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Guest Editors

Valerio Cozzani
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Formalized Approach in Prevention through Design and Detailed Definition of the Input Data on the Basis of Occurred Accidents: Some Experiences at Italian Extractive Activities

Alberto Martinetti*[a], Mario Patrucco[a], Paola Molina[b] Raffaele Romano[b]

[a]Dipartimento di Ingegneria dell'Ambiente, del Territorio e delle Geotecnologie, Politecnico di Torino, Torino, Italy
[b]Servizio Tutela Ambientale, Provincia di Torino, Torino, Italy
alberto.martinetti@polito.it

The paper deals with the principia and results of a formalized approach in Prevention Through Design applied to a number of North Western Italian extractive activities. The goal of an effective occupational Risk Analysis and Management, coherent to the national enforcements of the European safety regulations for the exploitation plan and development, involves a pro-active approach. The statistical data confirms in fact that the extractive activities should be considered with special care, due to the impressive figures of work related accidents (in number and seriousness), and of the health impairments associated with the presence of quite noxious pollutants at the workplaces.
Taken into account on one hand the impressive developments in the geotechnics – geomechanic sciences, and in the mining techniques and technologies, and on the other hand the results of the recent epidemiologic surveys, in particular with reference to the possible criticality of the silica dust, a Prevention through Design approach appears to be the only solution to correctly manage the substantially modified overall safety situation.
Obviously, the availability of reliable input data drawn from occurred accidents is essential for the development of an exhaustive Risk Analysis and Management in the Prevention through Design pro-active approach. To overcome the physiological limits to the work related accidents available databases, and to get detailed information on the chain of intermediate events up to the root causes laying at the very base on an accident, a special technique was developed, useful also to pinpoint the safety measures necessary to prevent the accident. The characteristic of the technique and the possible results are discussed, together with the possibilities and advantages of its implementation in a computer assisted tool.

1. The occupational Safety and Health situation of the Italian extractive sector

In 2009, the Italian mineral industry reflected the conditions of the global recession showing severe decreases in the production of most mineral commodities.
The bentonite production fell by 48 %, granite production decreased by 31.8 %, and the estimated cement output decreased by about 15.5 % compared with that of 2008. Nitrogen production, however,

increased by 400 %, and there were also increases in the production of ball clay (81 %), salt (58 %), common clay (41.4 %), and silica sand (41.1 %) (Figure 1).

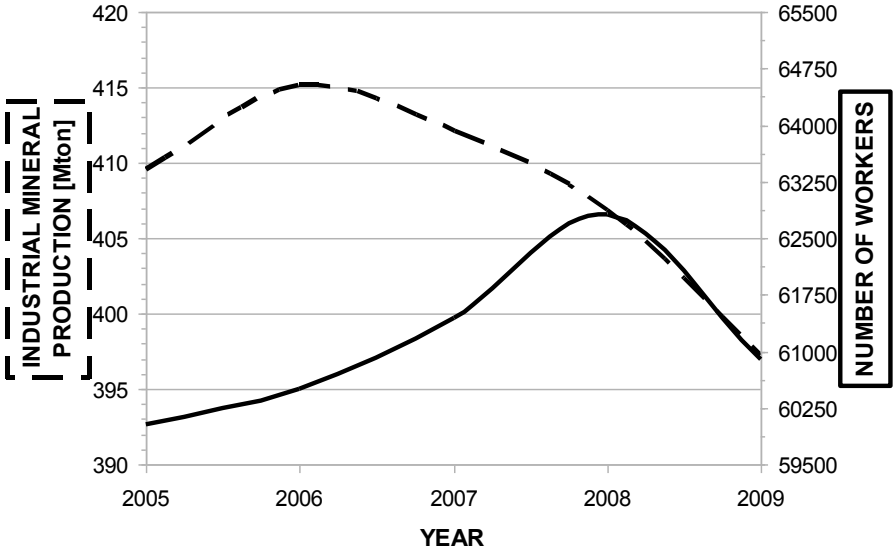

Figure 1: Industrial Mineral Production / Number of Workers in Mining sectors in Italy – INAIL/USGS data mean 2005-2009

