

Chapter 49

Industry Process Safety: Major Accident Risk Assessment

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ABSTRACT

This chapter deals with the issue of process safety in industrial companies and major accident prevention. In the present-day technologically advanced world, industrial accidents appear ever more frequently, and the field of major accident prevention has become a dynamically developing discipline. With accelerating technical progress, risks of industrial accidents are to be reduced. In the first part, possible approaches to quantitative risk assessment are presented; and continuing it focuses on the system of risk management in industrial establishments. This chapter aims at providing experiences, knowledge, as well as new approaches to the prevention of major accidents caused by the implementation of the Seveso III Directive.

INTRODUCTION

In the past and also recently, major accidents have represented, owing to their consequences on human health, property and the environment, important events that should be avoided. The need to assess objectively the risk, to which employees or populations are exposed in connection with the production, processing, storage and transport of hazardous materials, appears. What will enable the regulation or management of risks to employees and the surrounding environment is only adequate evaluation.

The aim of major risk prevention is to operate process installations at an acceptable societal level. Risk acceptability limits can differ depending on the maturity of the state, the size of establishments and a number of other factors that must be, however, included into the analysis and assessment of risks.

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The chapter describes benefits of carrying out the risk assessment. The results of risk assessment brings information on the identification of hazards to possible targets of impact; the targets can be employees and installations of the establishment, the surrounding human population and the environment. Risk assessment presents information on possible preventive means and risk reduction priorities. Results of analysis assess preparedness for accidents and it is a source of information for emergency plan preparation.

The area of major accident prevention represents a relatively new branch of science. Nevertheless, transportation accident prevention requirements are an outgrowth of this branch. The first approach is to evaluate stationary risk sources with the largest amount of dangerous substances. However, dangerous substances limits have been decreased (amendments of Seveso Directives) and current attention was moved to so called “unclassified risk sources” and to mobile risk sources. Greater and greater amounts of dangerous substances are transported by road and rail. A growing interest in the subject area is also related to the threat of terrorist actions, possibly involving the stationary risk sources or the transport of dangerous substances.

The objectives of the chapter are to promote area of process safety for prevention of industrial accident.

BACKGROUND

Process safety focuses on preventing fires, explosions and accidental chemical releases in chemical process facilities or other facilities dealing with hazardous materials. Process safety considers a wide range of technical, management and operational disciplines coming together in an organized way. Main focus is on design and engineering of facilities, maintenance of equipment, effective alarms, effective control points, procedures and training. Process safety generally refers to the prevention of unintentional releases of chemicals, energy, or other potentially dangerous materials during the course of chemical processes. The consequences of so call major-accident can have a serious effect to the plant and environment.

By Seveso III Directive (Seveso, 2012) ‘major accident’ means an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment covered by this Directive, and leading to serious danger to human health or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances.

In the world, a number of major accidents have occurred; to the best known of them, FEYZIN (France – 1966), FLIXBOROUGH (Great Britain – 1974), SEVESO (Italy – 1976), BHÓPÁL (India – 1984), HOUSTON (USA – 1989), and others belong. The majority of significant accidents are described in the specialized literature in detail, see e.g. (Lees, 2005). Information on major accidents taking place in the countries of European Union is collected in the Joint Research Centre, MAHB (Major Accident Hazards Bureau) in Italian Ispra. The Major Accident Reporting System (eMARS) was established to handle the information on major accidents submitted by Member States of the European Union to the European Commission in accordance with the provisions of the Seveso Directive (eMars, 2019). Currently, eMARS holds data on more than 980 major accident events (by September 2019, see Figure 1).

In some countries, statistics on accidents involving the transport of dangerous substances are recorded. For example, in the U.S. Department of Transportation (DOT), PHMSA - the Pipeline and Hazardous Materials Safety Administration has public responsibility for the safe and secure movement of hazardous materials to industry and consumers by all transportation modes. Argonne National Laboratory (ANL, 2000) also reports on transport risk in the USA. The purpose of this National Transportation Risk As-

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