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Hazard and operability studies (HAZOP studies) – Application guide

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HAZARD AND OPERABILITY STUDIES (HAZOP STUDIES) – APPLICATION GUIDE

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61882 has been prepared by IEC technical committee 56: Dependability.

This second edition cancels and replaces the first edition published in 2001. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) clarification of terminology as well as alignment with terms and definitions within ISO 31000:2009 and ISO Guide 73:2009;
b) addition of an improved case study of a procedural HAZOP.

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

FDIS	Report on voting
56/1653/FDIS	56/1666/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 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
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- amended.

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

INTRODUCTION

This standard describes the principles for and ~~procedures of~~ approach to guide word-driven risk identification. Historically this approach to risk identification has been called a hazard and operability study or HAZOP study for short. This is a structured and systematic technique for examining a defined system, with the objectives of:

- identifying ~~potential hazards~~ risks associated with the operation and maintenance of the system. The hazards or other risk sources involved ~~may~~ can include both those essentially relevant only to the immediate area of the system and those with a much wider sphere of influence, for example 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~~ risks 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 set of guide words. The technique aims to stimulate the imagination of participants in a systematic way to identify ~~hazards~~ risks and operability problems. A HAZOP study 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.

Historically, HAZOP and similar studies were described as hazard identification as their primary purpose is to test in a systematic way whether hazards are present and, if so, understand both how they could result in adverse consequences and how such consequences could be avoided through process redesign. ISO 31000:2009 defines risk as the effect of uncertainty on objectives, with a note that an effect is a deviation from the expected. Therefore HAZOP studies, which consider deviations from the expected, their causes and their effect on objectives in the context of process design, are now correctly characterized as powerful risk identification tools.

There are many different tools and techniques available for the identification of ~~potential hazards and operability problems~~ risks, ranging from checklists, ~~fault~~ failure 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 detail regarding the systems under consideration, but produce more comprehensive information on ~~hazards~~ risks and ~~errors~~ weaknesses in the system design.

The term HAZOP is sometimes 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 judgment, 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 and the needs of decision-makers.

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 standard.

HAZARD AND OPERABILITY STUDIES (HAZOP STUDIES) – APPLICATION GUIDE

1 Scope

This International Standard provides a guide for HAZOP studies of systems using guide words. It 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 examples, as well as a broad set of examples encompassing various ~~industries~~ applications, illustrating HAZOP studies are also provided.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-192, *International electrotechnical vocabulary – Part 192: Dependability* (available at http://www.electropedia.org)

~~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*~~

IEC 61882

Edition 2.0 2016-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Hazard and operability studies (HAZOP studies) – Application guide

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

IEC 61882:2016-03(en-fr)

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La Norme internationale IEC 61882 a été établie par le comité d'études 56 de l'IEC: Sûreté de fonctionnement.

Cette deuxième édition annule et remplace la première édition parue en 2001. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) terminologie clarifiée, et alignement sur les termes et définitions de l'ISO 31000:2009 et du Guide ISO 73:2009;
b) ajout d'une étude de cas améliorée d'un HAZOP de procédure.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
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INTRODUCTION

La présente norme décrit les principes et l'approche relatifs à l'identification des risques à partir de mots-guides. Historiquement, cette approche de l'identification des risques a été appelée étude de danger et d'exploitabilité ou, par abréviation, étude HAZOP. Il s'agit d'une technique structurée et systématique appliquée à l'examen d'un système défini en vue:

- d'identifier les risques liés à l'exploitation et à la maintenance du système. Les phénomènes dangereux ou les autres sources de risque peuvent comprendre à la fois ceux qui se présentent seulement à proximité immédiate du système et ceux qui ont des effets plus étendus, par exemple certains phénomènes dangereux environnementaux;
- d'identifier les problèmes potentiels d'exploitabilité posés par le système et, en particulier, les causes des perturbations d'exploitation et des écarts dans la production susceptibles d'entraîner la fabrication de produits non conformes.

Un avantage important des études HAZOP est que la connaissance qu'elles apportent, en identifiant de manière structurée et systématique les risques et les problèmes d'exploitabilité, s'avère d'une grande utilité pour déterminer les mesures à prendre.