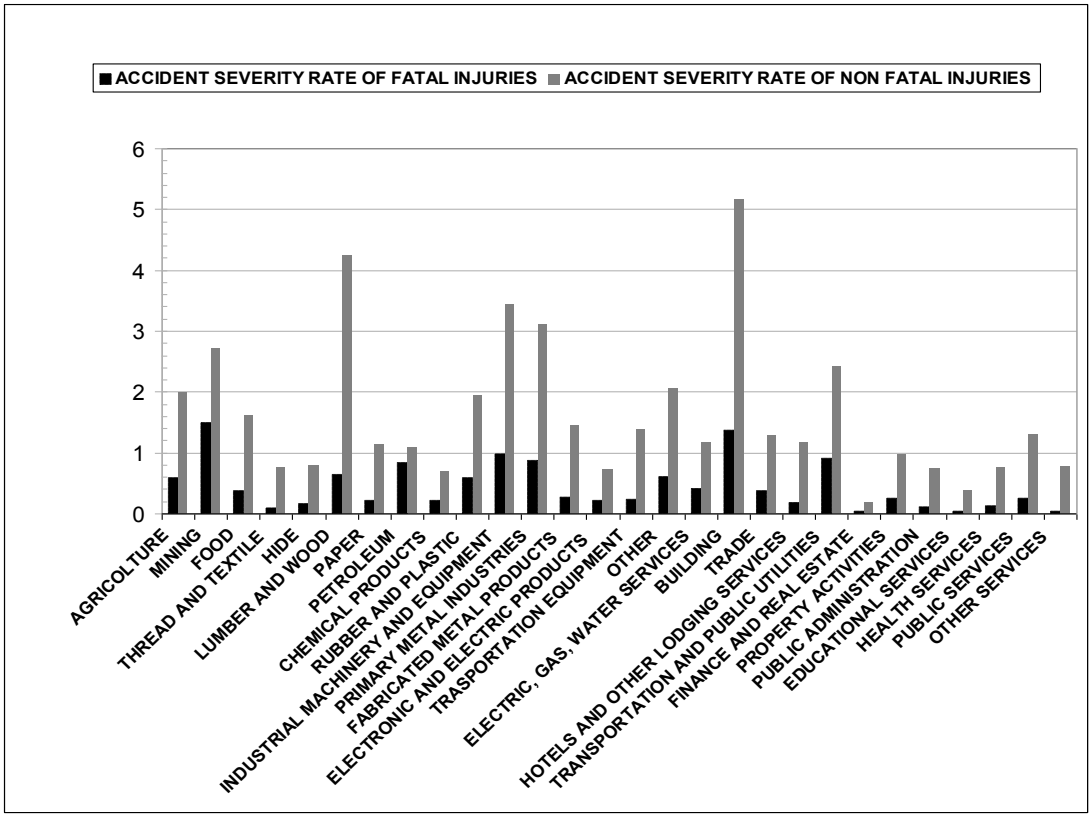

Figure 2: Accident Severity Rate of Fatal/NON Fatal injuries in Italy - INAIL data mean 2006 - 2008

With reference to the occupational level and the Safety and Health aspects, in Italy more than 60,000 workers are involved in the mineral production activities, and more than 1200 accidents were recorded each year (data from INAIL, 2009)
Even if the number of invalidating and fatal injuries and health impairments is apparently low if compared with the overall national data, the following charts confirm the paramount criticality of the considered industrial sector in terms of Safety and Health problems and in particular in terms of the Frequency Index values. Moreover the extractive activities are characterized by the typical problems both of the building and constructions sites sector and by the problems of the industrial sector; the resulting accident scenario to take into account it is certainly worthy of attention and must be properly analyzed in terms of frequency and severity index and not only in absolute numbers.

