From expert judgement to decision-making in the major risk management process around SEVESO sites in France

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ABSTRACT: Since the Toulouse accident (2001), the French Authorities have emphasized the position of the Safety Study in the risk management process. In this new context induced by the promulgation of the law n°2003-699 of 30 July 2003 about the "prevention of the technological and natural risks and to the compensation of the damages", the Safety Studies performed by the industrials is: 1. a demonstration of the risk control, 2. a support to the urbanization control around Seveso sites using Technological Risk Prevention Plans TRPP. Different categories of actors, such as general manager, operators, contractors, central and local Administrations, associations, etc., are involved in the risk management process making it more complex. As a technical support to decision-makers in risk prevention from both public and private sectors, INERIS plays an important role in the evolution of the French risk prevention plan. This paper aims at revealing the different decisional and expertise problems faced during the Safety Study and the Technological Risk Prevention Plans.

INTRODUCTION

If we take a look to the way the industrial risk prevention process was structured in France, we will easily distinguish two times: before and after the Toulouse accident (September, 2001).

During the last fifteen years, three aspects where classically considered, in France, to prevent the occurrence of industrial accidents: reducing risk at its source; limiting the effect of an accident; restraining the consequences of an accident. Regulation measures related to these aspects consist in:

(a). ***Risk reduction.*** Based on Safety Studies (SS), this refers to the risk reduction inside the industrial site by choosing the right technical solutions according to the best available ones (ex. Reducing quantity of substances, pressure and temperature of reactions, etc.) and by setting safety barrier up (ex. Installations survey, operability parameters control, intervention in case of default).Thus, the severity and/or the probability of an accidental even are than reduced..

(b). ***Public information.*** Two structures where in-charge of public information:

- a regional structures such as “Permanent secretary for the Prevention of Industrial Pollution”. This structure bring together locals actors (ex. administrations, local authorities, industrialist, media, experts, etc.) that have common interest in questions dealing with industrial environment aspects. The aim of this structure is to build a trustful climate of dialogue between the actors.
- a local structure, such as “Local Committee of Exchange”, created by Seveso industrialists in dialogue with local associations and/or local authorities and/or administrations. This structure allows to: helps the industrialist to have a better understanding of resident expectations; inform the residents of industrialist constraints and recent risk reduction measures.

(c). ***Land use planning.*** According to the conclusions of the Safety Studies (SS), the land use planning was based on a determinist approach that consist in taking into account the worse consequences of an accidental event that is the “consequences without the risk reduction measures”.

(d). ***Emergency plans***.

As we can notice, the 4 aspects presented above are based on the Safety Study (SS) and more precisely on the way "risk analysis process" is performed. The deterministic conclusions consist in freezing the urbanisation in the largest diameter that represents the worse accidental scenario.

The Toulouse AZF factory accident related to the storage off specification ammonium-nitrate, September 21, 2001 revealed the need to go towards a greater control of the risks and their consequences and towards a stronger implication of the various stakeholders in the industrial risks prevention process. The Toulouse accident (2001) marks a turning in the industrial risk prevention process. Indeed, with more than 30 deaths in a radius of 500 meters, thousands of wounded and more than 26000 residences damaged on a radius of 3 kilometers [1], this accident has revealed the following needs:

1. ***Control of the risks by acting on their source.*** This mainly consists in improving the way the risks control demonstration is carried out within the framework of the Safety Studies (SS).
2. ***Reduction of the vulnerability around the Seveso sites (High Threshold)***. This consists in using natural hazard "Risk Prevention Plans" experience feedback to carry out "Technological Risk Prevention Plans". Using the proportionate financial mechanisms, it will become possible to limit population exposure to the consequences of an accidental event. These mechanisms depend on the delimitation of three "regulation zones" to limit the present and the future building around the Seveso industrial sites.
3. ***More implication and more dialogue with the various actors in the risk prevention process***. This consists in:
   - instituting a greater participation of the employee in the risks control process, with a widening of the Health, Safety and Working Conditions Comity (HSWCC) missions;
   - going towards more implication of the various actors of risk prevention using the Local Committees of Information and Dialogue (LCID).

These three objectives aim at increasing the transparency of the risk analysis process, and at going towards a greater coordination between the different actors in of the preventive risk management [2, 3].

