Managing knowledge to improve industrial safety

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Context

September 21st 2001, explosion of the AZF plant in Toulouse, France, stressed the need for a completely new process for the assessment of industrial risks in process plants, the delivery of authorisations to operate and the definition of land use planning restrictions.

This lead to the voting of a new law in July 2003 and the enactment of a new regulation in 2005.

It also stressed the need for an improvement of the knowledge of a variety of actors to improve the quality of:

- risk analysis

- risk management

- risk communication and governance

This knowledge should not only be improved but also better shared, leading to a common safety culture

Objectives

In this context INERIS launched several programs aiming at :

- **producing and making available** the « missing » **knowledge** on risk analysis, hazardous phenomena, safety barriers

- improving the capitalisation, management and use of **safety critical knowledge** by all the actors

Safety critical knowledge = knowledge which, if lost, may be at the origin of an accident because it can causes a failure of the risk management process in one of the life cycle steps of an hazardous plant

Several steps

1. Formalisation of the expert knowledge : textbooks, guidelines

2. Organisation of the expert knowledge in a large website including texts, databases and tools, glossary and, above all links between these elements : PRIMARISK, shared with other actors

3. Building of tools to improve the capitalisation of knowledge of experts from all types of document they produce - based on an ontology of industrial safety

4. Extension of these tools for use in industry for the capitalisation of any safety related document

5. Extension of the tools for the capitalisation of knowledge produced during risk analysis

6. Creation of tools and methods to capitalise the tacit safety critical knowledge

PRIMARISK - Plate-forme de ressources intégrées pour la maîtrise des risques majeurs - Mozilla Firefox

Fichier Édition Affichage Historique Marque-pages Outils ?

http://127.0.0.1/accueil.php

Débuter avec Firefox | À la une | ANR | journal of cleaner pr... | NewsFeeds | Really Simple Syndica... | Blackwell Synergy: Ri... | Connexion à InfoView

PRIMARISK

Actualités Agenda

Plate-forme de ressources intégrées pour la maîtrise des risques majeurs

Session : Accès libre

INERIS

Connaissances de base | Evaluer les risques | Ressources, données | Outils de calcul

Recherche

mots clés OK

> Recherche avancée

Accueil

PRIMARISK

Plate-forme de ressources intégrées pour la maîtrise des risques industriels majeurs.

PRIMARISK est un nouvel outil à l'usage des professionnels de la maîtrise des risques (industriels, administrations, bureaux d'étude).

PRIMARISK a pour vocation de faciliter l'accès aux connaissances sur les risques industriels majeurs, en particulier celles produites par l'INERIS dans le cadre de sa mission d'appui au pouvoirs publics, et de rendre ces connaissances plus directement applicables en fournissant les outils qui les mettent en œuvre.

PRIMARISK propose un ensemble de ressources : glossaire, documents, outils de calcul en ligne, liens vers des sites Internet pertinents, bases de données, notes de synthèse ; qui sont autant de supports de formalisation des connaissances des experts de l'INERIS dans le domaine des risques industriels majeurs.

