



# IChemE Safety Centre Guidance

Good practice in  
virtual HAZOP



released June 2021



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# 1. Preface

The global pandemic of COVID-19 has changed the world in so many ways. Industries and companies have had to adapt to all health advice and regulation requirements. Face-to-face meetings were replaced with virtual meetings due to travel restrictions, mandatory quarantine in some locations, the need to maintaining physical distancing and capacity limits. This led to the requirement for the development of this document, which describes good practice in virtual HAZOP meetings. This is a guide based on inputs from ISC members and their lessons learnt to make virtual risk assessments more effective and avoid pitfalls.

When undertaking a HAZOP there are four stages in the study as described in *IEC61882*. As is common practice for face-to-face HAZOP meetings, the number of attendees might be large including juniors and trainees. It is also usual practice to have hard copies of drawings and technical documents at hand or either displayed on the walls or on the screen for ease of access for the participant to reference. All of this is much harder in a virtual environment. The nature of the virtual environment makes the contents and quality of the HAZOP briefing package all the more important.

This document does not set out to describe the HAZOP process but focuses on how to lead effective virtual HAZOPs. Running any HAZOP consistent with *IEC61882* requires extensive planning beforehand. Some additional elements when planning a virtual HAZOP include:

- how many attendees and at what level of competency makes the meeting more effective?
- what sort of technology and communication equipment is available to everybody?
- are documents and drawings accessible to everyone during the meeting?
- what is the time difference in participants' locations?
- how do we keep everyone engaged and avoid distractions?
- how will attendance be recorded?

This document attempts to answer some of these questions based on current industry experience.

## 2. Acknowledgements

ISC would like to acknowledge the following companies for contributing their learnings to develop this guidance document:

- Arup
- CSE-Engineering
- Dalhousie University
- Dekra
- HIMA
- IRESC Global
- KBR
- Oji Fibre Solutions
- Petronas
- RAS Limited
- Safety Solutions Limited
- Santos
- Sherpa Consulting
- Worley

The ISC would also like to acknowledge the work of Ms Maryam Lameie for compiling this document on our behalf.

## 3. Disclaimer

The information contained in this guidance document is provided in good faith but without any liability on the part of IChemE and the IChemE Safety Centre.

While virtual HAZOPs are being undertaken due to circumstances, they do not remove the need for face-to-face sessions in the future. While this document sets out the current best practices in virtual HAZOP, it does not promote virtual HAZOP over face-to-face sessions. There is not yet enough evidence to determine if virtual HAZOPs are more or less effective.

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# 4. Definitions and terminology

In this document the terms 'leader' and 'facilitator' are used interchangeably, as are 'recorder' and 'scribe'.

HAZOP	Hazard and Operability, a structured study undertaken to identify risks and operability problems (IEC, 2016, p10)
P&ID	Piping and Instrumentation Diagram
PSI	Process Safety Information
TOR	Terms of Reference
VPN	Virtual Private Network

Table 1. Definitions and terminology used in this document.

# 5. How to use this document

This guidance document is intended for use by process safety managers, HAZOP facilitators and, in general, by anyone in charge of managing process safety risk at a facility. It identifies good practice and pitfalls when considering virtual risk assessments.

This guidance document is applicable to any process facilities that utilise HAZOP; at least in any of the stages of the lifecycle of the facility, as defined in the IEC standard (IEC, 2016). The general approach presented may be adapted to other forms of risk assessment, though this is not specifically addressed in this guidance.

The IEC standard (IEC, 2016) describes the different risk identification studies across the facility life cycle. For specific guidance on undertaking a HAZOP refer to the IEC standard (IEC, 2016) or its equivalent in your jurisdiction.

As there are a number of elements that need to be managed differently in a virtual HAZOP, it is recommended that you undertake a Management of Change (MoC) process to ensure all elements are addressed.

# 6. HAZOP requirements (IEC, 2016)

## Key features of a HAZOP study

The IEC standard outlines four stages in the HAZOP study as follows:

1. Definitions – where the study is initiated, scope, objectives, roles, and responsibilities defined;
2. Preparation – where the study is planned, data and documentation collected, and guide words and deviations established;
3. Examination – where the structure of the examination is determined and then performed; and
4. Documentation and follow up – where the method of recording is applied, output described, information recorded, documents signed off and follow up and responsibilities documented.

For more information on these stages refer to *IEC61882:2016*. This document follows a similar structure.

Section 7 defines the good practice and pitfalls for each of these stages in a virtual risk assessment.

# 7. Conducting a virtual HAZOP study

## 7.1 Definitions

As per the IEC standard (IEC, 2016) for a face-to-face study, the virtual study is initiated by a person called the manager, who defines the scope and objectives.

