

# Conduct an Effective Process Hazard Analysis From a Distance

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This article provides guidance on how to successfully conduct process hazard analysis (PHA) studies in a virtual environment.

The regular assessment of process hazards and risk is a cornerstone of process safety management (PSM). Industry organizations such as the Center for Chemical Process Safety (CCPS) and regulatory bodies across the globe consider process hazard analyses (PHAs) as essential to safe operation of facilities in the chemical process industries (CPI).

High-quality PHAs are built upon in-depth discussions of the technical details of a process by knowledgeable individuals to identify hazards and then determine if sufficient mitigative safeguards are in place. The chief role of a PHA study leader is to effectively lead these discussions and obtain team consensus on the process risk and any needed recommendations.

When outside factors, such as a global pandemic, disrupt the ability to hold these discussions and other “normal” aspects of work, companies may be inclined to do the minimum regulatory requirements in order to weather the storm of travel limitations and restricted access to facilities. Companies may consider delaying the PHA study, using a

less-thorough revalidation methodology, or performing the study with a smaller team. This approach is problematic for several reasons. A long-term concern is that this approach could erode an organization’s commitment to process safety excellence. The most immediate concern, however, is that hazards in a process go unidentified when a study is delayed, conducted less thoroughly, or lacking enough knowledgeable personnel. Any of these situations could potentially lead to an increase in process safety incidents at the facility.

An organization should want to optimize the performance of PHAs to avoid gaps in risk assessment and risk management, even during difficult situations. If risk-management activities such as PHAs are compromised when difficult situations arise, it could send a message to the organization that these activities are not of long-term importance to management.

Necessity is an important motivation for invention. The global pandemic could ultimately lead to permanent improvements in how work is performed, including conducting effective PHAs. The ability to conduct an effective PHA from a distance allowed for a critical risk-management activity to be completed safely during pandemic restric-

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tions. In the future, this ability could allow for a long-term reduction in money or time spent traveling to sites and an increase in work flexibility for employees. By evaluating facilitation techniques and technology to allow for remote work, an organization could find opportunities to improve both the tools and methods used to conduct any PHA study, not just the ones conducted at a distance.

### The challenges of remote PHAs

Conducting PHA meetings with remote team members has several challenges. Team members might have limited access to the chemical facility and its equipment, people, and information. Seeing the equipment and the operating environment is crucial to understanding potential hazard scenarios resulting from equipment placement, facility siting, or human factors issues. Having easy access to personnel and information during the study will result in a more thorough understanding of the process design and operation, with fewer recommendations to follow up on questions from the team after the study.

Remote meetings require reliable and effective technology for success and can be limited by the shortcomings in technology. It is difficult to keep the team together in discussions if all team members do not have access to necessary software, hardware, and network capabilities. Access to requisite technology is not the only concern; team members must also have competency in using collaboration technology, otherwise the study meeting will become mired in the frustration of waiting on participants to get connected or find and display the correct resources.

PHA team meetings are mentally taxing even under the best conditions. With the limited visibility of remote meetings, it can be difficult to “read the room” to detect and address fatigue, distraction, and other dysfunctional meeting behaviors. It is also a challenge to effectively convey detailed chemistry or engineering information and keep all team members engaged in the discussion for the duration of the study.

All of these issues can set up a perfect storm of inefficiency, miscommunication, and frustration, which could derail the PHA, resulting in a less-thorough risk evaluation for the process.

### How improvements are made

As the need for high-quality remote PHAs became more important over the past two years, companies and process safety professionals developed various methods, tools, and guidance to assist PHA teams. Training specialists generally recommend that improvements to learning be based on a mix of three areas: learning from others, learning from experience, and formal learning events (1). When faced with the challenge of shifting to remote work in early 2020, Eastman

Chemical Co. used these techniques to develop guidance and tools for leading successful virtual PHAs.

*Learning from others.* Most large, global companies have many employees involved in PSM activities, often located in different geographical locations and supporting facilities of varying sizes. Tapping into this variety of experience can help the entire organization learn and improve. With remote work becoming more of a certainty as the COVID-19 pandemic increased in scale, organizations had to conduct PHAs with limited access to the facilities and required personnel. To jumpstart these efforts, experienced study leaders and process safety experts brainstormed the roadblocks of virtual PHAs and recommended solutions for overcoming them. The results of this effort included a guidance document for remote PHA best practices and clarification of existing processes and procedures to reflect the remote work environment.

