONS ABOUT HUMAN FACTORS FROM MAJOR ACCIDENTS AND SOME 'NEAR MISSES'

Rivington HUMAN FACTORS LTD

OPEX - Operational Experience

The 'Swiss cheese' model – fill in the holes for more resilience!



Successive layers of defences, barriers, & safeguards

Esso Longford (1998)

- Esso claimed their operators were trained and competent and so, that operators' errors were to blame for the incident. The Royal Commission disagreed….
- the Longford plant was poorly designed, and made isolation of dangerous vapours and materials very difficult;
- inadequate training of personnel in normal operating procedures of a hazardous process;
- excessive alarm and warning systems had caused workers to become desensitised to possible hazardous occurrences;
- the relocation of plant engineers to Melbourne had reduced the quality of supervision at the plant;
- poor communication between shifts meant that a pump shutdown was not communicated to the following shift.

- "*The lack of knowledge on the part of both operators and supervisors was directly attributable to a deficiency in their initial or subsequent training. Not only was their training inadequate, but there were no current operating procedures to guide them in dealing with the problem which they encountered on 25 September 1998*." (Report of the Longford Royal Commission, p 234)

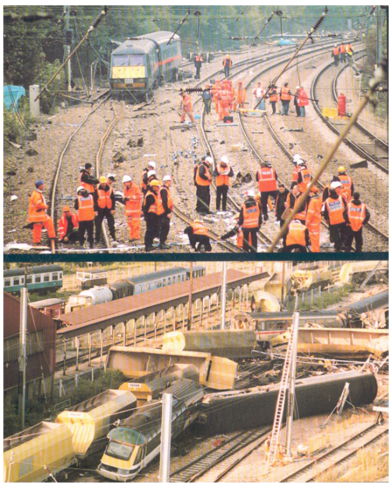
Longford - competency

Competency was the key strand

- Operators and others clearly did not understand what was happening
  - Initial leak – tried to tighten flange bolts
  - Tried to restart after system had cooled
- Competency assurance system did not test for real understanding -
  - Operators could give correct answer to test questions without understanding what they meant

Transportation

- Dependence on 'safety critical' front line staff
- Drivers, signallers, maintainers
- Significant attention to ergonomics of cabs, signalling systems
- Clapham Junction
- Southall
- Potters Bar



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Ladbroke Grove rail crash 5 Oct 1999

- Thames train and First Great Western collided head on outside Paddington station at combined speed of 130 mph. Both drivers killed.
- 29 passengers killed and 400 injured some critically
- Thames train driver had passed red signal at danger (SPAD)

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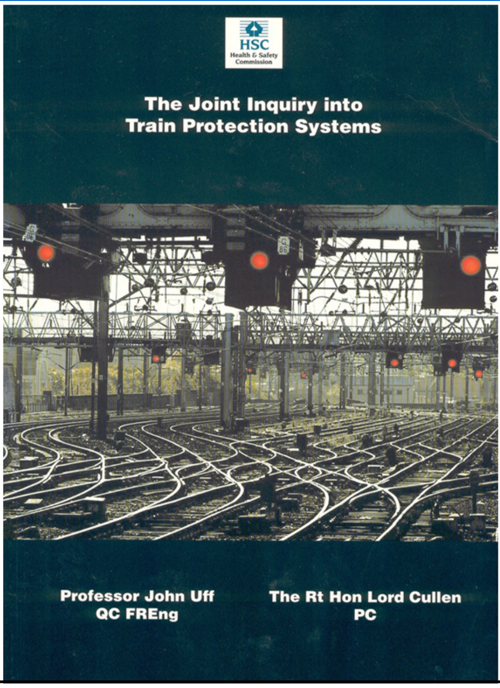

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Ladbroke Grove public inquiry

- Driver Hodder was not a railway man ('armed forces' background)
- short period of training
- crash shortly after declared competent
- no assessment on routes outside Paddington station
- competence standards not set down, assessors made their own criteria
- Thames Trains competence management criticised

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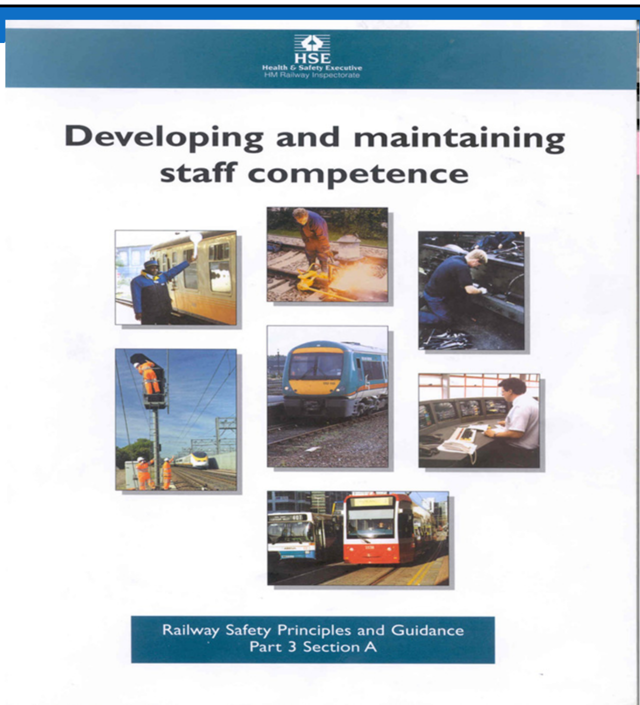

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Competence

- "*The ability to undertake responsibilities and to perform activities to a recognised standard on a regular basis.*"
- "*.. A combination of practical and thinking skills, experience and knowledge, and .. A willingness to undertake work activities in accordance with agreed standards, rules and procedures.*"
- ORR Guidance on Developing and Maintaining Staff Competence (2007, 2nd Edition)

Video

Davis Besse NPP 2002

- Lack of management attention & questioning attitude.
- Poor learning from internal & external experience.
- Failure to address/recognise repetitive recurring problems
- Poor internal self-assessment of safety performance.
- Weaknesses in response to employee concerns
- Lack of compliance with procedures.
- Strained resources & acceptance of degraded plant.
- Addressed symptoms (not root causes). Lack of rigour (complacency / mindset)
- Some evidence of production pressures.

Davis Besse
Under the Reactor
Vessel Head

PAKS Hungary NPP - 2003

- Operations had been 'turned-over' to the contractor;
- ' *Neither HAEA nor PAKS NPP used conservative decision making in the rigour of safety assessment given to an unproven fuel cleaning system*';
- The aggressive schedule to develop and use the vessel, influenced the rigour of safety assessment and design review;
- Communication between organisational units was not encouraged except at senior levels;
- Inadequacies in training and in procedures;
- The regulator underestimated the safety significance of the design – this resulted in less review and assessment than required

Buncefield - 2005

- Most costly petrochemical disaster in UK - £1 billion
- 5 organisations were fined more than £5m in total for criminal safety failings
- Board Judge – companies had shown ‘a slackness, inefficiency & a more-or-less complacent attitude to safety’
-

Buncefield – some of the causes:

- Handover time for supervisors was too short to be meaningful
- Supervisors not able to maintain situational awareness as out of control room on other work
- Single overview screen so only one tank gauge visible at any time
- Control room actually had no control over pipeline deliveries
- Since 2002 fuel input into site had doubled leading to max storage capacity but no assessment of workload to cater for this change
- Supervisors spent time reconciling stock between different tanks

Buncefield – some of the causes:

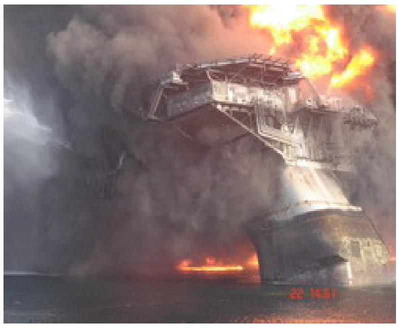
- Senior staff workload (ops manager & terminal ops) far too high with duties at other sites.
- Previous 'near miss' of 2003 when ATG stuck did not get thorough response ATG stuck at least 14 times in previous 3 months – trend not picked up as systemic fault
- System for monitoring contractors doing safety critical tasks was seriously defective e.g. no monitoring/audit of performance
- Failed to realise the replacement IHLS were not 'like for like' (the switches had an inoperable position) & therefore critical role of the padlock
- *More account needed to be taken of concerns expressed by those on the ground*
- *Investigation board recommended more focus on attributes of 'high reliability organisations'*

Deepwater Horizon: The Causes

- Most, if not all, of the failures at Macondo can be traced back to underlying failures of management & communication.
- Better management of decision making processes within BP & other companies, better communication within & between BP & its contractors, & effective training of key engineering & rig personnel would have prevented the Macondo incident.
- BP's management process did not adequately identify or address risks created by late changes to well design & procedures.
- BP did not have adequate controls in place to ensure that key decisions in the months leading up to the blow-out were safe or sound from an engineering perspective.
- Halliburton & BP's management processes did not ensure that cement was adequately tested.