One can notice that the two official documents represented by the "Safety Study" and the "Emergency Plan" did not faced major evolution in their form and their finality.

However, the limit between the "demonstration of risk control by the industrialist" and the "land use planning around the industrial sites" has been emphasized: while the first aspect is still the concern of the Safety Study, the second one is done in an other document called " Technological Risk Prevention Plan".

Moreover, the Technological Risk Prevention Plan offers the potentiality of two major modifications in post-Toulouse French context making the technological risk prevention process, in one hand, more readable by being aims oriented (demonstration, land use planning, emergency) but, in an other hand, more complex. The following points give some aspects of this complexity:

- The probability of occurrence of the accidental event is now systematically considered for the land use planning around the industrial sites. That was not the case before the Toulouse accident were a perimeter was fixed, around the industrial site, without considering the measures set up by the industrialist to reduce the risk: This is the so called "determinist approach". Due to a lack of experience feedback, the assessment of a probability value to the occurrence of an accidental event is difficult to find.
- A level of criticality is obtained for each major accidental scenario considering their kinetic, their probability of occurrence and their intensity. The aggregation of theses three aspects for each scenario is complicated to Asses.
- The various actors concerned by the decision in the risk prevention process are now all consulted. The part and the limit of their intervention in the decision making process raised a difficult problem.
- A set of measures is defined to reduce the vulnerability around the Seveso sites. The choice of the adequate measure is done in dialogue with different stakeholders on the basis of technical proposal.

In what follow, we will first present the different steps of two separate processes that will end up by the publication of the two official documents that are the "Safety Study" (SS) and the "Technological Risk Prevention Plan" (TRPP). We will then present the different difficulties faced when these two processes are put into practice. We will finely synthesize the different difficulties and present some conclusions.

1 ELABORATION PROCESS OF THE OFFICIAL DOCUMENTS

The French law n° 2003-699 of July 30, 2003, relating to "the prevention of the technological and natural risks and to the damages compensation", has introduce a distinction between the reduction of the risk to the source (hazard) and the urbanization control around Seveso sites. This distinction became effective in two different procedures: the Safety Study (SS) and the Technological Risks Prevention Plan (TRPP).

Both the SS and the TRPP are legal documents based on complex processes were different stakeholders took part. These two processes are presented next.

1.1 The Safety Study (SS)

The SS document aims at giving a report of the examination process carried out by the industrialist, in order to prevent and to reduce the risks of an installation or a group of installations, as much as technologically possible and economically acceptable. These risks can be caused by products used, dependent on the processes implemented or due to the vicinity of other internal or external risks [4].

The elaboration of the SS document is, in the majority of the cases sub-contracted completely at a engineering and design department. The SS is seldom the work of the only industrialist who in almost all the cases helped by external specialists especially during the “risk analysis” and “risk modeling” phases presented below.

The SS process is built around the following phases:

1. *Identification and characterization of the danger potentials*. This phase aims at giving an image of the chemical products, the processes and the reactions dangers produced by the industrialist’s installations. This is done according to the industrialist’s knowledge and can be possibly enriched by information coming from the products suppliers, the processes licensors or coming from data- bases.
2. *Description of the environment*. This phase is carried out by the industrialist or, generally, by an engineering and design department on the basis of information received from the various French Administrations (town council, DIREN, DDE, VNF, DRIRE…) and visual information. The principal objective is then to identify the vulnerable entities and the potential attackers in order to appreciate the potential gravity of the accidental scenarios generated by its installation and to identify, as well as possible, the accidental scenarios whose origin is an external site aggression.
3. *Reduction of dangers potentials*. The industrialist must carry out a technico- economic examination aiming either at (i) removing or at substituting to the processes and/or the dangerous products, processes or products presenting less dangers, or at (ii) reducing as much as it is possible the quantities of dangerous matters blamed
4. *Assessment of the consequences of dangers materialization*. This phase aims at determining, for the Administration, dangers distances with an aim at establishing the Particular Intervention Plans (PIP). For that purpose, specialists in accidental scenarios modeling are involved. These specialists must make a choice and establish assumptions on the industrialist procedure with the assistance or not of a engineering and design department. The modeling specialists can belong to industry site, but generally, they came form an engineering and design department, or of specific services of the industrial group to which the site belongs.
5. *Listing of accidents and incidents that have occurred*. This phase consists in establishing an experience feedback on the accidents and incidents, which have occurred on the factory site. To this end, the industrialist, or the employed engineering and design department, must identify all the accidents or incidents that have occurred on his site or on an other sites implementing similar installations, similar products or similar installations. The industrialist can use his own database, or the database of the industrial group to which it belongs, quasi- systematically the ARIA BARPI[1] data base and in some cases trade associations data bases.
6. *Preliminary evaluation and detailed risks reduction study*. This phase proceeds in four times. Initially, an exhaustive identification of the whole major accidents scenarios that can be generated by an installation is carried out. This work, which constitutes the heart of the SS, must be performed in a working group by im-

