Accidents at work in the period 2002-2011 in petrochemical sector workers: considerations on the phenomenon and preventive measures

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Summary

Background: in recent years, Italy has shown a reduction in the number of accidents as a whole, including fatal accidents. However, there are many factors that determine the frequency and severity of accidents: general economic conditions, technological innovation, rhythms and shift work, productive sector, company size, age of the workers, the task being performed, and others.

Objectives: the objective of this study is to examine the available data in the database INAIL on accidents that occurred in the period 2002-2011 in the petrochemical industry, to assess the possible risk factors for work-related injuries in this specific production sector, and any possible preventive measures.

Materials and Methods: the present study analyses the trend of injuries in workers in the petrochemical industry from 2002 to 2011, taking into account the number of events reported and recognized, the defined consequences, the geographical distribution and the task. To identify areas of research, we selected 11 classifications used by INAIL to determine rates of insurance premiums attributable to activities in the petrochemical industry (items 2191, 2193, 2194, 2195, 2196, 2197, 2154, 2145, 2141, 2146, 3620).

The risk of working in the petrochemical industry can be broadly divided into two categories: I) risk in refineries; II) risk in petrochemical complexes.

The occupational hazards in refineries depend substantially on flammability of materials; occupational hazards in the petrochemical complexes are more numerous, because of processes and classes of products that are characterized not only for flammability, but also for toxicity.

Results: the data from INAIL relating to the period 2002-2011 show a dramatic decline in the overall incidence of accidents, in cases defined as temporary and without permanent consequences. However, cases with permanent disability were up to 5%; cases with permanent disability were up to more than 5% and the fatal cases appear almost constant. Therefore, the preventive measures taken may have had some good results on the total number of accidents, but on the other hand, it is an almost constant trend of medium and serious injuries, and death.

Discussion: the data show that risks persist and are perhaps hardly capable of reduction for events with serious injury or death, probably related to the specific production circumstances. However, this could result from an underestimation of more minor injuries, not reported to INAIL.

Conclusions: the target remains an effective preventive action, in the context of a business inspired by the values of “social responsibility”, raising awareness among companies on the costs of lack of security and emphasizing the economic and social benefits linked to good policies of prevention.

KEY WORDS: petrochemical, risks of occupational injuries, preventive actions.

Background

The examination of accidents at work in Italy in recent years has shown a reduction in the overall number of work accidents, including fatal ones (1-3). However, there are many factors that affect the frequency and severity of accidents, in general. They are: 1) performance of the general economic situation; 2) rate of technological innovation and 3) working patterns and shift work; 4) the production sector; 5) size of the company; 6) age of workers; 7) task being performed; 8) the degree of employee involvement in preventative action; 9) the level of training / information for workers; 10) the degree of unionization; 11) season of the year; 12) day of the week and time of day; 13) Daylight Saving Time; 14) working conditions; 15) the presence of atypical workers and temporary workers; 16) the presence of foreign workers.
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**Objectives**

The aim of this paper is to examine the available data in the database INAIL on accidents that occurred in the period 2002-2011 in the petrochemical industry (1), in order to assess the possible risk factors for work-related injuries in this specific production sector, and any possible preventive measures (4).

**Materials and Methods**

In this study, we examined the workers employed in the petrochemical industry, using data derived not from ISTAT NACE codes, but by 11 codes used in the determination of insurance premium rates by INAIL (items 2191, 2193, 2194, 2195, 2196, 2197, 2154, 2145, 2146, 3620) in order to expand the number of employees (Tab. 1) (5, 6).

