Performance Improvement and Human Resources Transition Management in D&D Projects – 15440

Gilles Clément*, Bertrand Ytournel*, Vincent Gauthereau**, Matthieu Rosenberg***

* AREVA NC, 1 Place Jean MILLIER 92084 PARIS LA DEFENSE CEDEX, FRANCE
** STMI, 1 Place Jean MILLIER 92084 PARIS LA DEFENSE CEDEX, FRANCE
*** AREVA NC, La Hague, 50444 Beaumont-Hague Cedex

ABSTRACT

Power generation and other nuclear facilities production is mainly characterized by stable working environment, with continuous efforts for improvement based on previous achievements, constant workload, foreseeable and established organizational hierarchy; and generation of cash. In contrary to normal production - when phasing down the facility for final shutdown, decommissioning and dismantling - one has to manage a new, highly dynamic working environment, with decreasing workload, new skills required; and consumption of cash.

The key to successful transition is to recognize the need for establishing an explicit performance improvement program with an effective change management process in order to address this profound evolution as early as possible in the project.

AREVA owns and operates large nuclear material processing facilities. This includes the responsibility for their end of life up to final Decommissioning and Dismantling (D&D). Faced with this transitional challenge, AREVA took example from well-known management methods (Lean Management, 6 Sigma, TPM…) successfully applied by the non-nuclear production industry with the corresponding philosophy of Operational Excellence. These methods were adapted to the specifics of nuclear decommissioning projects. Furthermore, specific computerized tools were developed to assist managers in implementing measures for re-deploying, re-training and re-qualifying personnel as well as re-organizing the work structure while maintaining safety and social consensus.

Significant improvements in the dismantling works as well as in the management of generated waste were achieved early after start of the implementation of the performance improvement programs.

INTRODUCTION

D&D Challenges

Decommissioning and Dismantling projects are challenging from a human, management and organizational points of view. As compared to a structured and stable production environment, D&D projects have to face new and changing references, such as the continuous modification of the arrangement of working areas inside buildings. This could lead to significant impacts in terms of nuclear safety: you have to manage the constant evolution of your facilities, sometimes in contradiction with experience gained in design and operation of these facilities. Safety regulations and experts are not used to deal with a plant configuration that keeps changing almost every day.

Another significant challenge is the higher number of uncertainties and unexpected situations encountered, as compared to the operating phase. The as-built (and as-operated) basis is not always sufficiently documented and many "surprises" do occur during execution of the works. This relates frequently to the Initial State and to the End State definitions.

- The Initial State of the facility could be insufficiently characterized and may lead to serious problems during the dismantling and cleanup works (such as the discovery of unexpected quantities of nuclear material in a concealed area, or actual contamination extending beyond the initially assumed basis).
- The precise definition of the desired End State – defining the end condition of the D&D phase - is also quite sensitive, with a potentially serious impact on the project cost and schedule. For example the level of decontamination ("how clean is clean") is a traditional issue with the ending phase of D&D projects.

As a consequence, setting-up a performance and change management process is key to the cost effective success of a D&D project.

Performance Improvement Genesis

Learning from early experience, AREVA looked for ways and means to improve its projects performance. We started with the Lean/Kaizen methods, mainly developed in the manufacturing industry, and especially preeminent in the automotive industry. Lean is a set of tools designed to focus on the "added value" in a given process, i.e. any activity positively contributing to the delivery of a product (what a customer would be ready to pay for). With that in mind, Lean tools will concentrate on the identification of losses - or so-called "waste" - and try to reduce or suppress those. Further to the Lean approach, we upgraded our process with additional tools coming from other related approaches such as TPM (Total Productive Maintenance), to upgrade the Overall Efficiency of Equipment and 6-Sigma, a statistical approach to improve processes according to the stakeholders/clients specifications (such as the regulatory authorities for example).

Together with to the tools and methods to be developed and deployed in the field, the key to the successful implementation of such a program is personnel buy-in and implication at every level of the management lines of authority, as summarized in the following Fig1.

