Chemical accident risks in Europe and beyond – Where are we now? [1]

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Society is becoming increasingly risk-averse and failure is less readily tolerated. There are indications that the frequency of serious chemical accidents is higher than expected in many industrialized countries. In 2015 the number of deaths from major accidents on the ~10,000 EU Seveso sites is already estimated to be at least 15. This statistic, if confirmed, means that the frequency of 1 fatality on a major hazard site in the European Union was as high as 1.5 X 10-3, that is, at least 3 orders of magnitude higher than would be considered acceptable in many EU countries. In 2013 the President of the United States issued an Executive Order to improving chemical facility safety and security following various high profile chemical accidents. In other major industrialized countries, such as China and Brazil, in recent years that chemical accident frequency and severity is approaching, or has approached unacceptable levels.

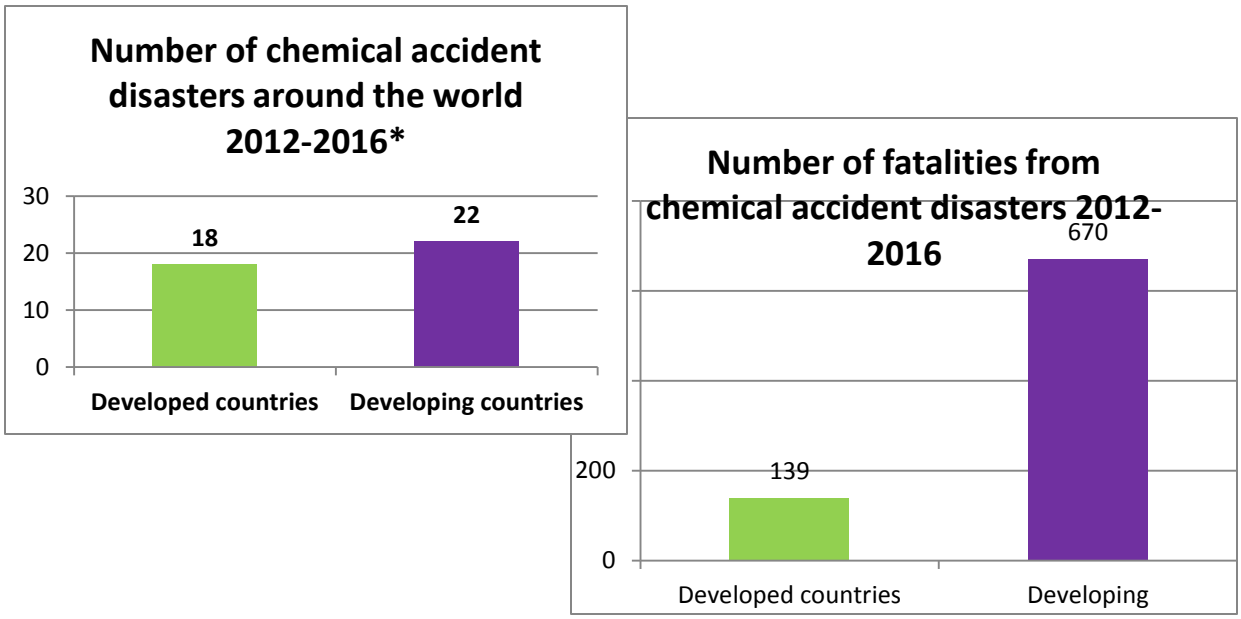

Figure 1: Developed and developing countries have the same number of disasters. Developing countries are causing far more fatalities. Developed country disasters have reduced human exposure to the worst impacts, but still have other high costs.

[1] This paper summarizes two studies that will be published in 2017 Science (and technology) for Disaster Risk Management,

- "State of the Science" subchapter on chemical accident disaster risks (2017). (An EU contribution to the Sendai Framework for Chemical Accident Risk Reduction)
- Chemical accident disasters around the world 2012-2016, Publication TBD (2017)

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Reflection on the underlying causes

A number of underlying causes in society and large organisations have emerged from studying collective findings from reports of chemical accidents occurring in the last several years. Sites can be affected by just one or several of these underlying causes can work in combination to create conditions conducive to disaster.

Lack of visibility. A paucity of chemical accident data and inconsistent media attention has exacerbated the lack of interest in reducing chemical accident risks in recent decades

Failure to manage across boundaries. The failure to see beyond one's own boundaries fosters a piecemeal approach to risk management and results in lost opportunities in sharing lessons learned and developing strategies that address site-specific needs.

Failing to learn lessons from past accidents and near misses. There is substantial evidence that neither government nor public authorities are sufficiently learning from past accidents. Even when problems are recognized, the failure to learn leads to inappropriate solutions.

Social drivers. Both good and bad intentions can interfere with good risk decisions. For example, employees will tolerate bad conditions because they need jobs. Similarly, well-intentioned operators may delay maintenance and repairs on aging sites. Economic and civil instability and a combination of long-standing cultural and structural deficiencies are a particular concern of developing countries.

