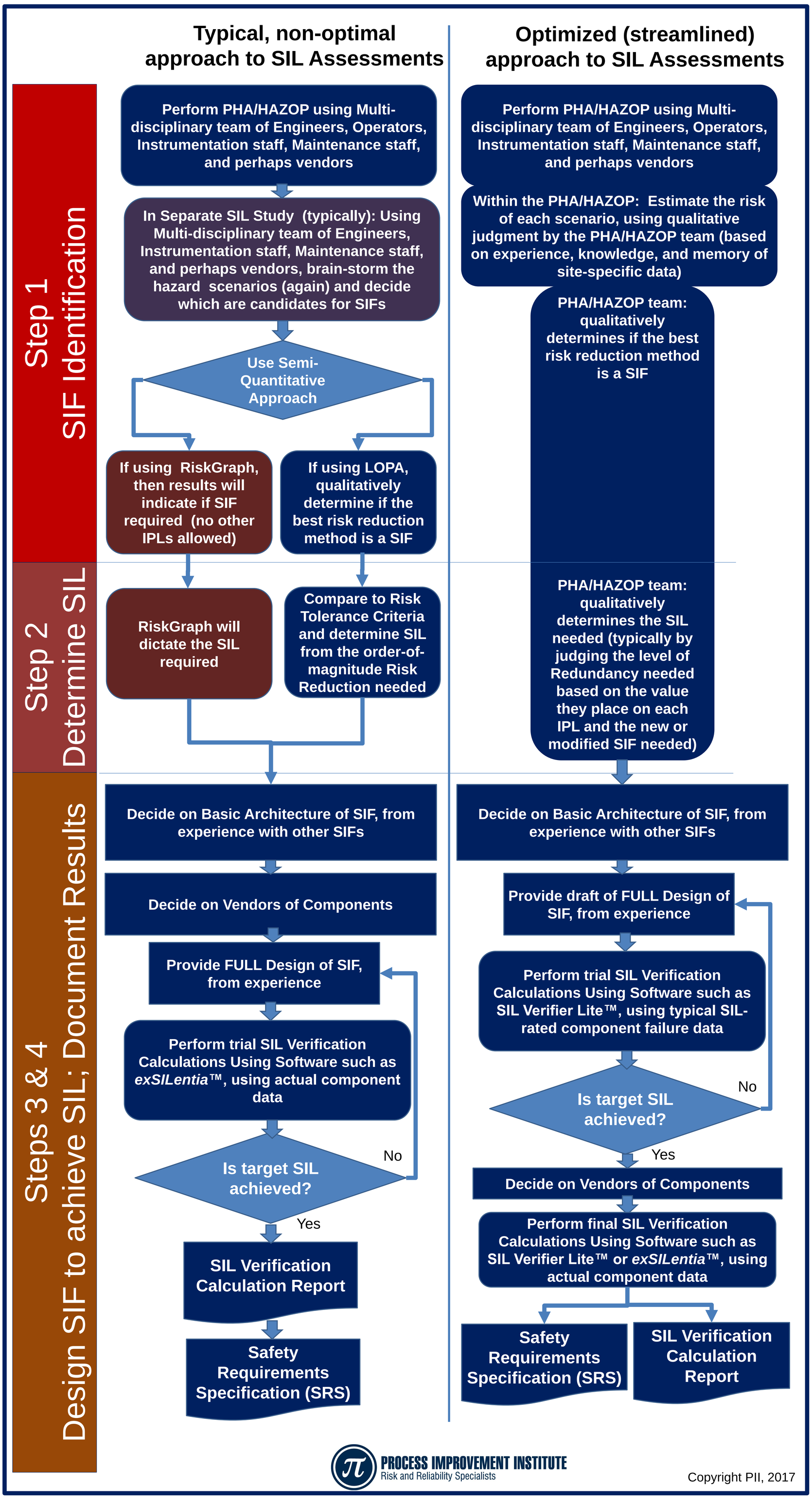
A Proven Streamlined Approach to SIL Assessment Requirements

Many companies put FAR too much redundant effort into determining what SIL is needed and then verifying the SIF design will give the SIL targeted. This paper shows how to apply the qualitative definition of IPLs within the setting of a process hazard analysis (PHA) to get most of the gain from LOPA without doing a LOPA (without using numerical values). We show the way we use a PHA team to identify when a SIF is needed and to select the proper target SIL. This portion of the SIL evaluation and the identification and labeling of the IPLs during the PHA/HAZOP does not take any longer than a normal PHA/HAZOP, once the right habits are established. Note that this approach eliminates the need for a separate SIL Evaluation Study to identify the SIFs and select the target SIL. Then, this paper describes how to perform the SIL Verification and Safety Requirements Specification remotely, again without the need for a redundant team meeting. This approach has been used at more than a hundred sites and for thousands of SIFs.



