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Diagnosis, forecast and sensemaking activities of a National Technical Support Team

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ABSTRACT

In crisis situations, urgency and uncertainty make it difficult for people to identify the current situation and risks incurred. Because of the unforeseen nature of the situations, off-site crisis cells, like the National Technical Support Team (NTST), are implemented in order to focus on situation sensemaking and anticipate future states of the facility.

The study's aim is to understand the reasoning of the NTST and how it builds a representation of the situation. A programme of observing crisis management simulations and interviews allowed to identify the diagnosis/forecast/recommendation activity as an iterative process that improves with interactions with the other stakeholders.

KEYWORDS

Crisis management, nuclear industry, expertise, resilience, sensemaking

INTRODUCTION

High-risk organisations are questioning their ability to face extreme and very rare accident situations, over and above those covered by the current design of technical and organisational urgency schemes. Crises are low-probability situations with major consequences (Weick, 1988). They require extensive interpretation and sensemaking efforts. The unique dimension of these situations requires the participants to engage in reasoning at higher levels of abstraction (Crichton & Flin, 2004).

Because of the unforeseen nature of the situations off-site crisis cells are implemented in order to focus on situation sensemaking and anticipate future states of the facility. During crisis management, these crisis cells are responsible for the anticipatory activity by remotely analysing the situation and preparing possible sequences of actions. Managing an incident requires setting new macro-goals, based on a means-ends analysis of the means and resources to be deployed. The crisis unit's work is centred on the identification of levers needed for implementing a new action plan.

Klein (1999) underlines the importance of this forecast activity for the revaluation of the actions to be implemented. The purpose of the forecast is to suggest actions, or even to change the current strategy, and to review the goals so that they match the development of the situation and of the probable future facility states. The anticipatory activity brings about a projection into the future. This activity is part of a different temporality than that of front-line teams. The forecast activity is critical in crisis management, especially in high-risk dynamic processes.

In the nuclear industry, crisis management has a number of specificities. Nuclear production is made by a complex and continous system, that changes slowly: the evolution can last from a couple to tens of hours. The system proceeds under its own impetus and partly escapes the participants' control (Hoc, 1989).

This communication aim is to understand the off-site crisis cells functioning thanks to observation methods during different crisis management simuations.

THE STUDIED SOCIO-TECHNICAL SYSTEM

Within the organisation under study, different operational states of the facility are anticipated.
Because of the severity of the situation, an in-house Emergency Plan is set off, leading to the mobilisation of a multi-level crisis organisation (Figure 22):

- Locally: Local Command Post, Local Crisis Team, Shift Manager.
- Nationwide: National Technical Support Team, National Command Post, AREVA Crisis Team, Institute for Radiological and Nuclear Safety (IRSN) Crisis Team (regularoty) and SEPTEN Crisis Team (another utility's team of experts).

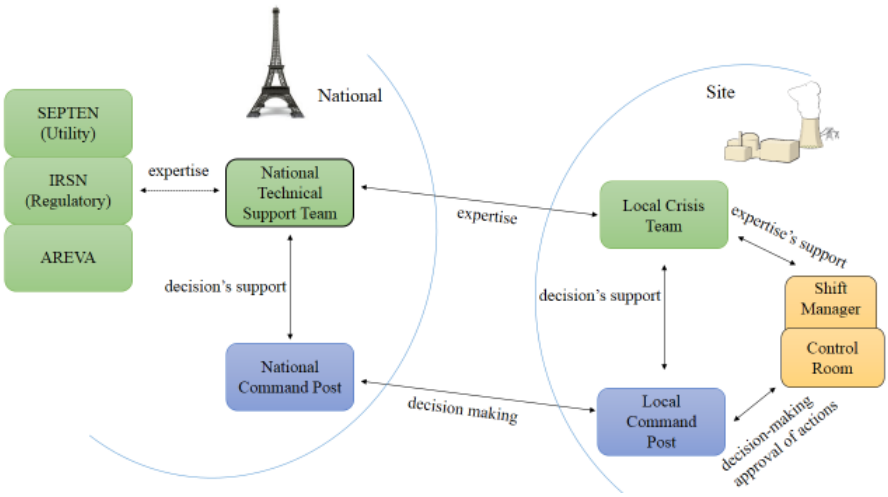

Figure 22: The crisis management organisation under study

This study focuses on the National Technical Support Team (NTST). The NTST comprises twelve general operations and environmental specialists. The NTST is not actually managing the plant. Its purpose is to make its expertise available to the Site by proposing a diagnosis and a forecast of the development of the situation. It also provides information, solutions, and recommendations for action to the Site (through the Local Crisis Team or Shift Manager). The NTST develops a global picture through its technical skills that complement those of the Local Crisis Team. The NTST is an essential resource for the Site to anticipate problems to come and tasks to be undertaken. The recommendations to the Site may concern changes to procedures, the implementation of preventive or mitigating actions. In this crisis organisation, the NTST prognosis has an additional objective : to provide the National Command Post with population protection measures, while confronting their diagnosis/prognosis to the other national expert entities (IRSN, Areva, SEPTEN).