### 7.1.1 Selection

The manager selects a facilitator who should be very experienced in both HAZOP facilitation as well as chairing virtual meetings to be able to keep everyone on track and engaged in the virtual environment.

In addition to all duties outlined in the IEC standard (IEC, 2016), the manager and the facilitator should agree upon the following items:

- selection of the virtual platform;
- whether to have the cameras on or off during the meeting;
- communication protocols; and
- the scheduled duration for each meeting.

The workability of the virtual platform is crucial. Some virtual conferencing platforms let the users share/use multiple documents at the same time which could be convenient when discussing specific aspects of the project where there may be linkages.

### 7.1.2 Information gathering

Pre-assessment preparation is important and feeds into the review of data section. Proper time needs to be allocated to gather and distribute all the information. All related documents should be included in the briefing pack. These include:

- Terms of Reference (TOR) for the study, including responsibilities in the team;
- team composition and contact details;
- session dates and list of the P&IDs to be discussed at each session;
- previous relevant risk assessments;
- node descriptions and boundaries, including latest revision of drawings with nodes marked up;
- process description;
- key design parameters;
- risk matrix;
- PSI and P&IDs;
- any generic hazard information or chemical in process need to be assembled;
- list of deviations and typical causes;
- HAZOP procedure; and
- how-to guide for the meeting platform.

All relevant documents should be part of the briefing pack and must be provided ahead of time. Making the briefing pack available on cloud-based platforms can be considered, though participants' ability to print documents should be taken into account. If sending the drawings via post or courier, privacy and health concerns should be adequately addressed.

At the first session of the meeting, the facilitator should take the time to explain the process and the methodology and meeting software, such as how to raise your hand or comment. It is not the facilitator's role to teach the team how to use the software, if this is needed it should be addressed ahead of time by a suitably trained person. A grounding presentation would be helpful in which all the key design parameters are listed.

## 7.2 Preparation

### 7.2.1 Review of data

As per the *IEC61882* (IEC, 2016) standard, a briefing package is required for all members of the HAZOP study team and should be provided prior to the study commencing. This is to allow the team to familiarise themselves with the material, as well as provide feedback on their suitability to participate.

The study facilitator is responsible for ensuring that an adequate design representation is available. A list of proposed guide words to be used needs to be included in the information pack or TOR. This allows the leader and the team to agree on which sequence to use: 'property first' or 'guide word first', for details refer to *IEC61882:2016* standard.

All members should be familiar with the process and provided with documents to avoid confusion or wasting time during the meeting.

### 7.2.2 Assembling the examination team

The personnel required to perform the examination are the same as those required for a face-to-face HAZOP. However, it should be noted that in a virtual environment, a smaller more focused team may be more effective. As per *IEC 61882:2016*, these include:

- study facilitator;
- scribe;
- designer(s);
- user(s), eg operations and maintenance;
- specialists, with relevant expertise in the system being studied; and
- others may be needed from time to time, such as equipment suppliers etc.

The study facilitator is responsible for ensuring participants have access to all the information prior to the study commencing. The facilitator needs to be highly experienced and active to be able to keep the virtual meeting live and everybody engaged. Conducting a virtual meeting could be very complicated so this is not a place for training. *IEC61882* states in clause 6.2.3 that "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 and consistent with the relevant skills and experience available. The larger the team, the slower the process, however, all relevant areas of knowledge should be represented." So, a large team is not recommended unless it is necessary to have all the important roles represented. For a virtual meeting, a small team of those knowledgeable in the process is also easier to manage.

The scribe should be someone who has worked as a HAZOP facilitator before and is well experienced in that role as well as in conducting virtual meetings. The assigned scribe should limit their activities to supporting the assigned facilitator and scribing.

A pool of other agreed personnel can be arranged as back up. In case of any emergency that the facilitator, the scribe, or any other key attendees falls sick, this allows to have the backup person readily available. The facilitator and scribe must remain independent of the process.



## 7.3 Examination

### 7.3.1 Kick-off meeting

At the start of the study the facilitator should hold a kick-off meeting covering the following items:

- ensuring all participants received the briefing pack and have reviewed it;
- recap of the study procedure;
- discussion of the meeting rules:
  - how to ask questions;
  - how the software platform is going to be used and what features it has, ie thumbs up or raise hand functions;
  - how agreement will be obtained, ie digital voting or verbal;
  - describe the communication protocol, including what to do if disconnected;
  - how team members need to introduce themselves when speaking (at least initially until they become familiar with each other);
  - directing the use or not of cameras (good practice is using cameras to ensure people remain engaged, though there may be valid reason to not use them);
  - agreeing how the mute function will be used (it may be necessary due to background noise) and the facilitator may choose to regularly check in with participants to ensure they are still connected and engaged;
  - how attendance will be recorded for participants;
  - agreeing break times and the need for attendees to remain focused on the study and not be distracted by outside issues such as emails etc, other communication platforms should be shut down or notifications silenced so they do not disrupt the study;
  - how any changes to drawings identified during the study will be managed;
  - advice may be given on how to switch between screens, depending on the platform being used; and
  - permission for recording of the session from attendees if this is to be done, including how long the recording will be stored for and who will have access to it.