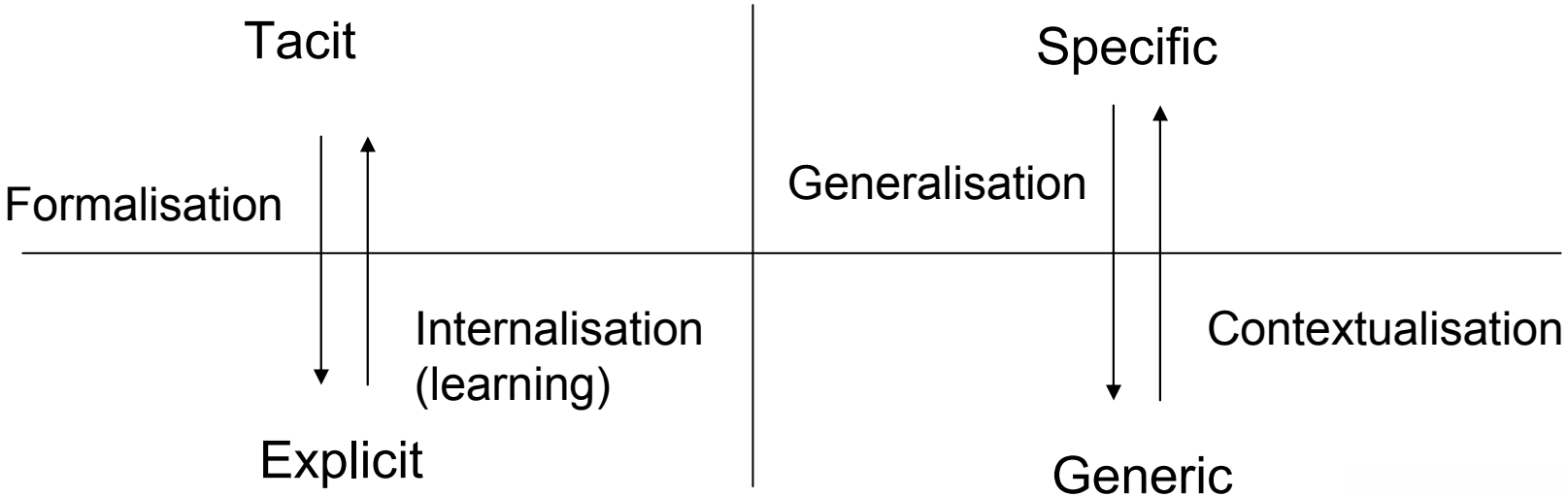
L'Institut National de l'Environnement Industriel et des Risques a pour mission d'évaluer et de prévenir les risques accidentels ou chroniques pour l'homme et l'environnement, liés aux installations industrielles, aux substances chimiques et aux exploitations souterraines. Maîtriser le risque pour un développement durable.

Terminé

Démarrer | Microsoft ... | BCRD | Gestionnai... | Microsoft ... | Rapport_A... | Sans titre ... | EasyPHP | PRIMARI... | FR | 16:54