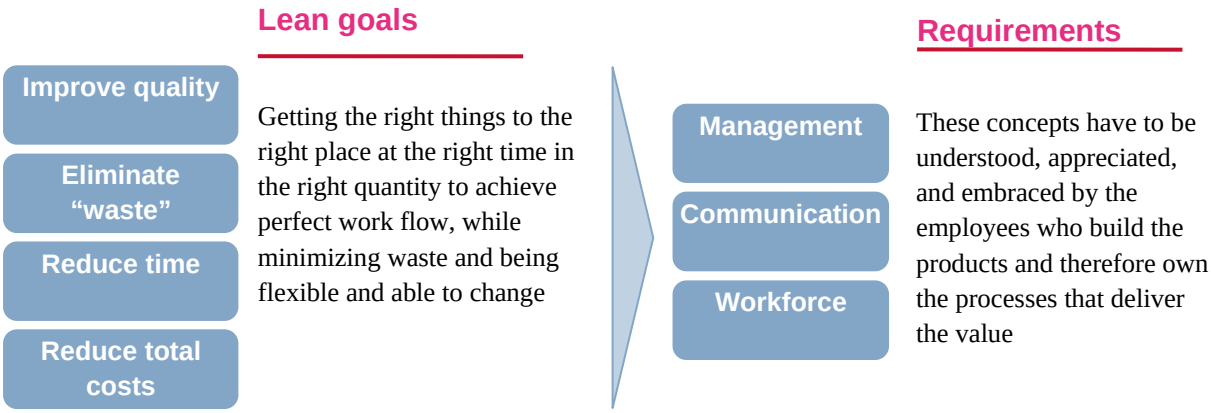

Fig. 1: Lean Management goals and requirements

Implementing such a program within AREVA D&D programs was not straightforward. Not so much because of personnel reluctance, but due to the specifics of the activity. Following a fist period of questioning and astonishment ("we are not manufacturing cars or mass market products"), most of the personnel actually welcomed the initiative as everybody knew that a change of paradigm was needed.

The issue was to adapt the tools and processes to our own work place. Lean methods are mostly developed for mass manufacturing where repeatability is an asset, performance is relatively easy to measure and the impact of small improvements – when factored through the mass multipliers – lead to significant figures. In the nuclear D&D world, projects are specific, often one of a kind, metrics are rare and improvements on one project may not be directly transferable to another one. Nevertheless, we were able to identify sufficiently repetitive tasks (to measure improvements and allow standardization), to define simple and adequate metrics, (how to define good performance indicators), and to implement them successfully while preserving social consensus.

METHODS

AREVA Performance Improvement Process

The whole approach is followed and supported by "Coaches" or performance improvement specialists who bring the methods and promote dialogue and implication of the performance improvement team's participants. The "AREVA way" to performance improvement follows a four phases approach:

- Diagnose
- Analyze and Prioritize
- Implement
- Standardize

Diagnose

Analyzing the facts at the source - the "Diagnostic" phase - is aimed at understanding the way operations are performed and managed in order to identify areas of potential improvement. A special emphasis is given on sources of "losses" (or wasted time, schedule, cost, resources, space, equipment, supplies, material etc…). The analysis is focused on the three main drivers of operational excellence which are: the Processes, the Organization and the Mindset and Behavior of people. As illustrated on Fig 2.

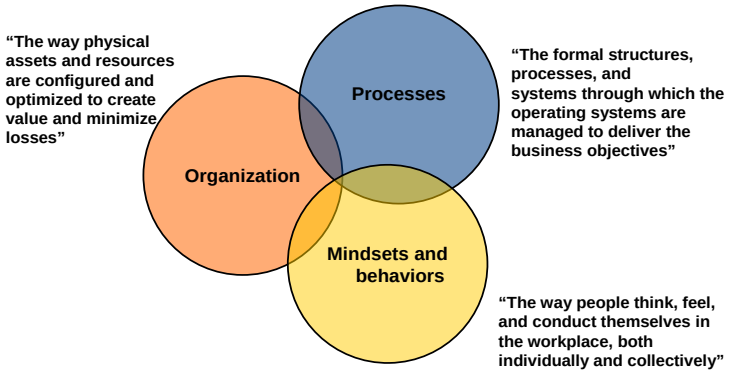

Fig. 2: Main drivers of Operational Excellence

Analyze and Prioritize

The "Analysis and Prioritization" phase consists of understanding the root causes of issues identified at the diagnosis phase from the detailed review of field data, and selecting the most relevant or appropriate areas of progress according to a set of criteria. Usually, the main criterion remains naturally the impact of proposed improvements on project costs and schedule.