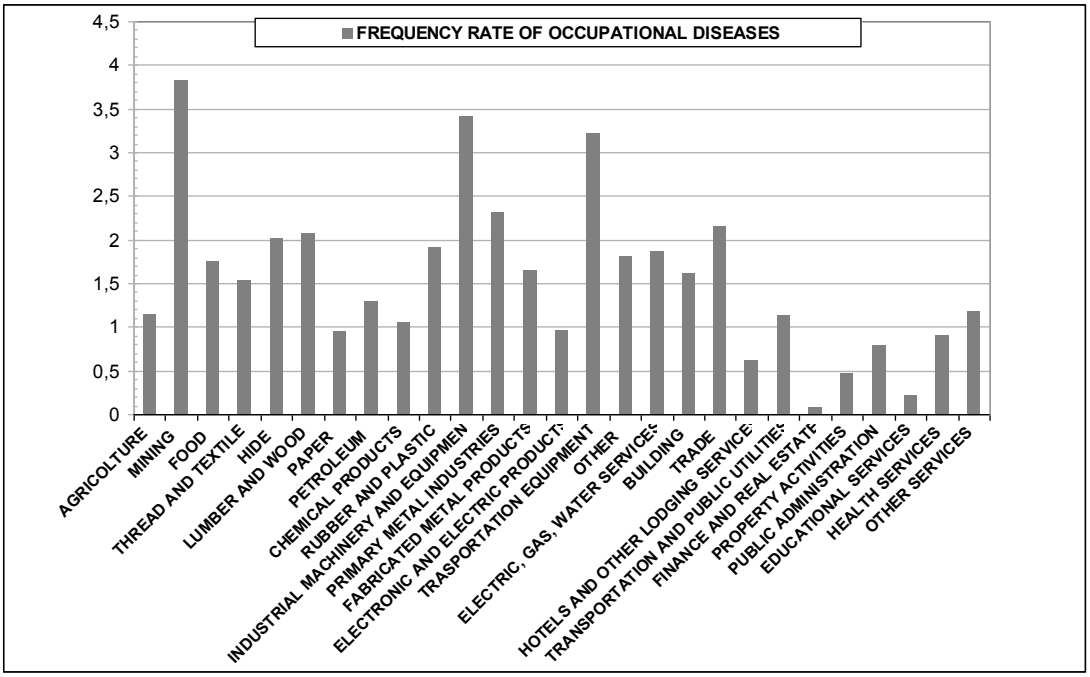

Figure 3: Frequency rate of occupational diseases for sectors in Italy - INAIL data mean 2006 - 2009

2. The approach to the problem in the Italian Safety & Health regulations

The Italian regulation on the safety and health of workers at work D.Lgs. 81/2008 (Italian Regulation, 2008), directly drawn from the 89/391 EEC Directive (EC, 1992a,b) on the measures to encourage improvements the safety and health actions, introduces the Risk Analysis as a mandatory task for the employer. Where the extractive operations are considered, taken into account their criticality in terms of accidents and of correlated health impairments, a special "daughter" regulation should be furthermore applied -derived from 92/91 and 92/104 EEC Directives (EC, 1992a) - which integrates the main directive statements with further detailed clauses, and imposes a special Safety and Health Document to be drawn and carefully kept up to date, covering the relevant requirements of Articles 6, 9 and 10 of the 89/391 EEC Directive (EC, 1992a,b).
It must be strongly underlined that, even if in the Italian enforcement of the 92/104 EEC Directive (EC, 1992a) is not included in the afore mentioned Safety and Health Document, the Safety and Health problems should be carefully considered from the very first phases of the activity design and must be set in force at the beginning of the exploitation activities, in coherence with the statements of art.6 (and in the corresponding National enforcement) of the afore mentioned 89/391 EEC Directive (EC, 1992a,b).
This is a substantial difference from the 92/57 EEC Directive (EC, 1992b), and from the corresponding National enforcement, on the implementation of minimum safety and health requirements at temporary

or mobile construction sites where along the design phases the PSC document (Safety and Health Plan) has to be drawn up with the safety analysis and followed by a final document. Even though the DSS (Safety and Health Document) corresponds formally to the POS (Safety and Health Plan at execution stage), the resulting situation being potentially confounding for some *self proclaimed* Risk Analyzers.
The special Italian regulation for extractive industries charges the Local Mining Inspectorates Offices of the task to verify both the mining plan, an official approval being required before the activity start up, and the Safety and Health Document, and to carry out routine inspections on the safety conditions at workplaces during the mining operations.
The previously mentioned Offices, in cooperation with the Politecnico di Torino, according to the articles 15, 17, 28, 29 of the D.Lgs. 81/08 (Italian Regulation, 2008), are starting to request a "preliminary hazard identification" to induce a more careful consideration during the activity design phase.