Deepwater Horizon: The Causes

- Decision-making processes at Macondo did not adequately ensure that personnel fully considered the risks created by time- & money-saving decisions.
- Regulatory oversight: Many critical aspects of drilling operations were left to industry to decide without agency review



Some common themes:-

Leadership
Operational attitudes and behaviour
Business environment

Competence
Risk management
Oversight of process safety
Communication

Use of contractors

Organisational learning

Role of regulators

- Well established organisations across all industrial sectors
- Organisational processes in place for:
    - Leadership & its development
    - Quality Management Systems
    - Change Controls
    - Training – of staff & contractors
    - Metrics – for processes & safety
- Risk assessments are done & risk control/safety management systems exist
- At board level there is a professed focus on safety
- They are subject to some form of safety regulation
- They try to learn lessons from major events – not always successfully

What else can they do?

HIGH RELIABILITY ORGANISATIONS

What does the concept mean?

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High Reliability Organisations:

- ‘Just’ culture
- Mindful leadership
- Learning anticipation
- Problem anticipation
- Containment & recovery from unexpected events

Internal review of key areas such as :-

- Hazards & controls
- Training & competence
- Incident & near miss reporting
- Learning from incidents
- Management commitment to safety
- Ability to contain problems

The UK Nuclear Regulatory context - Leadership and management for safety

Leadership

Directors, managers & leaders at all levels should focus the organisation on achieving & sustaining high standards of safety & on delivering the characteristics of a high reliability organisation

Capable Organisation

The organisation should have the capability to secure & maintain the safety of its undertakings

Decision Making

Decisions at all levels that affect safety should be rational, objective, transparent & prudent

Learning from Experience

Lessons should be learned from internal & external sources to continually improve leadership, organisational capability, safety decision making & safety performance

Characteristics

Leadership

- Nuclear Safety Policy – deeds not just words
- Actions demonstrate commitment to safety
- Resolution of conflicts between safety & other goals
- Reward systems to promote the control of risks & accident prevention
- Oversight of safety performance

Capable organisation

- Adequate resources
- Competence (including directors)
- Intelligent customer capability
- Knowledge management
- Organisational design & management of change

Characteristics

Decision Making

- Safety priorities evident in decision making
- Basis for decisions (including limitations of information sources e.g. KPIs)
- Management of conflicting goals - safety versus other goals (commercial etc)
- Conservative decision making
- Active challenge (expected/encouraged)

Learning

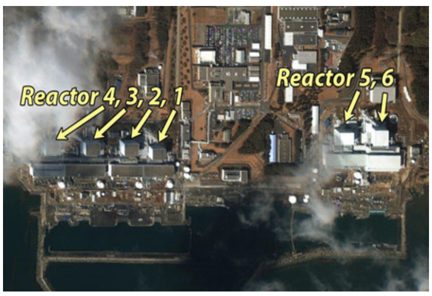
- Willingness to learn from a wide/diverse range of sources
- Benchmarking (within industry & more widely)
- Implementing lessons & effectiveness reviews

Recovery – ‘Organisational resilience’

- Emergency planning
- Thinking ‘outside the box’ about what can go wrong
- And how to contain unexpected adverse events
- Symptom based procedures and simulator training
- Sufficient staff available – minimum manning
- Demonstrations to safety regulator

- But in reality it can all come down to heroic efforts by individuals
- Improvising untried solutions
- Staying at their posts to do the best they possibly can

Fukushima March 2011 – lessons still to be learnt



CONDUCT OF OPERATIONS

How do you move to be a High Reliability Organisation?

IAEA Safety Standards NS-G-2.14
Conduct of Operations at Nuclear Power Plants (2008)

- ***To ensure safety, it is necessary that the management of a NPP recognizes that the personnel involved in operating the plant should be cognizant of the demands of safety, should respond effectively to these demands, and should continuously seek better ways to maintain and improve safety…….***
- ***That it ensured to a high degree that policies and decisions for safety are implemented, that safety is continuously improved and that a strong safety culture is developed and promoted.***

Key

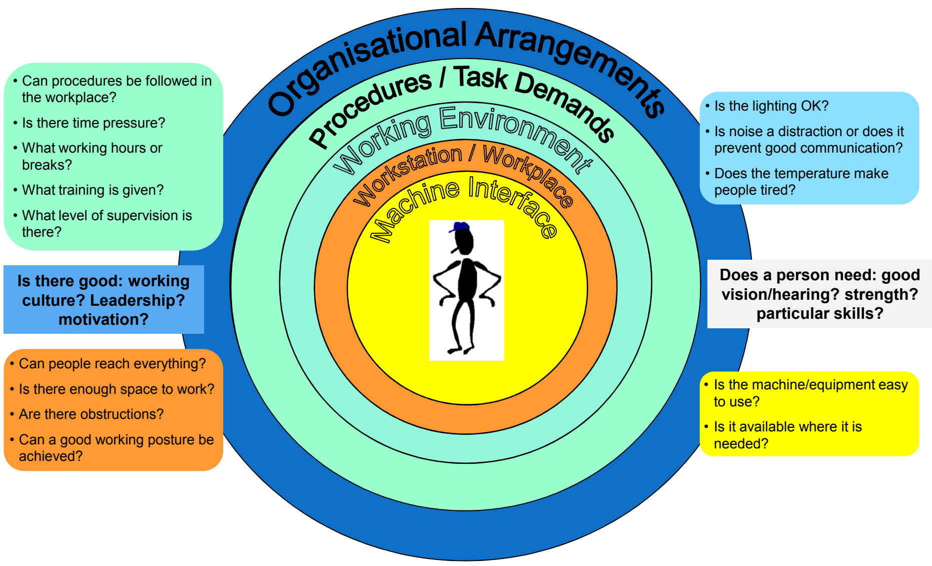
- It defines clear expectations for safe and reliable operations
- It places emphasis on the rigour required in applying these expectations
- Based on well established nuclear industry operational practices and guidelines – 'relevant good practice'

Content covers:

- Management and organisation of plant operations
  - eg Human resources and qualification of personnel
- Shift complement and functions
  - eg shift supervisor, operators
- Shift routines and operating practices
  - eg shift turnover, availability and use of operating procedures, pre-job briefings, communications, conduct in the control room
- Control of equipment and plant status
  - eg labelling of plant equipment, control of alarms
- Operations equipment and operator aids
  - eg housekeeping, communication equipment
- Work control and authorization
  - eg work planning and scheduling

Content:

- Includes ergonomics of control rooms
- Also work environment, competence, procedures
- But focus is on 'organisational arrangements'
- Good example of integration of human factors with operations
- Practical principles capturing relevant good practice – all in one document
- Can be used as a standard to enhance 'disciplined or professional' operations
- Some sites found it a helpful way to start a journey on safety



Links

Office of Rail Regulation – Guidance on Competence Management Systems at http://www.rail-reg.gov.uk/server/show/ConWebDoc.9915

HSE video on tanker spill - http://www.hse.gov.uk/humanfactors/resources/case-studies/gasoline-spillage.htm

IAEA guidance on conduct of operations - http://www-pub.iaea.org/MTCD/publications/PDF/Pub1339_web.pdf

HSE human factors - http://www.hse.gov.uk/humanfactors/

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Questions?