### 7.3.2 Participant considerations

Participants should be familiar with use of the virtual platform, such as how to split the screen. Their personal preparation may necessitate them developing these skills prior to the HAZOP.

If a portion of the workshop team is together physically, an individual should be identified that can clearly paraphrase and summarise discussion. This point-person can communicate conclusions to the facilitator and scribe for documentation.

The facilitator may need to slow the process down, taking into account any language barrier(s), internet buffering or connectivity issues and allow the team enough time to collectively catch up. They should make sure everyone's voice is heard before moving on to the next topic. It is recommended that the facilitator call each person by name and ask their opinion prior to closing out each node.

Other considerations that should be taken into account by the manager requesting the study includes the participants level of competence with the technology and their access to proper devices. It may be necessary to issue computers to some personnel for the activity. This needs to be arranged ahead of time, not left to the facilitator to manage in the session.

### 7.3.3 Technical considerations

Robust platforms and internet service are needed to guarantee a smooth and non-interrupted connection. It is important to note that the meeting could not continue if the facilitator and/or the scribe lose the connection. The facilitator and the scribe should have administrative control of the meeting platform. Cyber security is a critical element which must be addressed. Consideration should be given to the use of a VPN or other process to ensure secure access to the briefing pack and meeting platform.

Descriptions of plant/equipment items should be clear, using item numbers to avoid confusion, and if drawings are shared on the screen, using a pointer function to ensure everyone understands which equipment is being studied.

The leader/facilitator should perform a walk-through of the drawings system by system before beginning a node in that system or unit, using a pointer function on the shared screen. This will make sure everyone understands how the nodes tie together.

In the event a site visit is required, virtual (live or pre-recorded) tours, or CCTV images could be used.

### 7.3.4 Changes to drawings

There may be some need to change or mark-up drawings during the HAZOP. These changes should only be done if there is significant and valid challenge, and it is deemed appropriate by the facilitator to do so. Changes to mark-ups during the study should be done 'live' in the screen view that is being shared. To obtain this new revision of mark-up, participants should either have access to a shared location, or should be emailed the document before proceeding to use it in the study. Live mark-ups of P&IDs, to indicate HAZOP Study minutes outcomes such as correction of minor drafting errors, and additions of instrumentation and fittings, should be done by an appointed individual in the study, if practicable. If able to be done 'live', annotated mark-ups should be screen-shared at the end of each node's discussion as far as is practicable, for participant agreement.

### 7.3.5 Timing considerations

It is recommended that the meetings are scheduled no longer than five hours (this may need to be shorter when considering multiple time zones) a day with sufficient breaks to allow members to refresh and catch up on their needs/ other commitments. Meetings should not extend beyond the scheduled time. However, the facilitator and scribe might need a couple of hours discussion either before or after the main meeting. In the case of multiday meetings, having a day off between meetings lets participants manage their emails and other work commitments, helping to avoid absence and distraction. Where possible with multiple time zones, the meeting should be scheduled in time zones that are suitable for the attendees. Companies might need to allocate additional personnel to ensure participants do not spend long hours at work or participate while in transit. Everyone involved in the project should adjust their expectations as it is more likely to take longer to complete the study compared to a face-to-face study given the different format of the meeting.

## 7.4 Documentation and follow up

Note taking and report writing should be undertaken as normal. It may be necessary to adapt the note taking software to one that is more fit for purpose for the virtual environment. The facilitator needs to determine what screens will be shared with attendees. The HAZOP minutes are important to share, but there may be instances when the facilitator wants the team to all look at the same drawing or data. The scribe will need to manage these changing needs. Recording of the meeting may assist in the documentation and report writing. It may be advantageous for both the facilitator and scribe to be making notes for later consideration.

In the HAZOP report, for future reference, it is necessary to note that the meeting was virtually conducted as well as a recommendation to review the study for sufficient thoroughness and quality at a later date. A master final copy of the briefing pack should be included with the final report, so it is clear what information the team had access to during the study. There is not yet enough evidence to determine if virtual HAZOPs are more or less effective.

## 8. References

IEC, 2016. *IEC 61882 Hazard and operability studies (HAZOP studies) – Application guide*, s.l., International Electrotechnical Commission.

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