Communications between the Local Crisis Team and the NTST are made through periodic messages received from the Site every 15 mins and describing the status of the facility and through audio-conferences with all expert entities held every 90 minutes approximately.

The entire crisis organisation is tested during realistic simulations, which NTST takes part in. It is during such simulations that we collected our data. The aim of this study is to understand the reasoning of the NTST, and how it builds a representation of the situation.

METHODOLOGY

Six drills were observed and eight post simulation interviews were conducted. The collection of data included four steps :

- Step 1 – Preparing the observation. We gathered information regarding prescripted activities of the NTST and regarding scenarios divised for each simulation.
- Step 2 – *In-situ* observation of six crisis drills. Observations focused on a pair of NTST participants, the Emergency Operations Specialists, who play a central role in team coordination. A table of observations was used to log the time, the team members' associated communications and activity "stages" (NTST's briefing, audio-conference, collection of data, recommendation drafting). Communications between team members were recorded and transcribed. Additionally, their search for information (documentation, data acquisition methods, handwritten notes, written questions ...) was collected.
- Step 3 – Drawing up the data. In order to understand the NTST functioning during the six simulations, time charts were drawn. Theses time charts focused on Emergency Operations Specialists activity. In these time charts, the main activites related to the diagnosis/prognosis missions, their duration and frequency were traced : drafting of diagnosis/prognosis documents - these are shared during audio-conferences with all expert entities, drafting recommendations and all communications established to build the diagnosis/prognosis.
- Focused time charts were then made to highlight recommendation process : from the first draft of a recommendation to the final drafting and the sending - or not, to the Site.
- Step 4 – Post-simulation semi-directed interviews. Eight interviews were conducted based on a table of questions related to the time charts. These time charts – global time charts and focused time charts, served as support during the interviews. The main goal was to make explicit Emergency Operations Specialists activities, thanks to the charts. More precisely, explicitation was asked on : how first diagnosis was set up,

how prognosis was reassessed throughout the simulation and how recommendations were prepared and debated between team members.

This method allowed us to characterise the diagnosis/forecast process, the making of recommendations, and their implications regarding the temporal dimension and the collective management of the situation.

RESULTS

Two phases in the construction of diagnosis/forecast/recommendation

Data analysis based on interviews and time charts yielded general results about the NTST reasoning during crisis simulation. The diagnosis/prognosis NTST activity appears to be split into two phases : 1) a preliminary diagnosis phase – systematically obseved ; 2) a simultaneous diagnostic/prognosis/recommendation construction phase.

As Figure 2 shows, the first phase begins with a voice message from the Site about the emergency situation, and ends when the first audio-conference with all expert entites occurs.

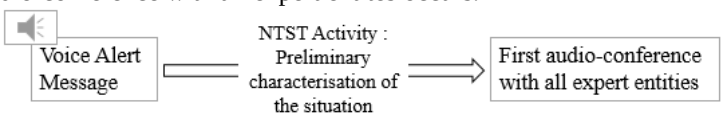

Figure 23 : Preliminary diagnosis phase schema

The voice alert message briefly defines the emergency situation declared in the Site and the facility states.
From that voice message, Emergency Operations Specialists made their first hypothesis about the situation and look for clue. Experts mainly look into the procedure applied by the operation team and into the information system to collect data on the safety parameters of the facility. Before the first audio-conference, a briefing is set up inside the NTST by the head of team. According to the team members, these briefings are valuable to share the same representation of the situation and to identify key questions before the audio-conference.

After the first audio-conference, the second phase begins. Explicitation interviews with the Emergency Operations Specialists indicate that:

- Team members assess the situation, using pivotal topics (i.e. the major functions required to ensure the safety of the facility); they identify weak points and possible solutions.
- This analysis of weaknesses and solutions requires both a functional assessment (lost functions, remaining functions, and a forecast of functions that may be recovered depending on the development of the situation and on available resources), and a temporal assessment (the amount of time a function will remain in operation, and a forecast of time remaining before a new failure, or time remaining before an additional worsening leading to an irreversible status change).
- This analysis of weaknesses is a debative activity (Schmidt, 1991). An iterative process of identifying weak points and solutions makes it possible to issue a formal recommendation. Recommendations may concern preventive actions (e.g. managing functions that can be weakened in the medium/long term) or mitigation (e.g. managing a loss of redundance of a safety-critical function).