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Policy position statement on competence management systems

Introduction

Making sure workers, supervisors and managers have, and continue to have, the appropriate skills ('competence') helps them to carry out their work safely, reducing risks to themselves and other people. An effective competence management system helps organisations to make sure that their staff have the skills they need. Our published guidance on competence management systems ('Developing and maintaining staff competence', Railway Safety Publication 1, second edition published in 2007) explains the legal basis for duties relating to competence management systems.

We recognise the following:

- Rail companies have a duty to assess whether workers have the necessary skills and are able to apply those skills in order to carry out their work. Those companies must record their findings for safety-critical work. (This is twelve broad areas of work carried out on the railway that could affect the health and safety of people working on or using it. They are explained in detail in 'The Railways and Other Guided Transport Systems Safety Regulations 2006 (ROGS) - A guide to ROGs').
- Rail companies have a duty to review that assessment if there is a doubt about a worker's skills or their ability to carry out their work, or if there is a change in the work to be carried out.
- Many rail companies have competence management systems in place.

What we believe

- An effective competence management system helps make sure that health and safety risks to staff, passengers and the public are properly controlled.
- An appropriately detailed risk assessment is essential to developing an effective competence management system.
- A competence management system must be properly designed, put in place, maintained, reviewed and audited.

What we expect rail companies to do

- Keep to their duties to assess and review whether their staff are skilled and fit to carry out safety-critical work.
- Apply examples of good practice when developing and managing their competence management system.

- Provide whatever information, instruction, training and supervision is necessary to protect the health and safety of their staff, passengers and the public, as far as is reasonably practical.

What we will do

- We will prioritise our inspection strategy on competence, based on the evidence we gather and our assessment of the risks.
- We will promote the importance of effective competence management systems in making sure that all staff have the appropriate skills to safely carry out their work.
- We will continue to share with rail companies and trade unions our guidance, expertise and advice on developing, maintaining and reviewing competence management systems.
- We will work with rail companies and other organisations to develop and promote good practice on competence management.
- We will maintain, and when necessary revise, our published guidance on competence management systems (see 'Introduction' on page 1).

Crystal Mark 18940
Clarity approved by Plain English Campaign

HFC

Safety culture in design
Safety at the ”blunt end”

Stian Antonsen

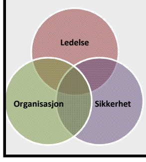
Mere informasjon:

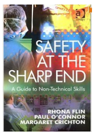
SAFETEC

Safety culture in design

Safety at the ”blunt end”

Stian Antonsen





SAFETEC

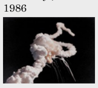
Outline

- Safety culture - background
- Culture and safety culture
- Safety in design
- Can focus on safety culture be an ”excuse” for not rethinking design?
- Safety culture in design phases - what do we know?
- Summary and discussion

SAFETEC

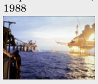
Safety and culture - background

Chernobyl, 1986



Challenger, 1986

Clapham Junction, 1988



Piper Alpha, 1988

- Chernobyl → *The accident can be said to have flowed from deficient safety culture* (IAEA 1992: 23)
  - reluctance to question the decisions of one's superiors
  - a propensity for procedural violation
  - a complacent belief in the ability to control the technology
  - making the production of energy, not the upholding of safety, the key priority of managers and operators
- Piper Alpha
  - *"It is essential to create a (...) culture in which safety (...) is accepted as the number one priority"* (Cullen 1990: 300)

SAFETEC

What is culture?

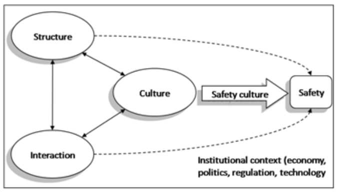
A loose definition:

The frames of reference through which we interpret information, symbols and action, and the social conventions regulating behaviour, interaction and communication.

SAFETEC

So what is safety culture??

- Safety culture refers to the relationship between organizational culture and safety



- Thus, there is no such "thing" or phenomenon as safety culture, it is nothing more than a conceptual label denoting this relationship

SAFETEC

Safety in design

- Three Mile Island

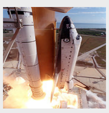
"The panel display showing the relief valve switch of the pressuriser as "closed" was displaying incorrect information"

"Inadequate control room instrumentation…"

- Flixborough explosion

"The site layout was poor, failing to consider the positioning of occupied buildings"

"The control room lacked the necessary structural reinforcements, resulting in windows shattering and the roof collapse"



- Columbia space shuttle

"Poorly designed layout of the engine instrument displays…

Source: Rollenhagen (2010)

SAFETEC

Can focus on safety culture be an ”excuse” for not rethinking design?

- The safety culture perspective has an operational bias
  - Cultural traits among operative workers
  - Safety at the sharp end
- Measures related to employee behaviour are less expencive than measures related to design
  - Focus moves from reducing hazards, to controlling hazards?
- Should we abolish the safety culture perspective and focus entirely on design??

Source: Rollenhagen (2010)

SAFETEC

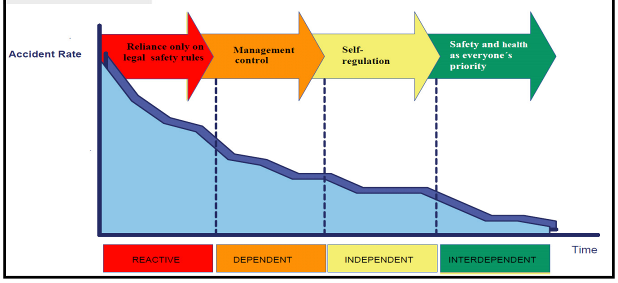
Safety culture in design

- The safety culture approach should be expanded to include the blunt end of the organization
- Cultural traits that influence on decisions in
  - Design/ engineering groups
  - Company management
  - Petroleum safety authorities?
- What do we know about safety culture in design?
  - Virtually nothing
  - A promising project under way in the Finnish nuclear industry
  - To my knowledge only one empirical publication

SAFETEC

What do we know?

- Leal et al. (2010): *Safety at the design stage of large engineering projects – a study of safety culture.*
- Based in well-known safety culture ”taxonomies”:



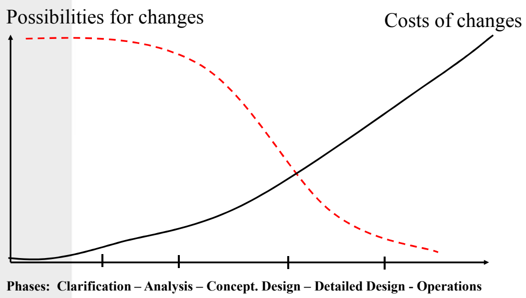
What do we know?

- Leal et al. (2010): *Safety at the design stage of large engineering projects – a study of safety culture.*
- Found important differences between the six design teams studied.
- Some of the discriminating factors:
  - Belief in designers' role in actively seeking the safest engineering solutions
  - Integration and continuous interaction between the various areas of expertise
  - Team members have operational experience (worker involvement)

What does this tell us?

- It indicates that the safety culture perspective may be important in order to
  - Understand decisions made in design phases
  - Understand and improve communication and interaction between the areas of expertise involved in design phases
  - Study the utilization of operative knowledge in design
  - Improve worker involvement in design
- But currently more questions than answers …

Costs of changes in projects



Source: Johnsen et al.(2011)

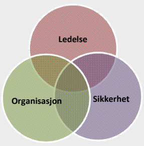
SAFETEC

Feedback and discussion

- Relevance
- Usefulness
- Future work

SAFETEC

Thank you for your attention!



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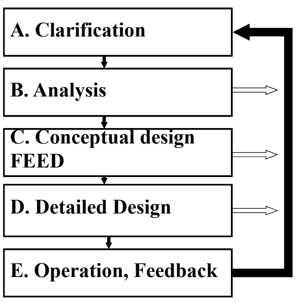
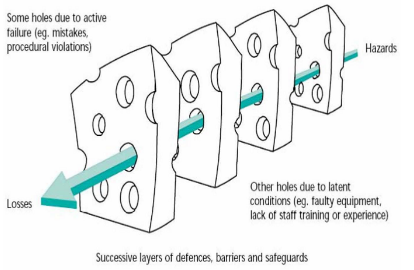


Primærkilde: Rasmussen (1996)

- Prosedyrer inngår i et barrieresystem
- Er det mulig å skape et "vanntett" system?
- Kan faglig skjønn være en form for barriere?