*Learning from experience.* Seeking advice and learning from others is important, but personal experience is often the best teacher. Study leaders have likely improved their remote PHA process with practice over the past two years and found ways to overcome barriers to success. In the interest of continual improvement, it is important to capture these learnings, pass them on to others, and determine if additional tools and guidance can be developed to further assist in remote PHAs or even more traditional meeting structures. Surveys directed at PHA study leaders and team members are useful tools to gather initial feedback, with more targeted follow-up occurring in discussion and networking meetings. This follow-up can identify what is working well, what pain points still exist, and any new ideas for improvement not considered previously.

*Formal learning events.* In the initial stages of the COVID-19 pandemic, many process safety consulting organizations offered training and services to assist with conducting risk-management activities remotely, including PHAs. Even for operating companies that facilitate their own PHAs, learning from the experience of others in the industry through webinars, articles, and training classes is an excellent way to broaden horizons and increase knowledge. Participating in training from a variety of external resources can offer different viewpoints, even challenging preconceived notions about best practices. The trainees can then determine which ideas would be a good fit for application within their organization.

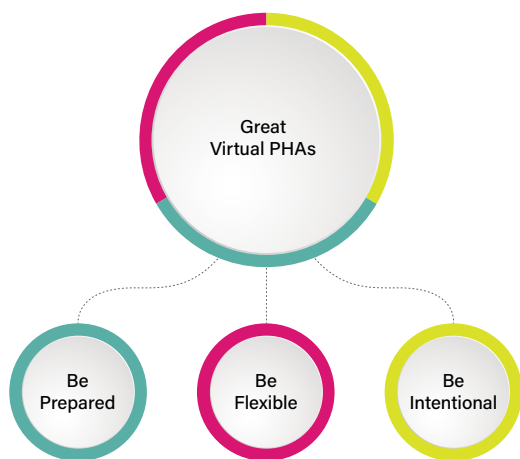
*The results of intentional learning.* The combination of these efforts highlighted improvements in three key areas. Successful virtual PHA meetings require diligent and thorough pre-planning, meeting technology and logistics contingency planning, and deliberate and thoughtful facilitation techniques. Virtual PHA leaders can achieve this by being prepared, flexible, and intentional (Figure 1).

### Be prepared

Due to the detailed nature of PHA studies, pre-planning is a crucial aspect of any successful study. Information about the chemistry, equipment, and procedures must be gathered, reviewed by the study leader, and then distributed to other team members for reference. The boundaries and structure of the study must be determined or, in the case of revalidation studies, reviewed and reconfirmed. With remote work, access to and distribution of this information shifts to electronic formats. The study leader may require extra time and assistance to prepare for the added complexity a remote study brings.

*Planning, planning, planning.* When the PHA is conducted remotely, additional issues must be considered in the preparation phase beyond routine PHA planning. The agenda and schedule require additional thought due to the potential for participants being in different time zones and the increased mental fatigue associated with virtual meetings. The responsibilities and interactions of the study leader and the scribe during the meeting must be planned in advance. The study leader and scribe should work together to decide who will be the virtual meeting leader, determine what information should be shown on the shared screen during the study, and prepare additional documents or visual aids needed for the study.

Ensuring all team members have access to the process information, as well as the hardware and software tools needed to participate virtually, is an issue unique to remote PHAs. This will require additional thought and preparation beyond routine PHA planning. Team members need to reliably see and hear the information being discussed, ideally with minimum distractions. It is also important for all team members to have a working knowledge of the virtual meeting technology used for the PHA, so it may be necessary to provide training or information (e.g., help documents) on



▲ **Figure 1.** Being prepared, flexible, and intentional are three key components of a successful virtual process hazard analysis (PHA) study.

the technology or do a test run of the meeting setup ahead of time.

*Local facilitator.* Consider naming a local on-site study facilitator to assist with gathering information and conducting any on-site study coordination for the study leader. This person can serve as the “boots on the ground” in pre-planning activities and could be of particularly high value to a study leader located in a different geographical location from the facility with limited travel capability. They can help retrieve and share process information, arrange technology needs for team members, and perform any other tasks best suited to an individual with access to the facility. This person can also help arrange space for operations team members to join the meeting with minimum distraction, away from the noise of the control room or shared operator spaces (e.g., a conference room or empty office). This individual could also conduct a virtual plant tour to gather photographs or videos of equipment and key operational tasks to share with members of the team located remotely.

