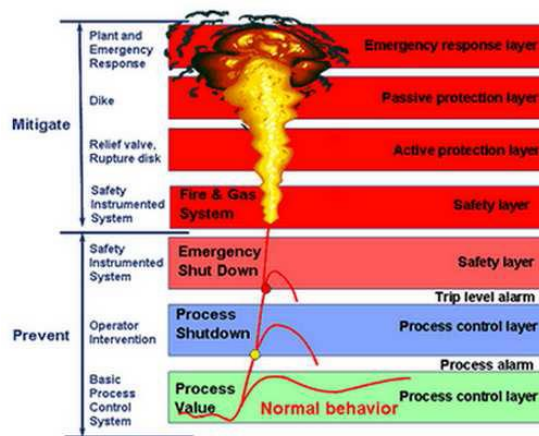
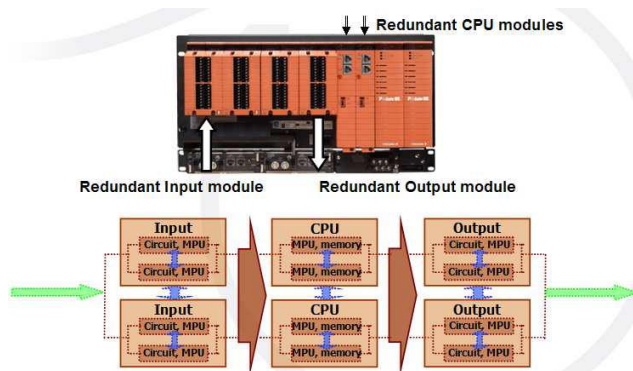
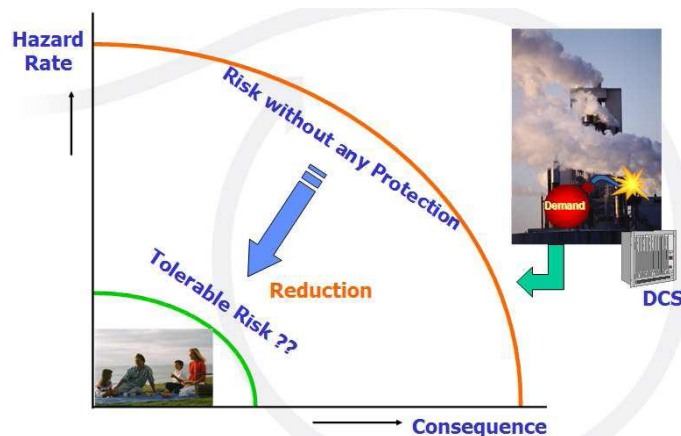


SCADA, HIL, SIL - SHS

C11: Safety process

Cuprins:

- Introducere
- Standarde de siguranta
- Arhitecturi “Safety process”
- Exemple

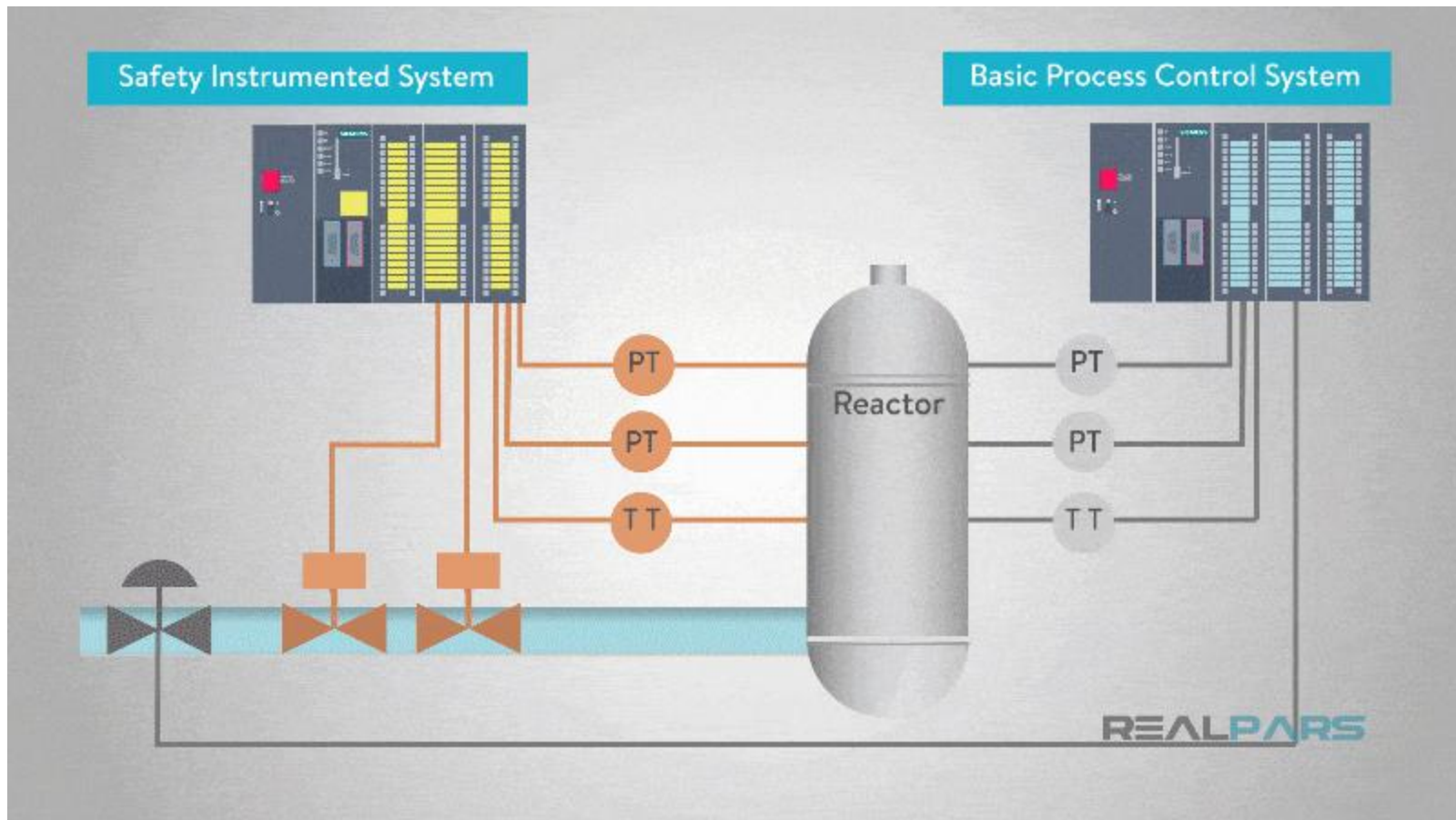
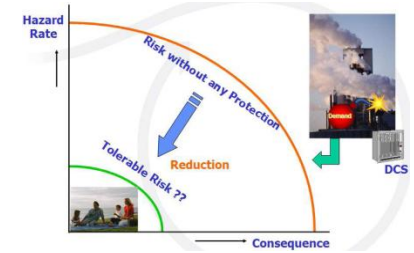


- Inspirat dupa Prosafe-RS training manual engineering - Yokogawa

C11: Safety process

1. Introducere

Sistem h-s independent

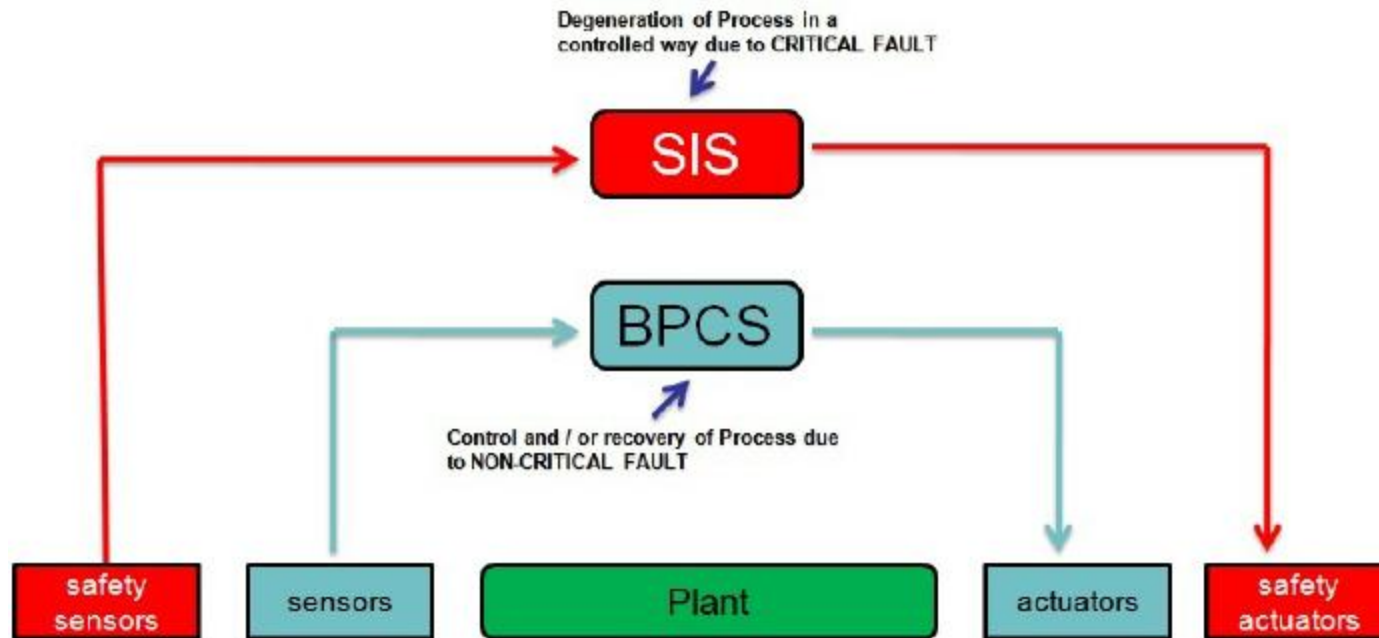
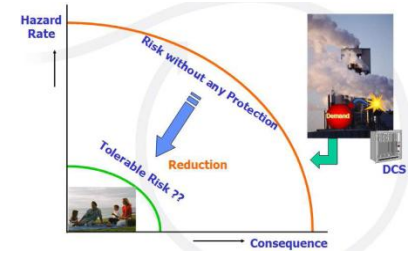


Safety Instrumented Systems (SIS). = Sistemele de Control a Siguranței (SIS).

