The art of PHA Scribing: The invisible role

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Abstract

Process Hazard Analyses (PHAs) and other of Hazard Review scopes are explained in detail in textbooks, guidelines, and papers. And the different methodologies and how to choose them are also described as are node sectioning approaches, software, PHA Leader skills, requirements and responsibilities, how to choose the team and their skills, how to perform more efficient meetings to optimize brainstorming and avoid burnout, and many other topics. However, there's a role that's usually underestimated and only barely explained: the scribe (CCPS Definition: *A hazard evaluation team member who is responsible for capturing the significant results of discussions that occur during a hazard evaluation team meeting*). There is not much information on PHA Scribing because the definition seems to be self-explanatory and the skills required, obvious: Organized and good typing skills. But, how much of a difference can a bad/decent/excellent scribe have in the PHA overall? Is *"As long as we don't have to wait too much for him/her to record"* enough? Should the scribe just *"listen and record"*? Is there anything the Scribe can do to improve the quality of the meetings?

This paper is backed by more than a million hours of PHA scribing and tries to answer all these question by going beyond the trivial set of skills needed. It describes key side-tasks the scribe can do to optimize the PHA team efforts, the skills required to do them, and the interaction with the PHA Leader.

1. Background

Documentation has always been a challenge for PHAs, and the PHA Scribe role has been present in one form or another from the beginning of PHA. In 1979, when one of the colleagues of the authors began to lead HAZOPs, the Leader and the Scribe roles were distinct. In those days, the Leader wrote the deviation, cause, consequences, safeguards, and recommendations on a blackboard or a flip chart, using many abbreviations. The Scribe captured the information in longhand on paper, expanded the abbreviations, and worked with a typist to generate a report produced on a typewriter. Other colleagues used scribes as early as the 1980s to take all of the documentation load off of the Leader and team, allowing the team to freely brainstorm and therefore find more accident scenarios by not being distracted with the documentation role.

As the technology evolved through whiteboards, photocopying whiteboards, and computer software, the Scribe role continued to provide a formal documentation of the PHA proceedings while the role also expanded to include steps to optimize the overall PHA process, from preparation through final report

2. Scribe description

Before digging into the Scribe's required skills and the best practices, a description of the role itself is needed. The following or various generally accepted descriptions of the role of a PHA Scribe:

2.1. CCPS

CCPS – Process Safety Glossary [1]

> *Scribe/Recorder: A hazard evaluation team member who is responsible for capturing the significant results of discussions that occur during a hazard evaluation team meeting.*

CCPS – Hazard Evaluations Guidelines book [2]

> *"The scribe is the individual designated to formally document the discussions that take place during studies using meeting-oriented techniques such as HAZOP Analysis. Typically, the scribe may be someone who is not as experienced as the team leader in the use of the chosen HE method, but who has had some basic HE experience.* ***It is frequently helpful if the scribe has good writing and organizational skills*** *since they will be deluged with information to sort out in the meeting. Sometimes, organizations assign the duties of scribe to relatively junior personnel; however, many have found this to be ineffective. Scribes with more process experience can better sort out the meeting discussions that should be documented from issues that should not."*

Going a step beyond the Guidelines book from CCPS, which PII staff helped to write in 1991 and 2008, PII has found it best to generally use a second competent PHA leader to serve as Scribe, but sometimes "leaders in training" are used as Scribes.

2.2. Others

IEC ([3]) and other references ([4], [5], [6], [7], [8]) share in broad terms the same definition for the Scribe. IEC-61882 is shown as an example:

IEC 61882 – HAZOP guide [3]

> *"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."*

2.3. Summary

A good Scribe takes the load off of the team by recording the notes of the hazard evaluation team discussion. A scribe needs to be able to listen to roughly 10,000 words of discussion on a complex accident scenario and be able to distill the discussion into roughly 100 words of written record. The scribe probably has the toughest job on the team and is critical to the team's success because the scribe allows the team to freely brainstorm.

3. When is a scribe needed?

For small PHAs the Scribe's role is fulfilled by the Leader. He/She takes the burden of leading the meeting and documenting the discussion as well. However, as the PHA grows larger, having a single person playing both roles becomes inefficient. It may appear extravagant to employ two people in a supporting role (Leader and Scribe); however, experience indicates that this arrangement greatly increases the rate of working of the team as a whole. It is better to employ seven people for two days rather than six people for four days on a given study. [9]

Having a scribe in the meeting **for analysis longer than 4-hours of meeting time** can help tremendously and easily pays for itself. While the Scribe is completing the summary of the team's discussion, the Leader can move on to the next topic of discussion. Table 1 shows the details of having a dedicated scribe. [10]

Table 1. When is a scribe needed? [10]

Best practice	Typical of current PHAs	Details
Use a dedicated Scribe, for meetings longer than 4-total hours	Most meetings do not have a scribe; the reason given is "cannot afford this luxury". However, the savings ratio in staff-hours for the whole team is about 2:1 when a scribe is used.	Use a well-trained scribe to take the documentation load off of the team. **This rule can save 30-50% of meeting time and increases brainstorming** (because the team is not daydreaming as they wait for Leader to complete the notes).