Economic trends. Instability in management and in business continuity has a knock-on effect on all aspects of risk management. In some situations, poor profit margins impose difficult decisions on various operations in terms of defining safety priorities when resources are stretched thin.

Increasing complexity. In current times, change occurs faster than the knowledge to understand how the change is affecting different aspects of our lives, including habits of living and working, but also political, commercial and economic dimensions. Modern trends such as wireless and automation technologies and frequent company reorganizations and ownership changes are having significant consequences on safety and security, whose long term impacts are still not fully understood.

Failure to apply risk management knowledge. Numerous accident studies indicate failure to apply the most well-known principles of the safety management system, even on well-resourced sites where staff are trained to be risk aware.

Disconnected risk decision-making. The globalization of hazardous industries has increased both the physical and mental distance between headquarters and the sites they manage. Headquarters staff lose a tactile understanding of how sites are experiencing chemical accident risks. Corporate leaders tend to over simplify risks and the trend towards short-term resource optimization continues to have disturbing implications for chemical risk management.

Insufficient risk communication and awareness. Hazardous industries are introduced in locations with little attempt to communication and build awareness of the risks, to foster meaningful preparedness

and planning, or ensure that training and expertise are adequate to the responsibilities associated with the risk.

Resource and infrastructure deficiencies. Many sites are compelled by a combination of circumstances and poor decisions to operate with less than adequate resources and infrastructure especially in terms of competence and mechanical integrity.

Deficiencies of the legal infrastructure. The legal framework may not exist or fail to fully foresee high risks. When a proper legal framework exists, regulators and operators may often lack the competence and resources to understand or enforce it.

Complacency in government and industry. The longevity of chemical accident prevention and preparedness regimes in developed countries also leads many politicians and industry leaders to reduce their attention to chemical accident risks, threatening to undermine decades of risk reduction progress. The perception that chemical accidents are no longer a threat eventually results in dramatic decreases in resources for enforcement and risk management.

Implications for scientific study in future

The main topics that emerge as areas for further study and experimentation for years to come are listed and described below.

Approaches that promote good risk governance

Motivating corporate and government leadership. New models for governance of hazardous industries should be explored and tested.

Systematic accident reporting, data collection and exchange. The availability of reliable chemical accident statistics will allow academics, politicians and the media to understand the magnitude and nature of chemical accident risks and identify appropriate risk reduction measures.

Promoting positive safety culture. Psychologists should work with industry and government to foster risk awareness and sensitivity among citizens. An informed safety-sensitive society can help support a broader mandate to insist that companies to exercise greater corporate responsibility for reducing the risks associated with their operations.

Risk management in SMEs in the chemical business. More study is needed on why SMEs have accidents, including geographic and economic differences that may influence these risks, and on strategies to reduce them.

Risk management in non-chemical businesses. Studies to develop strategies and guidance to support risk management in many of these industries are still needed

Business sector reduction initiatives on a global scale. Oil and gas, extractive industries, industrial parks, large scale chemical production should be the focus of a global collaborative effort between industry, government and aid organisations to reduce chemical accidents in these industries.

Reducing the most common violations of safety management principles

Mechanical integrity. The underlying causes should be studied and new approaches adopted that provide stronger motivation, including risk assessment requirements and government-operator interfaces for reinforcing mechanical integrity as an operating requirement.

Management of change. Finding methods that help companies and individuals to recognise change when a change can elevate risk is an important part of resilience engineering .

Learning lessons from accidents and failures. A greater investment is needed in projects to develop strategies to learn and remember, with a particular emphasis on industry/ government /academia collaborations.

Mechanisms and tools to address deficiencies in competence

Greater access to risk management knowledge and tools. Considerable future mechanisms are needed to make good management practice for all kinds of operations and equipment available.

Access to risk assessment competence. Both operators of hazardous sites and the regulators need to know the type and severity of accidents that could occur and a realistic understanding of the control measures needed to ensure that the risk of such accidents is minimized.

Strategies for reducing chemical accident risks in developing countries.

Long term investment and commitment to chemical risks in developing countries. Current efforts are underfunded and far too fragmented to have significant impacts, despite smart management and promising results from recent initiatives. Meaningful progress is only possible with substantial commitments from the most powerful international development organisations.

Resilience and risk awareness building. There has been considerable success with stakeholder involvement approaches such as UNEP APELL to manage risks at a local level within a systemic national and international regional strategy. A clear next step is to identify and to deploy mechanisms to provide significant and sustained support to countries ready to take big steps towards establishing such programmes.

Fostering regional and international networks and collaborations on chemical accident risk management. A critical mass of policy and technical initiatives at both regional and international level creating a constant pressure and giving developing countries easy access to expertise and technical support is a way to establish a new norm.

Improving performance measures for interventions. Further refinement and testing of capacity building performance indicators, and methods for qualitative assessment (e.g., level of political will, key drivers of change) can lead to better targeting of such initiatives.