[1] Bureau d'Analyse des Risques et Pollutions Industrielles.

plementing a risks analysis method. The working group is generally performed by the following stakeholders: specialists in various disciplines (Safety, maintenance, exploitation, instrumentation, processes, …), an organizer that is specialist in risk analysis methodologies and a technical secretary. In the majority of the cases, the specialists belong to the personnel of the site while the organizer and the technical secretary come from an engineering and design department. In the second time, a quotation of the whole identified of major accidental scenarios is carried out. This quotation consists in evaluating the gravity as well as the probability of occurrence of the scenarios by taking into account the organizational safety and technical barriers set up by the industrialist to avoid the occurrence of a done scenario. This quotation can be done according to two approaches: qualitative, in analysis of the risks working group, or quantitative starting from information coming from databases. In the third time, the owner must ensure himself of the acceptability of the risk induced by each identified scenario. For that purpose, it takes support on a "criticality grid" (Figure 1). The determination of the level of acceptability is the responsibility for the industrialist. To finish, the industrialist must prove that he has reduced or maintained his risks as low as "reasonably possible".

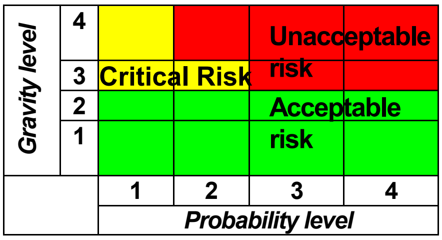

Figure 1. ***Criticality grid (probability / gravity)***

7. *Quantification and hierarchization of the various scenarios*. This phase, which is the last of the SS, consists: (i) in a hierarchization of the whole identified major accidental scenarios according to their gravity, their probability and their kinetics; (ii) in an quantitative evaluation of their consequences. Due to the significant number of the identified scenarios (in the preceding phase), the industrialist is obliged to identify and select the scenarios, considered as representative, for which a quantitative estimate of the distances from effects will be carried out. This work is carried out by the industrialist with the assistance of internal or external specialists (engineering and design departments in general). The quantitative estimate of the effects distances associated with these scenarios is carried out by modeling specialists. These specialists are internal or external to the industrial site or group.

The Administration, mainly represented by its Controlling Authority the "Direction Régionale de l'Industrie" (DRIRE), must make sure that the industry site known as "SEVESO high threshold" perform a SS that correspond to what is reglementary fixed. A third expertise done by an engineering and design department is performed to verify the validity and the quality of the SS according to the reglementary criteria.

1.2 The Technological Risk Prevention Plan (TRPP)

The TRPP aims at reducing the vulnerability around the Seveso sites notably by reducing vulnerability of the stakes. This consists in choosing a proportional risk reduction measure for urbanization control around Seveso sites. These measures refer concretely to a legal risk zoning which highlights the "zones" which would present the highest levels of risk according to the vulnerability of the stakes around the site. Crossing the hazard map and stakes map allows to make a first proposal of a set of measures for risk reduction.

Theses measures, proposed by technical experts, consist in three urbanization constraints: expropriation, renunciation and pre-emption zones.

The TRPP relate to "foreseeable technological events" and is not properly speaking an urban planning documents. But its must be taken into account in Local Urbanization Plans and aims at a stronger implication of the various actors concerned by risk prevention.

The Technological Risk Prevention Plans (TRPP) is structured around three important parts: a technical part, a regulation part, and a communication part.