C11: Safety process

1. Introducere

Sistem h-s independent

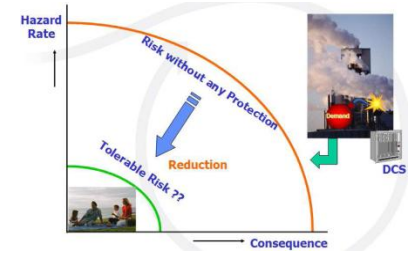


Safety Instrumented Systems (SIS). = Sistemele de Control a Siguranței (SIS).

C11: Safety process

1. Introducere

Risc –standarde moderne de siguranta



In standardele de siguranță moderne, "riscul" este definit ca un rău potențial pentru personal și/sau mediu.

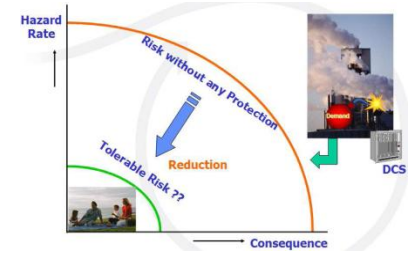
Cu toate acestea, cele mai multe companii extind **lista de risc(uri)** pentru a include următoarele categorii:

- Deteriorarea echipamentului și costurile de reparație
- Siguranță publică și sănătate
- Costurile de răspundere
- Întreruperi de producție și aspecte calitative

C11: Safety process

1. Introducere

Risc –standarde moderne de siguranta



Riscul este determinat atât de **probabilitatea** (sau frecvența, rata) cu care se întâmplă un eveniment periculos, precum și **consecințele** acestui eveniment.

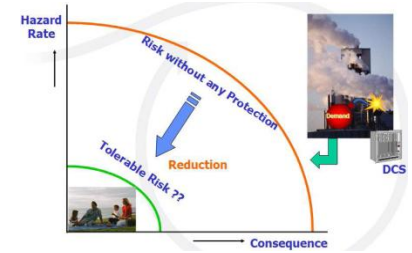
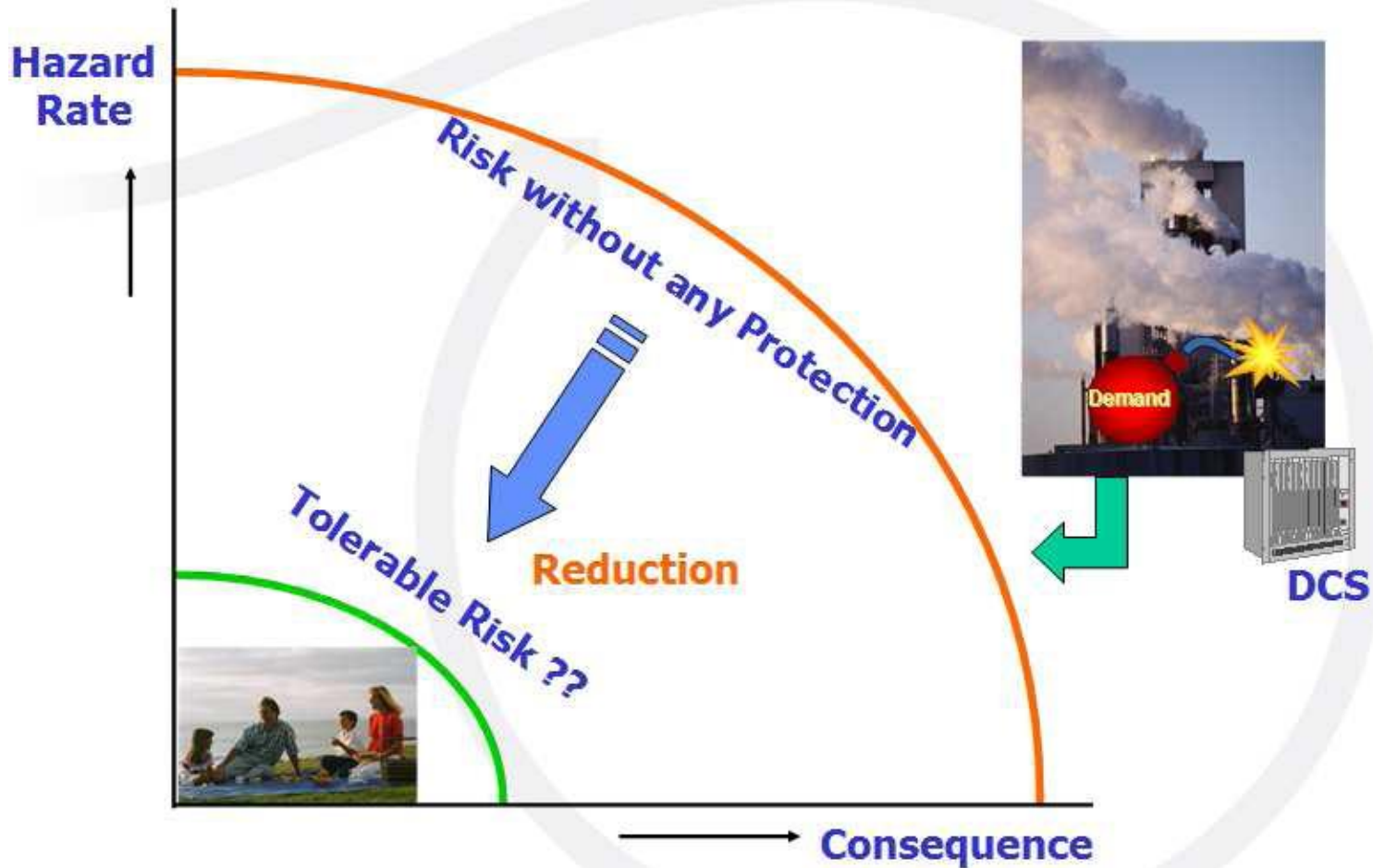
Majoritatea instalațiilor de procesare au multe piese si/sau echipamente si fiecare, contribuie la ceea ce se numește **riscului inițial** - cu alte cuvinte, **riscul care există din cauza naturii procesului**, inclusiv echipamentele și materialele prezente.

De exemplu, riscurile cititului într-o mașină includ accidentele cauzate de erori ale conducătorului auto, anvelope etc.