This is an important step, requiring skills and involvement of the whole workforce from top management to field workers in order to beneficiate from all available experience and to ensure sharing and buy-in of the conclusions. The outcome of this phase is a detailed mapping of selected processes and material flows with known dysfunctions, an improvement action plan, and a clear definition of performance indicators and quantified target to reach through the improvement actions. The target should be SMART: Specific (clearly stated), Measurable, Achievable (not too ambitious, not too shy), Relevant (to the matter at hand), Time-Bound (during the performance improvement session or "wave"). As perfection is an illusion: better get 60% now and the rest in the next improvement session than to fail.

Implement

The process is usually implemented into "waves", with a typical duration of about 5-6 months each and updated every month based on the results of respective audits regularly performed by the coaching team.

Standardize

The "Standardization" phase is another key concept. The goal is to ensure diffusion and application of the good practices throughout the projects and the company, but also to ensure long term sustainability of the program in order to avoid the "saw tooth" effect. A well known issue with performance improvement initiatives is the difficulty to maintain performance at a constant level (usually achieved during the first waves), and also further improve as a continuous effort and not just a one shot. As illustrated in Fig 3.

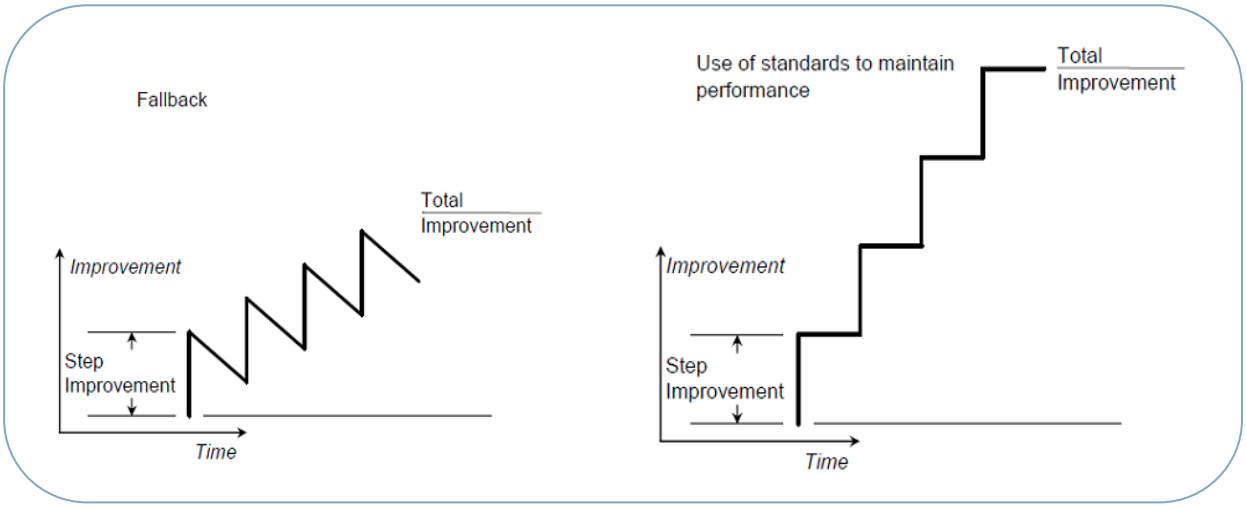

Fig. 3: Standardization to avoid the "saw tooth" drop and support continuous improvement

To achieve this objective, the performance improvement teams define standards, and the management process ensures their adherence with the help of quality auditing.