4. Going beyond the trivial set of skills

Despite the subtle differences in the previous descriptions and the level of detail of each one, there's a consensus in the main responsibility (Document the meetings) and the basic set of skills required to be a PHA Scribe:

- **Concise:** Be able to listen to roughly 10,000 words of discussion on a complex accident scenario and be able to distill the discussion into roughly 100 words of written record.
- **Trained**: in analysis techniques and software. (It is required for a Scribe to attend the same training as Leaders).
- **Attentive to details**: Able to decide quickly and without guidance where to show each step of the scenario in the PHA table
- **Well organized**
- **Excellent writing/typing skills**

All those skills are a "must have" for every Scribe to avoid being the one limiting the meeting speed. However, there's other skills described in the following sections of this paper that are usually overlooked despite being the difference between a good/decent scribe and an excellent scribe. That difference can have a huge impact in the overall performance in the PHA:

- Reduces documentation time
- Improves the quality of the entries in the PHA tables

- Enhances meetings to run smoothly (as long as other PHA best practices are followed) [10]

The reason why these skills are usually overlooked is because they don't make a significant improvement in small PHAs where the volume of data to handle is also small, but as the PHAs grow larger these skills become more and more important. So, this set of skills go from "nice to have" for small PHAs to "must have" for a unit-size PHA.

4.1. Skills to become an Excellent Scribe

The required skills to become an excellent scribe are described below. The use of them will be clearer in the next section (*Mastering PHA Scribing*) where the core requirements and additional value creating duties of an ideal Scribe are outlined.

Know and understand the process as much as possible

Some of the descriptions in the previous section mentioned that it is not a requirement for the Scribe to know/understand the process as long as he/she can follow the conversation. While that may be technically true, such a Scribe won't be anywhere near as effective as one with a basic familiarity with the subject (and any associated vocabulary).

If the Scribe knows and understands the process, or can quickly learn the chemical process, then he/she will understand easier what the team discusses, especially for those scenarios that affect several parts of a plant. This will allow him/her to record the scenario in the right place of the PHA tables and create all the deviation links (if *Linking* is used). If he/she doesn't understand it properly, then he/she will have to do the clean-up of the records outside the meeting (increasing the Documentation time), which can introduce errors or inadvertent omissions of key details.

> *Example: In a large gas plant, for the "Contaminants" deviation at the front-end nodes, the team would say "The actual consequence is in the Cold box. Knowing what the "cold box" is, where it is, and how it is connected to the equipment being reviewed allows the Scribe to record the path of the scenario through different nodes (links) without further input from the team.*

Good memory

It's been scientifically proven that memory does not work like a recording device, however despite its flaws it's still a powerful tool for the Scribe to use during a PHA.

The main use of his/her memory is for:

- **Instrument/Equipment tag numbers:** Faster input. Reduces the clean-up time.
- **P&ID Numbers:** Faster finding of other nodes of related or similar scenarios.
- **Node numbers** (and description) for faster linking. Reduces the clean-up time. Faster "jumping to the right node" in case the team wants to be reminded of what was written in a previous node.

Certainly it's not intended that the Scribe has to sit down to study and try to memorize all that information. However, he/she can do a little effort to try to absorb this kind of information while doing other tasks, as explained below in this paper.

Multi-tasking

Nowadays, multitasking is a skill required for almost any job; and Scribing is not an exception. The Scribe has to be able to:

- **Listen** to the team's discussion. This itself may require mental multiplism when several team members are speaking at once (often in a heated debate). Pulling relevant information from such chaos is more often than not unavoidable, especially when the team is includes more 'passionate' individuals.
- **Record** scenarios in the PHA tables

- **Look for information** (equipment/instrument tag numbers, nodes numbers, etc.) in P&IDs
- **Provide support to the PHA Leader** to ensure no deviation/node is skipped, no scenario is left incomplete, ensure the team is not saying something that conflicts with what they've said before.

Omnipresence

This skill requires the combination of the three skills mentioned above and it's the one that makes the biggest difference for the meeting. The Scribe has to be able to **"be in the past, present, and future" at the same time:**

- **Past:** This is where "good memory" plays its role either for faster input or supporting the Leader/Team with what was recorded in previous sections. This becomes more important for PHAs without back-to-back sessions.
- **Present:** The usually described task for a Scribe. Listen and record the discussion.
- **Future:** Be one step ahead of the Team to foresee future discussions for faster input. Sometimes, the pace of the meeting won't allow this task to be done because the listening/recording task requires too much effort. Sometimes the Scribe and pre-emptively input information on the evenings between long meetings, but then great care has to be used to correct or delete any text that does not match what was predicted. Also, a proficient Scribe should be alert and constantly anticipating the needs of the Leader, ready to assist with materials or information before being prompted.

