

Hazard and operability studies (HAZOP studies) — Application guide

ICS 29.020

National foreword

This British Standard reproduces verbatim IEC 61882:2001 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee DS/1, Dependability and terotechnology, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

Cross-references

The British Standards which implement international publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard, having been prepared under the direction of the Management Systems Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee and comes into effect on 28 August 2001

Summary of pages

This document comprises a front cover, an inside front cover, the IEC title page, pages 2 to 57, and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

© BSI 28 August 2001

ISBN 0 580 37625 7

**NORME
INTERNATIONALE
INTERNATIONAL
STANDARD**

**CEI
IEC**

61882

Première édition
First edition
2001-05

**Etudes de danger et d'exploitabilité
(études HAZOP) –
Guide d'application**

**Hazard and operability studies
(HAZOP studies) –
Application guide**



Numéro de référence
Reference number
CEI/IEC 61882:2001

CONTENTS

FOREWORD	4
INTRODUCTION	5
1 Scope	6
2 Normative references.....	6
3 Definitions	6
4 Principles of HAZOP	7
4.1 Overview	7
4.2 Principles of examination.....	10
4.3 Design representation.....	11
4.3.1 General.....	11
4.3.2 Design requirements and design intent	12
5 Applications of HAZOP	12
5.1 General	12
5.2 Relation to other analysis tools	13
5.3 HAZOP limitations	13
5.4 Hazard identification studies during different system life cycle phases.....	14
5.4.1 Concept and definition phase.....	14
5.4.2 Design and development phase	14
5.4.3 Manufacturing and installation phase	14
5.4.4 Operation and maintenance phase.....	14
5.4.5 Decommissioning or disposal phase	15
6 The HAZOP study procedure	15
6.1 Initiation of the study	15
6.2 Definition of scope and objectives of the study	15
6.2.1 Scope of the study	15
6.2.2 Objectives of the study.....	15
6.3 Roles and responsibilities	16
6.4 Preparatory work	17
6.4.1 General.....	17
6.4.2 Design description	18
6.4.3 Guide words and deviations	18
6.5 The examination	19
6.6 Documentation	23
6.6.1 General.....	23
6.6.2 Styles of recording.....	23
6.6.3 Output of the study	23
6.6.4 Reporting requirements.....	24
6.6.5 Signing off the documentation.....	24
6.7 Follow-up and responsibility.....	24
7 Audit.....	25

Annex A (informative) Methods of reporting	26
A.1 Reporting options	26
A.2 HAZOP worksheet	26
A.3 HAZOP study report	27
Annex B (informative) Examples of HAZOP	28
B.1 Introductory example	28
B.2 Procedures	34
B.3 Automatic train protection system	38
B.3.1 The application	38
B.4 Example involving emergency planning	41
B.5 Piezo valve control system	46
B.6 Oil vaporizer	52
Bibliography	57
Table 1 – Basic guide words and their generic meanings	10
Table 2 – Guide words relating to clock time and order or sequence	11
Table 3 – Examples of deviations and their associated guide words	19
Table B.1 – Example HAZOP worksheet for introductory example	30
Table B.2 – Example HAZOP worksheet for procedures example	35
Table B.3 – Example HAZOP worksheet for automatic train protection system	39
Table B.4 – Example HAZOP worksheet for emergency planning	42
Table B.5 – Example HAZOP worksheet for piezo valve control system	49
Table B.6 – Example HAZOP worksheet for oil vaporizer	53
Figure 1 – The HAZOP study procedure	9
Figure 2a – Flow chart of the HAZOP examination procedure – Element first sequence	21
Figure 2b – Flow chart of the HAZOP examination procedure – Guide word first sequence	22
Figure B.1 – Simple flow sheet	29
Figure B.2 – Train-carried ATP equipment	38
Figure B.3 – Piezo valve control system	47
Figure B.4 – Oil vaporizer	52

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HAZARD AND OPERABILITY STUDIES (HAZOP STUDIES) –
APPLICATION GUIDE**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61882 has been prepared by IEC technical committee 56: Dependability.