The " Swiss cheese" model of accident causation



Primærkilde: Reason (1997):

HFC

HFs in virtual and augmented reality applications for plant operation, maintenance and decommissioning

Presented by: Terje Johnsen
Contributors: Michael Louka, Niels Kristian Mark, Espen Nystad, Grete Rindahl, Aleksander Lygren Toppe

Mere informasjon:

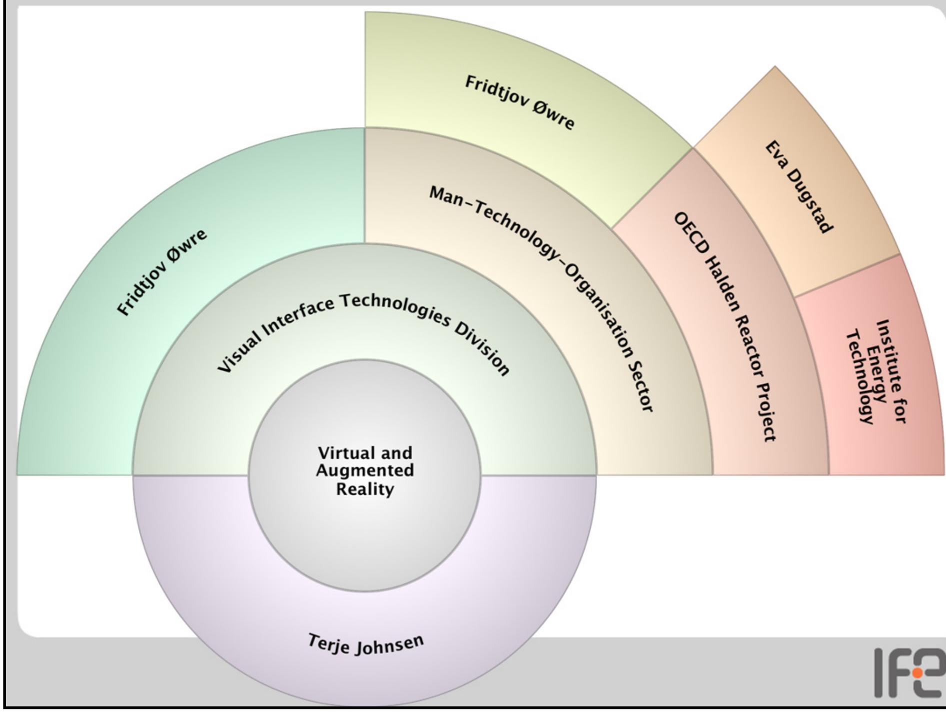
Human Factors in plant design, operations and maintenance.
October 2011 Trondheim, Norway

HFs in virtual and augmented reality applications for plant operation, maintenance and decommissioning

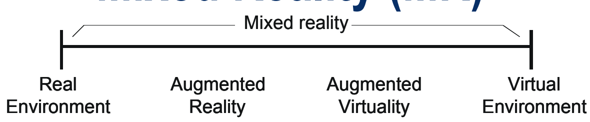
Presented by: Terje Johnsen
Contributors: Michael Louka, Niels Kristian Mark, Espen Nystad, Grete Rindahl, Aleksander Lygren Toppe

Table of content

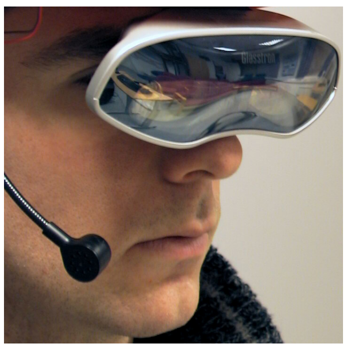
- Introduction to IFE/HRP/VISIT
- Two HF studies
  - VR/AR collaborative training in maintenance and decommissioning
  - Radiation visualization for raised radiation awareness
- Real-world projects in Russia and Ukraine
- Future work
  - Outage and field works
  - Ubiquitous computing



Mixed Reality (MR)



- VR completely replacing reality
- Augmented Reality (AR) is a mixed reality that attempts to supplement it
- Blends the real and the virtual in the actual physical environment
- HRP has more than 15 years experience with VR/AR



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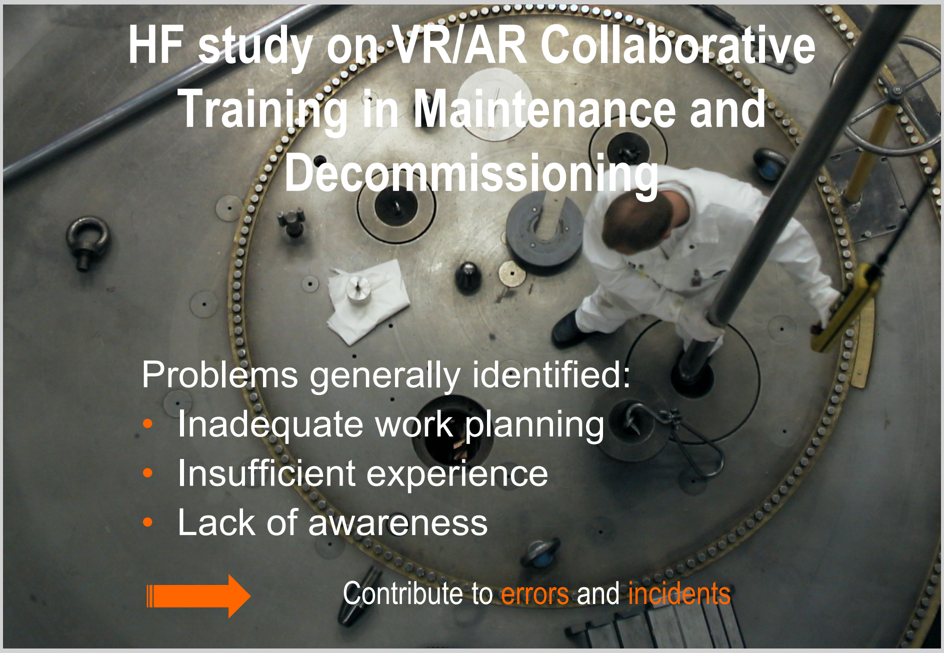
Halden Project MR Research

- Multi-disciplinary research team
  - Interaction design, visualisation, and computer graphics
  - Human factors
  - Domain knowledge experts (e.g. radiation protection)
- Research platform facilitating collection of experimental data
  - Halden Man Machine Laboratory (HAMMLAB)
  - ProcSee UIMS and Halden VR Software Platform
- Resulting technologies, methods & recommendations of interest to vendors, regulators & utilities
- Bilateral activities reflect research activities



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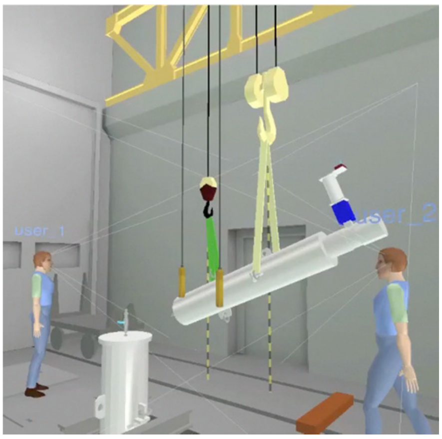
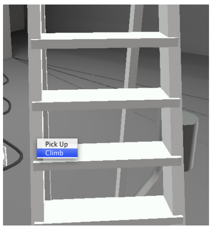
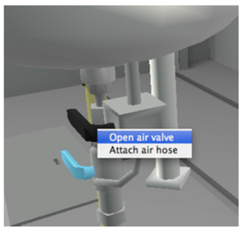
Collaborative Virtual Environments (CVEs)

- A CVE lets **a group of users meet and collaborate** in a virtual space
- A simulated environment
  - Work area and equipment
  - Work tasks
  - Hazards
- Avatars representing humans



Interacting with the Simulation





- Users can navigate, perform tasks and manipulate objects
- Can be used for pre-job briefings
  - What / how / who/ to do
  - Equipment needed