C11: Safety process

1. Introducere

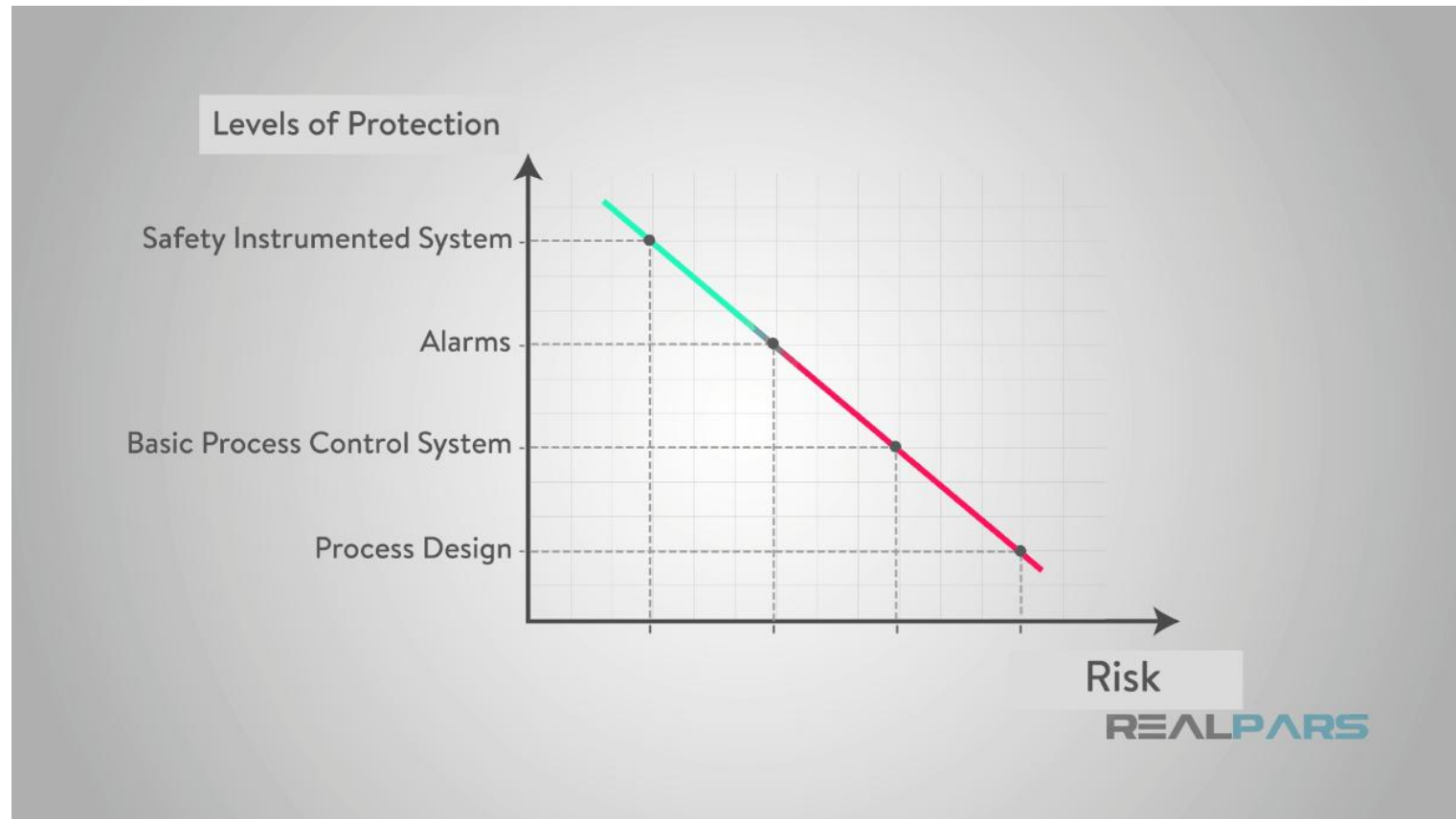
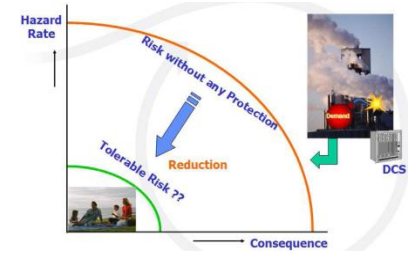
Risc –standarde moderne de siguranta



C11: Safety process

1. Introducere

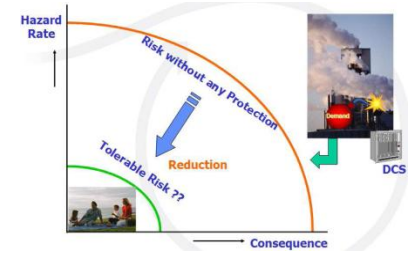
Risc –standarde moderne de siguranta



C11: Safety process

1. Introducere

Risc –prevenirea riscurilor



Un pas important în menținerea sau îmbunătățirea siguranței este capacitatea de a identifica riscurile.

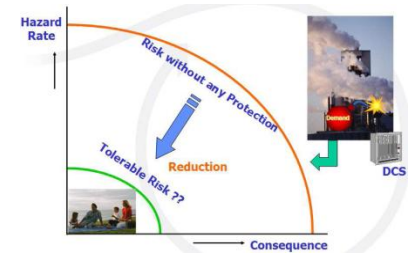
Provocarea este de **a identifica riscurile în avans**, astfel încât acestea sa poata fi reduse sau eliminate - de **exemplu**, prin schimbarea formulei unui produs, reducerea cantităților de materiale periculoase prezente, sau prin aplicarea unui sistem de siguranță. (safety system) (**Ex. Accident Mihailesti**)

C11: Safety process

1. Introducere

Safety Integrity Level (SIL)

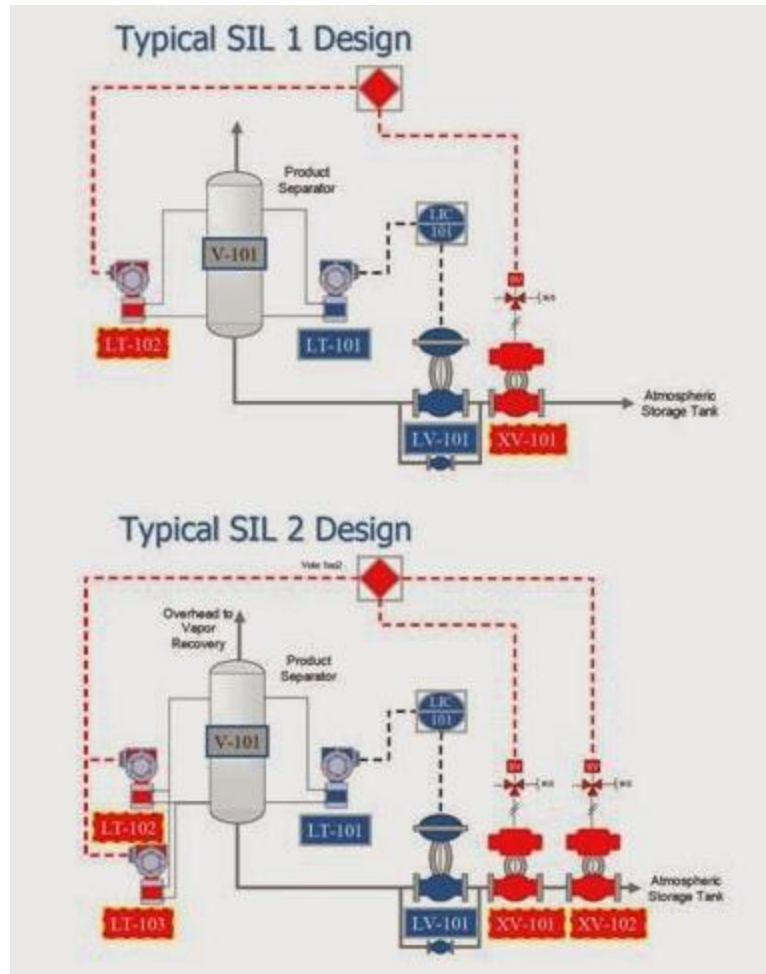
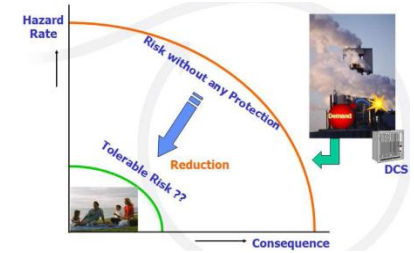
Fiecare nivel SIL este definit ca un interval de reducere riscului (aranjate în ordine de mărime).



SIL Level	Probability of Failure on Demand (PFD)	Risk Reduction Factor (RRF)
4	10^{-5} to 10^{-4}	100,000 to 10,000
3	10^{-4} to 10^{-3}	10,000 to 1,000
2	10^{-3} to 10^{-2}	1000 to 100
1	10^{-2} to 10^{-1}	100 to 10

C11: Safety process

1. Introduttore Safety Integrity Level (SIL)



<http://ichzenk.blogspot.com/2014/02/>

C11: Safety process

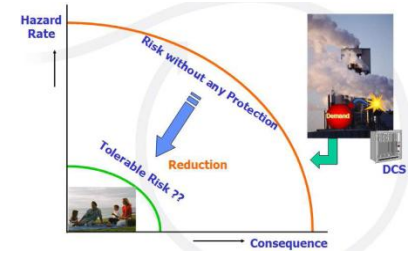
1. Introducere

Nivele de protectie (Protection Layers)

2 nivele:

Prevenire – Prevent

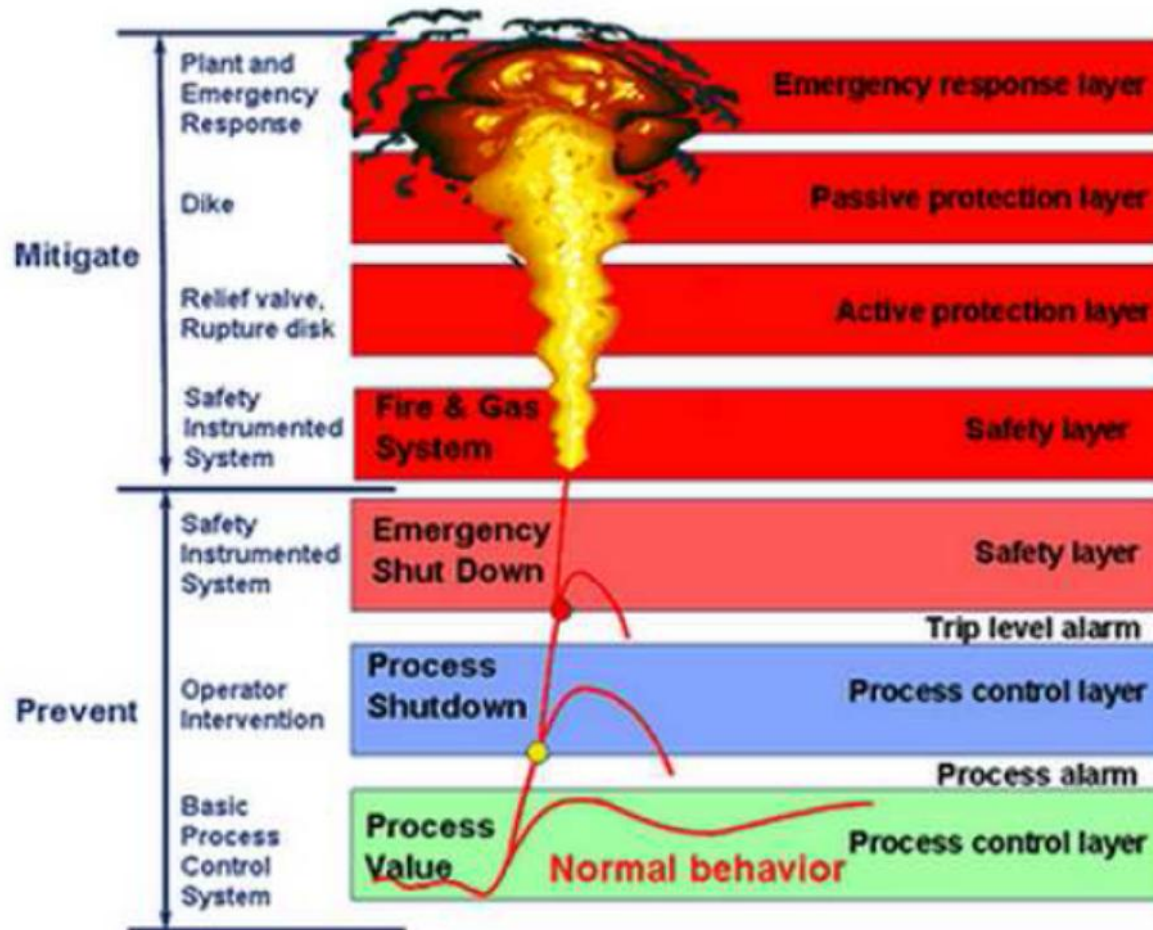
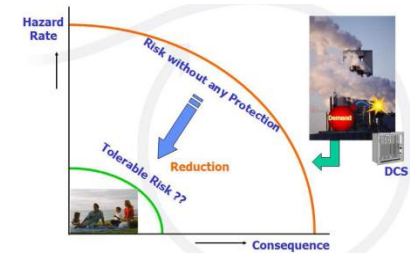
Diminuaire - Mitigate



C11: Safety process

1. Introducere

Nivele de protectie (Protection Layers)



C11: Safety process

1. Introducere

Exemple:

Catastrofa de la Bhopal

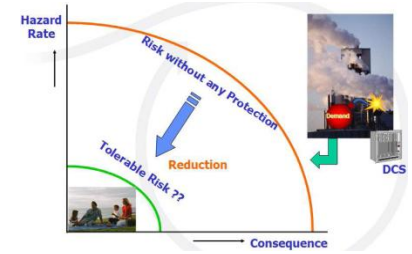
Catastrofa de la Bhopal este numele sub care este cunoscut unul dintre cele mai grave accidente industriale din lume și care s-a soldat cu peste 15.000 de victime și cu peste 500.000 de persoane afectate în mod direct. Evenimentul s-a petrecut în noaptea de 2 spre 3 decembrie 1984 în apropierea orașului Bhopal și a constat în eliberarea în atmosferă a peste 45 de tone de derivat gazos de cianură din incinta uzinei Union Carbide India.

Efectele catastrofei continuă să se manifeste la mulți ani după accident: s-au născut sute de copii cu deficiențe neuro-motorii, orbi sau cu alte dizabilități și malformații, mai ales la nivelul sistemului osos sau sistemului muscular.

Golful Mexic;

Cernobal - tragedia nucleara;

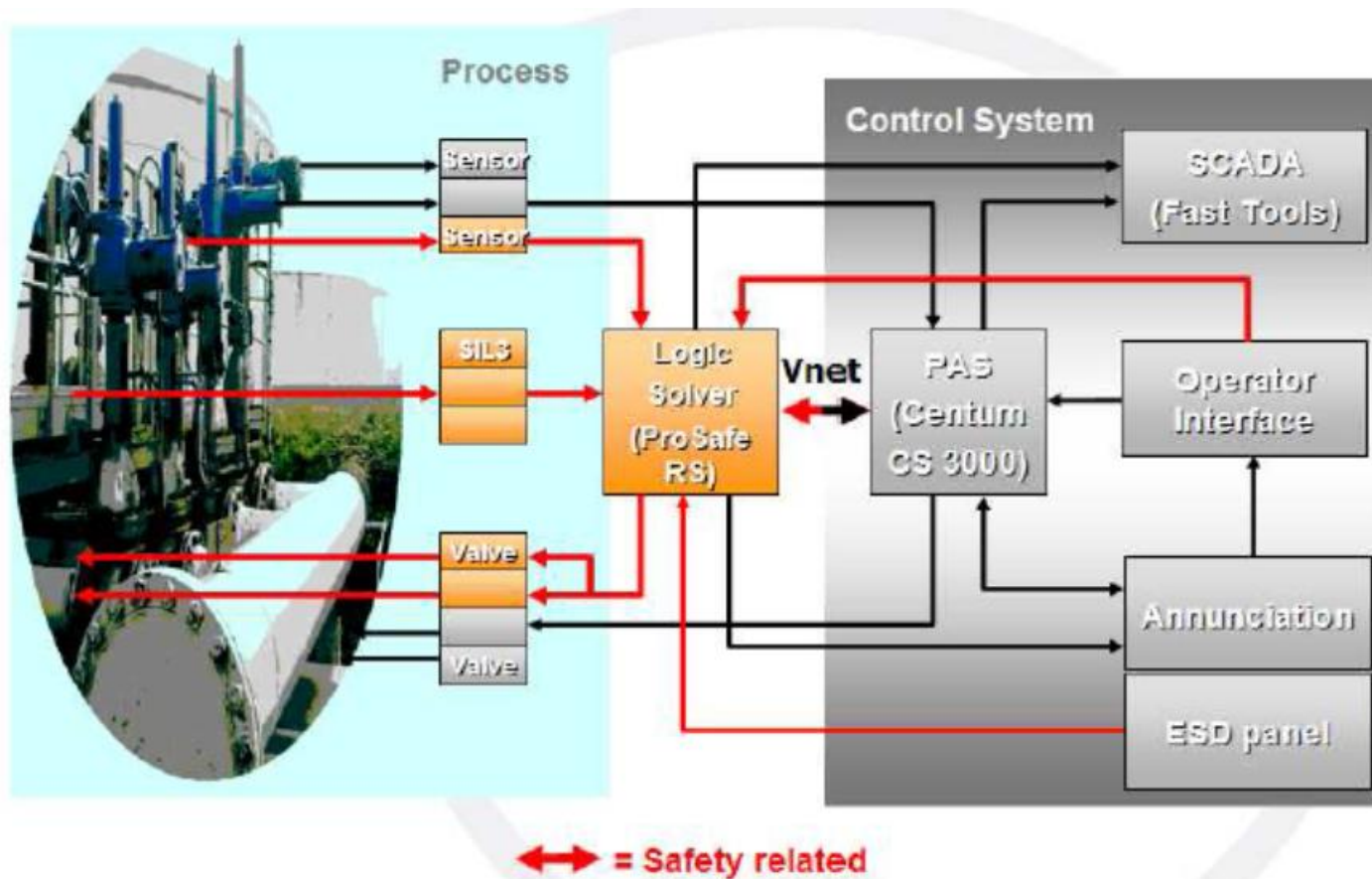
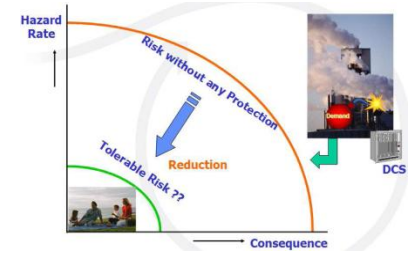
etc.



C11: Safety process

1. Introducere

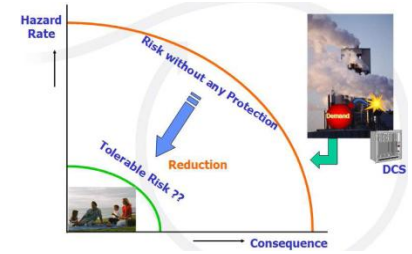
Nivele de protectie



C11: Safety process

2. Standarde de siguranta

Institutii



IEC – International Electrotechnical Commission

ANSI – American National Standards Institute

ISA – International Society of Automation

C11: Safety process

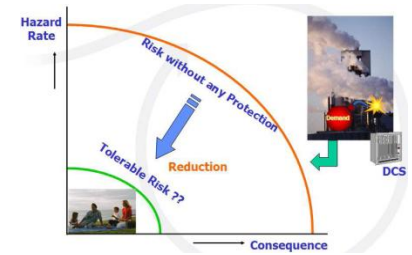
2. Standarde de siguranta

Standarde tipice

IEC 61508, IEC 61511,

sau

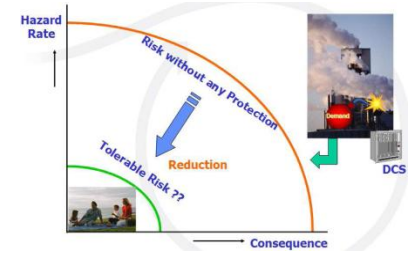
ANSI/ISA S84.00.01-2004.