3. The computer assisted technique developed in cooperation with the Local Mining Inspectorates Offices

Taken into account the impressive developments in the techniques and technologies characterizing the modern extractive activities, and the results of the recent epidemiologic surveys, the task of an effective Risk Analysis, upon which the activity plan and management should be based, involves a pro-active approach. Only such an attitude makes possible to produce positive results, since slapdash remedies and occasional inspections are clearly inadequate to effectively highlight and control the underlying safety criticalities typical of a complex activity.
The paper discusses the approach according to the 92/104 EEC Directive (EC, 1992a), developed by the Department of Land, Environment and Geotechnologies of the Politecnico di Torino (where since more of 20 years important research work is being carried on Mining Safety and Health topics), based on the analysis of the several accidents occurred in metal and non metal activities and available on the internet site of the Provincia di Torino.

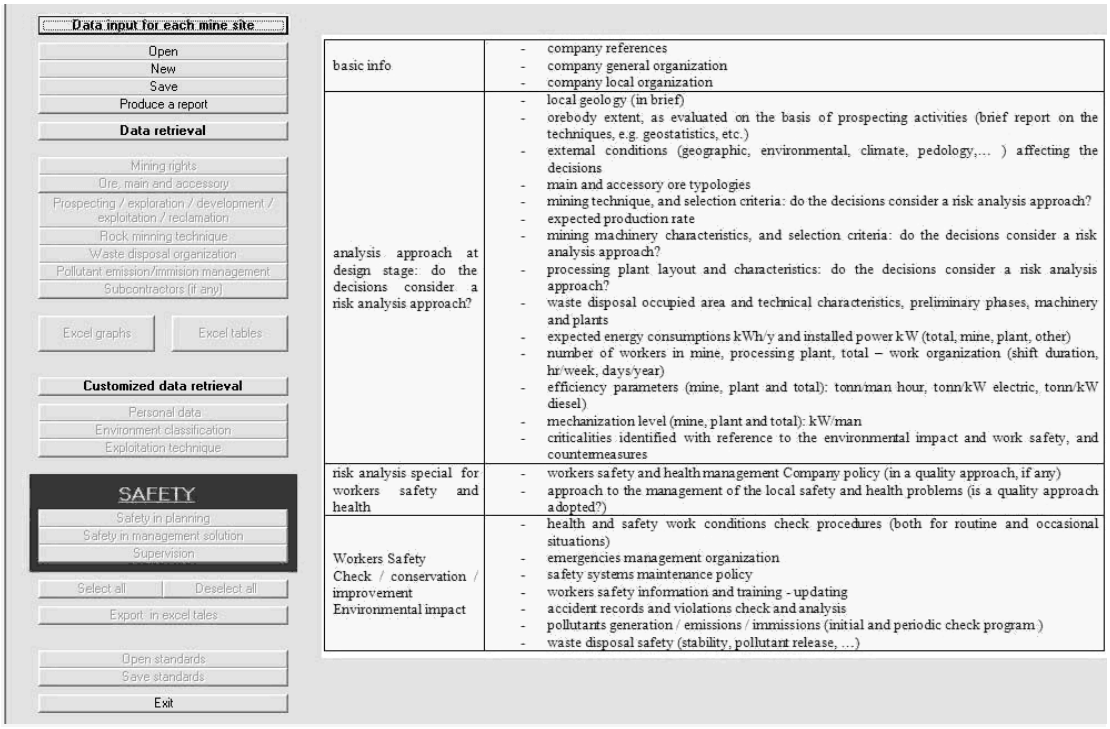

Figure 4: Data input features of the main input screen

The approach was substantially improved thanks to a computer assisted interactive technique, able to support the analysts -industrial technicians, consultants and inspectors- in the evaluation of both the general and special safety aspects, starting from the very first plan phase, up to the evolving development steps, taken into account the Risk Analysis improvements and revisions.
The following figures show the main screenshot of the data input and the data output. It must be underlined the free compilation system of the computer technique, the empty lines acting as a memo, so that they can be completed later, finally providing an exhaustive document suitable for the Official approval and the periodic revisions. A very interesting feature of the database is the updating through TCP/IP protocol: the main database resides on a main server, and users can add their own data to the archive. New entries, after a validation stage by the system operators, are finally added to the main database.