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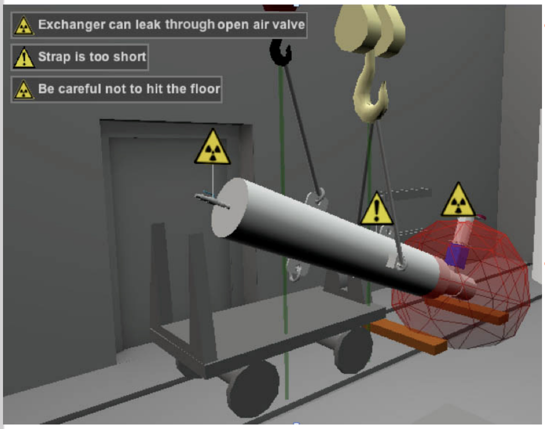
Hazard Visualization in CVEs



- Visualize potential hazards related to the maintenance activity:
  - Radiation risk
  - Equipment damage
  - Procedure omissions
- NPPs lack arenas for trial-and-error training

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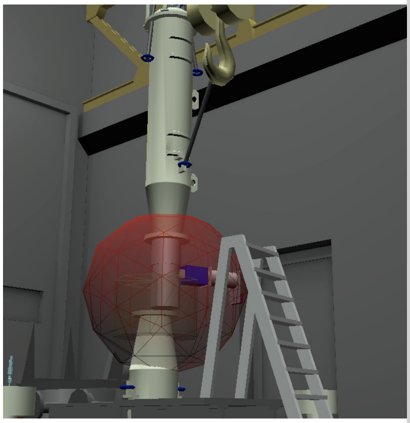
Hazard Awareness: Findings

- Hazard awareness transferred to other tasks: The participants became more aware of potential hazards in general
- The simulation created a focus on hazards



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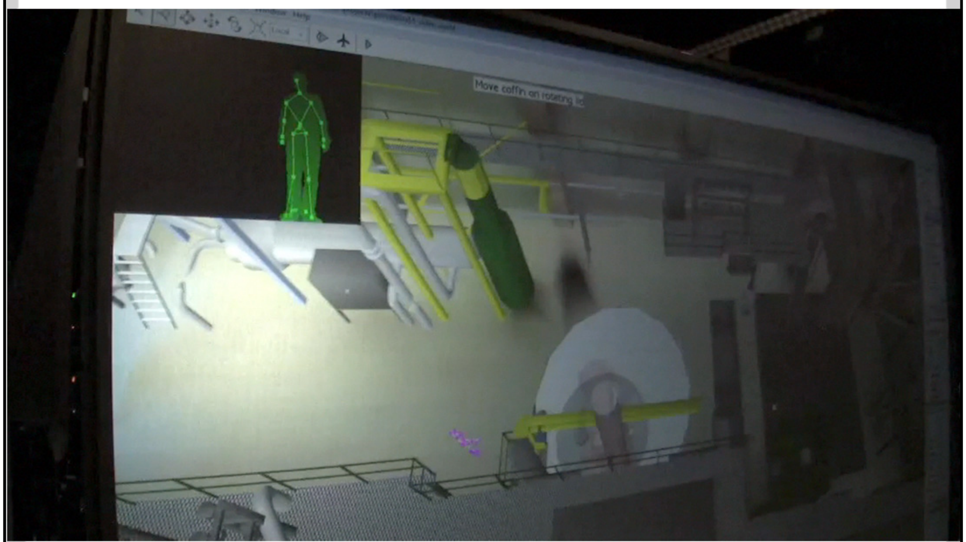
Microsoft Kinect - Device-less Interaction

- Device-less position tracking and gesture input
- Infrared camera creates depth-image of your body, registers body position and posture.
- Can be used to provide intuitive interaction with a virtual environment

Device-less Interaction: Kinect



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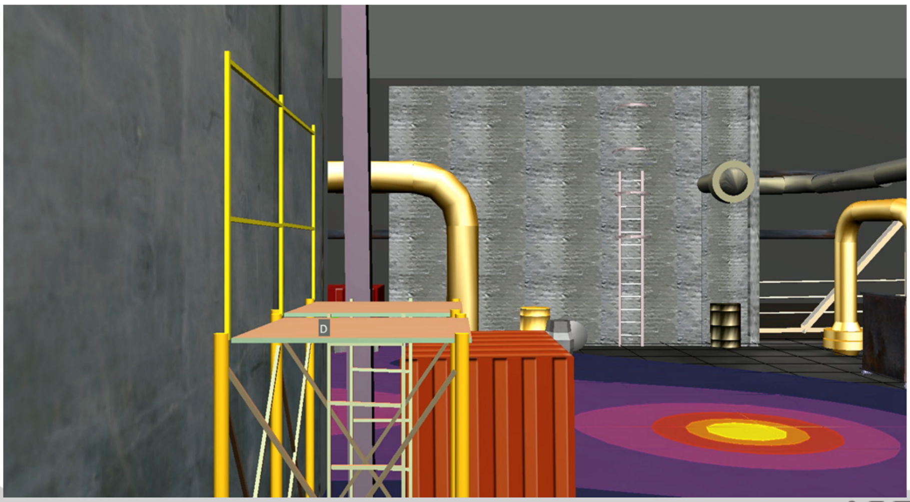
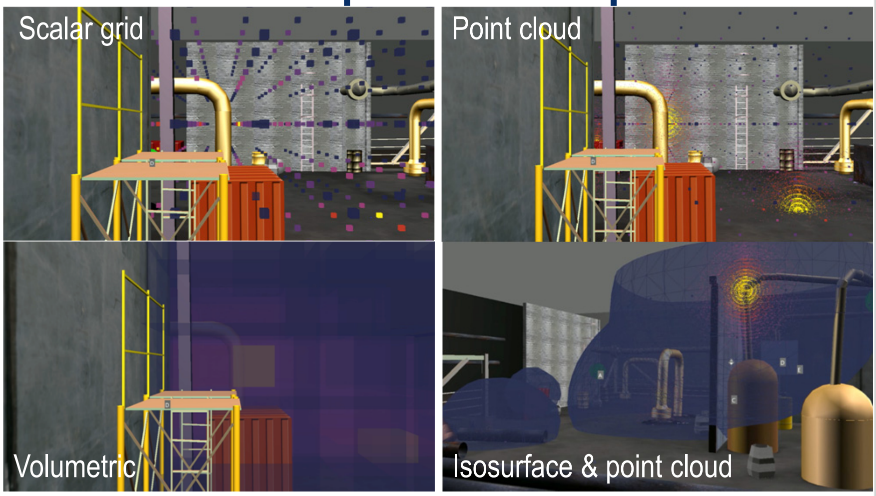
A Comparative Study of Radiation Visualization Techniques

- Radiation visualization can contribute to raised radiation awareness
  - Improve basis for ALARA-oriented decision-making
- Visualized radiation data must to be perceived correctly by user!
  - Misinterpreted visualization could be dangerous
  - Need to verify validity of visualization techniques used
  - and acquire a basis on which to justify enhancements
- Wanted to compare techniques as aids
  - for rapid assessment of radiological environment
  - for accurately estimating levels at specific locations

2D Cross-section Plane



Other Techniques for Comparison



Key Issues and Recommendations

- Overconfidence
  - If possible, ensure that the user is aware of the location of sources, especially if a 2D cross-section or map is used
  - Pulsing the sources might help to ensure that the user does not miss them and to keep track of the location of sources relative to the view
- Occlusion
  - For some use-cases, it might be helpful to make objects (or just walls and/or pipes) in the virtual environment partially opaque when occluding a radiation visualisation

