Effective PHA Studies - Challenges in Industry

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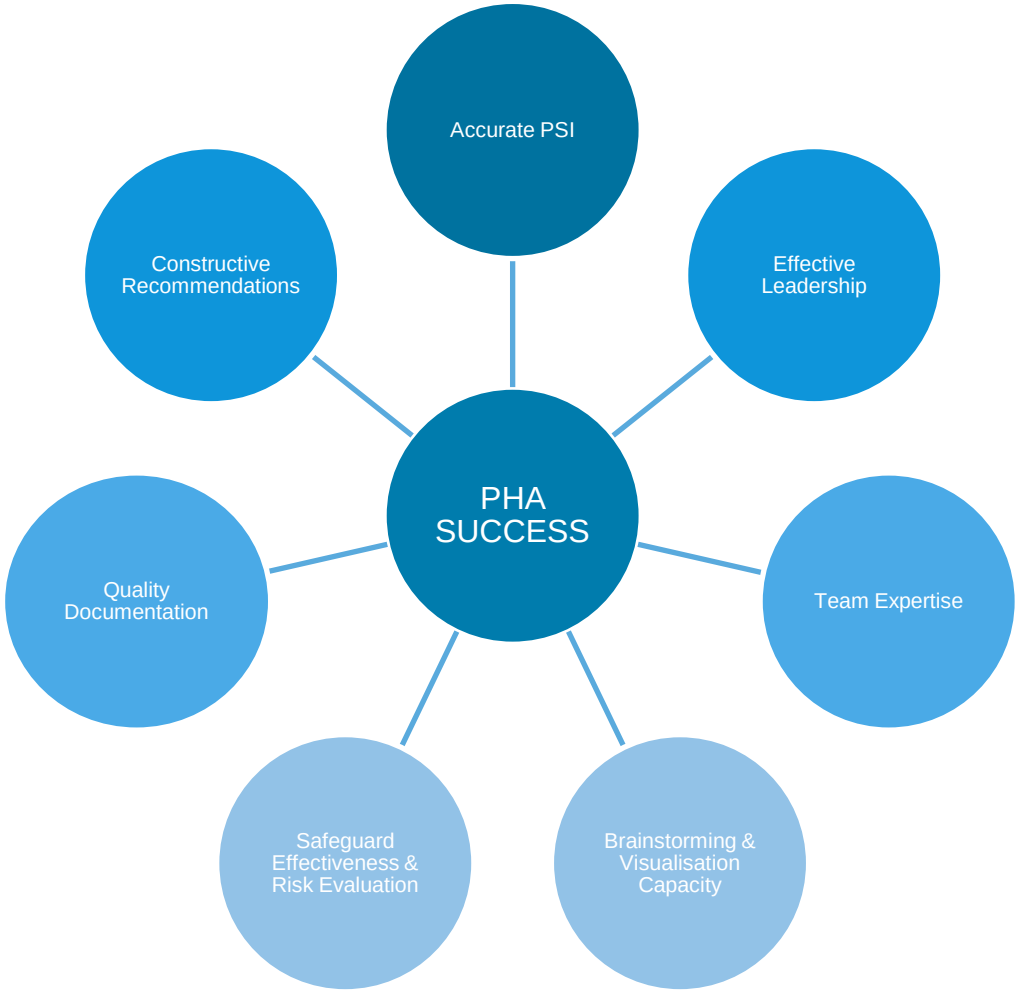
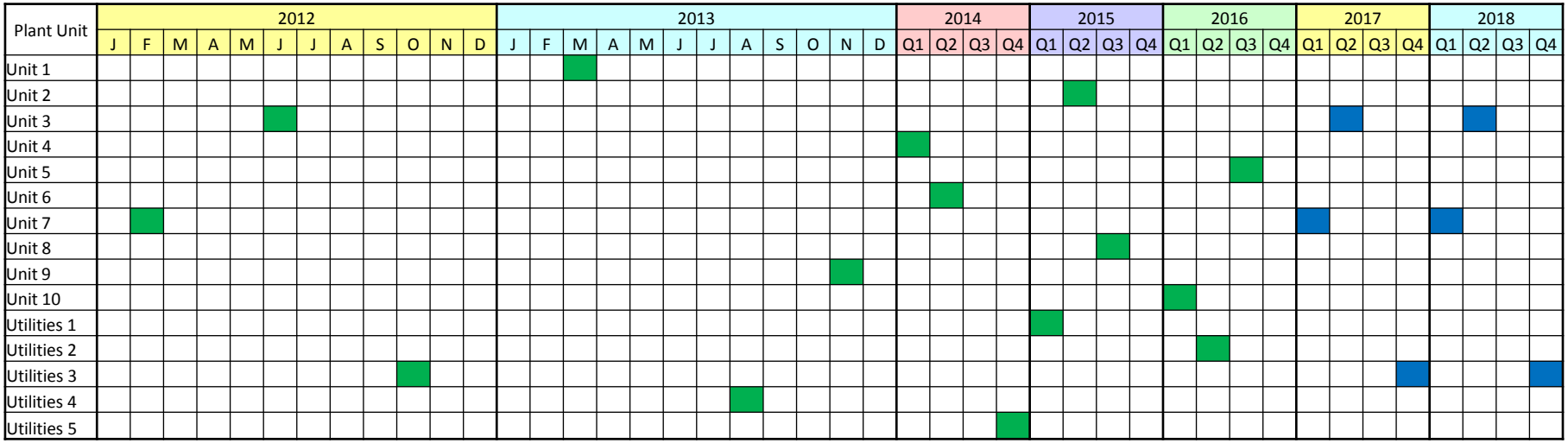
Challenges to Effective PHA Studies