The text of this standard is based on the following documents:

FDIS	Report on voting
56/731/FDIS	56/733/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes A and B are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

INTRODUCTION

The purpose of this standard is to describe the principles and procedures of Hazard and Operability (HAZOP) Studies. HAZOP is a structured and systematic technique for examining a defined system, with the objective of:

- identifying potential hazards in the system. The hazards involved may include both those essentially relevant only to the immediate area of the system and those with a much wider sphere of influence, e.g. some environmental hazards;
- identifying potential operability problems with the system and in particular identifying causes of operational disturbances and production deviations likely to lead to non-conforming products.

An important benefit of HAZOP studies is that the resulting knowledge, obtained by identifying potential hazards and operability problems in a structured and systematic manner, is of great assistance in determining appropriate remedial measures.

A characteristic feature of a HAZOP study is the "examination session" during which a multi-disciplinary team under the guidance of a study leader systematically examines all relevant parts of a design or system. It identifies deviations from the system design intent utilizing a core set of guide words. The technique aims to stimulate the imagination of participants in a systematic way to identify hazards and operability problems. HAZOP should be seen as an enhancement to sound design using experience-based approaches such as codes of practice rather than a substitute for such approaches.

There are many different tools and techniques available for the identification of potential hazards and operability problems, ranging from Checklists, Fault Modes and Effects Analysis (FMEA), Fault Tree Analysis (FTA) to HAZOP. Some techniques, such as Checklists and What-If/analysis, can be used early in the system life cycle when little information is available, or in later phases if a less detailed analysis is needed. HAZOP studies require more details regarding the systems under consideration, but produce more comprehensive information on hazards and errors in the system design.

The term HAZOP has been often associated, in a generic sense, with some other hazard identification techniques (e.g. checklist HAZOP, HAZOP 1 or 2, knowledge-based HAZOP). The use of the term with such techniques is considered to be inappropriate and is specifically excluded from this document.

Before commencing a HAZOP study, it should be confirmed that it is the most appropriate technique (either individually or in combination with other techniques) for the task in hand. In making this judgement, consideration should be given to the purpose of the study, the possible severity of any consequences, the appropriate level of detail, the availability of relevant data and resources.

This standard has been developed to provide guidance across many industries and types of system. There are more specific standards and guides within some industries, notably the process industries where the technique originated, which establish preferred methods of application for these industries. For details see the bibliography at the end of this text.

HAZARD AND OPERABILITY STUDIES (HAZOP STUDIES) – APPLICATION GUIDE

1 Scope

This International Standard provides a guide for HAZOP studies of systems utilizing the specific set of guide words defined in this document. It also gives guidance on application of the technique and on the HAZOP study procedure, including definition, preparation, examination sessions and resulting documentation and follow-up.

Documentation, as well as a broad set of examples encompassing various industries, illustrating HAZOP examination is also provided.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60300-3-9, *Dependability management – Part 3: Application guide – Section 9: Risk analysis of technological systems*

IEC 60812, *Analysis techniques for system reliability – Procedure for failure mode and effects analysis (FMEA)*

IEC 61025, *Fault tree analysis (FTA)*

IEC 61160, *Formal design review*

3 Definitions

For the purposes of this International Standard, definitions contained in IEC 60050(191) as well as the following terms and definitions apply:

3.1

characteristic

qualitative or quantitative property of an element

NOTE Examples of characteristics are pressure, temperature, voltage.

3.2

design intent

designer's desired, or specified range of behaviour for elements and characteristics

3.3**deviation**

departure from the design intent

3.4**element**

constituent of a part which serves to identify the part's essential features

NOTE The choice of elements may depend upon the particular application, but elements can include features such as the material involved, the activity being carried out, the equipment employed, etc. Material should be considered in a general sense and includes data, software, etc.

3.5**guide word**

word or phrase which expresses and defines a specific type of deviation from an element's design intent

3.6**harm**

physical injury or damage to the health of people or damage to property or the environment

3.7**hazard**

potential source of harm

3.8**part**

section of the system which is the subject of immediate study

NOTE A part may be physical (e.g. hardware) or logical (e.g. step in an operational sequence).