The Scribe is the interface between the PHA Team and the PHA records. The Scribe becomes the "search-engine" or "Google" of the PHA; the ability to rapidly retrieve key information and comments will dramatically improve the overall speed and convenience of the meeting.

Substitute Leader

Replacing the PHA Leader is far from being Best Practice or something desirable. However, there are situations in which it can't be avoided. If the PHA Leader has to leave the meeting for a given period of time and the meeting cannot be stopped due to a tight schedule, the Scribe may be able to take the responsibility and play both roles: Leader and Scribe (albeit it at a lower meeting pace). If the PHA Leader has to be absent and the Scribe cannot fulfill that role, then perhaps one of the more experienced members of the team can take over as Leader (since it is an easier role than Scribe); otherwise the meeting must be paused or rescheduled (depending on the situation).

5. Who can become an Excellent Scribe?

The Scribe role can be fulfilled by anyone who has all the skills mentioned above. However there are two skills that set the bar high in terms of requirements:

- The Scribe needs to know and understand the process; therefore some kind of engineering degree (or equivalent) is needed
- The Scribe has to be trained in the PHA techniques

Sometimes the Scribe role is filled by a fully competent PHA Leader or one who is still in training. Other times junior engineers are used for this role. The junior engineer won't be able to replace the PHA Leader in case of an emergency, but they tend to be faster and more comfortable with the software.

6. Mastering the Scribe role

The Scribe skills by themselves won't do very much for the PHA performance if they are not coupled with the proper tasks to exploit them. This section will go through a couple of things a Scribe can do before and during the meeting to provide the greatest support to the PHA.

6.1. Before the meeting

Study the process

Unless the Scribe is already familiar with the process to review, the first step for him/her to take is to study the process. It is not expected for him/her to be an expert; **knowing the materials and their main flow paths is enough for the role** (this is key to document scenarios that cover several parts of the plants properly without much team's input). Learning about flowrates, material/heat balances, applicable codes, etc., do not make a significant difference for the Scribe (though it does for the Leader and Team Members).

Define the nodes and set up the file

It is usually suggested that the Node sectioning is a Leader's responsibility, and actually it is; but he/she doesn't have to be the one doing it. It is best if the Scribe is the one highlighting (either by hand or electronically) and naming the Nodes. The two main reasons for this are:

- Relieves this burden from the Leader and gives him/her more time to study the process, read about previous incidents in the industry or in the site (if it's an existing plant), and study other PSI.
- **It's the best opportunity for the Scribe to get familiar with Nodes numbers/colors, P&IDs, and equipment/instrument tag numbers. This is when the Scribe has to do a little effort to try to retain some of this information.**

Even if the Scribe is a fully competent PHA Leader, this task cannot be done 100% by himself. The person in charge of leading the meeting is the PHA Leader and he/she may have some particular preferences for the node sectioning (merging low complexity nodes to use What-if, a specific order of nodes, etc.). Therefore Node sectioning is a task performed by the Scribe but with the Leader's input. This can be done by reviewing the process and P&IDs together before starting the sectioning; then the Scribe can do the sectioning following best practices (See rules from PII in their PHA/HAZOP Leadership course, ©2003-2018). For large projects this review can be done unit-by-unit or splitting Process/Utilities.

Every person is different and knows what works best for him/her to retain information. Even though, PHA software allows the user to enter Nodes information (Node number, Name, Associated drawings, etc.) it cannot be seen all at once unless a Nodes summary report is printed out or otherwise pulled up in the software. This is why it is suggested to create a Nodes list (such as the one shown in Table 2) and then use it to enter the information into the software. While creating this table, the Scribe subconsciously visualizes information about the nodes (not only the one being created), and it helps him/her to retain Node numbers, colors, some drawings associations and equipment numbers. Color coding helps prevents errors and it aids recall.

Table 2. Example: Suggested Nodes summary table

#	Name	Color	Drawings			
1	Refrigerant accumulator (VBA-23235)		523-746			
2	Refrigerant from Refrigerant Accumulator (VBA-23235) to High Level Propane/Butane Chiller (EBG-24005/24020) and through Low Stage Refrigerant Mixer (MX-22016) to Refrigerant Suction Scrubber (VBA-23240) and through High Stage Refrigerant Mixer (MX-22026) to Refrigerant Interstage Scrubber (VBA-23245)		523-746	523-741	523-742	523-743
3	High Level Propane/Butane Chiller (EBG-24005/24020)		523-741			
4	Refrigerant from High Level Propane/Butane Chiller (EBG-24005/24020) to Refrigerant Interstage Scrubber (VBA-23245)		523-741	523-743		
5	Refrigerant from High Level Propane/Butane Chiller (EBG-24005/24020) to Low Level Propane Product Chiller (EBG-24010)		523-741			
6	Low Level Propane Product Chiller (EBG-24010)		523-741			

