Major Process Safety Incident vs Root Cause Map

(Quick Reference Guide)

IChemE Safety & Loss Prevention Special Interest Group

Sector		Date	Event	Country	Type	Fatalities	Injuries	Context		Natural Hazards					Design Factors								
								Abnormal Operations	Escalation Potential	Earthquake	Tsunami	Flood	Hurricane	Extreme Cold or Ice	Process Design	Hazard Identification	Equipment/Piping Design	Matterials of Construction	Instrumentation	Safety Instrumented Systems	Protective Systems	Plant Layout	Occupied Buildings
Oil & Gas	Upstream	06-Jul-88	Piper Alpha	UK	Explosion	167	?										X				X	X	
		27-Jul-05	Mumbai High North	India	Explosion	22	?								X							X	
		20-Apr-10	Macondo	USA	Explosion	11	17	X							X	X	X		X	X			
		11-Feb-15	Camarupim	Brazil	Explosion	9	26	X							X	X			X			X	
	LNG	19-Jan-04	Skikda	Algeria	Explosion	26	74		X						X			?	X			X	X
	GPP	25-Sep-98	Longford	Australia	Fire	2	8	X								**X**				X			
	Downstream	04-Jan-66	Feyzin	France	BLEVE	18	84								X		X				X		
		23-Jul-84	Romeoville	USA	Explosion	17	22											X					
		22-Mar-87	Grangemouth	UK	Explosion	1	0	X	X							X	X		X	**X**	X		
		05-May-88	Norco	USA	Explosion	8	18															X	X
		24-Jul-94	Milford Haven	UK	Explosion	0	26	X	X								X		X				
		17-Aug-99	Izmit	Turkey	Fire	0	0		X	X					X								
		16-Apr-01	Humber	UK	Explosion	0	5		X							X	X						
		23-Mar-05	Texas City	USA	Explosion	15	180	X							X	X			X				X
		05-Nov-05	Delaware City	USA	Asphyxiation	2	0																
		16-Feb-07	McKee	USA	Fire	0	4		X					X	X	X				X		X	
		02-Apr-10	Anacortes	USA	Explosion	7	0	X								X	X	**X**	X				
		06-Aug-12	Richmond	USA	Fire	0	26											**X**					
		18-Feb-15	Torrance	USA	Explosion	0	4	X	X							X			X				
	Ship	24-Mar-89	Valdez	USA	Pollution	0	0		X					X			X		X				
	Rail	06-Jul-13	Lac Mégantic	Canada	Fire	47	?									X	X				X		
	Terminal	19-Nov-84	San Juan Ixhuatepec	Mexico	BLEVE	542	4,248										X		X	X	X	X	
		11-Dec-05	Buncefield	UK	Explosion	0	43		X						X	**X**			X	X		X	
		23-Oct-09	Bayamón	Puerto Rico	Explosion	0	?								X	X				X			
Petrohemical	Manufacture	01-Jun-74	Flixborough	UK	Explosion	28	104	X	X													X	X
		23-Oct-89	Pasadena	USA	Explosion	23	314	X									X		X		X	X	
		21-Sep-92	Castleford	UK	Fire	5	201	X														X	X
		01-Feb-94	Ellesmere Port	UK	Fire	0	18										X						
		27-Mar-98	Taft	USA	Asphyxiation	1	1									X							
		13-Jun-13	Geismar	USA	BLEVE	2	167	X								X							
		03-Jun-14	Moerdijk	Netherlands	Explosion	0	2	X								X			X	X			
		31-Aug-17	Crosby	USA	Fire	0	21					**X**	X			X							
Agrochemical	Manuf.	10-Jul-76	Seveso	Italy	Toxic Release	0	462	X							X	X			X	X			
		03-Dec-84	Bhopal	India	Toxic Release	2153	>200,000	X							**X**	X		X					
		21-Sep-01	Toulouse	France	Explosion	31	2442		X							X		X				X	
		15-Nov-14	La Porte	USA	Toxic Release	4	0	X								X	X				X		X
	Store	17-Apr-13	West	USA	Explosion	15	> 160		X							X		**X**				X	
Phar	Man	29-Jan-03	Kinston	USA	Explosion	6	38									**X**	X				X		X
		28-Apr-08	Cork	Ireland	Runaway	1	1								X	**X**	X						
Power Gen	Nuclear	28-Mar-79	Three Mile Island	USA	Near Miss	0	0		X						X	X			X			X	
		26-Apr-86	Chernobyl	Russia	Explosion	> 30	~ 7,000	X	X						X	X	X			X			
		11-Mar-11	Fukushima Daiichi	Japan	Explosion	0	13		X	X	X					X			X			X	
	Coal	08-Apr-99	Gannon	USA	Explosion	3	48																
		10-Nov-07	Dallman	USA	Explosion	0	0	X	X											X			X
Water	Dist	23-May-84	Abbeystead	UK	Explosion	16	28	X							X	**X**			X				
	Treat	06-Jul-88	Camelford	UK	Pollution	0	?									X						X	
		05-Apr-93	Milwaukee	USA	Disease	69	>403,000								**X**	X							
Food		03-Sep-91	Hamlet	USA	Fire	25	54									X			X	X		X	
		07-Feb-08	Port Wentworth	USA	Explosion	14	36								X	X							