Classical knowledge management issues

Our goal : produce the tools and methods to facilitate the various knowledge management processes in a variety of safety related contexts



Variety of Actors, variety of situations, variety of needs, common set of concepts

Actors :

- Plant operators
- Competent authorities
- Consulting companies
- Workers
- Experts

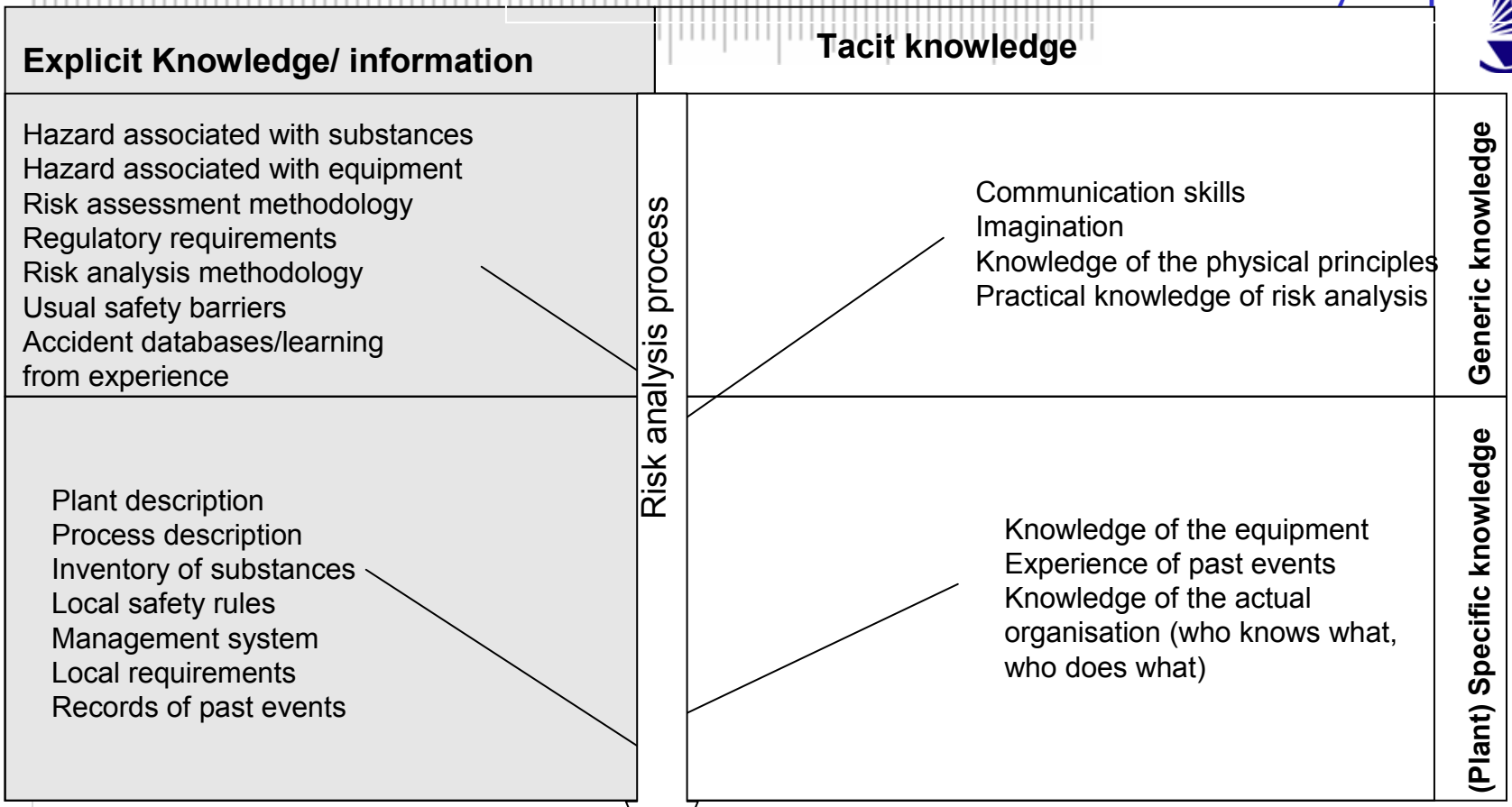
Concepts :

