

INTERVENTION MANAGEMENT FROM OPERATION TO SHUTDOWN

Cedric Garino, Eloy Reguero Fuentes, Jurgen De Jonghe, Fernando Baltasar Dos Santos Pedrosa, Alexandre Dorsival, Gerald Dumont, Katy Foraz, Benoît Daudin. CERN, Geneva, Switzerland

Abstract

The Intervention Management Planning and Coordination Tool (IMPACT) is now widely used in all the accelerator complex and beyond. This unique repository improves the availability of the intervention information for all facilities (accelerator, experiments, injectors...), and enhances its traceability. It supports a standardized approval workflow and direct link to the access system for improved control and productivity. IMPACT currently has 2021 active users who have defined 11845 intervention requests from January 2012 so far. In 2013, the CERN Accelerator complex has entered a shutdown mode after a long period of operation. Careful preparation and scheduling of activities is paramount in order to keep the shutdown as short as possible, whilst guaranteeing safety. During execution, strict control of access will be enforced considering the radiation levels. This paper will summarize the main improvements to IMPACT in this context: work dose planning with respect to the CERN ALARA principles including integration with the operational dosimetry system and automatic generation of safety documents from intervention data.

INTRODUCTION

Following a successful run period of 3 years offering a high availability to physics, the LHC complex has entered in a long shutdown phase of around 2 years in order to maintain, consolidate and upgrade the machine. Many projects are happening during this period requiring coordination of thousands of interventions. Passing from 1 stop every 6 weeks to a long shutdown brings new challenges: tool support is essential to help Coordination, Safety and Radiation Protection (RP) teams deciding the best way to organize the work and ensuring safety.

An Intervention Management Working Group (IMWG) has been set up in January 2011 to standardize the procedure of intervention data gathering and possibly the treatment of such requests across CERN facilities [1]. Subsequently a software application has been released in November 2011 to converge on common and agreed best practices. Since then IMPACT has evolved by supporting more facilities and extending its scope to the benefits of intervention participants' safety.

TOOL OVERVIEW

IMPACT is a central database application to capture intervention or more generally "Activity" requests and process them in a dedicated workflow.

Activity Request Form

An activity request form collects all necessary details to precisely inform on the intervention. The form is composed of meaningful blocks:

Table 1: Activity Form General Blocks

| Block name | Details |
|----------------|---|
| Header | Title, Priority, Facility, Responsible, Type |
| What | Description, System |
| Who | Participants, Contact Phone, Maximum Number of Participants at the same time |
| Where | Locations, Access Points |
| When | Proposal: Date, Duration, Working hours Scheduling: Scheduled and Access dates |
| How | Modus Operandi |
| Impact & Tests | Impacted facilities / systems, Alarms, impact on machine, powering tests and data |
| Comments | Person, Date, Comment |

Activity Workflow

A clear lifecycle has been specified: the activity requests have to progress through different statuses. Activity workflow has been refactored in 2012 to embrace safety and RP requirements. It can now be broken down in the following phases:

Table 2: Activity Workflow Phases

| Phase | Details |
|-------------|--|
| Preparation | Technical responsible declares the intervention in detail. |
| Approval | From the activity request data and IMPACT configuration, approval requests are sent to relevant actors: facility coordination team, safety team, and RP officers. Treatment is mandatory and can happen in parallel to speed-up the process. |
| Execution | The work is in progress. IMPACT propagates the access authorizations to CERN's access system. |
| Final | The activity is closed or cancelled. It cannot be modified anymore. |

SAFETY WORKING GROUP

As part of the IMWG initiative, a sub-working group has been created to support discussion on safety and RP aspects. It is a forum to bring together specialists from different areas: coordination, safety, RP, software development and equipment groups.

Regularly this working group has proposed improvements and new functionalities to be integrated in IMPACT for the benefit of activity participants.

SAFETY

Safety is part of the CERN culture. IMPACT has been tuned in many aspects to ease its implementation.

Activity Request Form: Hazards Block

Dedicated blocks have been set up in the activity request form to let the requestor think about safety and provide enough data for safety specialists to identify if special safety hazards are generated and check that the compensatory measures are adequate to mitigate the risk:

Figure 1: Hazards block.

Hazards have been categorized as:

- Location hazards: Associated to each location where the intervention will happen, a list of hazards induced by the area can be entered.
- Activity hazards: The work itself can generate hazards. IMPACT proposes a pre-defined list of hazards and compensatory measures associated.
- Co-activity hazards: To help coordination and safety teams, it's possible to declare hazards linked to the co-activity work which in some cases can limit the works that can be done in parallel.

Each hazard declaration must contain a compensatory measure. This requires the intervention responsible to think how to prevent or compensate the risks, before the intervention.

Activity Request Form: Safety Procedures

A dedicated block of the activity request form is available to link and even generate safety related documents from intervention data.

Figure 2: Safety procedures block.