*Field walk-through checklist.* One of the most significant issues identified in brainstorming efforts was the lack of access to the facility for a tour of the operating area. The field walk-through can give crucial insight into how equipment is arranged, how operators interact with equipment when performing their tasks, facility siting concerns, and potential human factors issues in the process. A photographic or video tour of the facility can convey this important information. Operations representatives familiar with the area can provide photos with context to supplement discussions in PHA sessions. Use a checklist of items important to hazard evaluations to better direct the local facilitator conducting the virtual tour (Table 1). Consider adapting the list in Table 1 to your facility and editing for local language or terminology to maximize usefulness and clarity.

The development of a field walk-through checklist is one example of an improvement that could apply to all future PHAs and not just those conducted virtually. Previously, this formal guidance did not exist for Eastman Chemical Co., and the ideas of what to look for on a tour were primarily based on study leader experience and judgment. This checklist can be used as a training tool for new study leaders, team leaders, and less-experienced PHA teams. This is an example of how re-examining existing processes and procedures during short-term disruptions or changes can reveal gaps and allow permanent improvements.

*Increased reliance on software tools.* In addition to using computer tools for conducting the PHA meetings, other software tools can help with planning for a virtual PHA. With limited access to office facilities in the 2020 pandemic, access to commercial copiers and printers became more difficult. This resulted in a shift toward using software tools (e.g., drawing management software pack-

ages) to annotate drawings and procedures with the PHA nodes and other notes and concerns. Collaboration software made it possible to share the annotated drawings and procedures with all team members without relying solely on hardcopy versions of key process information. Tutorials on using these tools were offered to study leaders to help jump-start their use. This is another example of an improvement in work processes that could have long-term benefits, with reduced paper and copier use and easier electronic archiving of PHA documents after study completion.

### Be flexible

Conducting meetings in the virtual environment requires flexibility. With a reliance on computer and network technology, meeting logistics can require contingency planning to anticipate unexpected issues. Consider having a backup

Table 1. Use a walk-through checklist to assist virtual plant tours.	
Overall Conditions of the Plant	
• Major pieces of equipment	
• Congestion, housekeeping, and general egress paths of routine task areas	
• Ventilation issues	
• Lighting issues	
• Drainage and spill containment areas	
• Proximity to other processes, boundaries, and occupied buildings	
• Deteriorated equipment (e.g., concrete spalling, erosion, corrosion, etc.)	
• Inadequate equipment support (e.g., sagging piping, noticeable vibration, etc.)	
• Equipment and piping labeling	
Safety Equipment	
• Fixed fire protection systems (e.g., coverage, activation points) and fire extinguishers	
• Safety showers and eye bath locations	
• Combustible or toxic gas analyzer locations	
• Presence/condition of grounding cables	
• Pressure relief devices and their discharge locations	
• Proximity of flares, furnaces, or other ignition sources in the area	
Operator Interface Locations	
• Tripping or falling hazards	
• Accessibility of key valves, filter housings, or other frequent manual tasks	
• Piping blocks access to equipment	
• Sample locations (e.g., egress, safety shielding, grounding, access to safety showers and eye baths, etc.)	
• Awkward or cramped positions or other ergonomic concerns	
• Unclear or confusing operator interface locations	

plan for network availability, such as a wireless hotspot, or have a secondary location available for team members to use if their computer or network is not cooperating or if excess noise or distractions are an issue. Also, consider having a list of information technology (IT) resources and contacts available in anticipation of any problems. Study leaders should consider investing the necessary training and practice time to gain expertise in the full capability of the networking tools and software to provide additional options for troubleshooting and improving connectivity and engagement.

The schedule of the PHA should have enough flexibility to allow for potential downtime due to network or other technical issues. The team should be prepared to change meeting arrangements if things are not working well for everyone on the team. The study leader should also be aware of non-technical issues, such as meeting fatigue, and be prepared to adjust the schedule to take more frequent breaks or shorten the meeting sessions if needed. In general, virtual meetings should not have sessions longer than 1.5 hours without breaks, which may be slower than the generally accepted pace of an in-person meeting. In addition, it may be necessary to adjust how the meeting is being conducted to ensure that everyone can follow the discussion and distractions are minimized. This may mean changing what is shared in the virtual meeting screen, such as using video cameras vs. sharing a screen of the PHA software or a procedure. It is also good practice to seek frequent feedback from the team on what is working well and what adjustments are needed as the study progresses.