At this point, **organization** is an important issue. Keeping Nodes organized will help during the meeting for faster searching and linking between nodes. It is a good practice to group the nodes that belong to the same area/unit; some software allows creating different folders within a file for different groups of nodes. Each Group/Folder would be like a block in a plant's Block diagram, but with no interconnections between the blocks. Having the Nodes organized and grouped will become a clear "road map" of the PHA. The process path will be somewhat coherent with the numbering; so, unless the process is too branched or has several parallel units, the Scribe knows that if the Team is reviewing Node 20 and they mention an equipment that is downstream, its Node number will be higher than 20. Auxiliary systems, utilities to the main process, and recycle streams are the exceptions, of course.

Once the Nodes have been defined and grouped, the Scribe can set up the file in the PHA software (also, these tasks can be done in parallel). Before the start of the first meeting, the scribe can develop the total Nodes and, if the software allows it, along with the standard set of deviations or what-if/checklist issues for each node/section (depending on the nature of it. Example: if it's a pipe Node, there'll be no Level deviations). This provides all of the blank spaces for each possible issue, so the scribe can quickly document issues that come up, regardless of the sequence they come up. This can save 10% of the meeting time and saves a little after meeting time, as well. [10]

Pre-populating tables with "almost obvious" causes/safeguards (like control loops, relief valves, etc.) to be confirmed during the team's discussion is something the Scribe could do before the meeting. However, the previous tasks are time consuming (especially if the P&IDs are highlighted electronically instead of by hand) and if the Scribe is expert enough, he/she will still be able to record all during the meeting without slowing the meeting pace down. Therefore, it'll be more time-efficient if the Scribe cleans-up the notes recorded after the meetings rather than pre-populating the tables beforehand. There may be a few exceptional cases in which the Leader, due to very tight schedules, adopts a pace in which the Scribe cannot adequately capture the material. For those cases, he/she may have to pre-populate obvious items; but this should be done only for the nodes that will be covered in the following sessions (this has to be discussed with the Leader beforehand). Another scenario in which pre-populating the tables is a good idea is when the software to be used does not allow the Scribe to do the entries fast enough.

6.2. During the meeting

Listen and record

This is ALWAYS the Scribe's priority over any other task he/she could do. Keeping record of the PHA Team's discussion is his/her only responsibility; the other side-tasks are for efficiency improvement.

The Scribe is meant to capture Causes, Consequences, and Safeguards as detailed as possible (trying to include information such as number of times a task is performed per week/month/year, RV sizing scenario, maintenance/inspection methods and frequencies, alarm responses, etc.). Almost always, he/she will have to sacrifice detail and grammar (during the brainstorming session) and use shorthand/abbreviations in order to record all the "enough" detail, without hindering the meeting speed. The wording can be fixed outside the meeting; as long as the scribe can understand 100% of his/her notes. This is one of the reasons why it is a good practice NOT to project the Scribe's screen (the team would tend to focus on editing his/her wording and will not appreciate the shorthand much, instead focusing on the brainstorming; thereby, wasting time and wearing the team out faster) [10]. It's better to record lots of information in draft, shorthand, than to have less information perfectly worded.

Recommendations are a little bit different than Causes, Consequences, and Safeguards because usually the discussion pace slows down to reach a consensus on the recommendation. Recommendations are a very important output of the PHA; therefore they require special attention. The scribe must record the recommendation intent, why is it needed (scenario description), and the team's suggestion (if any). How to word those depends on the Leader's preference since he/she will be the one cleaning-up the recommendations outside the meeting. In most of the PHAs at PII, the Leader will take full responsibility for documenting the Recommendation, and the scribe will simply keep track of where they go. Then, after the meeting, then Leader (who is the Scribe for the recommendations only) will clean up the recommendations, and send the edited version to the Scribe for importing into the software and replace the "place keeping" text or number that was entered by the Scribe in the analysis table.

The best style for writing a recommendation is shown below. Always begin with a general statement of the concern so that management can address it in the wisest way possible. Then, provide management with a listing of specific suggestions (if the team has any).

Recommendation Nº: Consider… [state general concern]. Otherwise… [state the consequence that could occur]. The team considered… [list the existing safeguards]. Specific suggestions from the team include…

- The Otherwise sentence is optional.
- If you don't list the existing safeguards, then management may think the team missed these safeguards and may judge that the risk is tolerable as is
- Specific suggestions from the team are listed without rating.

