

**Hazard & Operability  
Studies = HAZOP  
“SCOPE OF WORK”**

## ***Hazard and Operability Studies = HAZOP*** ***“SCOPE OF WORK”***

This is to identify and evaluate safety hazards in the plant and to identify operability problems which could compromise a plant’s ability to meet design productivity.

The purpose is to carefully review the process or operation in a systematic manner to identify potential “HAZARD” which could lead to undesirable consequences. This gives insight into the “HAZARDS“ that are present in the plant.

The results are identified “HAZARDS” and operability problems, recommended changes and studies.

### **Following steps and Procedure should be covered in each plant**

The requirements can be summarised as follows:

- 1- Data gathering
- 2- Understand the subject
- 3- Subdivide the plant and plan the sequence
- 4- Mark-up the drawings
- 5- Devise a list of appropriate Keywords
- 6- Prepare Table Headings and an Agenda
- 7- Prepare a timetable
- 8- HAZOP Study

Now you will see How to Approach the plan & what shall be accomplished in each of above.

#### **1- Data gathering**

All relevant documentation should be collected beforehand. This is consist of:

- Process Flow Diagrams.
- Comprehensive Process Description containing operating parameters, flow rates, volumes, etc., as well as a brief summary of how each plant item functions.
- P&IDs.
- Cause & Effect Charts setting out how control and trip systems operate.
- Details of vendor packages.

- Plant layout diagrams.
- PMS
- Equipment specifications
- Plant layouts
- All other relevant drawings

## **2- Understanding the subject**

- Good understanding of how the plant is meant to operate, by studying the data and if necessary talking to the design personnel involved/operators.
- Potential problem areas.

Private notes should be made of these, as they might possibly be missed during the course of the study.

This stage of preparation is perhaps the most important, because it is the foundation upon which the other steps in the preparation process will be built. Without a reasonable understanding of how the plant functions, it will be impossible to plan a sensible study strategy, decide how long the review is likely to take, or who needs to be included in the study team.

## **3- Subdividing the plant and planing the sequence\***

- Plant must be split into manageable sections (refer to attached Example because of the tabular means of recording the study). Also, the sequence in which these sections shall be studied.
- Progresses from upstream to downstream, with services such as drains, vent headers, instrument air, cooling water, etc. being considered separately and last.\*
- Subdividing the plant into small logical units. Therefore, a minor pump with its suction, discharge and kick-back lines might be grouped together in a Table. However, with a major compressor, the recycle line and its in-line cooler should be studied separately. Also, when studying a vessel the table should encompass those inlet/outlet lines up to and including any control/isolation valve/s, all level bridles, as well as vent lines up to the PSV.
- If a number of streams converge or coincide on a vessel, the study sequence should if at all possible deal with all of those streams before the vessel is considered.\*\*

---

\*With regard to splitting the plant into sections, there is no need to consider each line and every single minor item of equipment under a separate Table. This will be wasteful of time, and boring.

\*\* The rule is “never study a vessel until the incoming deviations are known”

- With batch operations, an entirely different approach is needed. In such a case the plant drawings are an accessory rather than the prime focus of the study. Of greater importance instead will be detailed flowchart or operational sequence of steps to be accomplished. It is these batch sequences which will need to be split into manageable sections, and key words may well target sequential operations such as prepare, charge, React, Transfer, Centrifuge, Dry etc. this methodology is required because an individual plant item is very likely to be put into differing states and serve different purposes at various stages of the sequence.

#### **4- Mark the drawings (If seen required for better approach)**

- When the study strategy has been decided, the plant items encompassed by each Table should be marked in distinctive and separate colours, with the Table Numbers alongside in the same colour.
- Lines should be paralleled, and equipment and vessels outlined in the chosen colour. Where a Table spans two or more drawings, the colour used should remain constant.