3.9**risk**

combination of the probability of occurrence of harm and the severity of that harm

4 Principles of HAZOP**4.1 Overview**

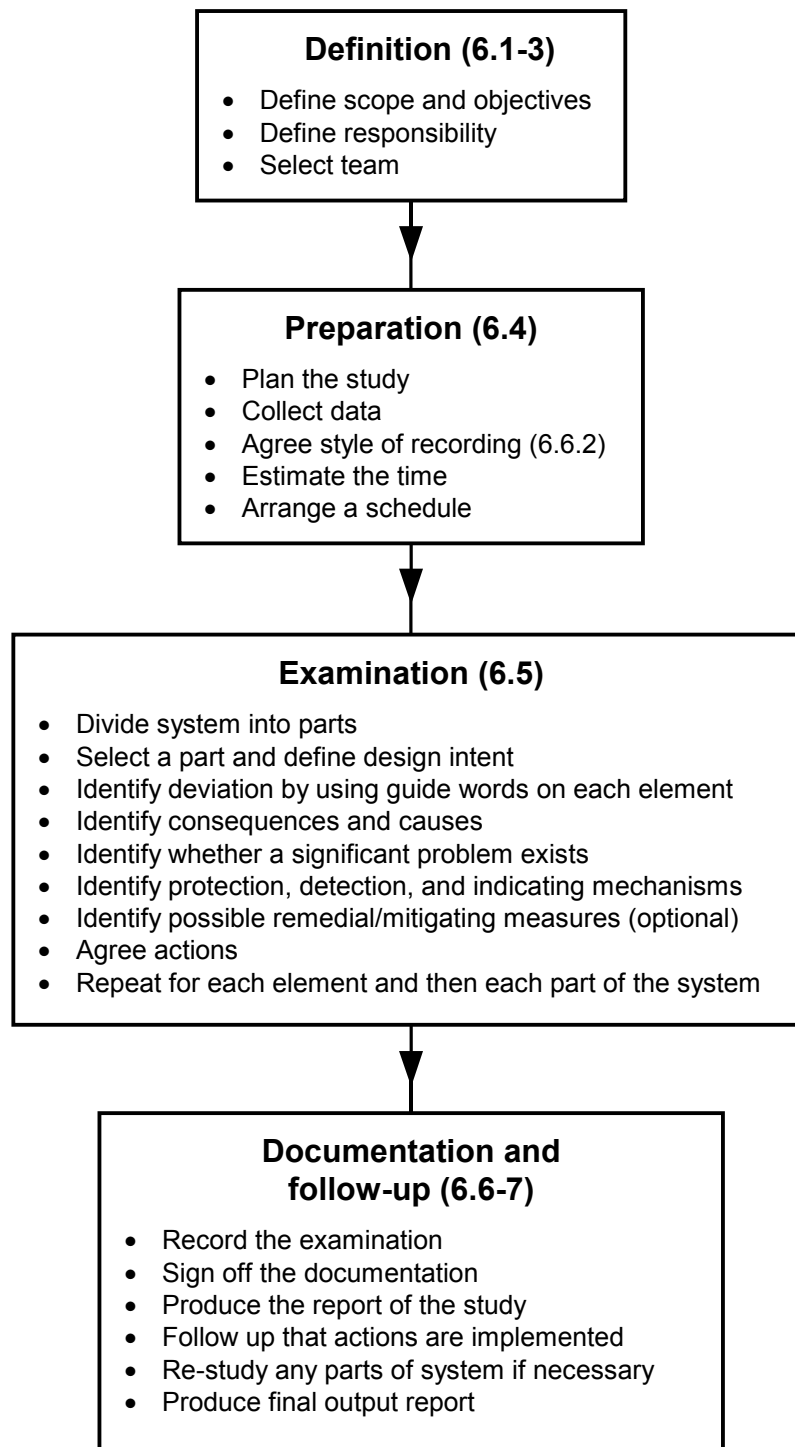
A HAZOP study is a detailed hazard and operability problem identification process, carried out by a team. HAZOP deals with the identification of potential deviations from the design intent, examination of their possible causes and assessment of their consequences.