- Risk
- Safety
- Safety management
- Safety barriers
- Hazardous phenomena
- Hazardous substances
- Hazardous equipment...

Situations :

- Plant design
- Plant operation
- Risk analysis
- Safety management
- Emergency
- Maintenance
- Plant inspection

Knowledge involved in and produced by the Risk Analysis process



Explicit, plant specific knowledge (formalised in the RA documents)

Potential accident causes
Potential accident consequences
Risk level of the plant
Specific safety barriers and rules
Management requirements on safety barriers
Safety critical explicit knowledge

Tacit (for the participants of the RA), plant specific knowledge

Common vision of the plant and its risks
Sharing of the models (component behaviour)
Sharing of rules, values, procedures and of their utility for safety
Safety critical tacit knowledge

Ontology as a way to formalise expert knowledge

An ontology is a tool to:

- Identify and organise concepts (taxonomy)
- Give definitions and associate terms to concepts
- Describe the relations between concepts (represent the conceptual and expert models)
- Use the concepts to structure information
- Use the ontology to ease and precise the information search and retrieval
- Use the ontology to annotate documents (multimedia)
- Create instances of generic concepts to represent the specific knowledge/information

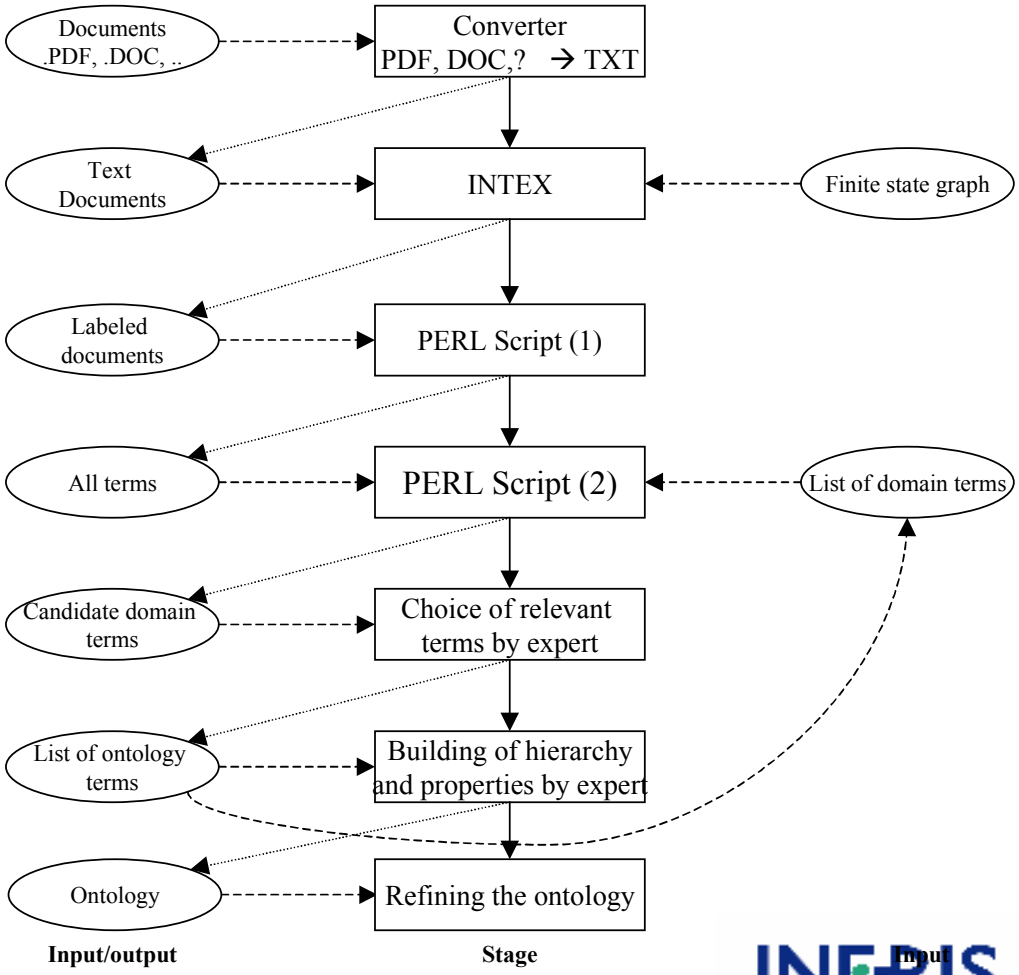
Building the ontology

Extracting concepts from previous formalisation of knowledge (reference documents)