C11: Safety process

2. Standarde de siguranta

IEC 61508

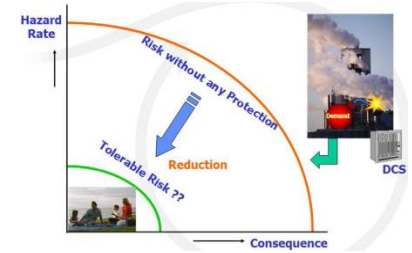


IEC 61508, Functional safety of electrical/electronic/programmable electronic safety-related systems

Ex: indicatori de sarcină în condiții de siguranță pentru o **macara**, sisteme de centralizare și controlul dozei de expunere de instalatii medicale de radioterapie, sau luminile de avertizare, de frânare antiblocare.

C11: Safety process

2. Standarde de siguranta IEC 61508



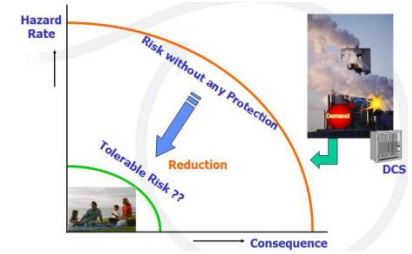
C11: Safety process

2. Standarde de siguranta IEC 61508

Parts framework of IEC 61508

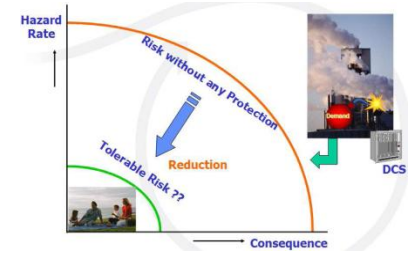
The standard consists of 7 parts:

- IEC 61508-1, General requirements;
- IEC 61508-2, Requirements for electrical/electronic/programmable electronic safety-related systems;
- IEC 61508-3, Software requirements;
- IEC 61508-4, Definitions and abbreviations;
- IEC 61508-5, Examples of methods for the determination of safety integrity levels;
- IEC 61508-6, Guidelines on the application of IEC 61508- 2 and IEC 61508-3;
- IEC 61508-7, Overview of measures and techniques.



C11: Safety process

2. Standarde de siguranta IEC 61508



Safety Instrumented Systems (SIS).

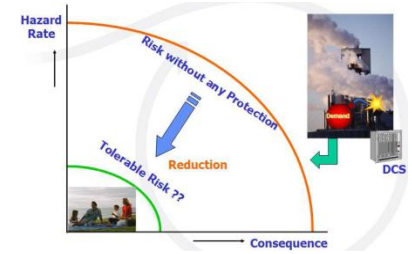
=

Sistemele de Control a Siguranței (SIS).

C11: Safety process

2. Standarde de siguranta

IEC 61511 – dezvoltare a 61508



IEC 61511 identifica trei tipuri de aplicatii software:

1. Application: The software you develop specifically for your SIS solution – in other words, the system configuration.

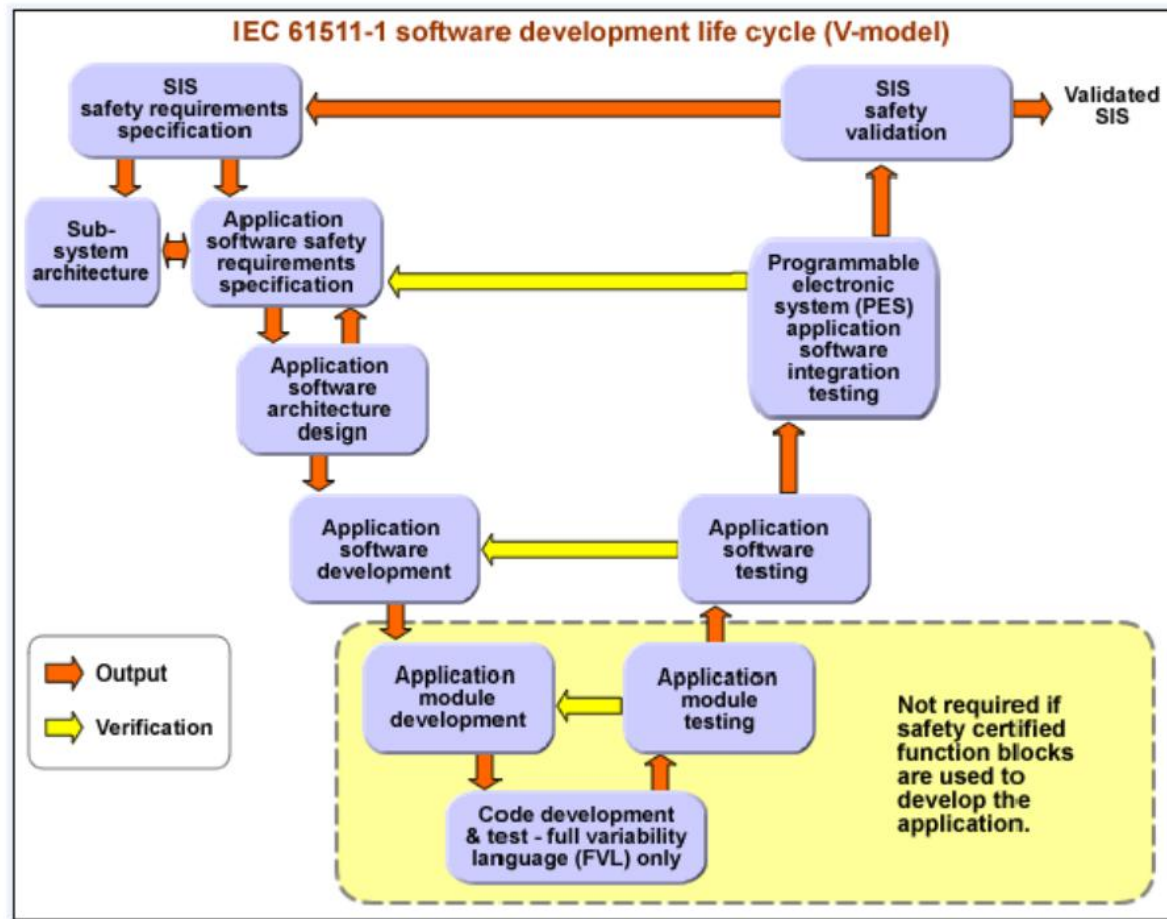
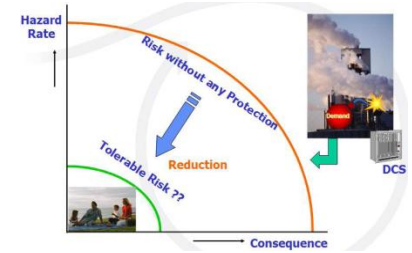
2. Utility: The software tools used to develop, verify, and maintain the application software. In the ProSafe-RS it is referred to as SCS Manager (Workbench) software.

3. Embedded: The software (also called firmware) that is “built-in” to SIS products. In the ProSafe-RS, the dual circuitry within the CPUs and I/O modules is an example of the “built-in” firmware.

C11: Safety process

2. Standarde de siguranta

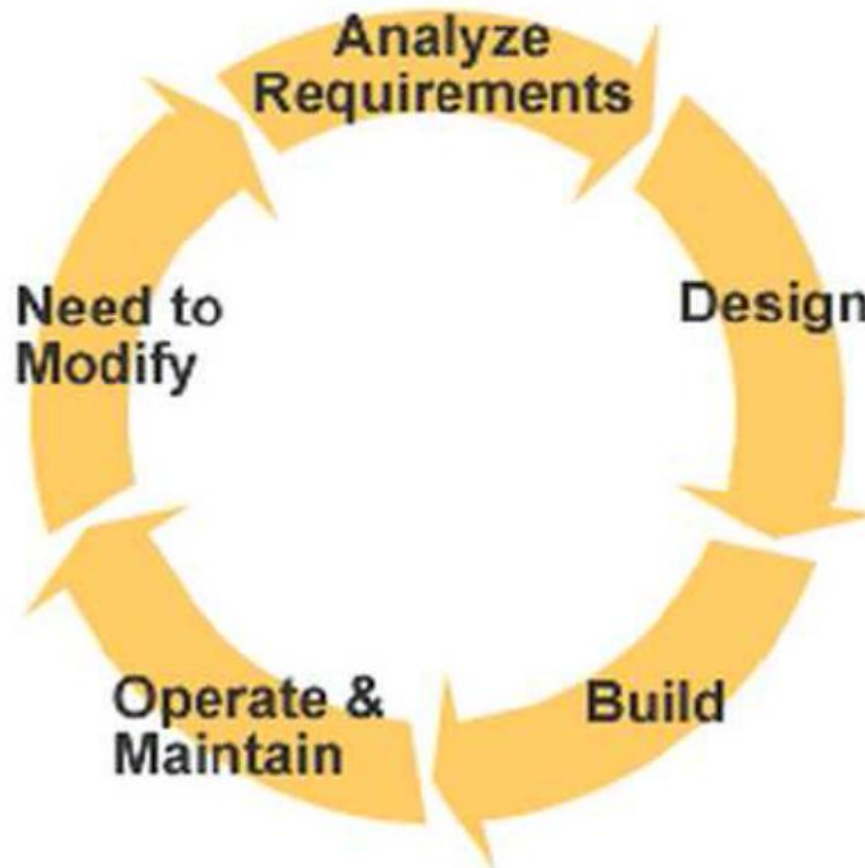
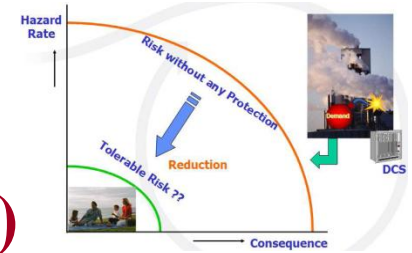
IEC 61511 – dezvoltare software (in V)