#### **5- Preparing list of appropriate keywords**

- Because most of the plant that they operate is of a similar nature, will have a standard set of Keywords. Such a list should be checked to ensure that it covers all aspects of the system to be studied. Any non relevant Keywords should be removed.\*
- The finalised list should be duplicated and a copy given to every team member. Also included should be schedule of appropriate keyword combinations (i.e. which Secondary keywords will be applied with each Primary keyword).
- When preparing the list, the smaller the number of words utilised, the more speedy the study. That is not to say that aspects of the process should be discounted. Instead, to illustrate what is meant, imagine a plant containing a separation vessel, some pump suction filters, and an environmental scrubber. Rather than have three keywords 'Separate', 'Filter', 'Absorb', have instead one keyword 'Separate' ... that, after all, is the basic function of all those equipment items. Similarly, 'Temperature' can cover heat transfer aspects of Heaters, Coolers, and Heat Exchangers.

---

\*For example, if the subject of the review is to be a pumping station, the inclusion of a keyword such as 'Absorb' is unnecessary.

- Where there are likely to be semantic problems as to what meaning/s a particular combination is intended to convey, then a full explanation should be given.

## **6- Preparing Table Headings and Agenda**

- Table Headings reference the relevant drawings, and contain a brief description of the design intent of the relevant plant section, with process parameters. Flow rates, and any other potentially informative details.
- The agenda is a list of those headings. A copy should be handed to each team member. In addition to being informative and an aid to full participation, it will serve to put into perspective the amount of work to be done in the time allotted.\*

## **7- Preparing a timetable**

- For all but a one day study, Preparing a timetable showing what needs to be accomplished at each study meeting if the schedule is to be maintained. In Preparing this schedule Manager will need to call upon his experience when assessing how much time the review will take.\*\*
- As a rough guide, with straightforward plant and with P&IDs which are not too 'complicated', on average three splitted drawings can be studied in a day. If the system to be reviewed is complex, or if each P&ID seems to have been drawn with the intention of not wasting any space (i.e. as many plant items as would fit are included on the drawing), then almost certainly only two or perhaps even one drawing will be completed in a day.

## **8- Hazop Study**

### **8-1 Identify:**

- *Deviations* from intended design / operation
- *Causes* of those deviations
- *Consequences* of those deviations
- *Safeguards* to prevent causes and mitigate consequences of the deviations
- *Actions* (recommendations) for design or operation changes to avoid deviation