- Preparation and planning
- Facilitation and team membership
- Cause identification and consequence development
- Safeguard evaluation and risk assessment
- Documentation of study
- Recommendation generation and management
- Quality Assurance



Preparation and Planning

- Develop a facility rolling schedule or project phase-based schedule for PHA studies
- Include PHA studies in business planning cycles
- Allocate a PHA Study coordinator for each study
- Select facilitator and key team members early



Accurate Process Safety Information (PSI)

- Early preparation!
- Start compiling PSI 3 months in advance for existing facilities
- Use frozen P&IDs for projects
- Best practice includes field walk of P&IDs by operators
- Other PSI validated by experts prior to study
- Examples of PSI typically referenced in PHAs:
  - P&IDs
  - Relief system design basis
  - Safety system descriptions
  - Design specs for equipment and piping
  - Safe Operating Limits

Effective Leadership

Facilitators must have:

- Appropriate engineering or operations experience and be competent in applying PHA methodology
- Demonstrated organisational and leadership skills
- Solid understanding or relevant process hazards and industrial accidents

Consider:

- Mentoring program for new internal trained facilitators
- Vetting and review program for external facilitators

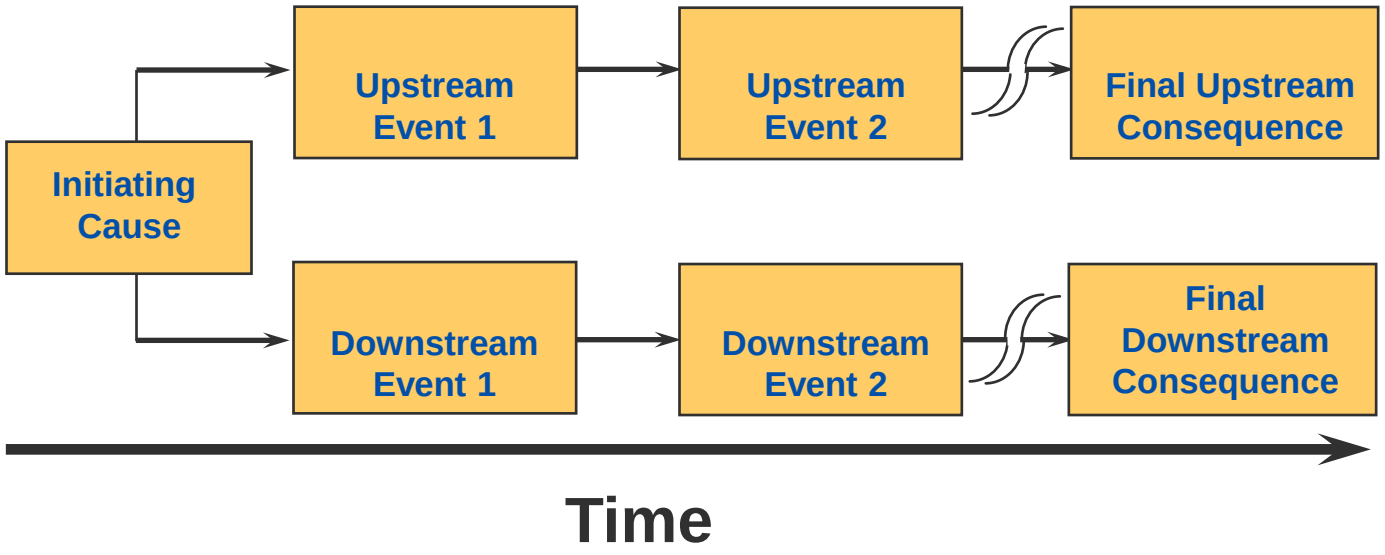
A qualified PHA team without an effective leader can still generate a poor quality outcome