C11: Safety process

2. Standarde de siguranta

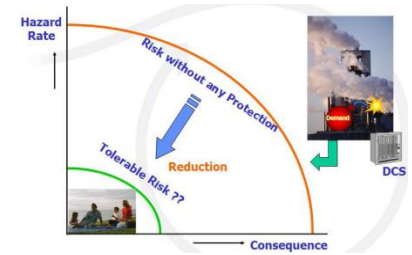
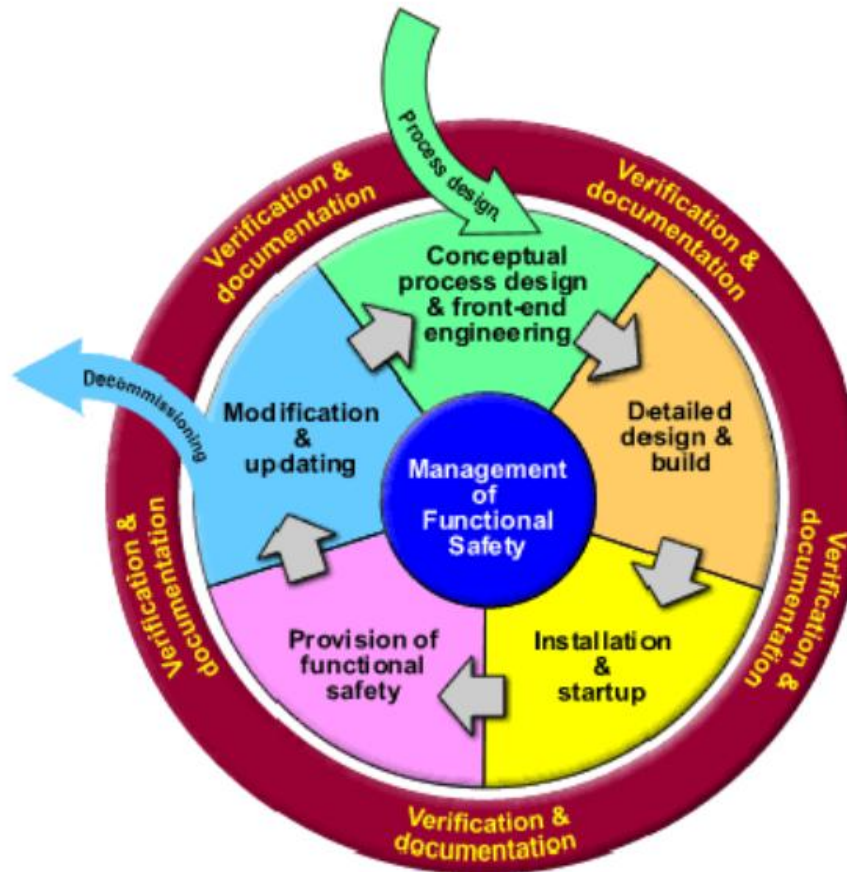
Modele pentru ciclu de viata (Life-Cycle)



C11: Safety process

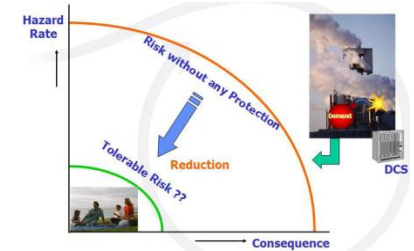
2. Standarde de siguranta

IEC 61511 - ciclu de viata (Life-Cycle)



C11: Safety process

2. Standarde de siguranta IEC 61511 / 61508



Risk graph according to IEC 61508/61511

		W3	W2	W1
C1		—	—	—
C2	F1	P1 SIL 1	—	—
		P2 SIL 1	SIL 1	—
	F2	P1 SIL 2	SIL 1	SIL 1
		P2 SIL 3	SIL 2	SIL 1
C3	F1	SIL 3	SIL 3	SIL 2
	F2	SIL 4 ¹⁾	SIL 3	SIL 3
C4		—	SIL 4 ¹⁾	SIL 3

Consequences

- C1 minor injury
- C2 serious permanent injury to one or more persons; death of one person.
- C3 death of several persons
- C4 very many people killed

Exposure time

- F1 rare to more often
- F2 frequent to permanent

Avoidance of hazard

- P1 possible under certain circumstances
- P2 almost impossible

Probability of unwanted occurrence

- W1 very slight
- W2 slight
- W3 relatively high

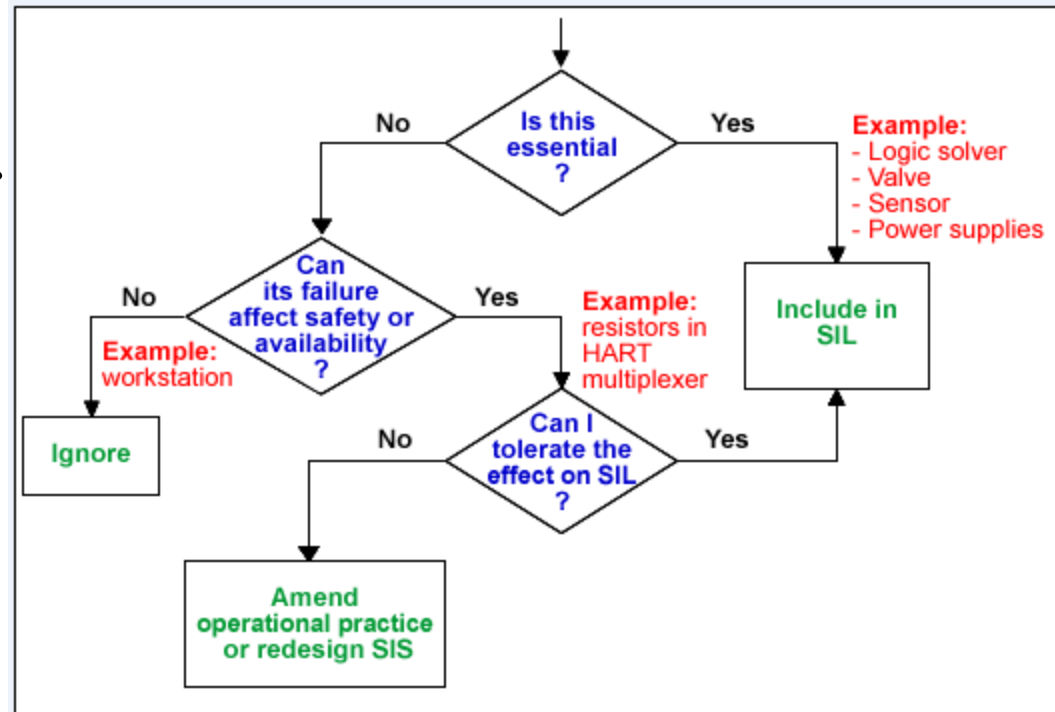
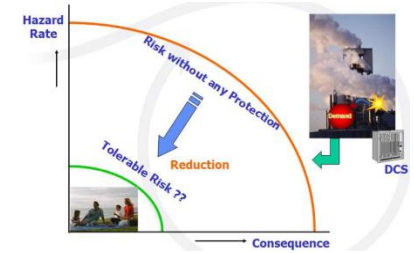
C11: Safety process

3. Arhitecturi Safety Process

Strategie -Yokogawa

Elemente:

- Esentiale,
- Ne-esentiale.