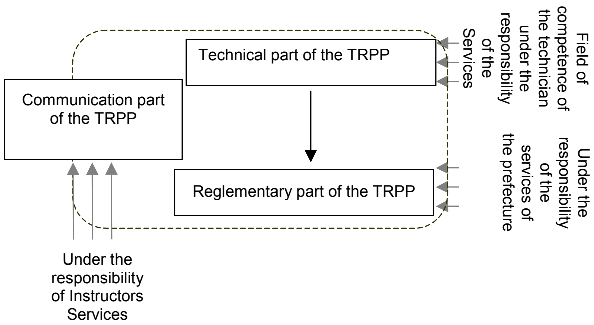

Figure 2. The three parts of the TRPP

The technical part of the TRPP includes (i) informative maps (can come from the SS), (ii) a hazard map, (iii) a stakes map [5].

The "hazard map" is elaborated by the control authority (DRIRE) using information coming from the SS documents. The following criteria are considered: intensity, probability and kinetic. The "intensity and "probability" criteria are fixed by the Authority in decrees.

The intensity criterion corresponds to three thresholds that delimit the four hazard levels to three categories of effects (Toxic, overpressure and thermic): significant lethal effects threshold, first lethal effects threshold and irreversible effects threshold. The French threshold levels are synthesised in the following table [6]:

Tableau 1. Three thresholds to characterize the intensity criterion

	Significant Lethal effects	First Lethal effects	Irreversible effects	Irreversible effects by breaking of panes
Toxic	LC 5%	LC 1%	SEI	-
Thermic	8 kW/m2 or 1800 [(kW/m2) 4/3]. s	5 kW/m2 or 1000 [(kW/m2) 4/3]. s	3 kW/m2 or 600 [(kW/m2) 4/3]. s	-
Overpressure	200 mbar	140 mbar	50 mbar	20 mbar

The qualitative probability criterion is defined according to the following information: data on accident causes, data on the safety barriers in place. These information are combined according to a multiple-steps method. The method suggested consisted in identifying the various major accidental scenarios and the various safety barriers installed. The method used indications on the frequency of the initial events and criteria to characterise the barriers (effectiveness, response time, Safety Integrity Level) [7].

The kinetic criterion helps to consider the possibility of putting at the shelter the population according to the evolution of the accidental scenario. This criterion is defined using the following information: response time of the safety barriers, prevention and protection measures inside or outside the industrial site considering the scenario kinetic [8].

The "vulnerable stakes map" (Figure 3) is elaborated by the "Direction Départementale de l'Equipement" (DDE) using a three steps method:

- Identify all the stakes (building and infrastructure) under the TRPP perimeter.
- Estimate the vulnerability of the identified stakes.
- Define a Technical- economic study to identify the stakeholders (operating, local authorities, State, private individuals) acceptability.

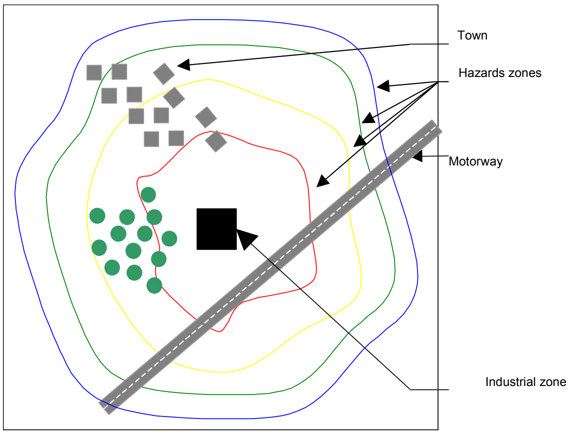

Figure 3. Vulnerable stakes map

The risk map is the result of hazard map and stakes map crossing.

The TRPP regulation map (zoning) uses the technical zoning proposal done by technical experts. This regulation map must consider local constrain. A local committee named "Local Committee of Information and Dialogue" (LCID) [9] is in charge of carrying the local acceptability of the vulnerability reduction measures.

The communication part of the TRPP starts at the first stage of the technical part and continues during the validation of the regulation map (Figure 2).

The TRPP aims at limiting the direct or indirect effects on public health and safety directly or by pollution of the medium of an accidental event accidents likely to occur in the installations at the major risks being able to involve effects. This will consist in delimiting risks exposure perimeters according to the nature, the intensity of the technological risks described in the SS and the proposed prevention measures.