AREVA Performance Improvement Plan

The approach introduced above is developed and implemented on AREVA D&D projects through a Performance Improvement Plan, focusing on the following six key activities (Fig 4) that were considered by experience as having the most impact on project costs, and overall performance.

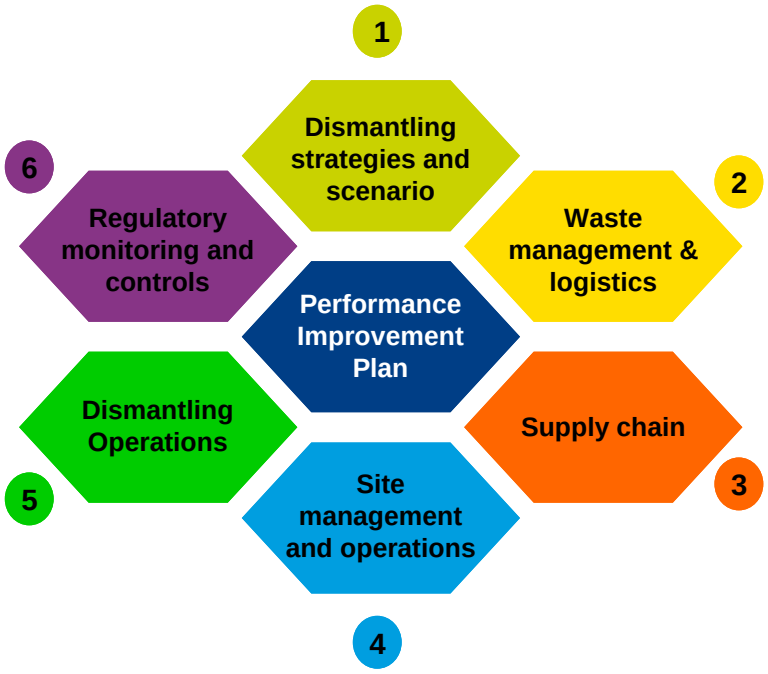

Fig. 4: AREVA D&D Key Activities of the Performance Improvement Plan

Strategies and scenario are the first elements driving the performance. Not only needed at start of the project but also to be challenged and improved during execution of the project, especially when meeting unexpected difficulties.

Waste management and logistics includes handling and processing of material removed from the facilities up to their interim storage and final disposal. These activities usually represent about one third of a dismantling project cost.

Supply chain management is complex in D&D projects because plant initial state and detailed work plan may not be fully available at start, to specify in details the sub-contracted activities. In addition, new and unknown specific skills may be required. New contract models have been developed to establish a balanced relationship with the contractors as well as innovative approaches such as common training of the contractors workforces in order to ensure homogeneous consistency and quality of the work throughout the plant.

Site management and operation, sometimes called “hotel costs” or “support costs”, encompasses all activities which are peripheral to the actual decommissioning and dismantling operations. One can mention for example: site infrastructure, maintenance, site security, utilities supply, effluent treatment stations, administrative services, catering, health physics… Site management activities represent also a significant part of D&D project costs. It can be a “mine” of improvements, especially if the configuration and organization of the site support functions have not changed - of have not been challenged enough - when transitioning from the operation to the decommissioning phase.

Dismantling operations is the core objective of the whole D&D project. Efficiency of the work and keeping the project on cost and schedule is a main driver. This is an area where the conventional quality and operational performance methods are most directly applicable.

Regulatory compliance is quite specific for D&D projects. Efficiency of the interfaces with regulatory authorities is key to the success of the project. As D&D is indeed a demolition project, maintaining nuclear safety is a special challenge. It is a “construction site” environment that looks quite different from what it was during the operation days.

The other important aspect of regulatory compliance is the definition or re-definition of the safety cases and the new license framework for dismantling operations. The former operating license has to be challenged and every requirements and dispositions revisited with regards to the new conditions. For example when a reactor is defueled, there is no fissile material in the reactor building, no fission reactions, no high pressure, no high temperature any more. The hazards are several orders of magnitude less significant. Hence the new license must be fit for the D&D purpose, nothing more, in order to be cost effective.