Pace: Trying to keep up with the discussion is the toughest part for the Scribe; even if the Scribe is extremely experienced there will be times when he/she has to ask the team to recap in order to record everything. The more experienced the Scribe the fewer times he/she will have to ask for a recap. To reach that point the Scribe depends mostly on:

- Fast typing skills
- Memory
- Knowledge of the process
- Software user interface and features

The first three bullets are explained and mentioned throughout this paper; however, little has been said about software. How much the software can aid the Scribe should be the main characteristic to look at when choosing the software; printing out fancy reports and charts shouldn't be the dominant feature. Figure 1 shows a suggested screen layout and it requires the software capability to have two (or more) nodes opened at the same time in different windows. The software used in the picture is HazardReview LEADER™ by ABS Consulting, which PII ranks as the best of the commercially available, PHA-specific software:

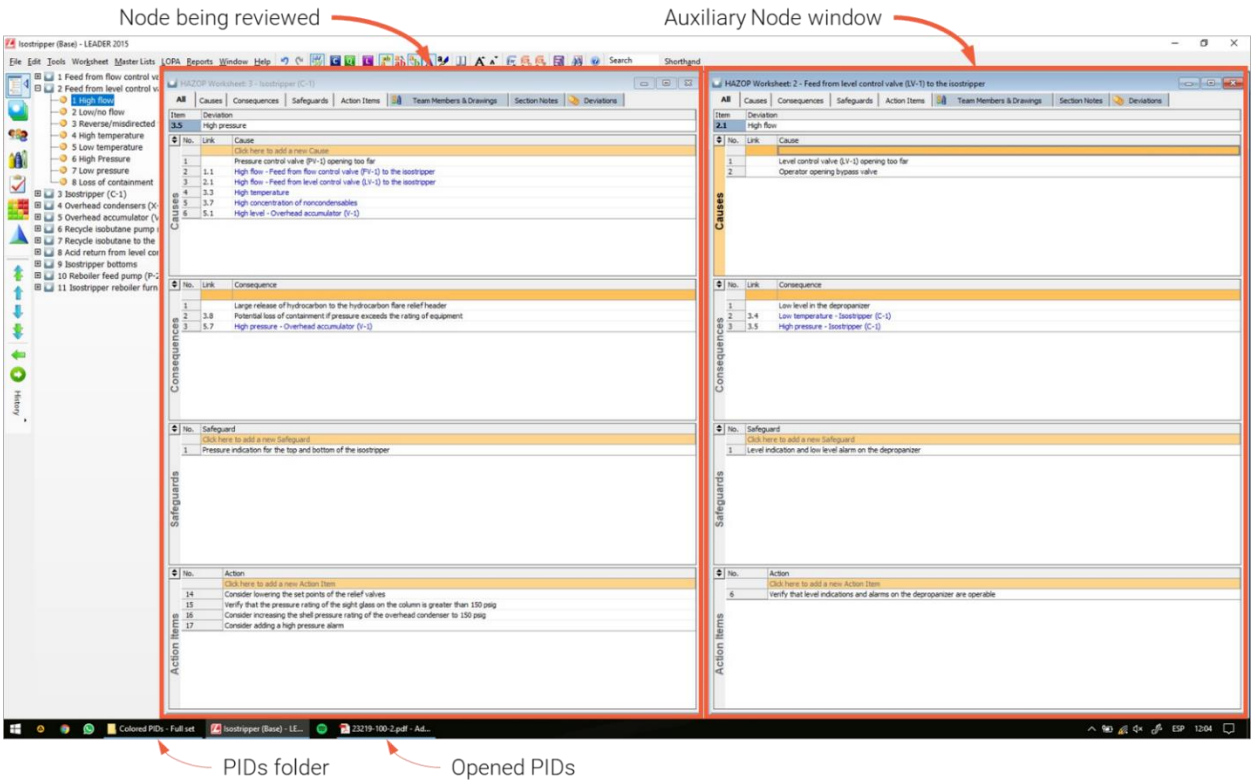

Figure 1. Suggested Scribe's screen layout (Software: LEADER by ABS Consulting)

The purpose for having two separate windows is to allow the Scribe to have the Node being reviewed on screen at all times to record anything the team says, and to have an auxiliary window to use for checking other nodes for reference (to copy/paste or drag and drop causes, consequences, safeguards), to review what was written in a previous node or to include links in upcoming nodes.

> *Example: In Figure 2, during the analysis of High pressure of Node 3, the team says: "High pressure in this node leads to possible rupture in the next node, Node 5". So, with that sentence the Scribe understands the scenario path even though it was not perfectly worded. The scenario path is:*
>
> *High Pressure in Node 3 → High Pressure in Node 5 → Loss of containment in Node 5*
>
> *In the left-side window the Scribe records as a consequence in Node 3 the link to High Pressure in Node 5. But, instead of using that window to complete the links, he opens Node 5 in the right-side window (in case someone says anything related to Node 3 – which is the actual concern now) and there completes the link from High Pressure in Node 5 to Loss of containment in Node 5.*