Organising the concepts in hierarchical structure

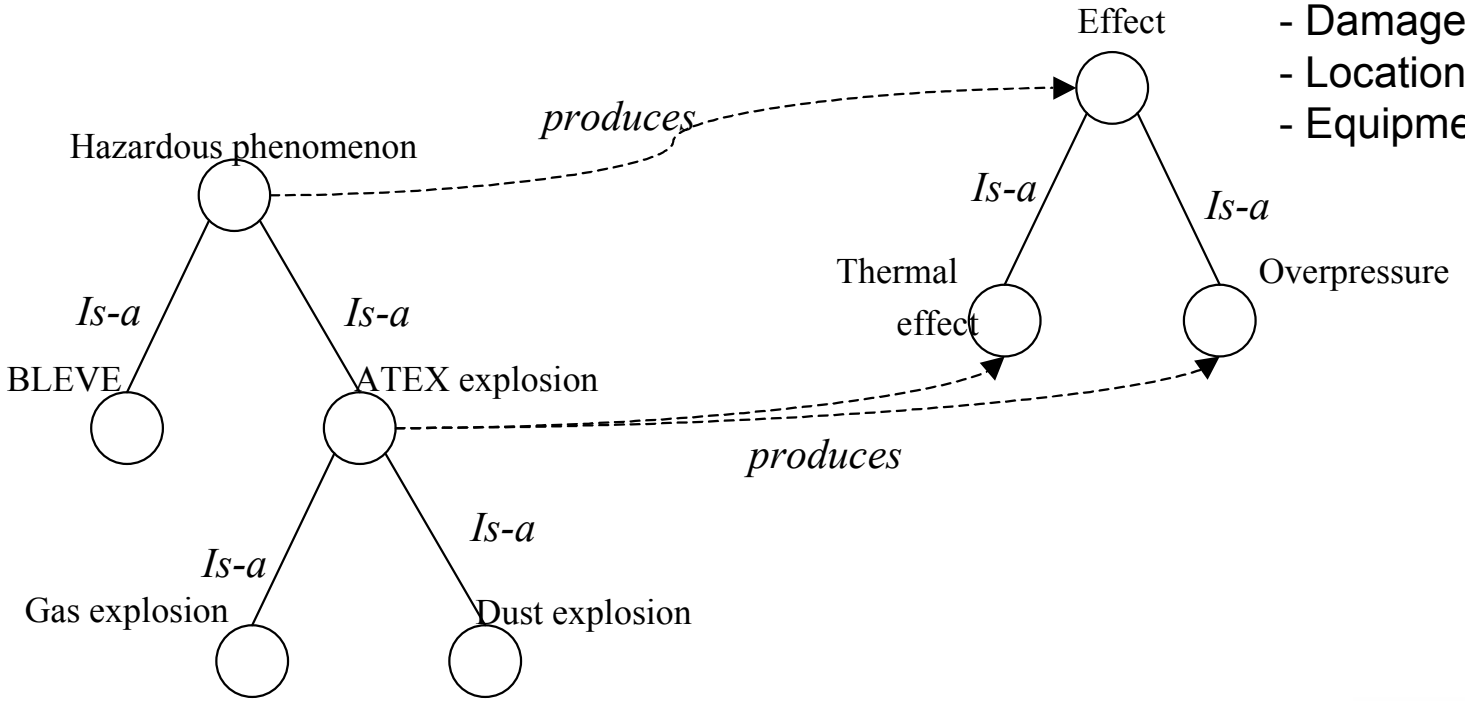
Defining the relations between concepts

Defining concept properties (ability to turn the ontology into a versatile database like information system)



Building the ontology

Hazardous phenomenon
- Effect
- Effect distance
  - -5%lethal
  - -1%Lethal
  - - Irreversible
- Damages
- Location
- Equipment