APPLICATION and RESULTS

The following sections provide examples of implementation and results obtained through the deployment of the AREVA Performance Improvement Plans on different facilities.

Improvement of Schedule Performance on D&D Projects at La Hague

This section illustrates a recent example that was successfully deployed at the La Hague site. The La Hague site, located in northern France, is a large nuclear complex, hosting used nuclear fuel recycling facilities of different generations. The earlier one - UP2-400 - is retired from service and currently under active dismantling. UP2-400 was the first commercial /used nuclear fuel recycling facility in France based on the PUREX process, having processed more than 26000 tons of fuel from different origins including mainly Natural Uranium graphite moderated and gas cooled reactors fuel. It is composed of five large facilities and 10 other support facilities, with highly active hot cells (built along the PUREX line) and several silos, filled with waste that could not be conditioned into acceptable final waste packages because, at that time, the waste treatment technology was not mature enough. D&D is a 25 years program with more than 500 staff at peak, generating about 50,000 m3 of waste to dispose of.

Fig 5. presents a typical example of a subproject consisting in HLW waste retrieval and conditioning from a silo.

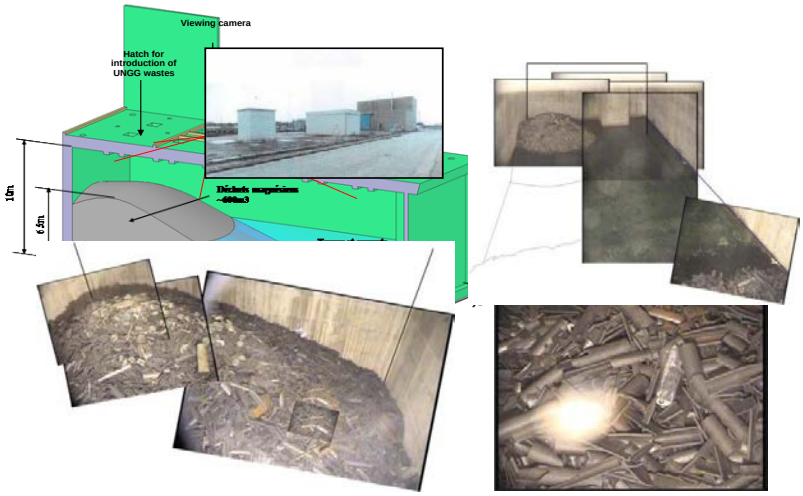

Fig 5: HLW retrieval project at La Hague

Some important sub-projects were behind schedule at La Hague, and the reasons were not clearly understood. Looking at macro-indicators like working plans or operation schedules, there were no obvious facts such as a significant regulatory approvals delays or serious technical difficulties encountered in the execution of the operations to justify the delays. Acknowledging that a schedule slip costs about 3k$ per day for the sub-project, a specific performance improvement project was launched on this matter in late 2012.

Diagnose

A detailed analysis of the concerned projects and sequence of events leading to impacting schedule was performed. It started with identification of all the actors and functions concerned or involved in the execution of a task order (i.e: Contractors, Maintenance, Facility Landlord, Waste Management, Health Physics and Project Management). For each of the subtasks a detailed monitoring of the activity was performed to record: the name of the task, who was in charge of performing the task, the schedule margin (positive or negative in terms of working days) and the major cause of the schedule slip if negative. Efficiency of this simple characterization tool was validated as it actually reflected closely the field operations, and provided direct evaluation of the “losses” in terms of schedule margin.

Analyze and Prioritize

Data from the field showed significant variations from one actor to the other. The analysis of frequency charts on a period of 18 weeks and concerning 60 tasks, highlighted that the origin of the delays was mostly coming from the interfacing of the facility landlord with the contractors and the health physics functions, as can be seen on Fig 6.