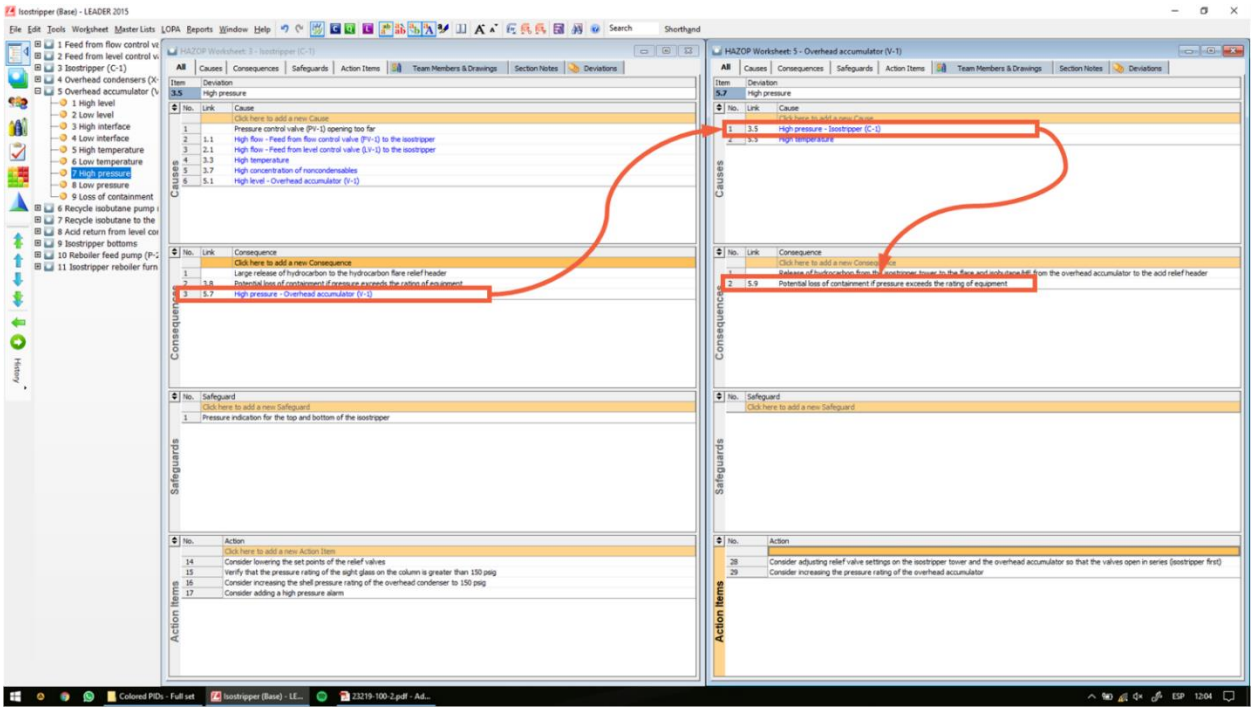

Figure 2. Multi-window use example

HazardReview LEADER™ by ABS Consulting, is the only PHA software that automates the completion of **links** between deviations (creating the words in the consequence column to show where this will be the cause of another deviations). This one feature alone can save 25% of the meeting time, when using HAZOP of a continuous flow process.

Another feature that some PHA software has and that can be very useful for the Scribe is Shorthand. Shorthand is the automatic replacement of a given string of text for another, triggered when pressing the space/enter key. For example *"nci"* is replaced automatically by *"No consequence of interest"*. If the Shorthand list is editable, the Scribe can add the abbreviations/acronyms of his/her preference. The use of this tool makes the input several times faster allowing the Scribe to catch the team's discussion without sacrificing details. This feature can save 10 to 20% of the meeting time.

Support PHA Leader and PHA Team

The Scribe is the Leader's sidekick. Just like Sam couldn't carry the ring for Frodo in *Lord of the Rings*; the Scribe cannot take the Leader's responsibility, but instead can help the Leader fulfill the mission. The attention span and memory are limited resources for both Leader and Scribe; however, the Scribe has a huge advantage - the PHA records in front of him/her. Therefore, the Scribe has to use what's typed/written to support the PHA Leader, when needed.

The main things that the scribe has to be aware of to support the Leader are:

- Ensure that all deviations were covered in the Node/Section under review.
- Ensure that what's being recorded does not conflict with anything recorded previously.
- Remind the Leader if a Recommendation/Open Item addressing a given issue already exists.
- Remind the Leader if there's a concern to be discussed in the Deviation under review. The concern can come from the initial Leader and Scribe review during the pre-meeting phase or the team's discussion in previous Nodes.

- Try to catch low-voice sidebar PHA-related discussion of Team members. The Scribe should pay special attention to Operations personnel where they mention accidents that have happened but the engineers are saying "No credible cause" or "No consequence of interest".