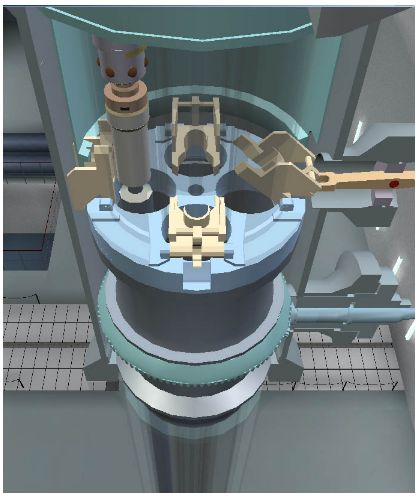
Key Issues and Recommendations

- Colour distortion
  - Do not make visualisations too transparent, and choose colour map carefully to avoid confusion caused by mixing of background colour (e.g. blue over yellow giving green)
- Uncertainty caused by diffuse boundaries
  - Try to combine visualisation techniques that give diffuse boundaries (such as point clouds and scalar fields) with 2D planes or isosurfaces to give a clearer indication of range limits

Conclusions

- Good scores with all four visualization types
- Understanding 3D radiation distribution is important
  - Requires active effort with 2D slices to avoid overconfidence
- Clear boundaries are important for rapid decisions and subject's confidence
  - Fuzzy information requires more effort to interpret
- Must be clear to the user what is represented
  - Isosurfaces prone to misinterpretation
- Combining & refining techniques will probably lead to consistently better scores with minimal training

Real World projects – NMFA Assistance Programs in Russia and Ukraine



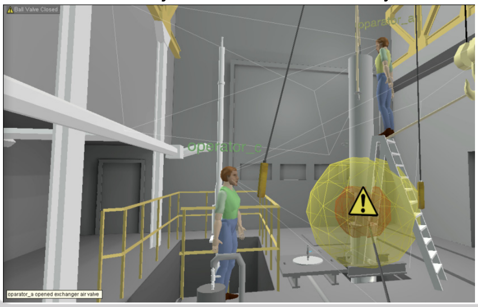
Increased Safety Through Better Planning and Training of Work Tasks

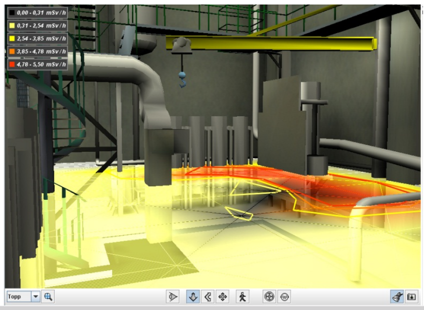
- **Refuelling operation simulator** – first part finished 2008
  - Simulating the refuelling machine for refuelling while running at full power
  - Connected to the full scope simulators for cooperation with reactor operators
  - Transferred to Kursk NPP and Smolensk NPP → In total ≈ 1000 users

Visual Interface Technologies Division, IFE Halden

Leningrad and Chernobyl NPPs

- **Procedure creator and trainer system** – finished 2011
  - Procedure training – both operation and maintenance (and decommissioning)
  - The instructor may easily set up new training scenarios
  - Collaborative training with assistance from the system to the trainees
  - Training of radiation awareness and risk assessment
  - Project started in Chernobyl Nuclear Power Plant 2007





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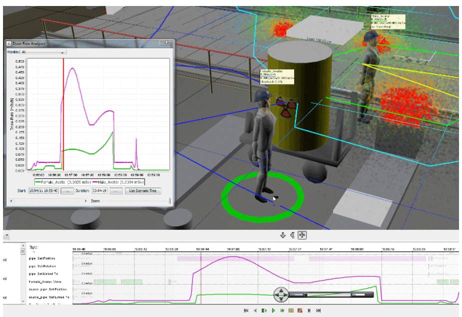
DRIVE project Andreeva Bay

- **"Dynamic Radiation Visualisation Engine" (DRIVE) 2011-2013**
  - IFE and Radiation Protection Agency (FMBC) develop software for
    - Visualise radiation data from the DOSEMAP and DATAMAP projects
    - Planning the use of personnel with dose calculation (dosimetry)
    - Training of personnel
  - End-users: Radiation Protection (FMBC) and operator (SevRAO)



ФМБА РОССИИ

Statens strålevern
Norwegian Radiation Protection Authority

Visual Interface Technologies Division, IFE Halden

Future work

OUTAGE AND FIELD WORK

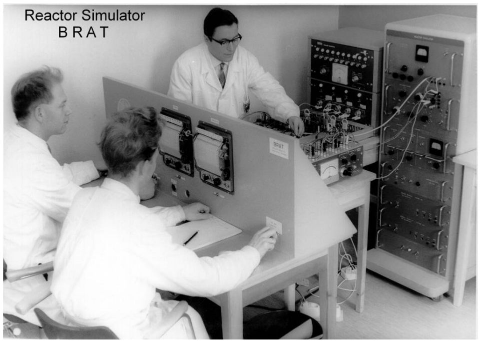
HRP Research Program 2012-2014

- Outage control centres can play an important role in prioritising outage activities
- Will be further developed in not too distant future
  - Pushed by larger utilities
- Work proposed in this area covers
  - Activities in the physical control centre
  - Extended team of field operators
  - Stakeholders at remote locations
- Multi-disciplinary topics
  - Collaborative HSI technologies
  - Visualisation technologies
  - Integrated operations in outage

Paradigms of Computing

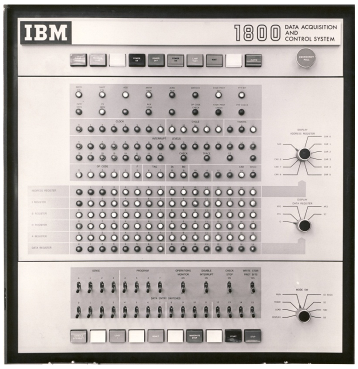
- The first computer to Halden in 1959

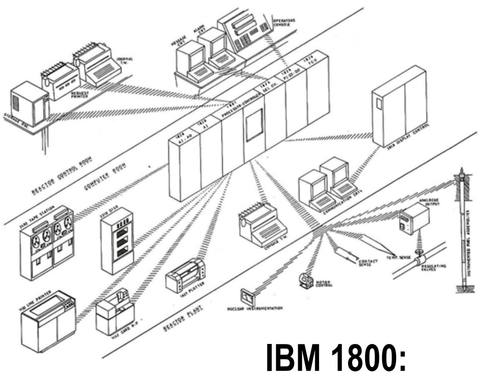
Number 1: Donner in 1959



Magnus Øvreeide and Tor Hveding

1967 – Mainframes Arrive in Halden





IBM 1800:
Memory: 24 K
Cycle time: 2 μ sec

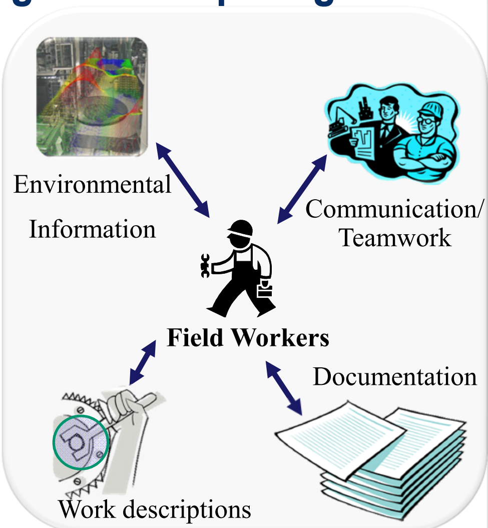
1980 – Personal Computers

- One-to one relation between user and computer
- Dominating for 30 years
- Big actors
  - IBM
  - Microsoft
  - Intel
- We are still (some…) there
  - But what next?