Date	Event	Operations Factors					Maintenance Factors								Personal			Competency			Culture						Regulator			Links
		Hazard Awareness	Process Control	Process Monitoring	Alarm Management	Creeping Change	Risk Assessment	Work Planning	Control of Work	Energy Isolation	Housekeeping	Material Degradation	Inspection	Preventative Maintenance	Human Factors	Role Clarity	Personal Protective Equipment	Communication	Procedures	Training	Management of Change	Emergency Preparedness	Failure to Learn	Production over Safety	Normalisation of Deviance	Process Safety Management	Design Standards	Land Use Planning	Regulatory Compliance Audits	Investigation Reports
06-Jul-88	Piper Alpha						X		**X**	X					X			X	X	X	X	X				X				Click
27-Jul-05	Mumbai High North	X					X								**X**	X		X	X	X									X	
20-Apr-10	Macondo			X			X							X	X	X		X	X	**X**		X				X	X		X	Click
11-Feb-15	Camarupim	X					X		X						X	X		X	X	X	**X**	X		X		X			X	
19-Jan-04	Skikda													X	X					X		X				X	X	X		
25-Sep-98	Longford	X		X	X							X			X			X	X	X		X			X	X			X	Click
04-Jan-66	Feyzin	X																	**X**	X		X					X			Click
23-Jul-84	Romeoville											X																		
22-Mar-87	Grangemouth	X							X										X	X	X		X	X		X				Click
05-May-88	Norco											X									X							X		
24-Jul-94	Milford Haven			X	X		X		X			X	**X**	X	X			X		X	X	X				X				Click
17-Aug-99	Izmit						X					X								X		X							X	
16-Apr-01	Humber											X	X	X				X			**X**					X				Click
23-Mar-05	Texas City			X		X	X		X			X		X	X	X		X	**X**	X	X		X	X	X	X			X	Click
05-Nov-05	Delaware City	X							**X**						X				X	X										Click
16-Feb-07	McKee						X						X								**X**						X			Click
02-Apr-10	Anacortes			X		X						X							X						X	X	X		X	Click
06-Aug-12	Richmond						X					X	X									X		X		X	X	X		Click
18-Feb-15	Torrance																		X		X		X			X				Click
24-Mar-89	Valdez			X											**X**			X	X	X		X				X			X	
06-Jul-13	Lac Mégantic					X	X					X			X				**X**	X	X	X		X		X			X	
19-Nov-84	San Juan Ixhuatepec					X	X							X						X	**X**	X		X		X	X	X		
11-Dec-05	Buncefield		X	X		X	X							X	X			X	X	X	X	X		X		X		X		
23-Oct-09	Bayamón																		X	X		X	X							Click
01-Jun-74	Flixborough	X					X					X	X		X			X	X	X	**X**	X		X		X		X		
23-Oct-89	Pasadena								**X**	X				X				X	X	X	X	X	X		X	X				
21-Sep-92	Castleford	X					X		**X**						X					X	X	X	X			X				Click
01-Feb-94	Ellesmere Port												X						X			X								Click
27-Mar-98	Taft	X							**X**										X											Click
13-Jun-13	Geismar	X																X	X		**X**		X			X				Click
03-Jun-14	Moerdijk	X	X												X			**X**	X	X	X	X	X			X			X	
31-Aug-17	Crosby																					X					X	X		Click
10-Jul-76	Seveso	X													X			X	X		X	**X**				X	X			
03-Dec-84	Bhopal	X					X							X	X				X	X	X	X		X		X		X		
21-Sep-01	Toulouse	X					**X**				X								X	X		X	X			X		X		Click
15-Nov-14	La Porte	X			X		X		X					X	X		X	X	X	X	X	X	X		X	**X**	X		X	Click
17-Apr-13	West	X					X													X		X	X					X	X	Click
29-Jan-03	Kinston	X					X				X							X	X	X						X	X			Click
28-Apr-08	Cork						X								X				X	X		X					X			
28-Mar-79	Three Mile Island				**X**										X			X	X	X		X							X	
26-Apr-86	Chernobyl	X													X			X	X	X	**X**	X	X	X		X			X	
11-Mar-11	Fukushima Daiichi						**X**												X	X		X				X			X	
08-Apr-99	Gannon								X										X											
10-Nov-07	Dallman		?	?										X																
23-May-84	Abbeystead	X																	X	X	X						X			Click
06-Jul-88	Camelford						X								**X**			X	X	X		X				X				
05-Apr-93	Milwaukee		X	X																X		X		X						
03-Sep-91	Hamlet														X			X	X	X		X				X			X	
07-Feb-08	Port Wentworth	**X**					X				X				X			X	X	X	X	X	X		X	X			X	Click

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