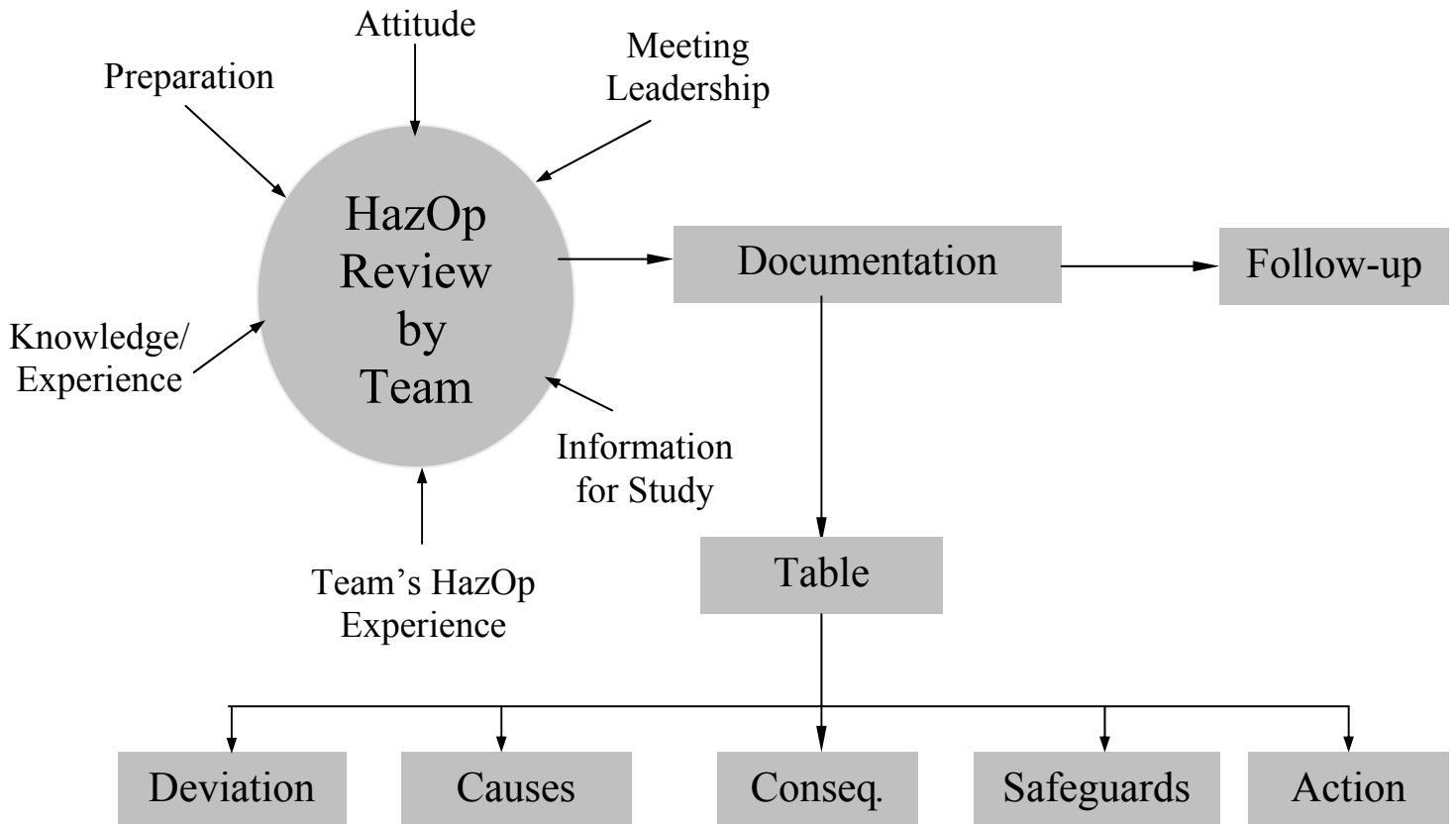
---

\* Hopefully this will induce an appropriate sense of urgency.

\*\* A great deal will depend upon the complexity of the plant as well as the experience of the team.

**8.2- Analysis**

**8.2.1- Table preparation for each splitted section**



**8.2.2- Check List**

**- General Layout**

<b>Item</b>	<b>Description</b>	<b>Completed</b>	<b>Does Not Apply</b>	<b>Further Study Required</b>
1.	Areas properly drained?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Aisle ways provided?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Fire walls, dikes and special guardrails needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Hazardous underground obstructions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Hazardous overhead restrictions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Emergency accesses and exits?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Enough headroom?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Access for emergency vehicles?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Safe storage space for raw materials and finished products?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Adequate platforms for safe maintenance operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Hoists and elevators properly designed and safeguarded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Clearance for overhead power lines?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**- Buldings**

Item	Description	Completed	Does Not Apply	Further Study Required
1.	Adequate ladders, stairways and escape-ways?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Fire doors required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Head obstructions marked?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Ventilation adequate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Need for ladder or stairway to roof?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Safety glass specified where necessary?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Need for fireproofed structural steel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**- Process**

<b>Item</b>	<b>Description</b>	<b>Completed</b>	<b>Does Not Apply</b>	<b>Further Study Required</b>
1.	Consequence of exposure to adjacent operations considered?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Special fume or dust hoods required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Unstable materials properly stored?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Process laboratory checked for runaway explosive conditions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Provisions for protection from explosions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Hazardous reactions possible due to mistakes or contamination?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Chemistry of processes completely understood and reviewed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Provisions for rapid disposal of reactants in an emergency?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Failure of mechanical equipment possible cause of hazards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Hazards possible from gradual or sudden blockages in piping?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Hazard possible from gradual or sudden blockages in equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Public liability risks possible from sprays, fumes, mists or noise?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Provisions made for disposal of toxic materials?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Material safety data sheets available for all chemical species?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Hazards possible from simultaneous loss of two or more utilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Hazards involved in sewerage materials?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Safety factors altered by design revisions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	Consequence of reasonably worst incident reviewed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	Consequences of combination of incidents reviewed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20.	Process diagrams correct and up-to-date?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**- Piping**