Another thing the Scribe should do is to be ready to support the PHA Team any time. The Scribe is the only one with access to what has been recorded; therefore is the only one who can retrieve information in case its needed. Usually, the information asked by the team is:

- What was recorded in a similar Node/Section for the deviation under review?
- What was the Recommendation recorded for a particular issue or does one already exist?

To be efficient in both supporting tasks (Leader and Team) takes hours and hours of experience in PHAs and, above all, requires the Scribe to be a fast software user. The Scribe must be quick in going to a specific Node, tab or window; it is suggested that the Scribe uses keyboard shortcuts or icons in the tool bar (if the software allows it). Also, a good scribe's memory reduces the "searching" time within the software.

> *Example: A team member says "High temperature in this vessel is almost the same as in V-101. What did we say there?". That's the trigger for the Scribe to start searching.*
>
> *- If the Scribe remembers V-101 Node number: he can quickly go to that node (maybe, using a shortcut), open the High Temperature deviation, and tell the team what's recorded in it*
>
> *- If the scribe does not remember: First, he/she will have to find in which unit/area the vessel V-101 is in. Then search within that unit/area by reading the Node titles until finding V-101. Open the node, go to High Temperature deviation and tell the team what's recorded in it. Or the scribe can of course look on the marked up P&ID and find the node number. Whichever is faster.*

For the second option to be efficient (i.e. to reduce the search time) a few things are needed:

- The Scribe has to know the process and have good memory to reduce the time needed to locate V-101 at a macroscopic level.
- The nodes have to be organized (preferably in folders/groups).
- The node numbers on the associated file have to be clear, correct, and if possible even color coded to the analysis worksheets.

Get ready for future discussions

Even in the smoothest PHAs has downtimes in the meetings (e.g. when switching Nodes, team members have to look for all the P&IDs involved in the next node; when a team member is looking for information on a data sheet; etc.). During that time, the Scribe can:

- Pre-populate some trivial causes or safeguards (like control loops, relief valves, etc.): All of them will have to be confirmed during the team's discussion. If the best practice of not projecting the Scribe's screen is followed; the team won't be biased with whatever he/she has written in the tables. It's better for the scribe to record some things that he/she is 95% sure are correct and delete them if the team proves him/her wrong, than to wait until the team says it to record it. This little saving of time allows the Scribe not to fall behind with the recording (while still recording with a decent amount of detail).
- Complete previous records: Add equipment/instrument numbers, links, etc.
- Talk with the PHA Leader about the short-term plan, remind him/her if anything is missing or was skipped, if the Scribe noticed something in the P&IDs that should be asked/discussed with the team, etc.
- Ask a team member to start looking for information needed in the upcoming node. Examples:
  - "Deadhead pressure of pumps P-101" to the Process engineer.
  - "PAHH-201 logic and set values" to the Instrumentation engineer.

- "Are there any Gas/Flame detectors around V-101?" to the Safety engineer.

Maintain integrity of the PHA minutes

A critical task for the Scribe is to maintain the integrity of the PHA minutes. Good practices (learned by painful experience) include:

- Ensure that the minutes are saved to the hard drive after each Node is entered (some software automatically saves any change made to the file).
- To avoid crashes, exit and restart the software at each break.
- To provide backup in case of file corruption, make a copy of the minutes file at each break and provide a sequential number for each working file. For example, the name scheme "XYZ Company Reactor PHA 20180203 1305" includes the date and time the copy was created (1305 or 1:05 PM, Feb 03, 2018). The file titles named in this way will sort in time sequential order. If internet or intranet access is available, upload the backup copy to a server (company server, Dropbox, Google Drive, etc.).
- Ensure that only the latest version of the minutes is edited.
- At the end of the day, backup the file to a server or memory stick.

These practices can avoid major time sinks to recreate work lost by file corruption or PC crash.

7. Time savings

It's hard to isolate the contribution of the Scribe from the overall PHA performance since there are many other factors affecting it as well (quality and availability of the PSI, team composition, experience and attendance, Leader's experience, etc.). However, his/her influence can be appreciated qualitatively in the quality and degree of detail in the PHA tables recordings and quantitatively in the number of hours required after the meetings to clean-up his/her notes (Post-meeting/Documentation phase of the PHA).

PII has tracked the evolution of one of its scribes in his first three large PHAs (+10 days). As his experience grew, the time needed for Documentation (tables clean-up after the meeting) decreased up to 30% compared with the time required for a good Scribe (Table 3). It's very likely that this can be reduced even further down to 50% in a PHA with excellent PSI, team composition, and leadership.

Table 3. Evolution of the Scribe's performance with experience

#	PHA Scope	Scribe experience	% Documentation time used vs. a good scribe
1	Large gas plant	. Good experience in PHA techniques . Little experience with the software . Little PHA/Scribing Best practices	100%
2	Large LPG Fractionation plant	. Good experience in PHA techniques . Good experience with the software . Good PHA/Scribing Best practices	90%
3	Cooling section of large LNG plant	. Excellent experience in PHA techniques . Excellent experience with the software . Excellent PHA/Scribing Best practices	70%

This time saving does not mean that he's become faster with the clean-up; it means that his notes are more complete and in better shape when the meeting adjourns and the notes need fewer edits.