Key features of HAZOP examination include the following.

- The examination is a creative process. The examination proceeds by systematically using a series of guide words to identify potential deviations from the design intent and employing these deviations as "triggering devices" to stimulate team members to envisage how the deviation might occur and what might be the consequences.
- The examination is carried out under the guidance of a trained and experienced study leader, who has to ensure comprehensive coverage of the system under study, using logical, analytical thinking. The study leader is preferably assisted by a recorder who records identified hazards and/or operational disturbances for further evaluation and resolution.

- The examination relies on specialists from various disciplines with appropriate skills and experience who display intuition and good judgement.
- The examination should be carried out in a climate of positive thinking and frank discussion. When a problem is identified, it is recorded for subsequent assessment and resolution.
- Solutions to identified problems are not a primary objective of the HAZOP examination, but if made they are recorded for consideration by those responsible for the design.

HAZOP studies consist of four basic sequential steps, shown in Figure 1.



IEC 450/01

Figure 1 – The HAZOP study procedure

4.2 Principles of examination

The basis of HAZOP is a “guide word examination” which is a deliberate search for deviations from the design intent. To facilitate the examination, a system is divided into parts in such a way that the design intent for each part can be adequately defined. The size of the part chosen is likely to depend on the complexity of the system and the severity of the hazard. In complex systems or those which present a high hazard the parts are likely to be small. In simple systems or those which present low hazards, the use of larger parts will expedite the study. The design intent for a given part of a system is expressed in terms of elements which convey the essential features of the part and which represent natural divisions of the part. The selection of elements to be examined is to some extent a subjective decision in that there may be several combinations which will achieve the required purpose and the choice may also depend upon the particular application. Elements may be discrete steps or stages in a procedure, individual signals and equipment items in a control system, equipment or components in a process or electronic system, etc.

In some cases it may be helpful to express the function of a part in terms of:

- the input material taken from a source;
- an activity which is performed on that material;
- a product which is taken to a destination.

Thus the design intent will contain the following elements: materials, activities, sources and destinations which can be viewed as elements of the part.

Elements can often be usefully defined further in terms of characteristics which can be either quantitative or qualitative. For example, in a chemical system, the element “material” may be defined further in terms of characteristics such as temperature, pressure and composition. For the activity “transport”, characteristics such as the rate of movement or the number of passengers may be relevant. For computer-based systems, information rather than material is likely to be the subject of each part.

The HAZOP team examines each element (and characteristic, where relevant) for deviation from the design intent which can lead to undesirable consequences. The identification of deviations from the design intent is achieved by a questioning process using predetermined “guide words”. The role of the guide word is to stimulate imaginative thinking, to focus the study and elicit ideas and discussion, thereby maximizing the chances of study completeness. Basic guide words and their meanings are given in Table 1.

Table 1 – Basic guide words and their generic meanings

Guide word	Meaning
NO OR NOT	Complete negation of the design intent
MORE	Quantitative increase
LESS	Quantitative decrease
AS WELL AS	Qualitative modification/increase
PART OF	Qualitative modification/decrease
REVERSE	Logical opposite of the design intent
OTHER THAN	Complete substitution

Additional guide words relating to clock time and order or sequence are given in Table 2.

Table 2 – Guide words relating to clock time and order or sequence

Guide word	Meaning
EARLY	Relative to the clock time
LATE	Relative to the clock time
BEFORE	Relating to order or sequence
AFTER	Relating to order or sequence

There are a number of interpretations of the above guide words. Additional guide words may be used to facilitate identification of deviation. Such guide words may be used provided they are identified before the examination commences. Having selected a part for examination, the design intent of that part is broken into separate elements. Each relevant guide word is then applied to each element, thus a thorough search for deviations is carried out in a systematic manner. Having applied a guide word, possible causes and consequences of a given deviation are examined and mechanisms for detection or indication of failures may also be investigated. The results of the examination are recorded to an agreed format (see 6.6.2).