**Table 1 - Codes of rate of insurance premiums INAIL related to the petrochemical industry.**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>2191</td>
<td>Production of synthetic polymers and fibers (excluding the production of intermediates, for which v. Heading 2145, including any subsequent operations preparation of plastics: additives, dyes and pigments, stabilizers, plasticizers, etc.; mixing, compounding, granulation; etc.).</td>
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<tr>
<td>2193</td>
<td>Man-made textile fibers: fiber production and revenue of yarns.</td>
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<td>2194</td>
<td>Synthetic rubber: production of synthetic elastomers of general and special; synthetic latex.</td>
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<tr>
<td>2195</td>
<td>Processing of rubber, crude; manufacture of semi-finished articles and rubber or mainly in natural and synthetic rubber, manufacturing, retreading and rebuilding of tires, waterproof fabrics and coating of cables, ropes and cords, production of hard rubber, balata, gutta-percha and manufacturing of articles.</td>
</tr>
<tr>
<td>2196</td>
<td>Repair of items in natural and synthetic rubber (vulcanization, ancorizzazione, etc.; Including the possible convergence and balancing of wheels of vehicles, for the convergence v carried out in its own right. Heading 6412).</td>
</tr>
<tr>
<td>2197</td>
<td>Shaping and processing of synthetic resins and polymeric materials thermoplastic and thermoset; production of finished articles, semi-finished or detached parts anyway obtained (by extrusion, injection molding, sintering, thermoforming, calendering, block polymerization, polymerization and foaming, etc.), production of laminated phenolic, urea, etc. (even limited to certain stages of the technology cycle); recovery and recycling of plastics in general (only if run as processes in their own right); coating of cables, ropes and cables and other metal objects and not, production of cards, ribbons and magnetic discs and the like (including the possible production of metal molds, excluding the production of raw materials, for which v. heading 2191, and excluding also the work referred to in sub-5330); production of manufactured polymeric coating and coagulation: tele, polymer films, etc.; waterproofing fabrics, manufacture, in itself, of artifacts from composite materials with process in an open or closed molds molds, chassis and vehicle superstructures, tanks, conical structures, wavy, etc.; hulls for boats, ships and boats, sailboards, surf, etc. (for the preparation of means of transport v. entries 6411, 6421 and 6430 subgroup). Construction of artifacts with prevailing phases of assembly intermediates in polymer materials purchased from third parties (except those provided for in other tariff items).</td>
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<td>2154</td>
<td>Fertilizers of animal and vegetable origin (mixing, stabilization, humidification, drying). Fertilizers of mineral origin or synthetic (simple, complex, even with the addition of compounds of calcium and magnesium and/or microelements; including the production of ammonia, when used as a raw material in the production cycles of the operating unit, for the production of ammonia in v itself. Heading 2173; Excluding the production of calcium cyanamide, for which v. Heading 2181).</td>
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<tr>
<td>2145</td>
<td>Oil refining and petrochemical industry: distillation and refining of mineral oils, production of intermediates and derivatives (except for the production of synthetic resins for which v. Subgroup 2190). Degasolinaggio of methane (only if carried out in its own right).</td>
</tr>
<tr>
<td>2146</td>
<td>General (maintenance, storage and distribution of raw materials, wastewater treatment, laboratory quality control, surveillance and security services, fire protection, first aid, etc.). Provided by third parties, refining of mineral oil and/or manufacturing plants for subsequent processing of refinery products (excluding research laboratories for which v. Heading 0612). Production of electricity, deionized water, steam, oxygen and nitrogen and other similar substances of general necessity, carried out by third party, refining of mineral oil and/or for subsequent processing plants of refinery products (including any sales of utilities also to other industrial sectors).</td>
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<tr>
<td>3620</td>
<td>Plant industrial machinery, tanks, boilers, pressure vessels, motors, process columns, ovens, integrated processing lines, lifting and transport equipment and various equipment, pipes and tubing service and process, industrial electrical lighting, power and control systems, instrumentation, automation and alarm systems, industrial fire (for industrial plants in general, mills, factories, power plants, telegraph and telephone, radio and television stations and radio guide for radio-determination, stations and substations of transformation, conversion and cutting, pumping stations, pumping, storage, treatment and distribution of fluids, gas stations and fuel distribution stations ferrofilotranviarie, sea and air, weather stations, traffic lights, etc.). Lifts, elevators and the like. Works of insulation removal of industrial plants (only if made in their own right). Cleanup work, carried out in their own right, factories, workshops, factories, installations and industrial plants in general, including the transport of debris and waste materials (for carriage of its own v. Subgroup 9120).</td>
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</table>
The risk of working in the petrochemical industry can be divided into two categories:
I) risk in refineries;
II) risk in petrochemical complexes.
The occupational hazards in refineries depend substantially on the flammability of treated materials; occupational hazards in the petrochemical complexes are more numerous, because of power, processes and classes of products that are characterized not only by the flammability but also from toxicity. The risk may be due in part to the aging of the plant (with a significant number of accidents caused by broken or leaky pipes, risk of fire and/or explosion); anomalies during start-ups or building projects, natural events; catastrophic events. For the refinery plant, process risk analysis starts from the planning stage, spreads throughout all stages of operating, ending with the decommissioning (permanent deactivation) and takes account of accidental events that can be grouped into the following categories: emissions and dispersion of toxic gases and vapours and/or flammable material, fire, explosion, pollution (release of hazardous material into the environment). The trend of accidents in the petrochemical industry over the years would have shown, according to forecasts dating back to 2004, a positive trend due to the adoption of safety management systems in high-risk facilities that would offset the adverse effects on safety due to more demanding operating conditions, necessitated by the new demands of the market which requires increased productivity and more variety in products.

Results

The data relating to the period INAIL 2002-2011 show an important decline in the overall incidence of accidents in cases defined as temporary and without permanent consequences, and cases with permanent disability are up to 5%; almost constant is the number of cases defined with permanent disability at more than 5%, and fatality cases (1, 2). Therefore, the preventive measures taken may have produced some good results on the total number of accidents but on the other hand, it is an almost constant trend in medium to serious injuries and death (Figs. 1-5).
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Figure 3 - Accidents at work compensated by INAIL in the petrochemical industry for spatial distribution years 2002-2011. It is noted that the majority of events compensated are concentrated in 4 regions (Piemonte, Lombardia, Veneto, Emilia Romagna).

Figure 4 - Accidents at work reported to INAIL in the petrochemical industry in the period 2002 - 2011 in 4 regions with the highest injury rates (Piemonte, Lombardia, Veneto, Emilia Romagna).

Figure 5 - Percentage distribution of occupational accidents in the petrochemical industry reported to INAIL by occupation - Three-year period: 2009-2011. It shows the figure of 28.7% classified under “other” because of the difficulty in classifying certain tasks.
Discussion

What can be the determining factors behind the stability in the number of serious and fatal accidents in the petrochemical industry? This might mean that, in a situation of global effective preventive action that has certainly been beneficial, risks still persist (which are perhaps difficult to avoid) of events that may result in death or serious injury, probably related to the specific sector of production; however, the data relating to minor injury could result from an underestimation of less serious injuries which may not all be reported to INAIL.

Conclusions

The target remains an effective action for prevention, in the context of a business inspired by the values of “social responsibility”, raising awareness among companies on the costs attributed to lack of safety and emphasizing the economic and social benefits linked to good policies for prevention. For preventive purposes, to better represent the reality of this specific production sector, in the future separate area identifications could be adopted: 1) refinery, in order to consolidate the already acquired capacity for prevention; 2) the so-called petrochemical activity, where there are more difficulties and shortcomings in the knowledge of workplace risks, given the speed and complexity of its evolution.

References

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