Team Expertise

- Select team members based on their expertise and experience both in industry and on the specific facility being studied
- Operations representatives need to have recent operating experience with the plant
- Determine if any specialists are required
- Establish clear expectations of full-time and part-time participants

Brainstorming and Visualisation Capacity

- Identify credible initiating events/causes
- Develop worst-case scenarios
- Evaluate consequences assuming all safeguards are ineffective
- Consider global consequences, both upstream and downstream of initiating event



Safeguard Effectiveness and Risk Evaluation

- Safeguards should be claimed only if they are documented and proven
- Clearly establish what the safeguard is doing to reduce, mitigate or respond to the risk

PHA Safeguard	Example Standard Documentation	Potential Analysis Considerations
Process control loop	LIC-800 at V-100 bottoms will operate to maintain level in column.	• Loop must be independent of the scenario cause (e.g., if a control valve open is the cause, the loop driving that valve is **not** a safeguard) • loop must be routinely in automatic mode during the phase of operation being studied
Corrosion prevention and monitoring	C-100 overhead control includes ammonia injection for pH control (AIC-100). C-100 overhead corrosion coupons tested quarterly to measure metal loss.	• Known corrosion mechanisms are controlled and/or closely monitored • corrosive materials are neutralized or inhibited • corrosion is actively monitored using sacrificial coupons

- Evaluate risk (consequence severity vs likelihood) to determine if additional safeguards, or barriers, are needed to effectively manage the risk of our operations

Quality Documentation

Clear documentation is essential for a quality PHA

- Consequence descriptions should be in chronological order starting with the initiating event and ending with the ultimate consequences
- Safeguards should define how they will prevent the scenario from occurring, or make the consequences less severe
- Recommendations should be worded clearly so that they can “stand alone”, outside the context of the PHA Worksheet

Constructive Recommendations

- Need to address the specific concern being assessed
- Deliver a measurable reduction in risk
- Be written to ensure the intent or risk reduction requirement will be met rather than prescriptive solutions to allow for optimal engineering input
- Promote safe and reliable operation of the facility

S – Specific
M – Measurable
A – Accountable
R – Relevant
T – Time Limit

Note: "A" and "T" not typically completed during PHA session – post workshop activity

PHA Assurance Process

There are five quality dimensions to a PHA study:

- Completeness
- Comprehensiveness
- Consistency
- Traceability
- Documentation

It is essential to have a process in place to review the quality of completed PHA studies prior to finalisation and acceptance

Sample Quality Assurance Checklist

When performing a quality assurance review of a PHA, the reviewer should use the following guidelines to ensure that all identified issues have been addressed:

1. Are the PHA team members identified?
2. Do team members meet minimum requirements?
3. Does the PHA report clearly identify the study boundaries? Are study nodes clearly defined, both in tabular form and on the P&IDs?
4. Is the design intent of each node/section clearly defined and understandable?
5. Do what-if questions generally address initiating causes/events rather than consequences?
6. Do the what-if questions or HAZOP causes generally address both equipment failure and human error?
7. Spot check P&IDs to ensure that obvious what-if questions or HAZOP causes are being identified and documented. (For example, check to make sure that all control valves fail open and close, pumps stop or do not start, etc.).
8. Spot check to ensure that consequences are being developed without safeguards.
9. Spot check to ensure that consequences are being developed in what appears to be chronological order, up to and including the worse-case consequences.
10. Spot check safeguards versus initiating cause to ensure that common-mode failure is considered.
11. Is there a description of the risk-ranking matrix, and how it is used as a tool to qualitatively evaluate a range of safety and health effects on employees and the public? Do the consequences described in the PHA worksheets illustrate how employees and the public may be affected by the scenario?
12. Compare Risk Priority Ratings of similar scenarios to determine if risk factors are applied consistently.
13. Do the recommendations appear to address the identified cause/consequence scenarios?

PHA Success Summary