REQUIRED ANALYSIS for SIS:

1. Safety Instrumented Function (SIF) Identification
2. Determining the Safety Integrity Level (SIL) for each SIF
3. Designing the SIF to meet the required SIL
4. SIL Verification Calculation (actually, this is iterative with 3, but the end calculation is a deliverable that proves 3 is correct)

Comparison of Risk Analysis Approaches

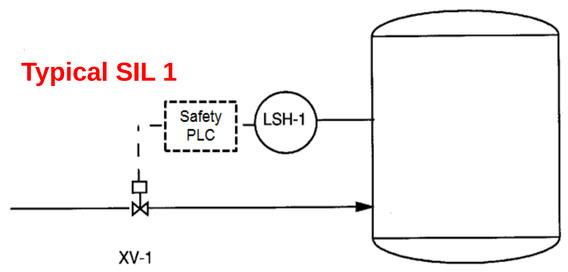
Approach	Assessment Methods	Risk Judgment Method	Risk Judgment Method	Estimated Range of the Results
Qualitative Only	HAZOP, FEMA	Expert Voting, focusing on site data	Capable >95% of time	Plus or minus 1/2 order of magnitude
Simplified Quantitative	LOPA, Risk Graph	Multiplication of statistical averages of general failure rate data; with broad assumptions on management systems	Needed on about 5% of the scenarios	Plus or minus 1 order of magnitude
Full Quantitative	FTA, ETA, QRA, HRA		Needed for less than 0.01% of the scenarios	Plus or minus 1 order of magnitude

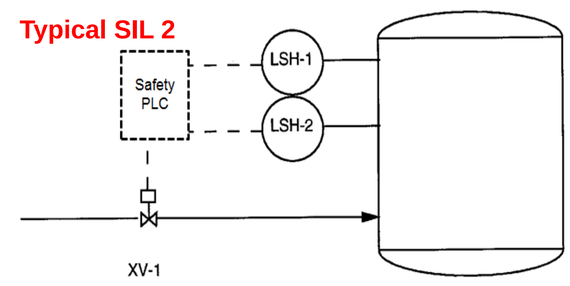
Allowed: ISA 84.00.01-2004, Part 3, Sec 3.8

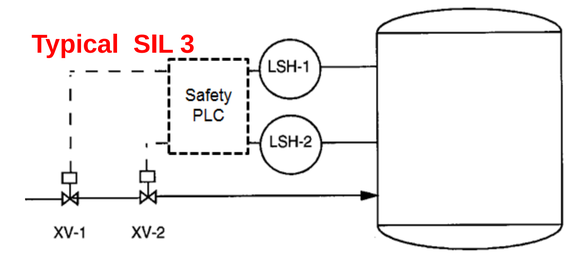
"A **qualitative** method may be used as a first pass to determine the required SIL of all SIFs. Those which are assigned a SIL 3 or 4 by this method should then be considered in greater detail using a quantitative method to gain a more rigorous understanding of their required safety integrity."

No.: 2 XXXX storage spheres xxx-T-XX A/B/C/D/E/F/G/H/I/J/K/L (1 of 12)

#	Dev.	Causes	Consequences	Safeguards	Recommendations
2.1	High level	Too much flow to one sphere from XX Plant (through their pump; about 40 bar MDH)	High pressure (see 2.5)	High level SIF with level sensors voted 2oo2, to close inlet valve - **SIL 1** Overflow thru pressure equalization line to other spheres (through normally open [NO] valve) - **IPL**	
2.2	Low level	Failing to switch from the sphere with low level in time (based on level indication)	Low/no flow - Liquid from spheres through high pressure product pumps to the vaporizer (see 4.2)	Level indication and low level alarm, inspected each year, per government regulation **(not IPL; part of the cause)** 9 other spheres with possibly enough level to switch to Feeding from two spheres at all times, so unlikely for BOTH spheres to have low level at the same time - **IPL**	Rec 4. Make sure the Human IPL of response to low level in all spheres and tanks is described in a trouble-shooting guide (like an SOP) and practiced once per year per unit operator. This will make this response a valid IPL.
			Low/no flow - Unqualified liquid from spheres back to Plant (see 6.2)	Two level indication from SIS level transmitter, with low level alarm, with more than 60 min available to switch tanks (SIF driven alarm and response) - **possible IPL, if action of the operator is quick enough**	







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