Item	Description	Completed	Does Not Apply	Further Study Required
1.	Safety showers and eye baths required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Sprinkler systems required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Provisions for thermal expansion?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	All overflow lines directed to safe areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Vent lines directed safely?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Piping specifications followed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Washing-down hoses needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Check valves provided as needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Protection and identification of fragile pipe considered?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Possible deterioration of exterior of piping by chemicals?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Emergency valves readily accessible?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Long and large vent lines supported?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Steam condensate piping safely designed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Relief valve piping designed to prevent plugging?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Drains to relieve pressure on suction and discharge of all process pumps?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	City water lines not connected to process pipes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Flammable fluids feeding production units shut off from safe distance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	Personnel protective insulation provided?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	Hot steam lines insulated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**- Equipment**

<b>Item</b>	<b>Description</b>	<b>Completed</b>	<b>Does Not Apply</b>	<b>Further Study Required</b>
1.	Designs correct for maximum operating pressure?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Corrosion allowance considered?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Special isolation for hazardous equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Guards for belts, pulleys, sheaves and gears?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Schedule for checking protective devices?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Dikes for any storage tanks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Guard rails for storage tanks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Construction materials compatible with process chemicals?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Reclaimed and replacement equipment checked structurally?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Reclaimed and replacement equipment checked for process pressures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Pipelines independently supported to relieve pumps?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Pipelines independently supported to relieve other equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Automatic lubrication of critical machinery?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Emergency standby equipment needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**- Venting**

<b>Item</b>	<b>Description</b>	<b>Completed</b>	<b>Does Not Apply</b>	<b>Further Study Required</b>
1.	Relief valves or rupture disks required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Materials of construction corrosion resistant?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Vents properly designed? (Size, direction, configuration)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Flame arrestors required on vent lines?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Relief valves protected from plugging by rupture disks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Telltale pressure gauges installed between rupture disk and relief valve?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**- Instrument and Electrical**

Item	Description	Completed	Does Not Apply	Further Study Required
1.	All controls fail safe?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Dual indication of process variables necessary?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	All equipment properly labeled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Tubing runs protected?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Safeguards provided for process control when instrument out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Process safety affected by response lag?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Labels for all start-stop switches?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Equipment designed to permit lockout protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Electrical failures cause unsafe conditions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Sufficient lighting for both outside and inside operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Lights provided for all sight glasses, showers and eye-baths?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Breakers adequate for circuit protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	All equipment grounded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Special interlocks needed for safe operation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Emergency standby power on lighting equipment required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Emergency escape lighting required during power failures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	All necessary communications equipment provided?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18.	Emergency disconnect switches properly marked?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	Special explosion proof electrical fixtures required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**- Safety Equipment**

<b>Item</b>	<b>Description</b>	<b>Completed</b>	<b>Does Not Apply</b>	<b>Further Study Required</b>
1.	Fire extinguishers required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Special respiratory equipment required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Diking material required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Colorimetric indicator tubes required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Flammable vapor detection apparatus required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Fire extinguishing materials compatible with process materials?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Special emergency procedures and alarms required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**- Raw Materials**

Item	Description	Completed	Does Not Apply	Further Study Required
1.	Any materials and products require special handling equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Any raw materials and products affected by extreme weather conditions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Any products hazardous from a toxic or fire standpoint?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Proper containers being used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Containers properly labeled for toxicity, flammability, stability, etc.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Consequences of bad spills considered?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Special instructions needed for containers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Special instructions needed for storage and warehousing distributors?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Does warehouse have operating instructions covering each product?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