Main concept categories

General

- hazard
- risk
- frequency
- consequences

Hazardous phenomena

- fire
- explosion
- toxic release

Events

- Critical events
- Causes
- consequences

Equipment

- Storage
- Processes

Safety barriers

- Active
- Passive
- Human

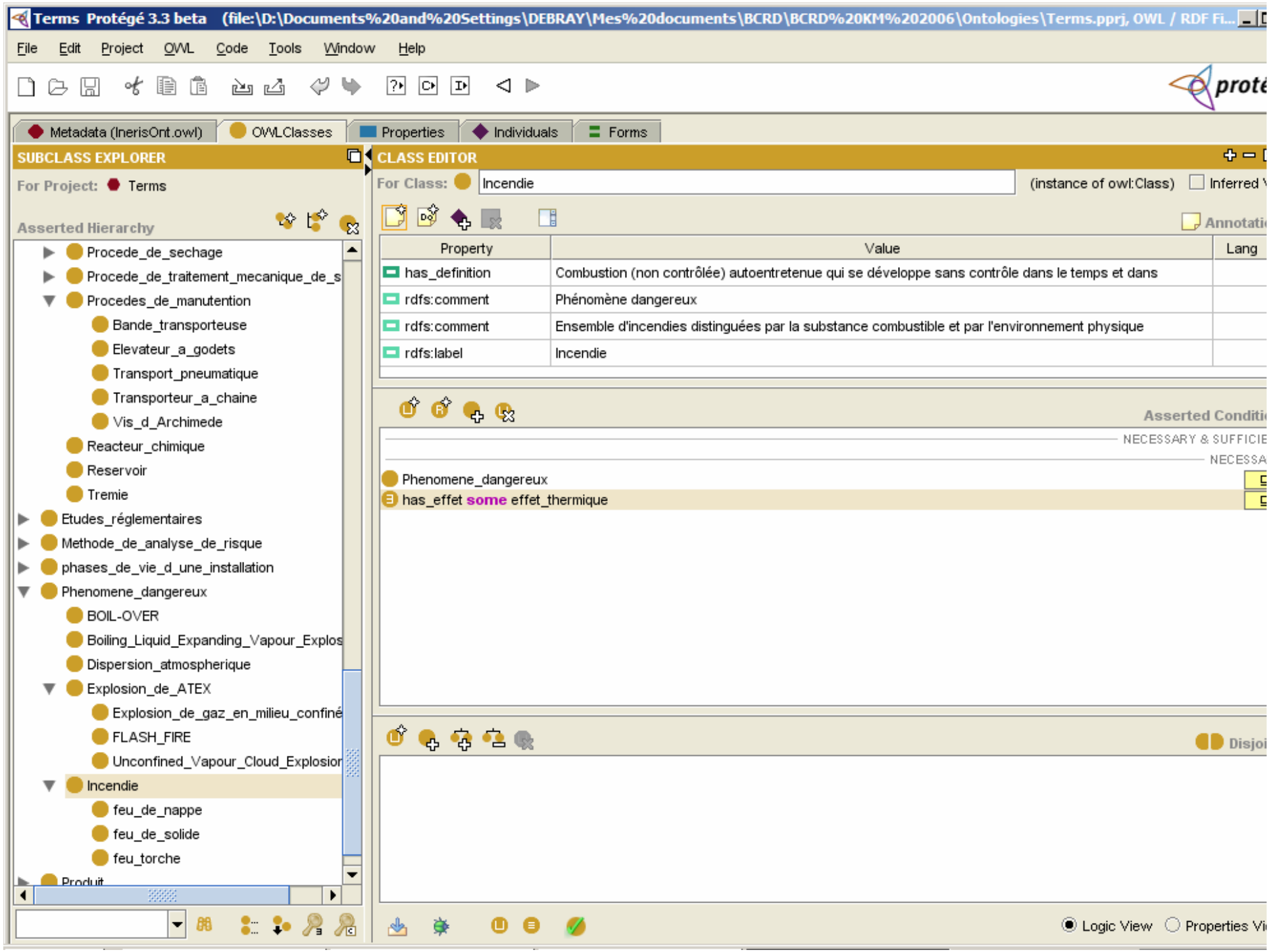
Hazardous substances

- Gases
- Liquids
- Solids

Accident

Actors

Activities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Metadata (InerisOnt.owl) OWLClasses Properties Individuals Forms
SUBCLASS EXPLORER
For Project: Terms
Asserted Hierarchy
Procede_de_sechage
Procede_de_traitement_mecanique_de_s
Procedes_de_manutention
Bande_transporteuse
Elevateur_a_godets
Transport_pneumatique
Transporteur_a_chaine
Vis_d_Archimede
Reacteur_chimique
Reservoir
Tremie
Etudes_réglementaires
Methode_de_analyse_de_risque
phases_de_vie_d_une_installation
Phenomene_dangereux
BOIL-OVER
Boiling_Liquid_Expanding_Vapour_Explos
Dispersion_atmospherique
Explosion_de_ATEX
Explosion_de_gaz_en_milieu_confiné
FLASH_FIRE
Unconfined_Vapour_Cloud_Explosion
Incendie
feu_de_nappe
feu_de_solide
feu_torche
Produit
CLASS EDITOR
For Class: Incendie
(instance of owl:Class)
Inferred
Property
Value
Lang
has_definition
Combustion (non contrôlée) autoentretenue qui se développe sans contrôle dans le temps et dans
rdfs:comment
Phénomène dangereux
rdfs:comment
Ensemble d'incendies distinguées par la substance combustible et par l'environnement physique
rdfs:label
Incendie
Asserted Conditi
NECESSARY & SUFFICIE
NECESSA
Phenomene_dangereux
has_effet some effet_thermique
Disjoi
Logic View
Properties Vi