Illustration from Wikipedia

Ubiquitous Computing – the Third Paradigm of Computing

- "Computing everywhere around you"
- Information processing integrated into everyday objects and activities
- Interaction with several systems simultaneously
- Context-based
- Facilitating informed decision-making
- Enabling collaboration



Augmented Reality – To See the Invisible

ARLAB NORWAY

AHO Arkitektur- og designhøgskolen i Oslo
The Oslo School of Architecture and Design

Forsvarets forskningsinstitutt

Kyoto University
Graduate School of Global Environmental Studies

Future Work

- Outage control centre
- Field testing of the handheld radiation prototype with EDF
- Human Performance Improvement for NPP Field Workers (INL)
  - Mobil technologies
  - Augmented reality

eDF

INL Idaho National Laboratory

LWRS Light Water Reactor Sustainability

Final Comments

- A new paradigm of computing
  - Hand-held devices
  - Visualisation of hazards
  - Context based information
- Development should not be technology driven
  - Human factors
  - Domain knowledge
- Enabling technologies for field operators will be developed and tested in MTO labs and in cooperation with partners

HFC

Human factors in technical maintenance
Experiences from aviation

Jens Rolfsen

Mere informasjon:

Human factors in technical maintenance

Experiences from aviation

Jens Rolfsen
201011

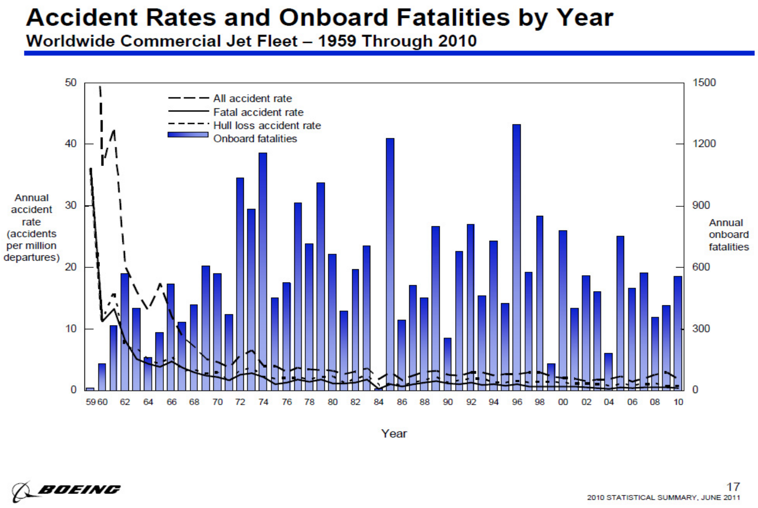
MANAGING RISK DNV

Agenda

- Aviation and Human Factors
  - A short summary
- Human factors in Maintenance
  - A case study
- The "awakening"
  - Human factors initiatives
- Drift into failure
  - Strategies for managing drift

MANAGING RISK DNV

Airline safety



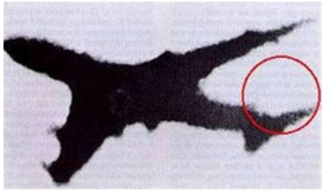
A case study – The BAC1-11 Windscreen Accident

- 10th of June 1990
  - A BA BAC1-11 bound for Spain was climbing through 17300 feet when left windscreen broke loose
  - The captain was sucked through the window, cabin crew rushed in and restrained him
  - The copilot landed safely
  - The triggering cause was the use of wrong bolts when replacing the windscreen
- Many of the contributing factors were rooted in what, under other circumstances, would be regarded as valuable strengths

(see «Beyond Human Factors, Averbury 1995)

The «awakening»

- «Maintenance can seriously damage your planes» (James Reason)
- Avg. cost of an in-flight engine shutdown is $500,000
- Avg. cost of a flight cancellation is $50,000
- Avg. cost of a return to gate is $15,000
- Avg. ground damage incident costs $70,000 – 10 billion dollars yearly in total
- In-flight problems caused by mistakes in the hangar can be very difficult (impossible) to handle for the flight-crew



Predicting challenges involving human error

- The question of «hands-on»
  - Which activites involves most direct human interference?
- The question of «criticality»
  - Which activites poses the largest threat to safety if carried out incorrectly?
- The question of «frequency»
  - How often are these activites carried out?

Relative likelihood of problems associated with human error

Activity	Hands On	Criticality	Frequency
Normal Operations	Low	Moderate	High
Emergency	Moderate	High	Low
Maintenance	High	High	High

The 8 most common maintenance problems (CAA UK 1992)

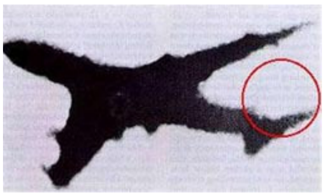
- Incorrect installation of components
- The fitting of wrong parts
- Electrical wiring discrepancies (including cross-connections)
- Loose objects left in aircraft
- Inadequate lubrication
- Cowlings, access panels and fairings not secured
- Fuel/oil caps and refuel panels not secured
- Landing gear ground lock pins not removed before departure

The 7 most common causes behind Inflight Engine Shutdowns in Boeing Aircraft

- Incomplete installation (33%)
- Damaged on installation (14,5%)
- Improper installation (11%)
- Equipment not installed or missing (11%)
- FOD (6,5%)
- Improper fault isolation, inspection, test (6%)
- Equipment not activated or deactivated (4%)

The “Dirty Dozen”

- Complacency
- Distractions
- Fatigue
- Norms
- Pressure
- Stress
- Lack of Assertiveness
- Lack of attention
- Lack of knowledge
- Lack of resources
- Lack of teamwork



Moving beyond «Dirty Dozen»: Early human factors initatives

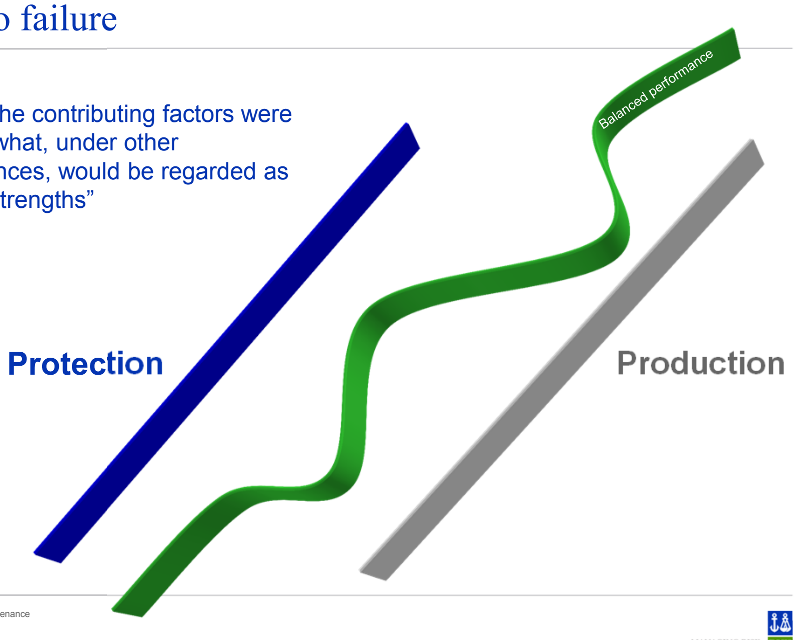
- Managing human factors through SMS
  - Internal incident reporting and investigation systems
  - Human factors awareness for maintenance personnel
  - Continual identification and treatment of uncontrolled risk

- Human factors training for maintenance personnel mandated in JAR145

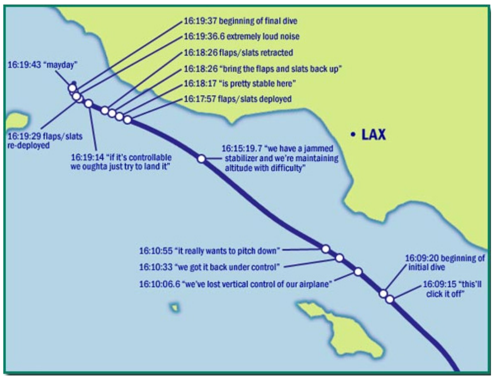
CAP716 (2003) – Aviation maintenance and human factors
The objectives of Human Factors training, within a human factors and error management program, should be to:
improve safety;
decrease organizational exposure to risk;
reduce errors;
capture errors.