At the interior of the perimeters of exposure to the risks three types of zones are given according to the nature of the risks, their gravity, their probability and their kinetics. These zones, respectively called zones of urban right of pre-emption, zones of renunciation and zones of expropriation, represent three constraints of urbanization with which are associated the financial mechanisms with adequate compensation (Figure 4).

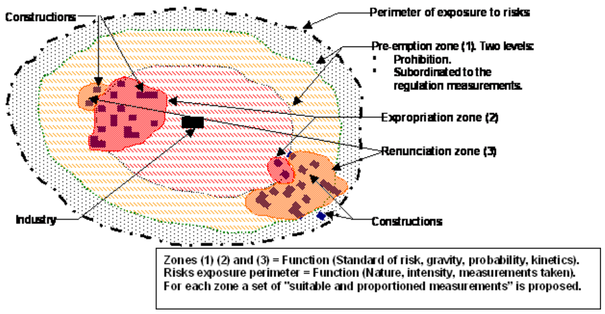

Figure 4. Various zones defined within the framework of the Technological Risk Prevention

Under perimeter delimited by the TRPP, the local authorities can initiate three kinds of destructive mechanism that represent different financial compensation to the local citizen:

- ***Expropriation***. This exceptional mechanism is chosen only if the population protection measures are too expensive to be locally used. Expropriation requires, after the approval of the TRPP, the signature of a convention between the plant operator, the local authorities and the State, as well as a declaration of utility easement for the benefit local community (municipality).
- ***Renunciation***. This solution is used only for the building and consists in the given possibility to the *owner* to "*put in residence"* the local authorities to acquire its good.
- ***Pre-emption***.

The constructive mechanism, applied to the existing building, consists in a re-enforcement of the constructions that mean to reduce their vulnerability.

The different stakeholders involved in the SS and the TRPP processes face different problems that we will discuss in what follow.

1 PRACTICAL PROBLEMS FACED DURING THE IMPLEMENTATION OF THE *REGLEMENTARY* STUDIES

The SS and the TRPP processes reveal decisional and expertise problems faced in practice. Due to the fact that the TRPP process is highly dependent on the SS one, we will insist on this last one.

1.3 The Safety Study (SS)

The preceding chapter reveals the reasons of the SS process complexity. In fact, the SS calls upon many competences and cannot be held without the presence of multidisciplinary knowledge.

1.1.1 *Identifying the right stakeholders*

Competences and knowledge necessary to the implementation of the SS are generally brought by experienced people that share their knowledge either individually, in quite special situations, or collectively, in working group.

A considerable part of competences and knowledge comes from the industrialist. Indeed, it is him who knows the best the installations and him that most precisely apprehends the situations of exploitation being able to be at the origin of a major accident. It is also in general him who follows the maintenance actions and which manages the modifications of its installations. Moreover, the SS is entirely of his responsibility and that why he is in-charge to provide his own risk acceptability definition.

Let us note that in general, the industrialist calls upon external specialists (either specialized services coming from the industrial group, or an engineering and design departments) for the following aspects in the process: control of work, the animation of the risks analyses process during the meetings or the modeling of the accidental scenarios.

According to the different possibility of involving interns actors as well as external actors necessary to the risk analysis process and according to the importance of information which they will have to provide, it is necessary to make sure that all these actors have the right competence and the necessary experience. This implies that the industrialist must on one hand be able to identify various competences necessary to the SS and on the other hand to determine the corresponding internal or external actors.

However, the majority of the industrialists do not have a right vision of all the actors necessary to the development of a SS and it can happened moreover, that they use the available and not the appropriate human resources. This is why, they often prefer to be advised by an engineering and design departments which they must also choose according to their competence in the required field. Thus, the difficulties are here to make sure that:

- the industrialist has a right vision of the needed competencies and experience to elaborate the SS;

- the industrialist lays out in-house or into external people answering these criteria.

1.1.2 *Representativeness of the selected stakeholders*

The question "of the *representativeness* of the stakeholders in the risk analysis process" is raised when the stakeholders are selected. Indeed, the "risks analysis" working group must be able to identify the dangerous situations and to evaluate the risk level for each scenario. This evaluation is generally carried out in a qualitative way and depends: on the competence and the experiment of the stakeholder, on the risk perception he has and on his attitude with regard to the risk (risk aversion or risk attraction). Thus, it is important to consider the optimistic or pessimistic nature of the stakeholder during the risk analysis process: the optimistic one will have a tendency to underestimate the major accidental scenario risk level whereas a pessimistic one will over-estimate the risk level for a same scenario.