Some methodological difficulties

Choose the right granularity for the concept hierarchy

- Very dependent on the application

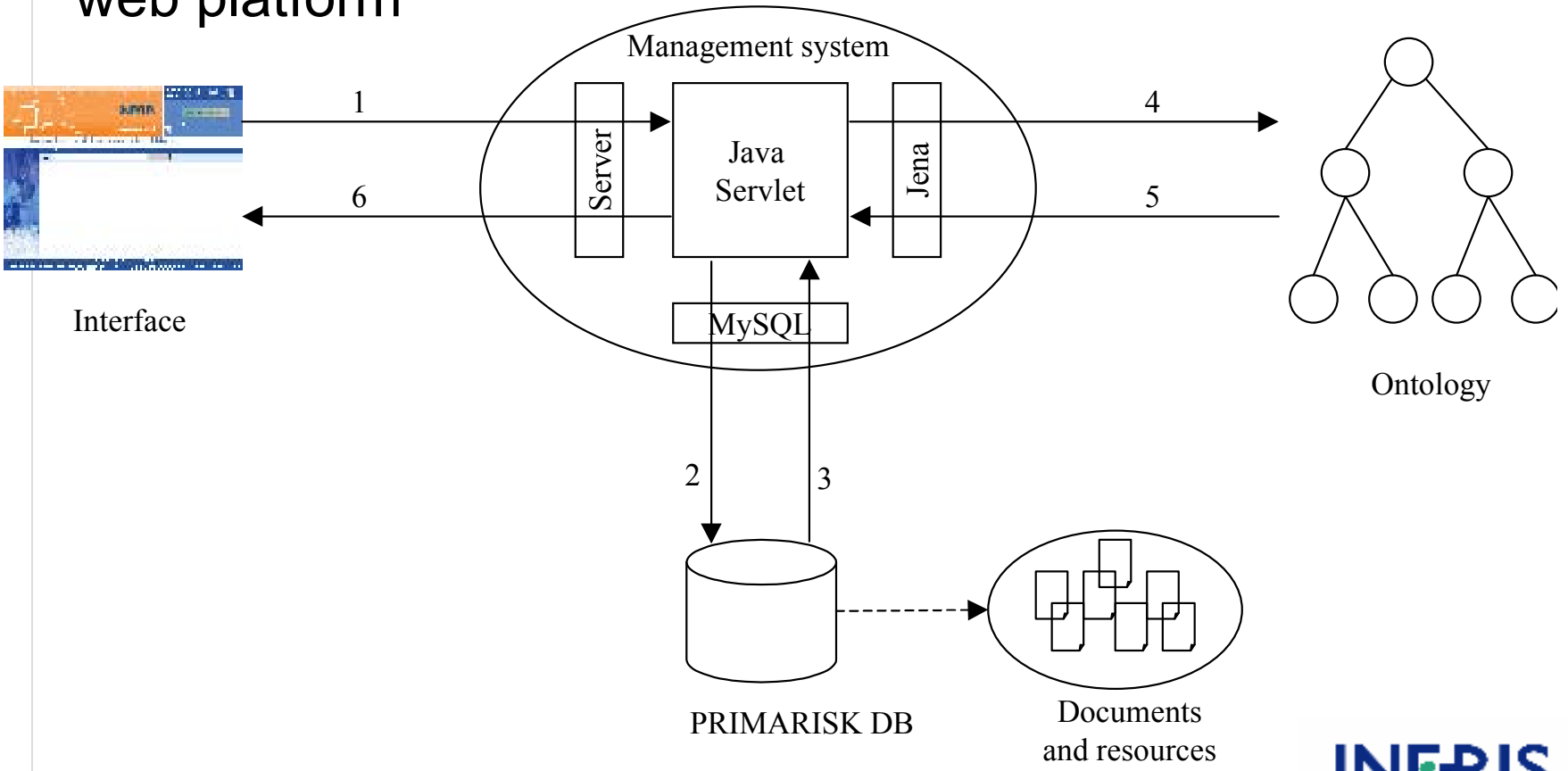
- Conditions the capacity to create instances

e.g.. Is a pump an instance of the equipment class or should it remain a concept (use : annotation/indexing of generic knowledge in documents) so that pump n°1 of plant X (use annotation of plant specific information)

Define the generic relations between concepts that will be instantiated in specific situations : relations are ways to express expertise models (eg : representing generic and specific fault trees as relations between instances of the “events” concept)