Guide word/element associations may be regarded as a matrix, with the guide words defining the rows and the elements defining the columns. Within each cell of the matrix thus formed will be a specific guide word/element combination. To achieve a comprehensive hazard identification, it is necessary that the elements and their associated characteristics cover all relevant aspects of the design intent and guide words cover all deviations. Not all combinations will give credible deviations, so the matrix may have several empty spaces when all guide word/element combinations are considered.

There are two possible sequences in which the cells of the matrix can be examined, namely column by column, i.e. *element first*, or row by row, i.e. *guide word first*. The details of examination are outlined in 6.5 and both sequences of examination are illustrated in Figures 2a and 2b. In principle the results of the examination should be the same.

4.3 Design representation

4.3.1 General

An accurate and complete design representation of the system under study is a prerequisite to the examination task. A design representation is a descriptive model of the system adequately describing the system under study, its parts and elements, and identifying their characteristics. The representation may be of the physical design or of the logical design and it should be made clear what is represented.

The design representation should convey the system function of each part and element in a qualitative or quantitative manner. It should also describe the interactions of the system with other systems, with its operator/user and possibly with the environment. The conformance of elements or characteristics to their design intent determines the correctness of operations and in some cases the safety of the system.

The representation of the system consists of two basic parts:

- the system requirements;
- a physical and/or logical description of the design.

The resulting value of a HAZOP study depends on the completeness, adequacy and accuracy of the design representation including the design intent. Care should be taken, therefore, in preparation of the information package. If HAZOP is being conducted in the operational or disposal phase, care should be taken to ensure that any modifications are reflected in the design representation. Before starting the examination, the team should review this information package, and if necessary have it revised.

4.3.2 Design requirements and design intent

The design requirements consist of qualitative and quantitative requirements which the system has to satisfy, and provide the basis for development of system design and design intent. All reasonable use and misuse conditions which are expected by the user should be identified. Both the design requirements and resulting design intent have to meet customer expectations.

On the basis of system requirements a designer develops the system design, i.e. a system configuration is arrived at, and specific functions are assigned to subsystems and components. Components are specified and selected. The designer should not only consider what the equipment should do, but also ensure that it will not fail under any unusual set of conditions, or that it will not wear out during the specified lifetime. Undesirable behaviour or features should also be identified so they can be designed out, or their effects minimized by appropriate design. The above information provides the basis for identifying the design intent for the parts to be examined.

The “design intent “ forms a baseline for the examination and should be correct and complete, as far as possible. The verification of design intent (see IEC 61160), is outside of the scope of the HAZOP study, but the study leader should ascertain that it is correct and complete to allow the study to proceed. In general most documented design intents are limited to basic system functions and parameters under normal operating conditions. However provisions for abnormal operating conditions and undesirable activities which may occur (e.g. severe vibrations, water hammer in pipes, voltage surges which may lead to failure) are rarely mentioned, but should be identified and considered during the examination. Also deterioration mechanisms such as ageing, corrosion and erosion and other mechanisms which cause deterioration in material properties are not specifically stated. However they have to be identified and considered in a study using appropriate guide words.

Expected life, reliability, maintainability and maintenance support should also be identified and considered together with hazards which may be encountered during maintenance activities, provided they are included in the scope of the HAZOP study.

5 Applications of HAZOP

5.1 General

Originally HAZOP was a technique developed for systems involving the treatment of a fluid medium or other material flow in the process industries. However its area of application has steadily widened in recent years and for example includes usage for:

- software applications including programmable electronic systems;

- systems involving the movement of people by transport modes such as road and rail;
- examining different operating sequences and procedures;
- assessing administrative procedures in different industries;
- assessing specific systems, e.g. medical devices.

HAZOP is particularly useful for identifying weaknesses in systems (existing or proposed) involving the flow of materials, people or data, or a number of events or activities in a planned sequence or the procedures controlling such a sequence. As well as being a valuable tool in the design and development of new systems, HAZOP may also be profitably employed to examine hazards and potential problems associated with different operating states of a given system, e.g. start-up, standby, normal operation, normal shutdown, emergency shutdown. It can also be employed for batch and unsteady-state processes and sequences as well as for continuous ones. HAZOP may be viewed as an integral part of the overall process of value engineering and risk management.