Une des caractéristiques d'une étude HAZOP est la session d'examen durant laquelle une équipe multidisciplinaire dirigée par un chef d'étude examine systématiquement toutes les parties d'une conception ou d'un système concernées par l'étude. Elle identifie les écarts par rapport à l'intention de conception du système, en utilisant un ensemble de mots-guides. La technique vise à stimuler de manière systématique l'imagination des participants pour les aider à identifier les risques et les problèmes d'exploitabilité. Il convient de considérer une étude HAZOP comme une amélioration d'une conception juste, utilisant des approches basées sur l'expérience, telles que les règles de bon usage, plutôt qu'un succédané de ces approches.

Historiquement, les études HAZOP et assimilées étaient présentées comme une identification des phénomènes dangereux dont l'objectif premier est de soumettre à l'essai de manière systématique la présence de phénomènes dangereux et, le cas échéant, de comprendre à la fois comment ils pourraient provoquer des conséquences négatives et comment une nouvelle conception du processus pourrait les éviter. L'ISO 31000:2009 définit le risque comme l'effet de l'incertitude concernant les objectifs, en notant que l'effet est un écart par rapport à ce qui est escompté. C'est pourquoi les études HAZOP, qui ont trait aux écarts par rapport à ce qui est escompté, ainsi qu'à leurs causes et à leurs effets sur les objectifs dans le cadre de la conception du processus, sont désormais correctement caractérisées comme de puissants outils d'identification des risques.

Il existe de nombreux outils et techniques destinés à identifier les risques, depuis les listes de contrôle jusqu'à HAZOP en passant par l'analyse des modes de défaillance et de leurs effets (AMDE). Certaines techniques, telles que les listes de contrôle et l'analyse par simulation, peuvent être utilisées dès le début du cycle de vie du système alors qu'il existe peu d'informations, ou lors d'une phase ultérieure si une analyse moins détaillée est nécessaire. Les études HAZOP exigent plus de détails sur les systèmes à l'étude, mais fournissent des informations plus complètes sur les risques et les faiblesses dans la conception du système.

Le terme HAZOP est parfois associé, dans un sens plus large, à d'autres techniques d'identification des phénomènes dangereux (par exemple HAZOP sur liste de contrôle, HAZOP 1 ou 2, HAZOP basé sur les connaissances, etc.). L'utilisation du terme HAZOP en relation avec ces techniques est considérée comme inappropriée et elle est volontairement exclue de ce document.

Avant de commencer une étude HAZOP, il convient de s'assurer qu'il s'agit de la technique la plus appropriée (autant individuellement qu'en combinaison avec d'autres techniques) pour la présente tâche. Il convient que cette appréciation prenne en compte l'objet de l'étude, la sévérité de toutes les conséquences possibles, le niveau approprié de détail, la disponibilité des données et des ressources pertinentes ainsi que les besoins des décisionnaires.

La présente norme a été mise au point pour donner les lignes directrices dans un grand nombre d'industries et types de systèmes. Dans certaines industries, notamment les industries de transformation où cette technique a vu le jour, il existe des normes et des guides plus spécifiques qui établissent des méthodes d'application préférentielles pour ces industries. Pour plus de détails, voir la bibliographie donnée en annexe de la présente norme.

ÉTUDES DE DANGER ET D'EXPLOITABILITÉ (ÉTUDES HAZOP) – GUIDE D'APPLICATION

1 Domaine d'application

La présente Norme internationale constitue un guide pour les études HAZOP de systèmes qui utilisent des mots-guides. Elle donne des lignes directrices relatives à l'application de la technique et à la procédure de l'étude HAZOP, y compris la définition, la préparation, les sessions d'examen ainsi que les documents et le suivi qui en résultent.

Elle fournit également des exemples de documentation ainsi qu'un grand choix d'exemples concernant diverses applications qui présentent les études HAZOP.

2 Références normatives

Les documents suivants sont cités en référence de manière normative, en intégralité ou en partie, dans le présent document et sont indispensables pour son application. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

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