Drift into failure

"Many of the contributing factors were rooted in what, under other circumstances, would be regarded as valuable strengths"



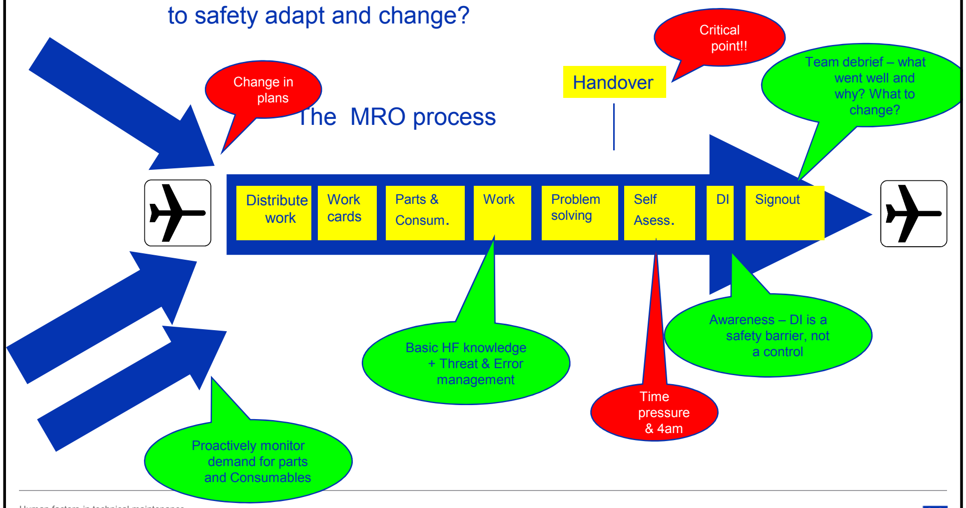
Alaska Air 261 - 30/1-2000, 88 fatalities



MANAGING RISK DNV

The MRO process and robustness

How to establish and maintain an organizations ability to safety adapt and change?



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and the environment
www.dnv.com
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DNV

INVITASJON

Human Factors in Control

19.-20. oktober 2011

Human Factors in plant design, operations and maintenance

24.juni

Kjære deltaker!
Vi vil med dette invitere til møte i HFC-forum (Human Factors in Control).

Møtet holdes onsdag 19. og torsdag 20.oktober 2011 i Trondheim. Vi starter kl 11:00 onsdag på Prinsen hotell og avslutter etter lunsj på torsdag med bedriftsbesøk på togledersentralen til Jernbaneverket i Osloveien 105.

Vi har reservert rom på Prinsen Hotell, og på Gildevangen, i Trondheim. Frist for beskjed om rombestilling er 12.oktober. Dere kan ta kontakt direkte via tlf: 73807000, opplys da om at det gjelder HFC forum. Sintef kan også bestille rom for dere – kryss da av på siste side. Vi har innlegg fra Idaho National Laboratories, Lloyd's, DnV, Ptil, Safetec, Statoil og Sintef.

Program (NB: Endringer kan forekomme)
Tema for møtet vil være " Human Factors in plant design, operations and maintenance" og vi har spennende innlegg, diskusjoner og workshop. Foredrag holdes bl.a. av Dr R. Boring og Dr Debbie Lucas. Dr R. Boring kommer fra Idaho National Laboratories. Tidligere erfaring: "worked as a human reliability scientist at Sandia National Laboratory, as a usability engineer for Microsoft Corporation and Expedia Corporation, and as a guest researcher in human-computer interaction at the National Research Council of Canada". Dr Debbie Lucas kommer fra Lloyd's Register Human Engineering Services. Tidligere erfaring: "15 years experience as a UK health and safety regulator working across civil nuclear, onshore chemical and rail sectors. She was Head of Human Factors in Her Majesty's Railway Inspectorate and gave evidence to the public inquiries after the accidents at Southall and Ladbroke Grove."

Det blir besøk hos Jernbaneverket, hvor vi får besøkt kontrollrommet til toglederne.

Visjon og hovedoppgave for HFC forumet
HFC visjon: "Kompetanseforum for bruk av HF innen samhandling, styring og overvåkning i olje og gass virksomheten." HFC hovedoppgave: "Å være et forum for erfaringsoverføring som bidrar til å videreutvikle HF metoder til bruk ved design og vurdering av driftskonsepter." (Om HFC, se: www.hfc.sintef.no)
Vi vil også benytte anledningen til å minne om kurset "MTO-Human factors" ved UiS som går høsten 2011, og NTNU kurset "Introduksjon til HF og integrerte operasjoner" - høsten 2011, se videre.ntnu.no/link/nv12296

Vennlig hilsen
Arne Jarl Ringstad /Statoil, Atoosa P-J Thunem/IFE, M. Green/HCD, Håkon Fartum/DNV, Stig Ole Johnsen/SINTEF og Irene Wærø/SINTEF.

Vær vennlig og returner registreringen innen 12.oktober 2011 til:
Siri.texdahl@sintef.no

HFC Møte

AGENDA

19. til 20. oktober 2 0 1 1

Human Factors in plant design, operations and maintenance

Trondheim, Prinsen Hotell, Kongens gate 30

Dag 1	**Innlegg med spørsmål etter**	**Ansvar/Beskrivelse**
11:00-11:30	Registrering	HFC
11:00-12:00	Lunsj	Prinsen - Lunsjrom
12:00-12:30	Velkommen	Prinsen - Lunsjrom
12:30-13:15	Human Factors in plant design, operations and maintenance	Dr. R.Boring/Idaho
13:15-13:45	Diskusjon/Pause	
13:45-14:15	Human Factors - fra kontrollrom til prosessanlegg	B. Mostue, S. Hauge/Sintef
14:15-14:45	Human Factors - fra kontrollrom til prosessanlegg	E. Lootz/Ptil
14:45-15:15	Diskusjon/Pause	
15:15-16:30	Innledning til workshop og workshop: ”Where and how can Human Factors contribute to better and safer plant operations outside the control room?”	S.Hauge/PDF, A. Balfour/HFS
16:30-16:45	Pause	
16:45-17:15	Human Factors tool (OTS) to monitor and improve safety in operations and maintenance	A.J. Ringstad, S. Sklet/Statoil
18:00	Middag i Studentersamfundet	HFC
21:00	Ukerevy i Studentersamfundet	Billetter ved registrering
Dag 2	**Innlegg med spørsmål etter**	
08:30-09:00	Kaffe og noe å bite i	
09:00-09:45	Human Factors and the Conduct of Operations: the next step after good ergonomic design	Dr.D. Lucas/Lloyds
09:45-10:15	Diskusjon/Pause	
10:15-10:45	Sikkerhetskultur i designfasen ved utforming av prosessanlegg	S. Antonsen/Safetec
10:45-11:15	Diskusjon/Pause	
11:15-11:45	HFs in virtual and augmented reality applications for plant operation, maintenance and decommissioning	T. Johnsen/IFE
11:45-12:00	Diskusjon/Pause	
12:00-12:30	Human factors in technical maintenance: experiences from aviation	J.C. Rolfsen/DnV
12:30-12:45	Diskusjon/Pause	
12:45-13:00	Avslutning og oppsummering	HFC
13:00-14:00	Lunsj	
14:00-14:15	Buss til togledersentralen til JBV	
14:15-15:15	Besøke togledersentralen til JBV	Togdriftsleder/JBV
15:15-15:45	Buss til Værnes	

REGISTRERING

Human Factors in Control

19. til 20. oktober
2 0 1 1

Trondheim, Prinsen Hotell, Kongens gate 30

Human Factors in plant design, operations and maintenance

Ja, jeg vil gjerne delta:

Navn: __ ____________________________________

Tittel / stilling: ____ __________________________________

Organisasjon: ___ ___________________________________

Adresse: __ ____________________________________

Kryss av for:

__ Lunsj 19/10, __ Middag 19/10, __ Revy 19/10, __ Bestiller hotell 19/10 __ Lunsj 20/10

Tlf. : __________ Fax: ___________

E-post: _______________

Hvem faktureres (PO-Nr/Bestillingsnr/Referansenr:)___________________

Deltaker fra PDS forum (Ja/Nei:)___________________

For å være med må man betale inn medlemsavgift eller møteavgift. Medlemsavgiften er pr år:

- 25.000 for bedrifter med mer enn 15 ansatte (dekker 3 deltakere)
- 12.500 for bedrifter med mindre enn 15 ansatte (dekker 2 deltakere)
- 6.500 kr pr møte for ikke medlemmer (og overskytende deltakere)

Medlemsavtale, informasjon og publikasjoner om HFC kan finnes på WEB-siden: http://www.hfc.sintef.no

Vær vennlig og returner registreringen innen 12.oktober 2011 til:

Siri.texdahl@sintef.no