IMPACT integrates with others systems such as CERN's Electronic Document Handling (EDH) to create and prefill existing safety documents:

- Fire Permit: Special work permit to perform dedicated hot works and declare the dedicated compensatory measures associated.
- IS37: Request to disable all or part of systems generating a level 3 alarm for at least 4 hours in a pre-determined location.

Word templates are also generated and pre-filled from the application to ease and standardise safety procedures. E.g. Plan for Safety and Health Protection.

Finally, IMPACT provides an attachment feature in the activity request form. Any file (document, image, etc.) can be stored with the activity request to gather all meaningful content associated to the intervention.

RADIATION PROTECTION

As a specific area of safety, which can create major work limitations, RP is treated with all the necessary care to fulfil legal constraints enforced by CERN's Host States and ease the heavy load associated to the procedures that works have to follow.

“Dossier d'Intervention en Milieu Radioactif” (DIMR, intervention file in radioactive area)

To minimize the exposure to radiation of intervention participants, CERN follows “As Low As Reasonably Achievable” (ALARA) principles [3]. An intervention or a group of interventions can be classified at an ALARA level (1, 2 or 3) depending on foreseen individual and collective doses, as well as the dose rate and the contamination risks. A level 3 triggers an ALARA committee: contribution of experts leading to detailed and highly optimized work plan [4].

IMPACT embeds a DIMR module to support these interventions. The activity request form captures RP details such as dose estimates, radiological conditions and whether RP officer presence is needed. By grouping together activity requests as a work package, IMPACT aggregates data to be used for preparation meetings, reporting, dose following and feedback.

Depending on the ALARA level a specific workflow provided by EDH gathers RP officer signatures to ensure a correct appliance of the rules [2].

Work Dose Planning (WDP)

To plan and follow a work package, IMPACT generates a pre-filled excel file with activity requests data, participants dose history and participants doses attached to the activity requests. All this information gives RP officers the opportunity to perform data analysis, dose estimations and advice for the remaining execution of the work package to limit exposure to radiation.

Dosimetry Integration

Since April 2013, IMPACT is connected to CERN's operational dosimetry system (DOSISERV). IMPACT provides to DOSISERV the list of participants in an activity along with relevant radiological information such as individual maximum dose, collective dose and an individual dose alarm per intervention.

This data are used from DOSISERV to validate that the person who is trying to access a controlled area is allowed to participate in the activity. The worker is required to present his operational dosimeter device and enter the activity request number for the intervention before getting access to the work site. DOSISERV validates with the data provided from IMPACT if this person is authorized to work for the selected intervention, in this case the operational dosimeter is switched-on and configured according to the parameters provide by IMPACT.

During the intervention the dose registered by the operational dosimeter is compared with the maximum dose a worker can receive along an intervention. In case the dose is reached the operational dosimeter will warn the worker by activating the alarm.

At the end of the intervention, the worker presents again the operational dosimeter in the reader to propagate all the data captured to DOSISERV and IMPACT and to switch-off the operational dosimeter. Once the synchronization is done, RP officers and work supervisors can further analyse the doses captured per participant and intervention.

Workflow

Safety and RP coordination teams can be configured in IMPACT per facility. Each location can be parameterized to require a formal safety and RP approvals if selected in the activity request. Included in the approval phase, safety coordination and RP officers have the possibility to be notified for the activities to review, contact the responsible if necessary, complete the form and finally accept or reject the intervention. In addition special rights are given for this roles in the tool to be able to interrupt (revoke participant access rights) and resume an activity execution.

CONCLUSION

Having one central application used at CERN to declare interventions is a tremendous opportunity to enforce critical aspects of safety, including the RP constraints. The continuous effort in this domain and the professionalism of all stakeholders has created an important asset for CERN.

So far for the shutdown period, more than 3900 activities have been created and in half of them activity hazards have been declared. 28 DIMRs level 2 and 3 and 50 Work Dose Planning documents have been generated. The dosimetry integration propagates to IMPACT 180 participant doses per day on average since 1st of April 2013.

WHAT IS NEXT?

IMPACT continues its growth in the core of CERN activity planning and safety procedures. The Safety Working Group has requested the integration in IMPACT of the following documents:

- Work Dose Planning: Currently the generated WDP files are stored in the CERN Engineering & Equipment Data Management Service (EDMS). The goal for the future is to substitute the excel file by a web form inside IMPACT to perform all radiological estimates.
- Joint Inspection Visits: Describes the work method.
- Lockout attestation (electrical, cryogenics).
- Dig permit.
- Replacement of the EDH document notifying the start of the work.

REFERENCES

- [1] K. Foraz, "Reliability and Intervention Management for the LHC". IPAC'12; <http://www.JACoW.org>.
- [2] CERN Safety Code F, Protection against Ionising Radiations. Radiation Protection Manual, Revision 2006, CERN.
- [3] D.Forkel-Wirth, P.Bonnal, "L'approche ALARA au CERN Regles Generales d'Exploitation (RGE) section 9, Consignes Generales de Radioprotection, Note d'Information S5-NII, EDMS No. 810169"
- [4] P. Bonnal, "Optimisation of radiation exposure at CERN's accelerator complex" ISOE symposium 2010