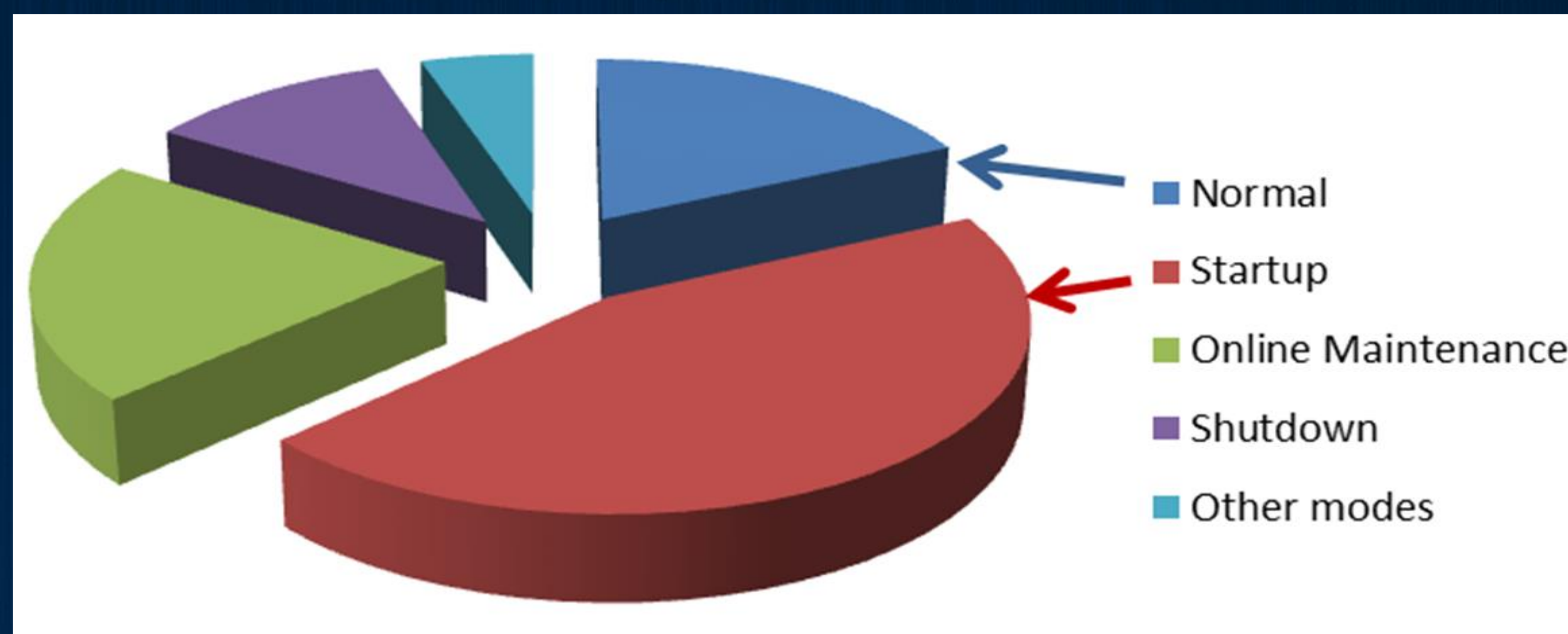


Further Lessons Learned on How to Efficiently Perform the Necessary PHA of Startup, Shutdown, and Online Maintenance

When Do Most Major Process Safety Accidents Occur?