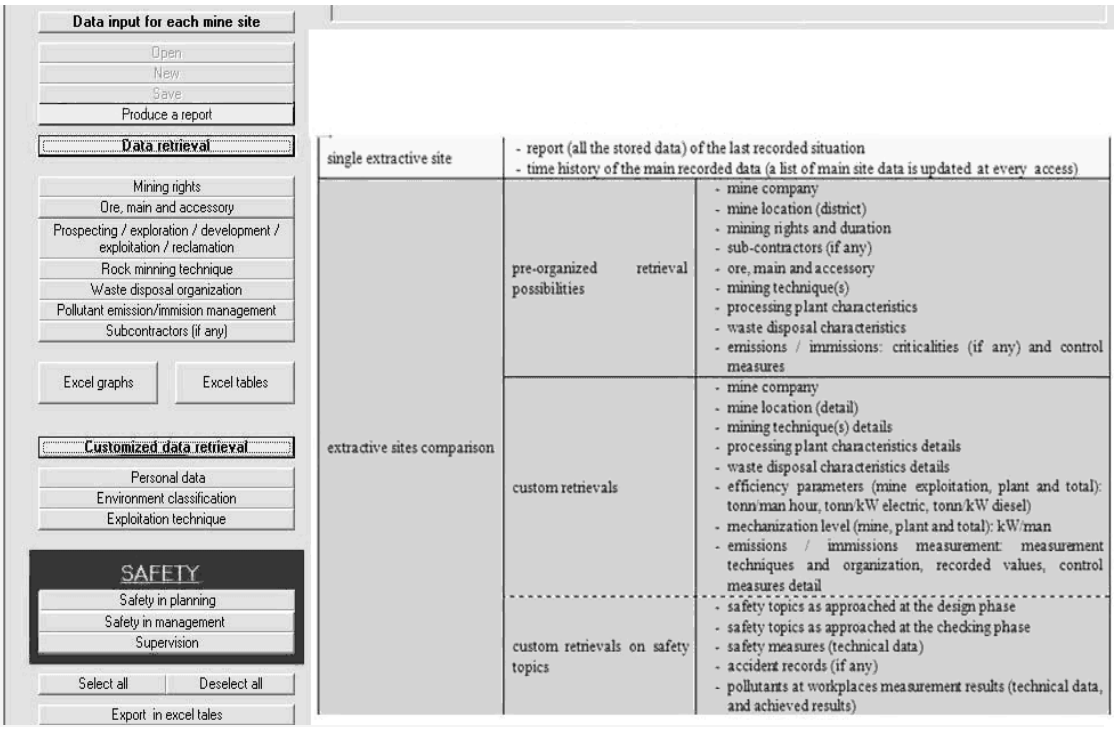

Figure 5: Data output features of the main output screen

The software proved effective to manage as many different analysis types as possible, in order to identify the administrative data, and the potentially critical working situations requiring a proactive workers safety approach, and careful safety management/improvement during the exploitation phases.
It has then been decided to develop such a package with Microsoft Visual Basic® 6.0 Professional, since many procedures, especially related to the high quality graphic output and to the available export procedures to standard data formats were already available, and this could significantly make our work faster, saving time that could profitably be spent in the data structure analysis. In addition, such an approach grants full compatibility with the Italian Public Administration existing data bases, so that information import and export are quite easy.
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4. Conclusion

The new Prevention Through Design in a pro-active approach cannot be suddenly established, it needs a sort of modulation in time according to a sustainable development modus operandi; moreover an effective result can be reached only by the cooperation of employers, safety analysts and inspectors and with the availability of reliable input data drawn from occurred accidents, essential for the development of an exhaustive Risk Analysis and Management. The authors are deeply convinced that, thanks to the user-friendly system and the exhaustive info available, it will become both an effective tool for the Mining Inspectorate to achieve both an objective evaluation of the safety approach of new projects submitted for approval, finally structured in a clear and comparable way, and a reference for the scheduling of the in field inspection activities, and a good reference for everyone involved both in the development of new extractive activities and in the correct management of the already in operation ones.

Furthermore, the technical, organizational and procedural solutions progressively introduced to improve the S&H conditions of workers at the workplaces, and to reduce the environmental impact of the extractive activities, can become as good practice references for similar situations, leading to a progressive reduction of work related injuries and health impairments.

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