5.2 Relation to other analysis tools

HAZOP may be used in conjunction with other dependability analysis methods such as Failure mode and effects analysis (see IEC 60812) and Fault tree analysis (see IEC 61025). Such combinations may be utilized in situations when:

- the HAZOP analysis clearly indicates that the performance of a particular item of equipment is critical and needs to be examined in considerable depth; the HAZOP may then be usefully complemented by an FMEA of that item of equipment;
- having examined single element/single characteristic deviations by HAZOP, it is decided to assess the effect of multiple deviations using FTA, or to quantify the likelihood of the failures, again using FTA.

HAZOP is essentially a system-centred approach, as opposed to FMEA which is component-centred. FMEA starts with a possible component failure and then proceeds to investigate the consequences of this failure on the system as a whole. Thus the investigation is unidirectional, from cause to consequence. This is different in concept from a HAZOP study which is concerned with identifying possible deviations from the design intent and then proceeds in two directions, one to find the potential causes of the deviation and the other to deduce its consequences.

5.3 HAZOP limitations

Whilst HAZOP studies have proved to be extremely useful in a variety of different industries, the technique has limitations that should be taken into account when considering a potential application.

- HAZOP is a hazard identification technique which considers system parts individually and methodically examines the effects of deviations on each part. Sometimes a serious hazard will involve the interaction between a number of parts of the system. In these cases the hazard may need to be studied in more detail using techniques such as event tree and fault tree analyses.
- As with any technique for the identification of hazards or operability problems, there can be no guarantee that all hazards or operability problems will be identified in a HAZOP study. The study of a complex system should not, therefore, depend entirely upon HAZOP. It should be used in conjunction with other suitable techniques. It is essential that other relevant studies are co-ordinated within an effective overall safety management system.

- Many systems are highly inter-linked, and a deviation at one of them may have a cause elsewhere. Adequate local mitigating action may not address the real cause and still result in a subsequent accident. Many accidents have occurred because small local modifications had unforeseen knock-on effects elsewhere. Whilst this problem can be overcome by carrying forward the implications of deviations from one part to another, in practice this is frequently not done.
- The success of a HAZOP study depends greatly on the ability and experience of the study leader and the knowledge, experience and interaction between team members.
- HAZOP only considers parts that appear on the design representation. Activities and operations which do not appear on the representation are not considered.

5.4 Hazard identification studies during different system life cycle phases

HAZOP studies are one of the structured hazard analysis tools most suitable in the later stages of detailed design for examining operating facilities, and when changes to existing facilities are made. Application of HAZOP and other methods of analysis during the various lifecycle phases of a system is described in more detail below.

5.4.1 Concept and definition phase

In this phase of a system's life cycle, the design concept and major system parts are decided but the detailed design and documentation required to conduct the HAZOP do not exist. However, it is necessary to identify major hazards at this time, to allow them to be considered in the design process and to facilitate future HAZOP studies. To carry out these studies, other basic methods should be used. (For descriptions of these methods, see IEC 60300-3-9.)

5.4.2 Design and development phase

During this phase of a life cycle, detailed design is developed, methods of operation are decided upon and documentation is prepared. The design reaches maturity and is frozen. The best time to carry out a HAZOP study is just before the design is frozen. At this stage the design is sufficiently detailed to allow the questioning mechanism of a HAZOP to obtain meaningful answers. It is important to have a system that will assess the implications of any changes made after the HAZOP has been carried out. This system should be maintained throughout the life of the system.

5.4.3 Manufacturing and installation phase

It is advisable to carry out a study before the system is started up, if commissioning and operation of the system can be hazardous and proper operating sequences and instructions are critical, or when there has been a substantial change of intent in a late stage. Additional data such as commissioning and operating instructions should be available at this time. In addition, the study should also review all actions raised during earlier studies to ensure that these have been resolved.

5.4.4 Operation and maintenance phase

The application of HAZOP should be considered before implementing any changes that could effect the safety or operability of a system or have environmental effects. A procedure should also be put in place for periodic reviews of a system to counteract the effects of "creeping change". It is important that the design documentation and operating instructions used in a study are up to date.