PII published a paper that shows the estimate for the time distribution of a PHA that follows best practices (based on a PHA with 90h of meetings) [10]:

Table 4. PHA time distribution following PHA Best practices [10]

PHA Phase	Time distribution	Leader	Scribe
Preparation	5%	15h	15h
Meeting	50%	90h	90h
Documentation	45%	80h	80h
TOTAL	**100%**	**185h**	**185h**

However, that prior paper did not include the Scribe's best practices included in this paper. As mentioned before, an excellent scribe could eliminate up to 50% the Documentation time after the meeting; on the other hand if the Nodes are colored electronically in PDF version, the Preparation time doubles. Taking into account those factors, Table 4 is updated to as shown in Table 5:

Table 5. PHA time distribution following PHA and Scribing Best practices

PHA Phase	Leader time distribution	Leader	Scribe time distribution	Scribe
Preparation	5%	15h	~20%	30h
Meeting	50%	90h	~55%	90h
Documentation	45%	80h	~25%	40h
TOTAL	**100%**	**185h**	**100%**	**160h**

The total time required for the PHA would be 370h for the PHA following best practices with a good scribe and no digital colored nodes and 345h for the PHA following best practices with an Excellent Scribe and digital colored nodes (Figure 3). **This means a ~10% of total time saving with the additional benefit of improved quality in the PHA worksheets content and the digital colored nodes.**

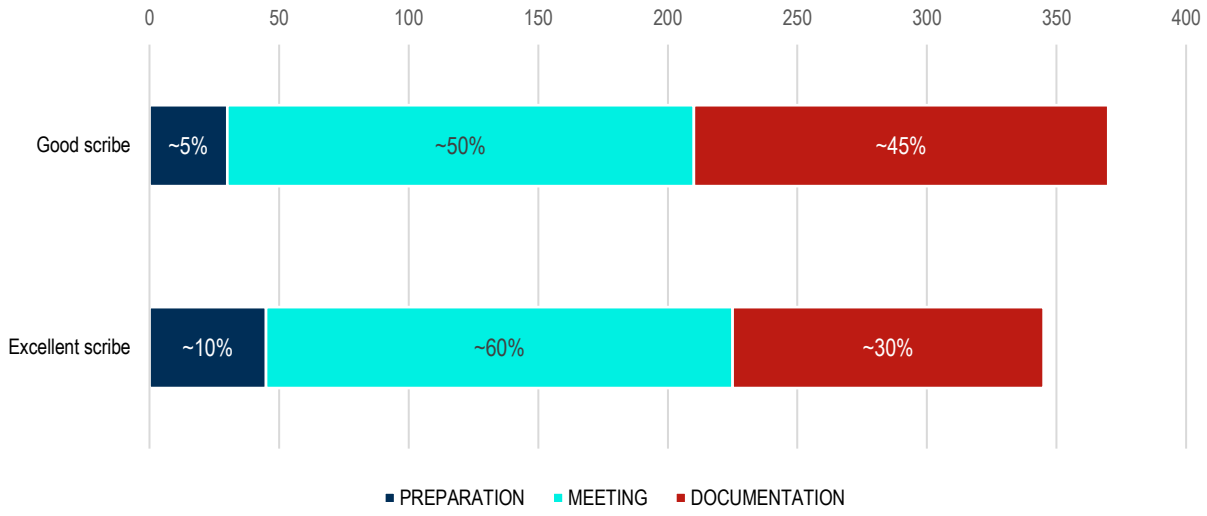

Figure 3. PHA Total time comparison

8. Conclusions

The Scribe role is usually underestimated, but this paper shows the Scribe can have a significant impact in the PHA quality and a major impact on the PHA speed (without sacrifice of quality). The main contributions are:

- **Reduces documentation time:** An Excellent Scribe can half the time required by a Good Scribe; this time saving could be used to color P&IDs digitally, thus improving the quality of the report.
- **Improves the quality of the entries in the PHA tables:** Following Best practices allows the Scribe to have a little extra time to add more details in the PHA records without falling behind with the PHA team discussion
- **Enhances meetings to run smoothly:** The Scribe plays a crucial support role for the PHA Leader and Team and also takes advantage of the small downtimes during a PHA meeting. All of the best practices sum to less delays to the team for the sake of meeting notes.

The overall improvement of an Excellent Scribe versus a good Scribe is **a saving of ~10% of total PHA time with the additional benefit of improved quality in the PHA worksheets content and the digital colored nodes. The overall benefit of a Good Scribe using best practices versus a Rooky Scribe is a 200% improvement in meeting speed while still improving documentation quality.**

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