70 to 80% occur during startup, shutdown, and online maintenance

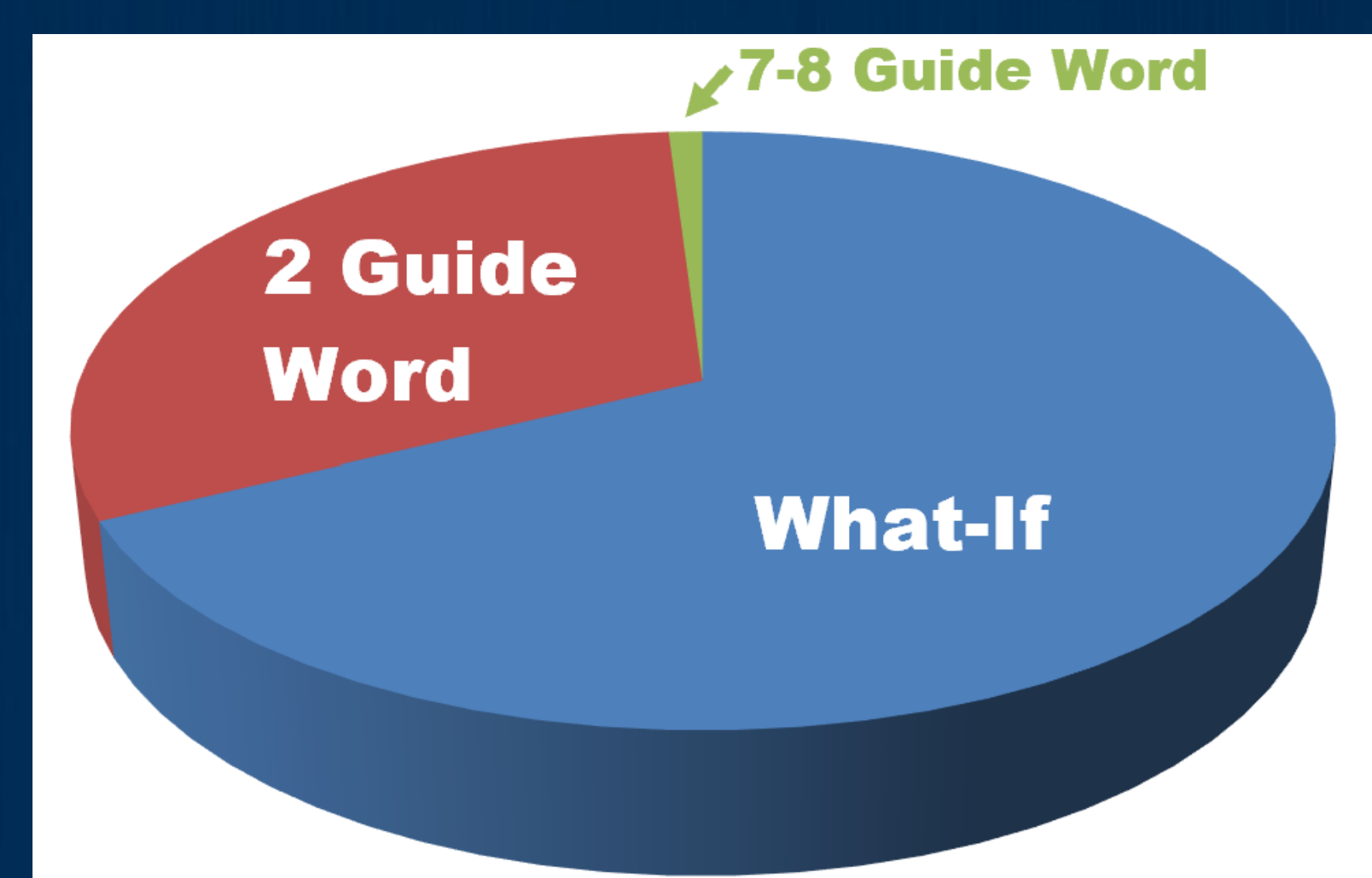


ENHANCED APPROACH TO PHA of NON-NORMAL MODES

#	SOP #	Description	Rev #	Risk Ranking
1	BUT 900	Vaporizer (AE-1131/S) Preparation for Maintenance	00	H
2	BUT 901	Commissioning Process (Hydrocarbon) to Vaporizer (AE-1131/S)	00	M
3	BUT 902	Propane Refrigeration Compressor Motor, AKM-1160A/B Lube Oil System	10	L
4	BUT 903	Propane Refrigeration Compressor, AKM-1160A/B Start-up	11	M
5	BUT 904	Propane Refrigeration Compressor Normal Shutdown	10	L
6	BUT 906	Instrument and Shutdown Logic System for Chilled Water	10	L
7	BUT 908	Refrigeration Compressor Emergency Procedure Loss of Cooling Water / Instrument Air & Electric Power	11	L
8	BUT 911	C6 Transfer to De-ethanizer Bottom Steam Stripper (AC-0851 / Used Wash Oil Drum (AV-0841 / Flare K.O. Drum (AV-1161)	09	L

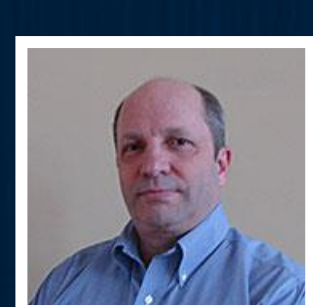
FIRST: Risk Rank the Procedures for Startup, Shutdown, and Online Maintenance (typically 20 to 30% of the total number of SOPs are selected for detailed analysis)

SECOND: Perform PHA of the procedures for each Medium and High ranked tasks, using the method appropriate to the hazard and complexity of the task



- 1 • HAZOP or WHAT-IF of normal mode of operation (HAZOP of nodes, etc.)
- 2 • 2 Guideword HAZOP of Critical Procedures (rarely 7 guidewords)
- 3 • WHAT-IF of less critical procedures
- 4 • Checklist of Global Issues (facility siting, human factors, utility failures)

Result: An efficient and complete PHA, addressing hazards and the resulting accident scenarios that can occur for ALL modes of operation (including the 80% that are the most hazardous scenarios, within non-routine modes of operation)



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