### Be intentional

One of the most challenging aspects of conducting remote PHAs is managing team dynamics and maintaining good team engagement. PHAs are frequently multi-day or even multi-week reviews requiring a high degree of focus and deliberation. Keeping a team fully engaged for this long is a challenge even in the best work environment. As previously mentioned, planning and flexibility can help avoid some engagement issues. Leading a PHA virtually requires a very intentional approach to meeting facilitation to manage issues that emerge as the study progresses, whether being facilitated by the study leader, scribe, local facilitator, or other team member.

*Calling on everyone.* When conducting an in-person PHA, leaders can “read the room” to determine if team members might have something to add to the conversation or if more discussion is needed on a topic. It can be challenging to assess this in a virtual meeting even when using video capability. This requires the facilitator to be very intentional about seeking input from team members by asking specific team members questions about the equipment or

the scenario being discussed. Frequently calling on people by name is also a good way to confirm that people are still connected and have not encountered a technical issue.

*Phrasing questions well.* When facilitating a virtual meeting, how a question is phrased or framed can significantly increase or decrease the level of interaction and discussion that follows. This is also true with in-person interactions, but it is even more crucial with virtual PHAs where the participants may not be able to see each other and respond to the energy in the room. Trying to word questions carefully to avoid silence is an important strategy for virtual meetings. Study leaders should avoid asking a question to the group that no one can answer (2). Try to keep the questions and conversation within the scope of knowledge and influence of the PHA team. Targeted, open-ended discussion questions can get the group engaged faster than short yes or no questions, especially when combined with intentionally calling on people for input. Asking team members to talk through how a particular piece of equipment works, how a task is performed, or other details can get them involved in the discussion of what could go wrong in that part of the process.

*Dealing with dysfunction.* When leading virtual PHAs, the combined responsibilities of managing the flow of the study and the meeting technology can mean potentially dysfunctional team behaviors go undetected more easily than in non-virtual meetings. Table 2 shows the most common

Table 2. These are common dysfunctional team behaviors that are disruptive to meetings (2).	
Avid cellphone user or workaholic	Person who is distracted by phone or computer work
Door slammer	Person who leaves the “room” in disgust
Dropout	Person who does not participate in the discussion
Interrupter	Person who interrupts others or finishes their sentences
Late arriver or early leaver	Person who habitually arrives late or leaves early
Loudmouth	Person who dominates the discussion
Naysayer	Person who is noticeably negative without offering solutions
Storyteller	Person who likes to tell long-winded stories
Topic jumper	Person who frequently takes the group off-topic
Verbal attacker	Person who makes negative comments about or directed at someone
Whisperer	Person who holds side conversations during meeting
Low energy (group)	Energy in the “room” is low, participation is waning

dysfunctional team behaviors that can disrupt a meeting (2).

Several of these dysfunctional behaviors can be addressed with the intentional interactions mentioned previously. Others may be more difficult to detect or discreetly address in the virtual environment. Be mindful of these interactions occurring as the study progresses. In addition, a local facilitator can serve as the eyes in the room, especially if only the PHA leader is located remotely. They can also brief the study leader on potential dysfunctional tendencies of team members ahead of time. Establishing some key ground rules for meeting conduct, such as “one conversation at a time” or “respect the speaker,” ahead of time will set expectations for the team. Considering possible ways to avoid some of the more common issues early on can help ensure a successful study.

While virtual meetings, including PHAs, can introduce additional challenges for the leader, a heightened awareness of facilitation techniques and intentional use of troubleshooting methods can produce a well-executed, collaborative evaluation of process hazards for the facility — even virtually.

### Closing thoughts

Although the COVID-19 pandemic is not an event anyone would like to see repeated anytime soon, in many ways it has forced a detailed, critical evaluation of existing work methods and what technology is available to connect people in new and different ways. Conducting PSM activities, such as PHAs, is no exception. With intentional efforts to determine and address potential roadblocks to remote PHAs, companies can establish tools and procedures that enable study leaders to prepare for and successfully conduct studies in the virtual environment.

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