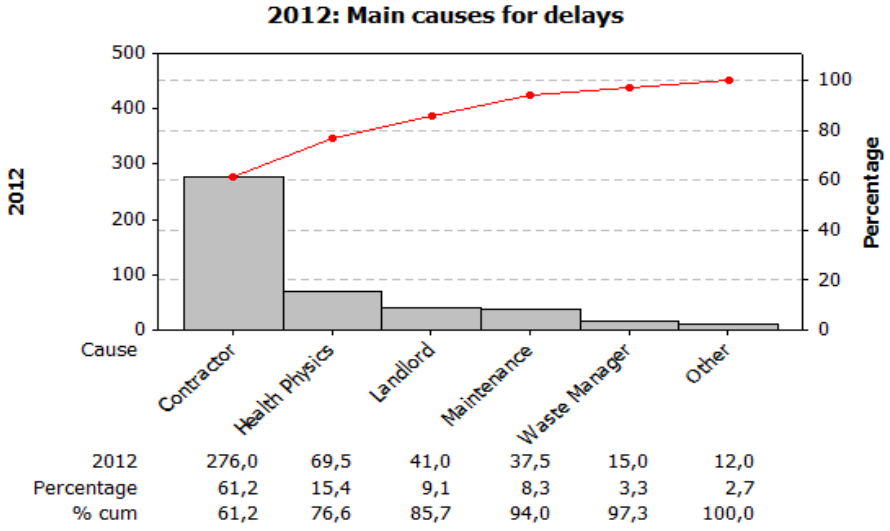

Fig 6: Initial Cause to Frequency chart

In other words, the cause of the delays was not to be found in external perturbations of the project, it was intrinsic. This was good news as it is easier to cure internal issues than external ones.

A further analysis of the methods and processes in place - involving subcontractors operation and health physics supervision - provided the elements for defining the improvements. The basic root cause was the organization of the work. 10 actions were proposed, funneled down to 7 after prioritization. A performance improvement plan was then setup on these 7 major actions and their corresponding improvement targets defined. The main actions focused on the promotion of anticipation of issues in close connection with the field, enhancement of training to improve responsiveness, simplification of the operating procedures and systematic use of “visual management” techniques to maintain personnel sensitivity to the performance. All targeted at reducing the down times.

Implement

After one year of implementation, the program could successfully claim a reduction of 20% of the schedule delay on the concerned projects as can be shown op Fig 7. The delays induced by health physics were almost reduced to zero and the work organization was seriously improved. The rise of maintenance in the 2013 figures, was due to another new situation.

Standardize

The method is now deployed on all La Hague D&D projects and new Key Performance Indicators have been integrated in the management responsibility matrix to focus on sub-contractor interfaces and related down-times.

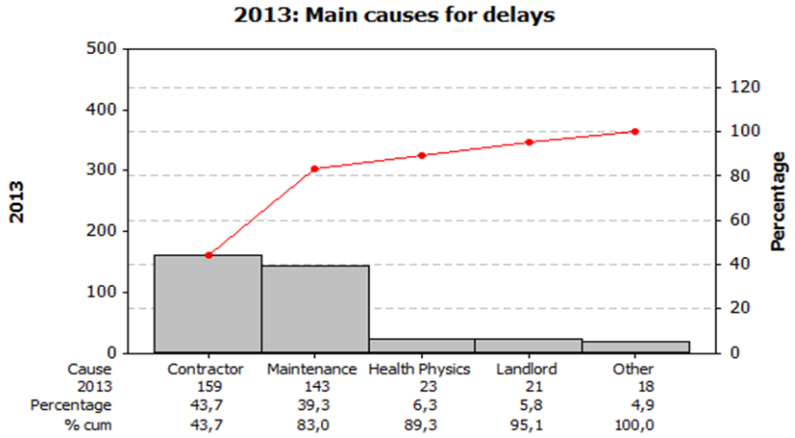

Fig 7: Final Cause to Frequency chart

Other Examples of Successful Implementation of the Method at AREVA's

A 16% life cycle cost reduction was possible to achieve at La Hague through waste management optimizations (package volume reduction), implementation of specific waste processing techniques to segregate high activity from low activity (resulting in reduced disposal costs), and innovative / alternative technologies for waste conditioning and packaging (Fig 8)

Fig 9. is presenting a 14% reduction of the Overall Equipment Efficiency achieved on a Plutonium facility decommissioning at Cadarache though he following approach: Standardization before each on-site dismantling operations; Accelerated work authorization delivery; Development of enhanced tooling; Optimization of dressing time; Visual management board close to field operations.