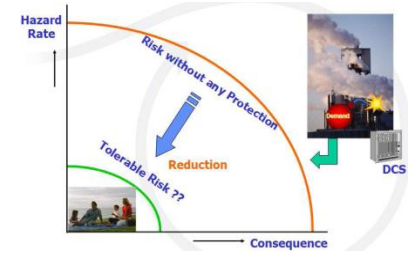
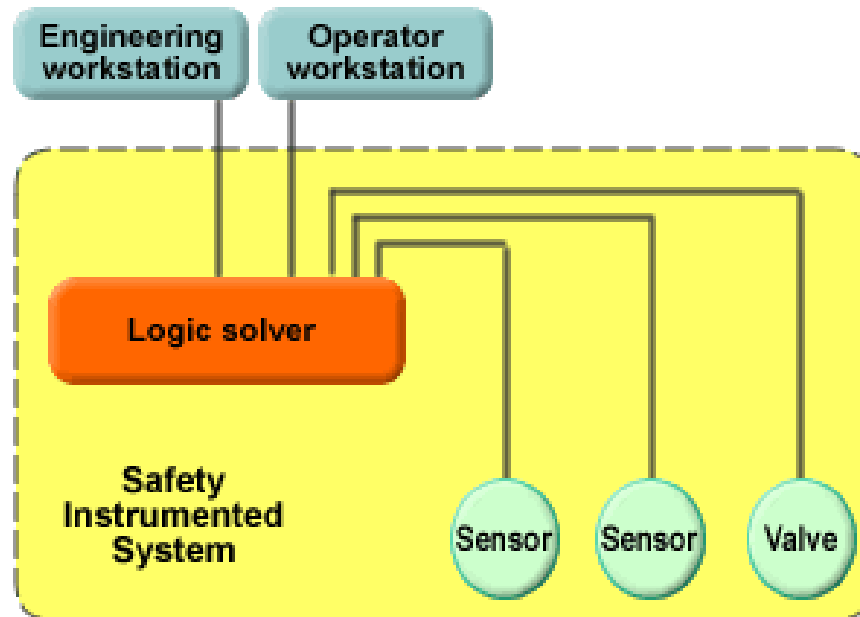
C11: Safety process

3. Architectural Safety Process

Strategie -Yokogawa

Elemente:

- Essentiale,
- Ne-essentiale.



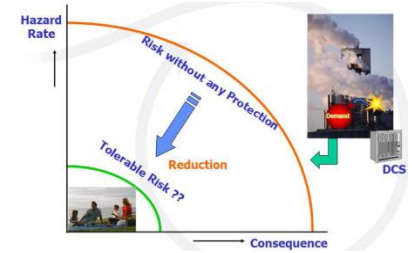
C11: Safety process

3. Arhitecturi Safety Process

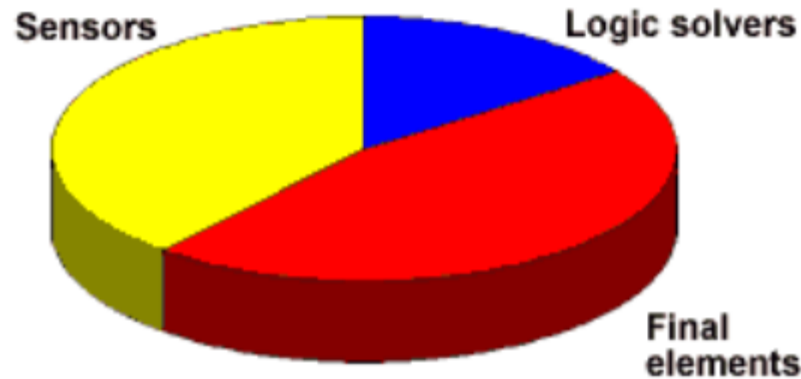
Strategie -Yokogawa

Elemente:

- Esentiale,
- Ne-esentiale.

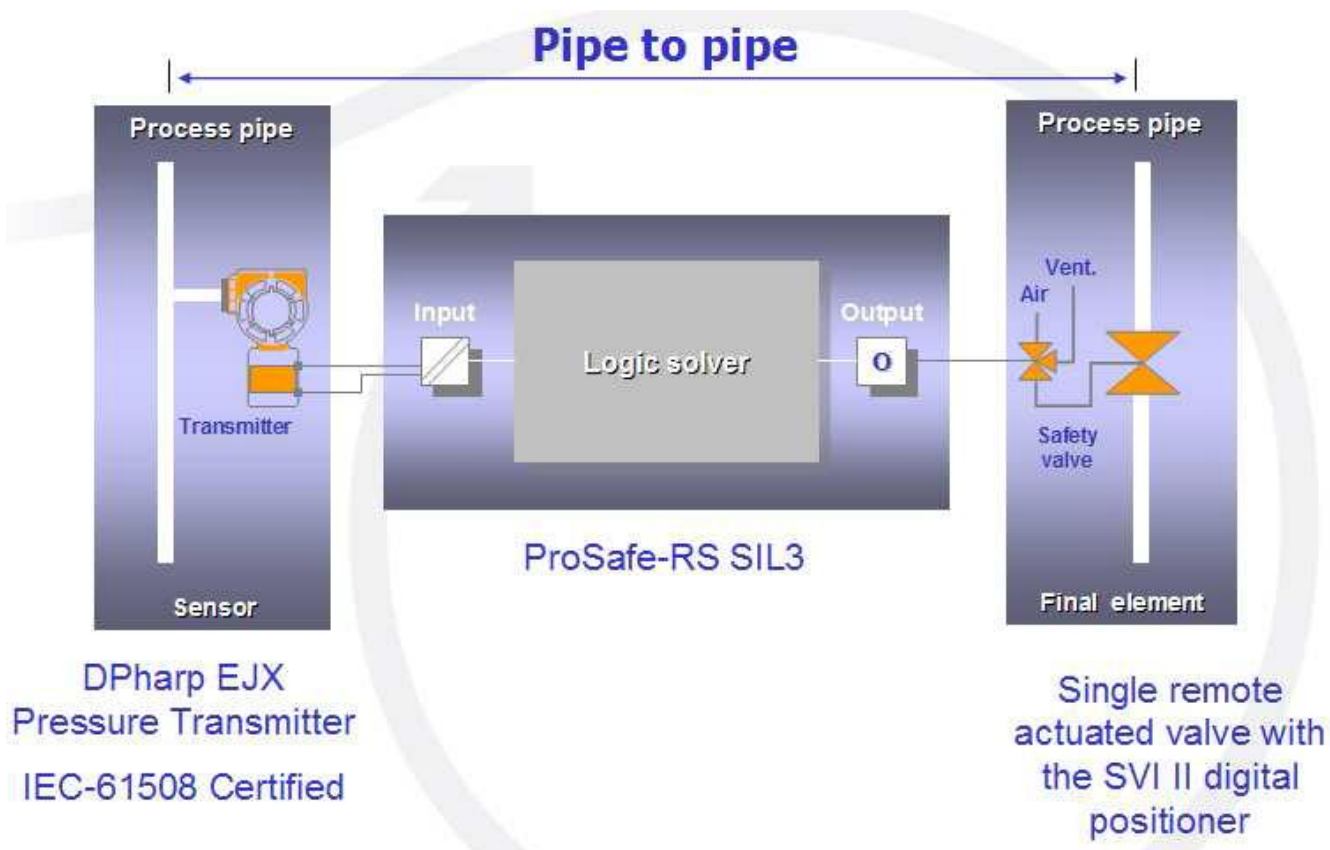
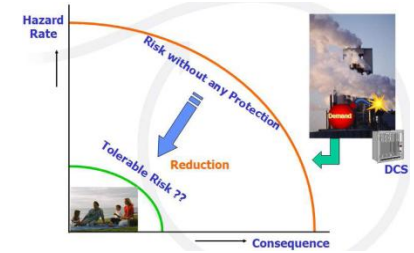


Sources of SIS failures



C11: Safety process

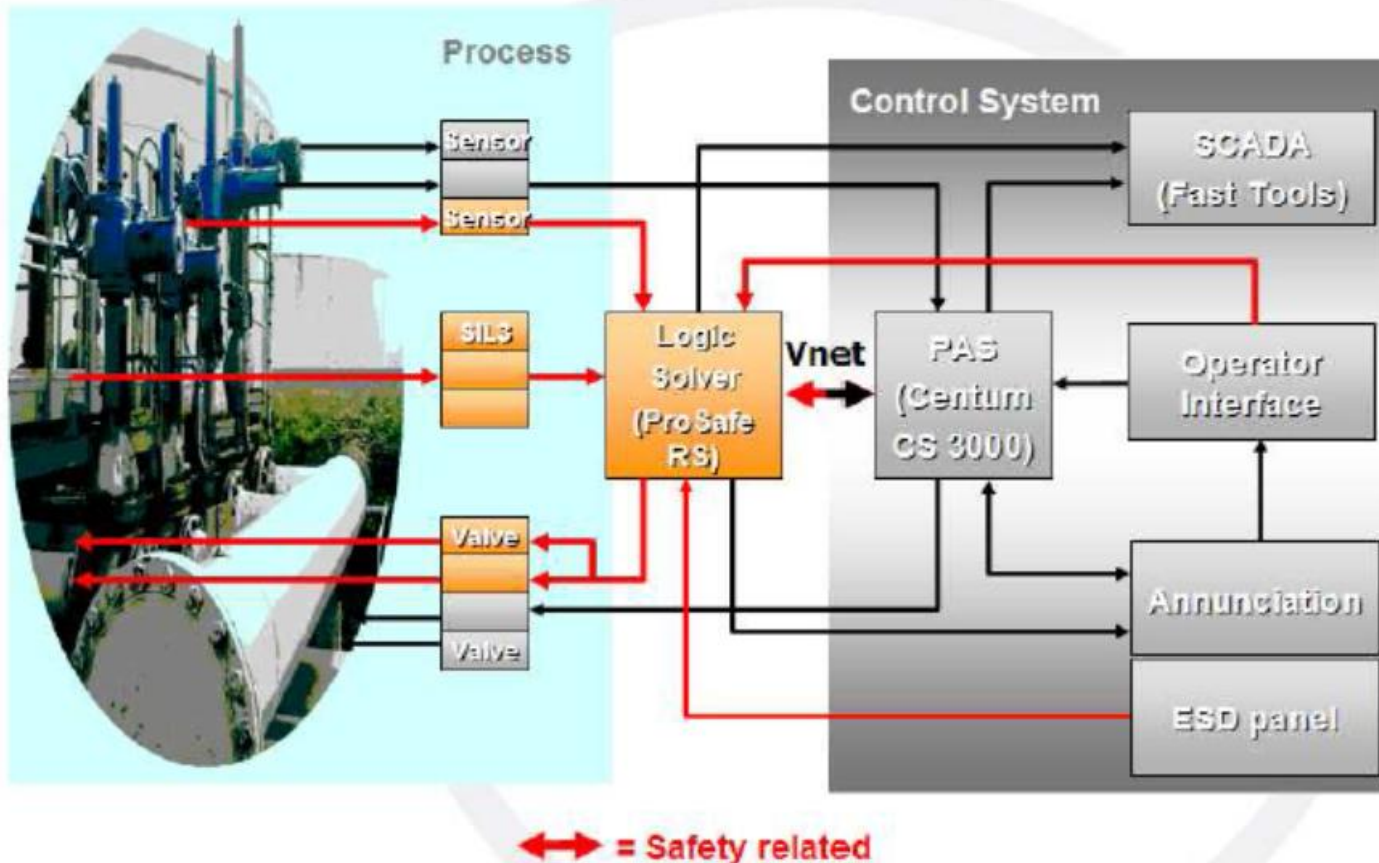
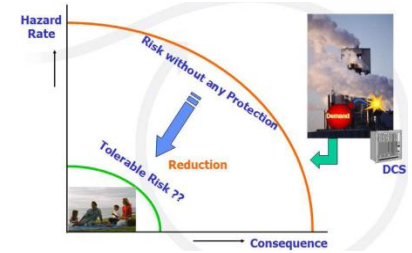
3. Architectural Safety Process Yokogawa



