

**OSART Good Practices**  
**LEADERSHIP AND MANAGEMENT FOR SAFETY**  
Human factors management

**Arkansas, USA**

Mission Date; 15 Jun.-2 Jul., 2008

The use of a Human Performance Programme to develop a culture of continuous improvement.

The plant has a focus on behavioral improvements that result in prompt feedback that drives continuous improvements. The focus on behavioral improvements is evident throughout the organization including the management positions and individual contributors. Feedback is provided and accepted freely. The feedback occurs from supervisor to individual contributor, from peer to peer and from individual contributor to supervisor. The behavioral focus has become engrained in the fleet culture where emphasis is placed not only on what is done but how it is done and the behaviors exhibited. Behavioral feedback has become natural, accepted and even sought by all levels of staff and contractors.

Various tools are utilized to provide structure for the behavioral improvements. Leadership Effectiveness Logbooks are utilized as a simple means to document the coaching interaction. Goals are utilized on the number of interactions to help ensure interactions occur. The information is tabulated in a database and reviewed by the second line manager. A simplified coding system of behaviors is utilized to minimize the documentation burden. The database is used to analyze the data for trends. During refuel outages the data is compiled and analyzed daily. Behavior improvement messages are formulated based on the analysis. The message is communicated daily and represents the focus area for the next days coaching. The subsequent day's data analysis is a means of checking for penetration of the message.

The mental and physical wellbeing of the employees is monitored by observation of their behaviors. By observation of the employee, the supervisor establishes a baseline of behaviors. The supervisor observes for deviations from the established norm. The supervisor certifies monthly by signature that the observations have been made and no deviations are noted. Supervisors are trained annually on what behaviors to observe. All employees (including contractors) are covered by this programme.

The foundation for the human performance programme is based on formal procedures. The procedures describe the roles and responsibilities as well as the process elements. The procedures also describe the various behavioral traps (time pressure, shift change, etc.) and provide tools (self check, peer check, etc.) to counteract the traps.

The fundamental benefit of the focus on improving behaviors is that it results in a culture of continuous improvement. The free flow of behavioral feedback both reinforcement (positive) and correction (negative) results in continuously driving to new levels of performance. Errors are reduced and thus plant performance improved because of the feedback on human performance. Employee well being is improved because of early identifications of behavioral issues. Corrections are made before significant consequences are experienced. Additionally, the human performance programme fosters an environment which encourages the development of complementary programmes within the plant.

## Dampierre, France

Mission Date: 31 Aug.-17 Sep., 2015

The regional contractors association (PEREN) provides independent advice and support to on-site contractors through the appointment of a dedicated on-site representative, who provides a number of services including coaching. This is done in partnership with the plant.

A dedicated advisor post for the on-site contractors was set up when the Quality, Health, Safety and Environment Committee of the regional contractors association PEREN, as part of a partnership agreement with the plant, decided to streamline its organization to ensure stronger focus on:

- Better control of maintenance work quality
- Risk prevention
- Professional enhancement and development of workers through training.

A representative of PEREN is on-site at all times and provides the following:

- Field walkdowns during power operations and outages, with a focus on maintenance operations;
- Identification, analysis, and support in processing 'near misses' and hazardous situations;
- Advice in work planning and execution, and provision of operational experience (OE);
- Provide specific advice and contractor training e.g. on-error prevention, oversight, legal matters, and foreign material exclusion (FME);
- Coaching to first line contractor supervisors;
- Specific support to contractor firms when needed;
- 'Just-in-time' training before outages.

These services provide contractors with direct and independent support in the field to help them understand the plant's regulatory requirements and communications on standards and expectations. This has resulted in better use of error prevention techniques by contractors on site.

## Bugey, France

Mission Date; 2-19 Oct., 2017

The plant's training department has used digital technologies in an innovative way to reinforce the use of human performance (HU) tools.

The plant has utilized digital technologies to improve the quality of its human performance training. The 3D immersion technology and camera goggles are used to complement initial and refresher training. These technologies have also enabled greater feedback from the instructor to trainees on the use of error prevention tools.