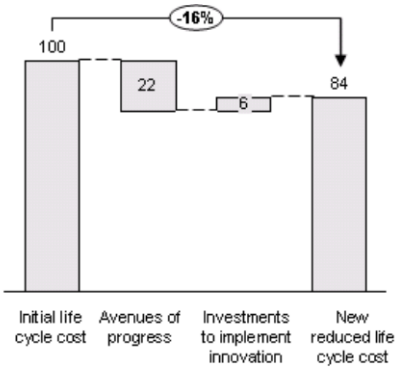

Fig 8: Life Cycle cost reduction

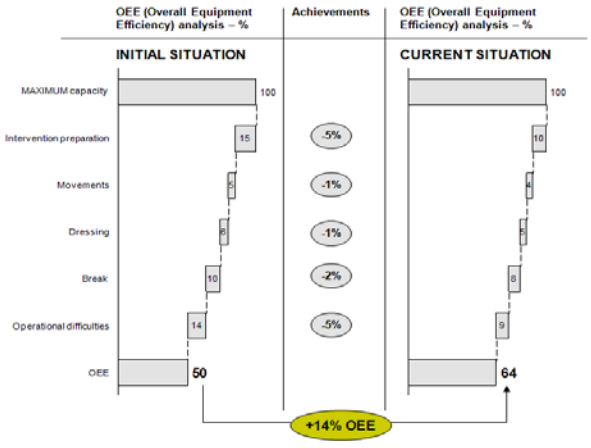

Fig 9: Overall Equipment Efficiency

Fig. 10. present a 12% reduction obtained in reducing Site Management Costs at Marcoule. And Fig 11 presents a 30% savings in the regularity monitoring and surveillance rounds at the same site.

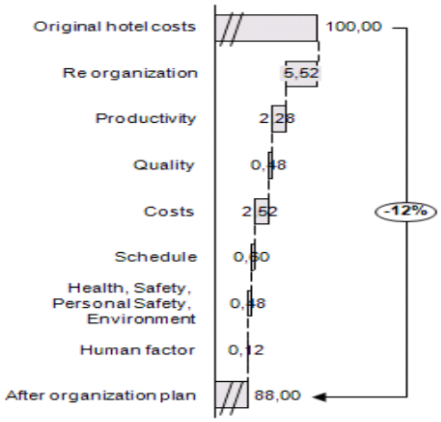

Fig 10: Site Management Costs reduction

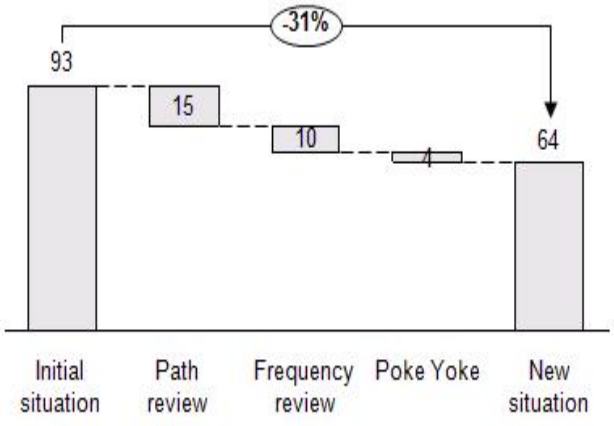

Fig 11: Surveillance and monitoring rounds optimization

CONCLUSIONS

Implementation of the philosophy of operational excellence based on Lean and 6-Sigma methods - adapted to nuclear D&D projects requirements - provides particularly rewarding results and turns out to be very supportive of the overall project management and control objectives. The success of such methods is however only possible with a full commitment of management at all levels together with a human resources program capable to sustain and support the change.