The purpose of the forecast activity is to bring proposals to front line actors to help them keeping the situation and the facility in a safe and controllable state.

The NTST activity is characterised by a double temporal dimension : it means coping with a constant oscillation between projecting the future state of the facility and updating NTST members' representation of the present situation. This double temporal offset requires phases of (re)synchronising the NTST and the Local Crisis Team that help with the sensemaking process. This double temporal dimension is highlighted throughout the recommendation process.

Recommendation process: a demanding cognitive activity with important synchronisation issues

Observations, time charts and interviews permit to underline that recommendation process is an iterative construction in wich Emergency Operations Specalists lead the team. They ask for specialist's advice, and manage different viewpoints in order to draft and send one clear recommendation to the Site.

In the 6 simulations observed, 21 recommendations were emitted. These recommendations were drafted by Emergency Operations Specialist 2. Recommendations are signed by the Head of team, and sent electronically to the Site. Then the Local Crisis Team relay to the Local Command Post for validation and application (cf. Fig. 3).
Interviews and time charts allowed us to focus on each recommendation made by the Emergency Operations Specialists during these simulations. It indicated that the recommendation process is a complex and demanding activity:

- Experts have to assess and reduce uncertainties related to a recommendation. They take into account the recommendations potential effects, regarding the potential process evolution and the actions initiated on Site.

These variables may change the facility state expected. This projection is crucial to reduce incompatibilities or unreliability risks.

- Experts assessment requires oscillation between projection on the future facility state and present-time, to update NTST members' representation of the facility.
- Experts need to get the "right picture" of the facility state and of what is possible to operate on Site. In one case, a mismatch was identified between the actions requested by the NTST and the possibilities on Site.
- Experts try to identify the right moment for carrying them out, if the participants are not already carrying out these actions and if the resources currently on-site are adequate to perform the recommended actions. In the observed simulations, one recommendation was made too early. It did not make sense to the front-line teams and was put on hold; and one recommendation was sent too late, the Site operated by itself.

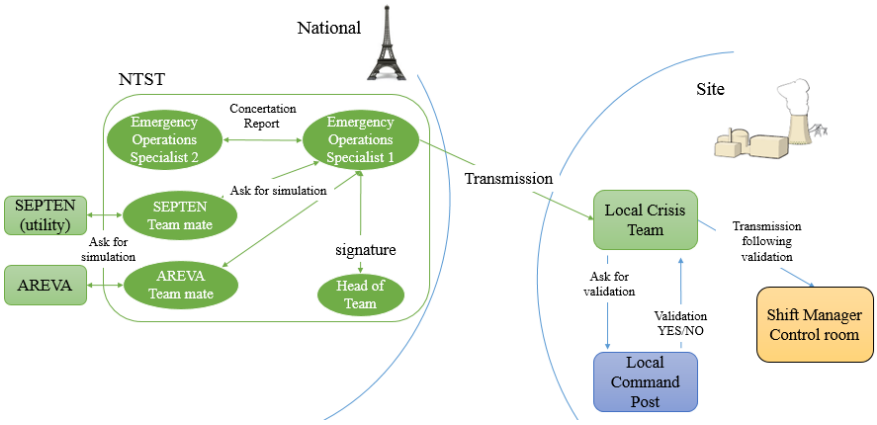

Figure 24 : Recommendation path example

CONCLUSION

NTST's role is to estimate the dynamics of the crisis, the consequences of the fluctuations in the process, and the ways to mitigate potential failures in the operations. This anticipatory activity involves requirements at two levels: at the NTST level for the construction of diagnosis/forecast, and at the collective level to support synchronisation between the NTST and the front-line teams. As regards the construction of the diagnosis/forecast, the NTST must oscillate continuously between future facility state and present state to update their representation of the situation. This oscillation is cognitively demanding but required for the development of a relevant diagnosis/prognosis (i.e. risks incurred, available resources). Concerning the collective level, the study underlined a constant need for synchronisation through the construction and transmission of recommendations. Recommendations have to be formulated at the convenient moment, and be in agreement with both the current state of the facility, and the available resources on Site. Synchronisation is essential to support the collective sensemaking.

Synchronisation seems difficult to maintain, and requires permanent adjustements between the NTST and the Local Crisis Team, achieved through the exchanges (audiconferences and written messages). Desynchronisation may lead to two risks: the recommendation content may not make sense for the Site, which may lead to non-application; the recommendation may be sent too late and be obsolete, or may be sent too early and not be applied. A further study will analyse those recommendations that are successfully implemented and those that are blocked at some point in the transmission chain between the different crisis centre. This will allow us to design training proposals complementary to those already existing and to approach differently these issues of synchronisation and sensemaking.

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