5.4.5 Decommissioning or disposal phase

A study of this phase may be required, due to hazards that may not be present during normal operation. If records from previous studies exist, this study can be carried out expeditiously. Records should be kept throughout the life of the system in order to ensure that the decommissioning issues can be dealt with expeditiously.

6 The HAZOP study procedure

6.1 Initiation of the study

The study is generally initiated by a person with responsibility for the project, who in this guide is called “project manager”. The project manager should determine when a study is required, appoint a study leader and provide the necessary resources to carry it out. The need for such a study will often have been identified during normal project planning, due to legal requirements or company policy. With the assistance of the study leader, the project manager should define the scope and objectives of the study. Prior to the start of a study, someone with an appropriate level of authority should be assigned responsibility for ensuring that actions/recommendations from the study are implemented.

6.2 Definition of scope and objectives of the study

The objectives and scope of a study are inter-dependent, and should be developed together. Both should be clearly stated, to ensure that:

- the system boundaries, and its interfaces with other systems and the environment are clearly defined;
- the study team is focused, and does not stray into areas irrelevant to the objective.

6.2.1 Scope of the study

This will depend upon a number of factors, including:

- the physical boundaries of the system;
- the number and level of detail of the design representations available;
- the scope of any previous studies, whether HAZOP or other relevant analyses, carried out on the system;
- any regulatory requirements which are applicable to the system.

6.2.2 Objectives of the study

In general, HAZOP studies seek to identify all hazards and operating problems regardless of type or consequences. Focusing a HAZOP study strictly on identifying hazards will enable the study to be completed in shorter time and with less effort.

The following factors should be considered when defining objectives of the study:

- the purpose for which the results of the study will be used;
- the phase of the life cycle at which the study is to be carried out (for details see 5.4);
- persons or property that may be at risk, e.g. staff, the general public, the environment, the system;

- operability problems, including effects on product quality;
- the standards required of the system, both in terms of safety and operational performance.

6.3 Roles and responsibilities

The role and responsibilities of a HAZOP team should be clearly defined by the project manager and agreed with the HAZOP study leader at the outset of the study. The study leader should review the design to determine what information is available and what skills are required from the study team members. A programme of activities should be developed, which reflects the milestones of the project, to enable any recommendations to be carried out in a timely fashion.

It is the study leader's responsibility to ensure that an appropriate communication system is set up and is used for transferring the result of the HAZOP study. It is the responsibility of the project manager to ensure that the results of the study are followed up and decisions regarding implementation made by the design team are properly documented.

The project manager and the study leader should agree whether the HAZOP team activity is to be confined to identification of hazards and problem areas (which are then referred back to the project manager and design team for resolution) or whether they are also to suggest possible remedial/mitigating measures. In the latter case there also needs to be agreement as to the responsibility and mechanism for selecting preferred remedial/mitigating measures and securing appropriate authorization for action to be taken.

A HAZOP study is a team effort, with each team member being chosen for a defined role. The team should be as small as possible consistent with the relevant technical and operating skills and experience being available. This will generally involve at least four persons and rarely more than seven. The larger the team, the slower the process. Where a system has been designed by a contractor, the HAZOP team should contain personnel from both the contractor and the client.

Recommended roles for team members are as follows:

- Study leader: not closely associated with the design team and the project. Trained and experienced in leading HAZOP studies. Responsible for communications between project management and the HAZOP team. Plans the study. Agrees study team composition. Ensures the study team is supplied with a design representation package. Suggests guide words and guide word – element/characteristic interpretations to be used in the study. Conducts the study. Ensures documentation of the results.
- Recorder: documents proceedings of the meetings. Documents the hazards and problem areas identified, recommendations made and any actions for follow-up. Assists the study leader in planning and administrative duties. In some cases, the study leader may carry out this role.
- Designer: explains the design and its representation. Explains how a defined deviation can occur and the corresponding system response.
- User: explains the operational context within which the element under study will operate, the operational consequences of a deviation and the extent to which deviations may be hazardous.
- Specialists: provide expertise relevant to the system and the study. May be called upon for limited participation with the role revolving amongst different individuals.
- Maintainer: maintenance staff representative (when required).