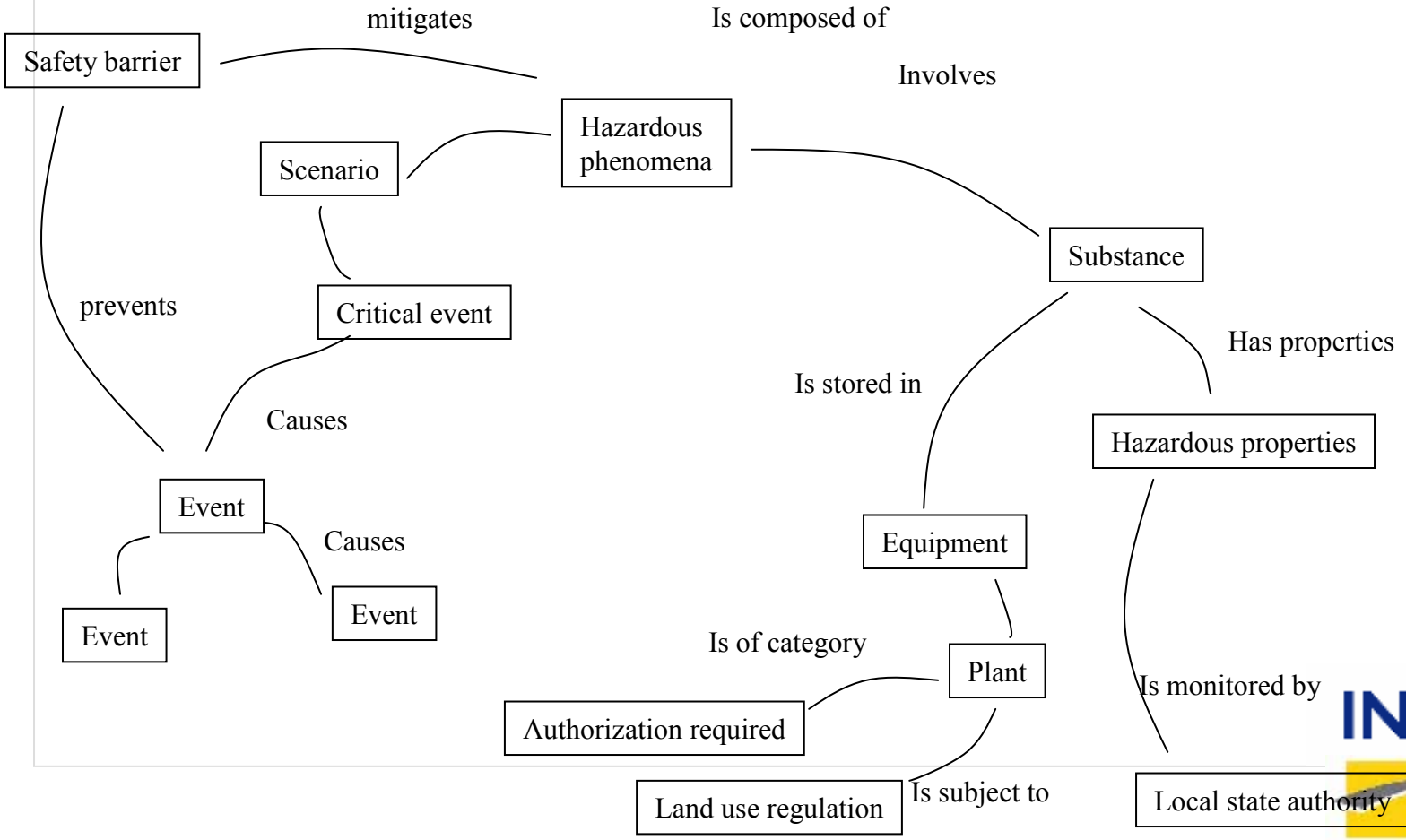
First application

Use for information indexing and retreival in the PRIMARISK web platform



Other application

Support tool for the capitatlisation of risk assessment information… and sharing of information between actors



Ongoing applications

- Use of the ontology to annotate and index thousands of documents produced by INERIS experts (GEIDE)
- Use of the ontology to annotate accident databases
- Use of the ontology to implement case based reasoning (gas sensors)
- Use of the ontology to manage the safety critical knowledge in hazardous plants
- Use of the same approach in two additional projects

REALEX : sharing knowledge between security experts for vulnerability analysis and real time response

COREGI : improving the resilience of organisation through knowledge management

Conclusion and perspectives

Research based on the identification of a need for better safety related knowledge management

Use of the ontology as a support to formalise knowledge and ease knowledge management

Structure basis for the organisation of risk analysis data and safety management information among a variety of actors

Some applications already developed

Much more to come … when we overcome the difficulties.