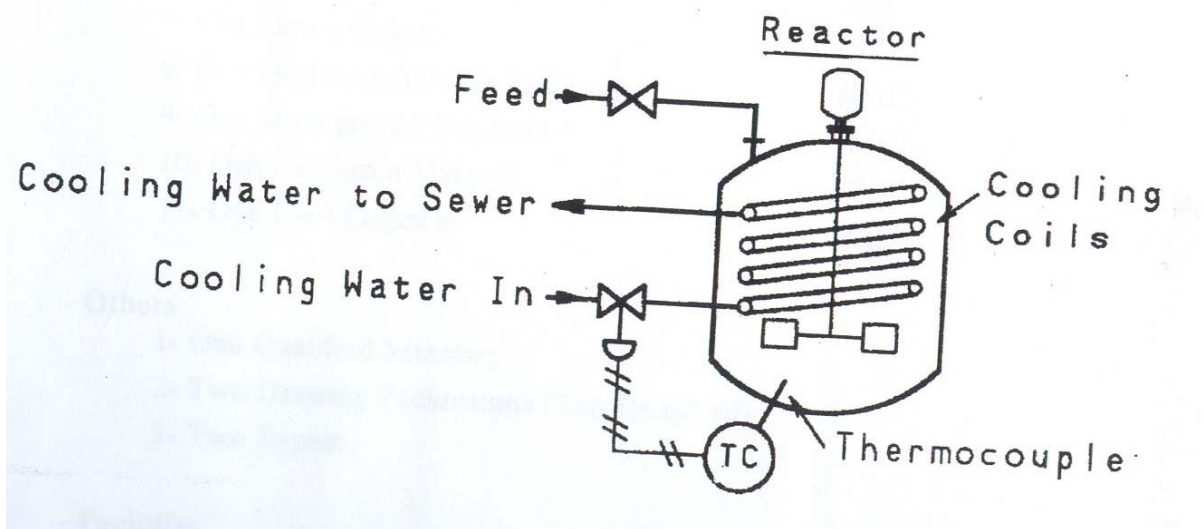
## **9- The Report**

- An outline of the terms of reference and scope of the study.
- A very brief description of the process which was studied.
- The procedures and protocol employed. The Keyword combinations applied should be listed, together with the explanatory meanings given to the team at the start of the study. Also the fact that action Sheets have been produced and responses will be recorded should be explained. A brief description of the action file (described in the following section) should be included.
- General comments. If, for example, the team were assured that high point vents and low point drains would be universally provided , mention that statement and its source. If certain details of vendor packages were not available , explain and list the items which were not reviewed.
- Results. This usually states the number of recommended actions. Also included in the Hazop Report would be an Appendix containing:
  - Master copies of the drawings studied.
  - Copies of technical data used.
  - Cause and Effect charts (i.e. matrices showing the executive action of safety related instruments and trips.)
  - Any calculations produced.
  - Relevant correspondence between departments, from contractor to vendor, or client to contractor.

Each of the above should be signed and dated by the Chairman.

**Example:**

The reaction system shown below is exothermic. A cooling system is provided to remove the excess energy of reaction. In the event the cooling function is lost, the temperature of the reactor would increase. This would lead to an increase in reaction rate leading to additional energy release. The result could be a runaway reaction with pressures exceeding the bursting pressures of the reactor.



**Identification / Preparation:**

Deviation	Causes	Consequences	Safeguards	Actions
No Cooling	Plug in Line	Temperature Increases	None	Temperature Alarm
	Blocked Line	Possible Runaway		Relief Valve
	Pipe Breaks	Broken Coils due to Block in		CW Low Flow Alarm
	CV Fails			Study of Water Reactant Interaction
	Controller Fails	Emergency Shutdown		
	CW System Fails	Back up CW System		
	Air System Fail	AFO Valve		
	Sewer Backs Up	Filter on CW		

**HAZOP Team & Facilities**

## **HAZOP Team & Facilities**

- **The engineering experts assigned to the process hazard analysis shall include all of the following:**

1- One Qualified person as team leader	(M)
2- One Process Engineer	(PrE)
3- One Machinery Engineer	(MeE)
4- One Piping Engineer	(PiE)
5- One Electrical Engineer	(EE)
6- One Instrument Engineer	(IE)
7- One Safety Engineer	(SE)
8- One Quality Assurance Engineer	(QaE)
9- One Maintenance Engineer	(MaE)
10- One Corrosion/Material	(CiE)
11- One Civil Engineer	(CiE)

- **Others**

- 1- One Qualified Secretary
- 2- Two Drawing Technicians (Top Qualified)
- 3- Two Typists

- **Facilities**

- 1- Four high Capacity Computer (Speed & Storage)
- 2- Two Colour Printers
- 3- Fully Furnished office, two offices double occupancy, one for the Expert Engineers & Drawings Technicians, Equipped with a large conference table and one for typists.