### 3D immersion technology and virtual reality:

The use of 3D immersion technology allows trainees to apply HU tools in a totally modelled environment, fully immersed, without exposing them to any kind of risks. The 'virtual consequence' of not using these tools properly is experienced by the trainee and reinforces the importance of using HU tools when performing tasks in the field.

The current set of scenarios are designed to reinforce the use of self-check, peer check, situational awareness, and 3-way communication. This will be further developed in 2018, applying it to the plant's industrial premises (water-filled systems, relays, electrical panels, etc), thereby directly connecting 3D training to the plant environment. It can also be tailored to the various plant departments.

The modelling costs are similar to those of a real mockup and this virtual tool can be used throughout a fleet, which would limit the additional deployment costs to those of the computer and headset purchase.



### Camera goggles:

The plant training department has developed video goggles for use during training of HU champions. The videos are used to replicate the activity as experienced by the trainee, showing what he/she has actually seen, said and heard. The goggles can be operated by the instructor using wifi. The videos are subsequently viewed during post training critique.



## Leningrad, Russia

Mission Date: 13-30 Nov., 2017

Implementation of specialized rooms for psychological and physiological support to improve individual performance reliability.

The plant has implemented four novel rooms for psychological and physiological support of personnel. The rooms include an individual counselling room, a sensory room, a functional rehabilitation room and a room for professionally important quality modification. The individual counselling room includes hardware and software equipment to support professional counselling following stressful plant evolutions or events, or to support general mental health of personnel. The sensory room utilizes visual, auditory, and tactile stimulation as therapy methods for personnel exposed to abnormal levels of stress either on or off the job. The functional rehabilitation room includes multiple tools for physical rehabilitation and relaxation in support of stress management for personnel. The room for professionally important quality modification utilizes specialized tools to assess and develop emotional resilience, sensory reaction, and sensory capability in support of job specific demands.

Utilizing these rooms and equipment, all licensed staff, including any individual in a role which could affect safety, must undergo examination to determine fitness for duty and professional reliability. An individual development plan is prepared for each person that utilizes this equipment. These services are also available to all other staff as needed. Approximately 1500 persons visit the rooms annually.

This psychological and physiological support has resulted in reduced stress, improved physical well-being, reduced fatigability, increased physical performance, improved mental capacity, and ultimately improved personnel reliability and error reduction amongst plant personnel.

Analysis of physiological value of plant main control room operators.

Plant Main Control Room (MCR) operator performance was analyzed by measuring work capacity status before and after shift for day, evening and night. The examination was based on three methods:

- A well-being and activity mood test which includes an on-line assessment of physical and mental state which allows determination of the stress rate of body functioning before and after shift.
- A method of variational chrono-reflexometry which allows assessment of the functional state of the central nervous system and working ability on five levels before and after shift.
- A questionnaire assessing work complexity.
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The analysis provided a correlation of working ability against each particular shift (day, evening, and night).

The results concluded that the third night shift and second day shift are least favourable from the viewpoint of operator working ability. The plant therefore minimizes complicated tasks to be performed on these shifts, resulted in reduced personnel errors and improving operator performance reliability.

## Flamanville 3, France

Mission Date: 17 Jun. - 4 Jul., 2019

Effective implementation of a holistic Human Factors approach throughout the life cycle of the plant to ensure safe operation.

In cooperation with the corporate organization, FLA3 has ensured that Human Factors aspects will be considered throughout the life cycle of the plant. Human Factors has not only been taken into consideration in control room modifications, but also in maintenance activities and in the development of severe accident management (SAM) documents. Experts in multiple disciplines including designers, human factors specialists, future users/operators and instructors have been consulted for more than 18 years. The consultations and assessments have resulted in corrective actions such as Human-Machine Interfaces (HMI) advancements, clearer documentation, improvements related to ergonomic aspects and organizational improvements to ensure safe operation. Examples of improvements made by the plant:

### Control room

- Better defined functionalities of operational HMI, such as the degree of automation, operator aids and the design features of operational displays for: plant status, control systems, electronic procedure visualisation also allowing management supervision, alarm visualisation and prioritisation, etc.
- Improved ergonomics of the main control room with 4 wall mounted screens which make it possible to perform real-time monitoring and allows the shift manager to have an immediate understanding of both reactor mode and operating conditions.