Moreover, two experts (stakeholders) having the same level of competence will never have completely the same experience and thus will not always put forth the same judgement compared to a given situation. Indeed, an operator, among several, who is the only one who have faced a specific danger situation, difficult to imagine, will easily identify this kind of accidental scenarios where the other operators would not be able to.

1.3.1 Working group Decision-making

One of the major difficulties faced during the decision-making phase occurred when divergences are noticed between the members of the "risk-analysis" working group. The risk analysis process, done in a working group, is the heart of the SS process where the organizer (leader) has to manage the different opinions of the stakeholders can diverge. These divergences can have considerable consequences on the evaluation of the accidental scenarios risk level. Indeed, the risk level of the accidental scenarios can be considered as acceptable, for some group members, and as unacceptable by the other group members. Let us notice that in absence of consensus the risk analysis process can be completely invalidate.

Let us notice that the presence of all the expected competence in the working group does not assure that these *competences* are really integrated during the risk analysis process. Indeed, some aspect can influence the behavior of a stakeholder in a group: the presence of a hierarchical superior stakeholder, the timidity of the individual or his *mood* during the meeting (eg. worried by other external subjects).

Lets notice that it is difficult to consider and evaluate the quality of the working group reflexions which can change from a risks analysis meeting to an other; this observation is transposable to the final *reglementary* SS document where a synthesis of the work done by the working group is presented. These observations make it difficult to the control Authority and to the "third expert" to estimate the quality of work carried out and present in the SS final document.

1.1.3 *Definition of the risk acceptability and quotation of the scenarios*

One of the principal objectives of the Safety Study (SS) is to present the industrialist's demonstration of his site risks control. This demonstration is built on a level of risk acceptability fixed *a priori* by the industrialist. In the development process of the SS, the risk acceptability fixed by the industrialist is partly supported by the "criticality grid" (Figure 1). The "criticality grids" are built in the majority of the cases starting from the gravity scale and the probability (or frequency) scale. For each couple (level of gravity, level of frequency), the grid help to identify if the given scenario present an acceptable or unacceptable risk level.

Let notice that:

- it seems difficult to conceive that an industrialist can fix itself the rules in term of risk acceptability for situations which endanger the external environment of the site as well as the site employee;
- it is interesting to note that there is not commonly allowed rule which defines what is "an acceptable risk" and what are the representative criteria to judge of that;
- in practice, only few industrialists present the way in which their "criticality grid" were built up and the acceptability fixed. It is often noticed that the "criticality grid" is selected in non consistent manner by the industrialist (ex. a copy of an existing grid).

The quotation methods currently used by the industrialists are centered on the acceptability of each identified major accidental scenario, without considering the aggregation of all the scenarios for a considered installation, a considered site or more largely of a considered country or an industrial group. Indeed, the "criticality grids" are all dependent to a selected scenario and not to the whole of the major accidental scenarios.

The questions raised are:

- Is it acceptable on the site level to have 10, 100 or 1000 major accidental scenarios considered individually as acceptable? And what about the cumulative of this scenarios?

- It is acceptable, considering the safety strategy of the industrial site, to have a variation of the safety levels when considering a small site having 10 identified major accidental scenarios and a large site having identified major accidental scenarios?

- How to build a "criticality grid" (Figure 1) adapted to the industry site?

Lastly, the "criticality grid» rests on probability and gravity scales which are as difficult to assess as the acceptability level. This difficulty is still present when it comes to choose the adequate method making it possible to quote various scenarios and to manage the uncertainties inherent to the various existing methods.

1.1.4 *Technico-economic studies of risk reduction process*

In addition to having to make sure, within the framework of the SS, that the risks level of the major accidental scenarios generated by the site installations are acceptable, the industrialist must on the one hand make a "technico-economic study" aiming at reducing the danger potential, and on the other hand, to reduce his risks to a level "as low as reasonably realizable". These complementary concepts are completely subjective and very difficult to really implement in the SS. Indeed, these aspects are considered depending on the "free will" of the industrialist because no limits are fixed.

1.4 Problems that can be faced during the TRPP

The TRPP are currently in an "exploratory phase". Indeed, de promulgation of the decree and of the methodological guide will fixe definitively the TRPP process and form. This chapter aims at revealing problems that can be faced during the TRPP process.

1.1.5 *Technical part of the TRPP process*

The DRIRE is in charge of producing a hazard map during the technical phase of the TRPP. This map is done according to the information provided by the industrialist (scenarios coming from the SS that leave the site limits) and consist in a requalification of the probability dimension, a recomputation of the effects distances and an evaluation of the kinetic dimension. This exercise raises the following problems:

- The DRIRE must treat the SS and TRPP processes differently, knowing that in the first process the DRIRE has a "control" role and in the second process the DRIRE is in charge (active actor). The DRIRE must then avoid giving recommendation about the admissibility of the SS when involved in the TRPP process.
- The aggregation of the three criteria probability, intensity and kinetics that qualify the major accidental scenarios can be considered in different manner to produce a hazard map. However, the choice of an aggregation approach can have an impact on the meaning and the nature of the hazard zoning.
- The crossing of the hazard map provide by the DRIRE and the vulnerability map provided by the DDE. This crossing must help the selection of a set of appropriate measures (expropriation, renunciation, etc.) suggested to an open dialogue within the LCDI committee. Going owing to the fact that the technical phase must lead to recommendations and not to decisions (decisions are done during the *reglementary* phase of the TRPP): which form must take these recommendations so as to take all the local constraints raised within the framework of the LCDI?

1.1.6 *Dialogue part of the TRPP process*

The *reglementary* phase of the TRPP becomes effective only after the communication phase (Figure 2). The communication phase consists partly in a dialogue process done by the LCDI committee. The following questions can be raised:

- How to take into account specificities of the local constraints without challenging the technical recommendations?
- How to take into account the heterogeneity nature of the stakeholders in term of roles, functions, training, etc.? This can be solved by proposing a common glossary?
- How to establish a conclusion (eg. Risk reduction measure) shared by the whole stakeholders?
- How as well as possible to help the Prefect and his representatives to take into account both the technical information and the LCDI opinions?

CONCLUSIONS

The Toulouse accident in September 2001 represents a turning point in the way technological risk prevention is currently taken in France.

The Safety Study (SS) and the Technological Risks Prevention Plans (TRPP) are two official documents: the first one is old and the second one is new. However, when put into practice, the two respective processes reveal difficulties in the way decision and expertise situations are driven.

This paper aims at bringing to the fore the various problems faced during the different expertise and decision-making phases present upstream, during and downstream the major accidental risks analysis process. The different problems were gathered in three groups:

- ***Actors Problematic:***
  - Checking of the *representativeness* of the analysis of risk working group. Selection of the stakeholders. This allows to make it possible to see whether the given opinions are neither too optimists nor too pessimists.
  - Difficulties to integrate the different perceptions and opinions of the various stakeholders.
  - Complexity of the decision-making process based on the information and ending documents provided by the Administrations (DDE and the DRIR) and considering the opinions expressed by the dialogue committee LCDI.
  - Difficulties (to the Administration) to consider the local territory specificity in a national process.
  - Management of the different roles played by the Administration (DRIRE) in both the SS and TRPP processes.
- ***Information and knowledge problematic:***
  - Presence of imperfect knowledge of the accidental phenomena and the various potentialities of their occurrence.
  - Integration of the complexity of the various information at disposal such as the of Security Management System (SGS in French), etc;
  - Difficulty of modeling the accidental situations and difficulties to identify completely their consequences. Limits of the calculation models. Difficulty of choosing the adequate model, etc.
- ***Identification and assessment problematic:***
  - SS process revealed an important set of whole of choice phases carried out by the stakeholders: e.g. choice of the studied scenarios, identification of gravity and probabilities levels for the whole scenarios, choice of effect distances, etc. The purposes of these choices are to reduce the uncertainty in a set of stakeholders conceded states. However, because of the strong effects of these "choices" on the industry risk control strategy and because of the strong overlap between SS and TRPP, it is necessary to institute a set of control mechanisms to validate their relevance.
  - Identification of the unusual situations. How to identify the probability of rare scenarios
  - Difficulty of selecting the scenarios to be taken into account within the framework of the TRPP.

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