### Maintenance activities

- To avoid having to climb down a ladder to the reactor and fuel cavities wearing a fully ventilated breathing suit, special doors have been designed and installed at the bottom of the cavities
- Increased diameter of steam generator manholes for easier access to steam generators and for reduced radiation exposure
- Improved lighting conditions for safer maintenance activities and reduced radiation exposure thanks to increased efficiency and reduced working hours
- To prevent people from going to the wrong train, room or piece of equipment, the signage rules have been changed to ensure easier and safer plant orientation and equipment identification
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### Severe Accident Management

- Creation of a Severe Accident Operating Guidelines orientation document that can be used for the entire SAM process and guide the operators to the procedure that is most suited to the unit conditions.

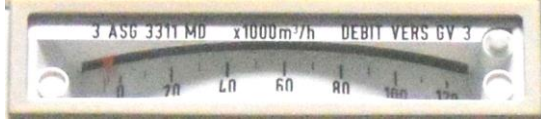
Furthermore, socio-organisational and human (SOH) analyses have been used to anticipate which activities of plant personnel will be affected by specific changes, how the work practices will alter, what risks are incurred or caused by the change and the future work quality for affected employees. Other SOH activities include studies during Crew Performance Observation (CPO) and emergency preparedness drills to evaluate safety related factors to improve human performance. In-depth event investigations have been performed to identify, and correct weak lines of defence and socio-psychological studies have also been conducted to guarantee a work environment which supports safe performance.

Photos of some of the improvements made at the plant:

Before improvements - Standard display unit (difficult to read for people of shorter stature)



After improvements - New display units with the requested modifications



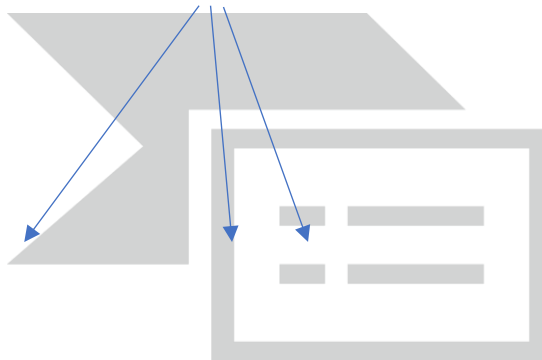
Alarm list menu and headers before improvements - Standard menu



Alarm list menu and headers after improvements - EPR FA3 menu



This picture illustrates the three special doors that have been installed at the bottom of the cavities.



Signage improvement (colour specific) to prevent people from going to the wrong safety train (before the improvements there was only a number)

Picture of the main control room with 4 wall mounted screens which make it possible to perform real-time monitoring.



## HEYSHAM 2, United Kingdom

Mission Date; 2 - 19 Oct., 2023

The plant has implemented a system called “wall hound” to detect electromagnetic interference and radio frequency interference (EMI/RFI) emitted by mobile phones, laptops and smart watches raising an audible and visual cue/prompt.

The device detects EMI/RFI (including Bluetooth) emissions from devices such as mobile phones, laptops, smart watches. The EMI/RFI system that works alongside the detectors logs all Media Access Control Addresses of devices detected. These are reviewed periodically.

If detected within the range (typically 0.3 - 5m) it gives an audible and visual cue. The sign lights up in red and plays an audible warning: “Mobile device detected”.

The plant has a set of personal key-less lockers nearby to store any devices if they are not removed prior to entry into the Radiation Control Area (RCA). The device can then be collected on the way back out of the RCA (or sensitive plant area).

The Wall Hound System was installed in 2020. The device is in 3 key locations on site: the entrance to the RCA, the reactor building, and in the safety circuit/main control room. Certain devices are authorized for use by the plant staff and provisions are established to determine whether detected items are allowed or prohibited.

When initially implemented, the system detected about 450 devices per month. In 2023, the system is detecting about 300 devices per month and about 5 devices per month were found to be unauthorized and required action to be taken.

The benefit of the Wall Hound System is the prompt detection of EMI/RFI which could impact sensitive plant equipment and possibly impair equipment function resulting in a transient or plant trip.



Figure 1.1: Picture of a Wall hound device