C11: Safety process

3. Arhitecturi Safety Process

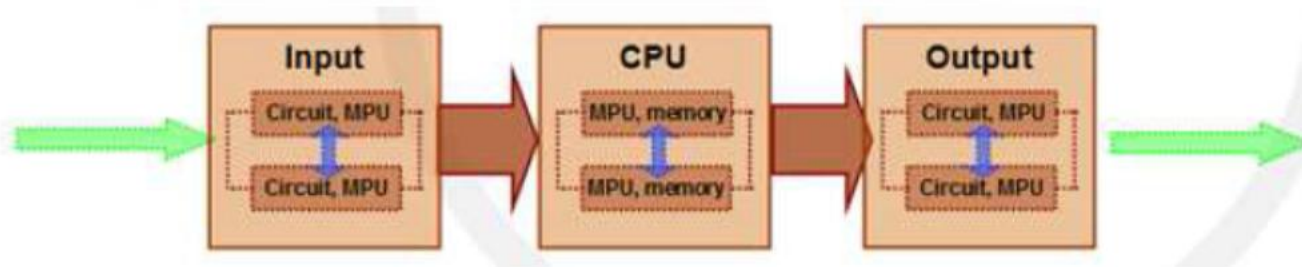
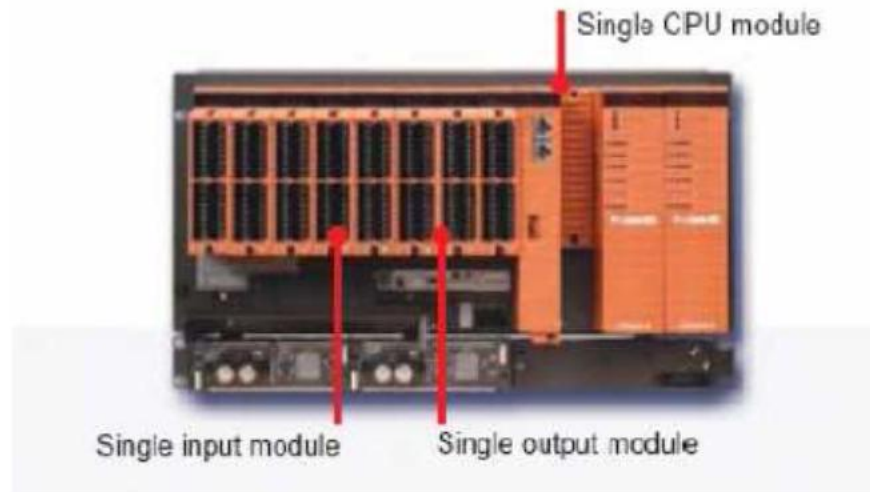
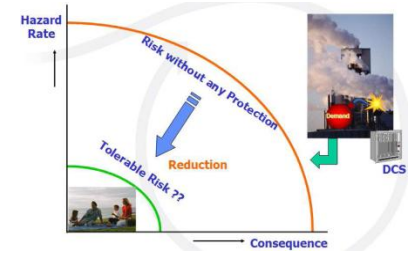
Yokogawa



C11: Safety process

3. Arhitecturi Safety Process

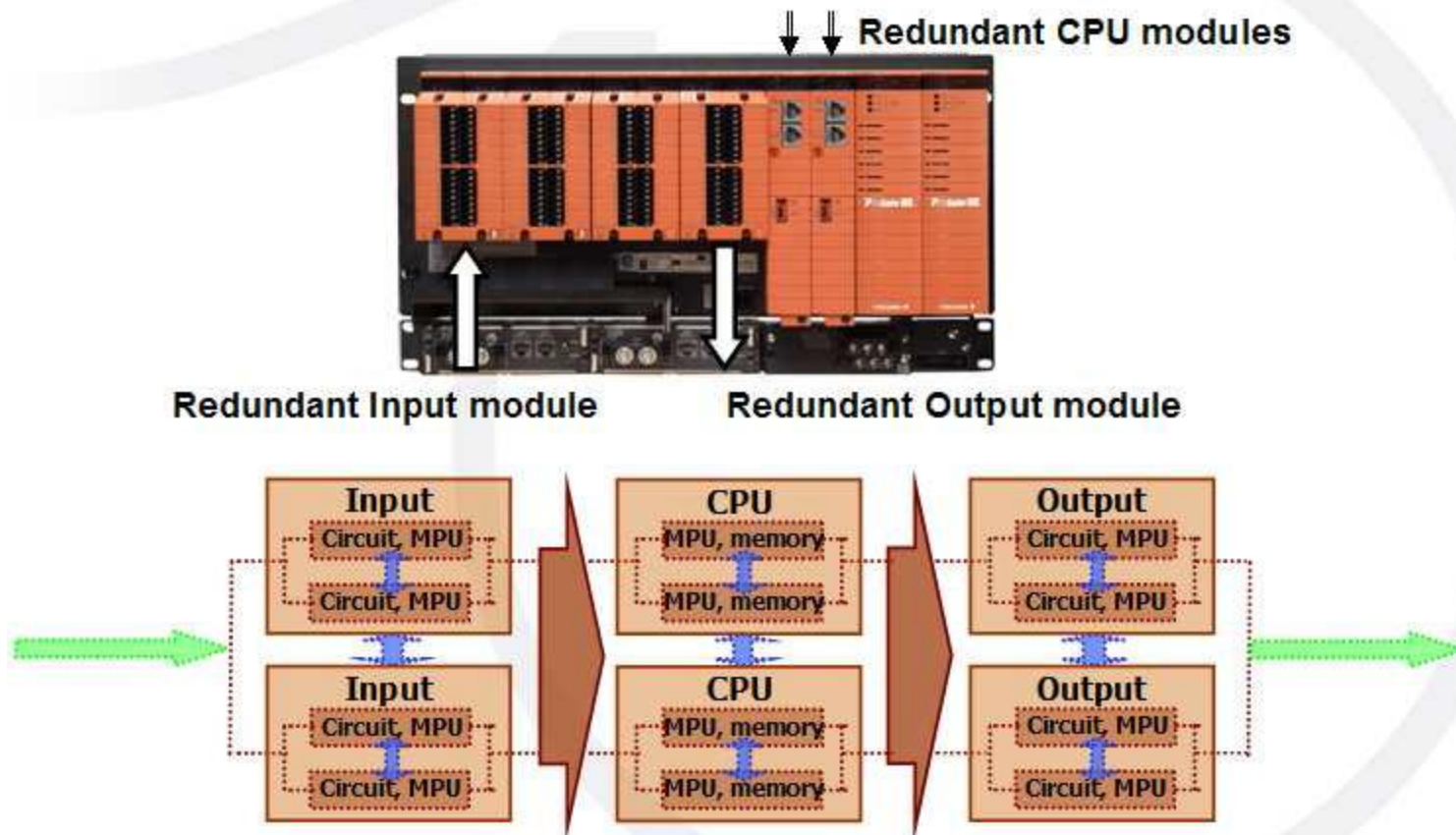
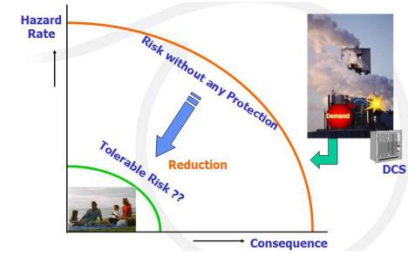
Yokogawa – ProSafe – SIL3



C11: Safety process

3. Arhitecturi Safety Process

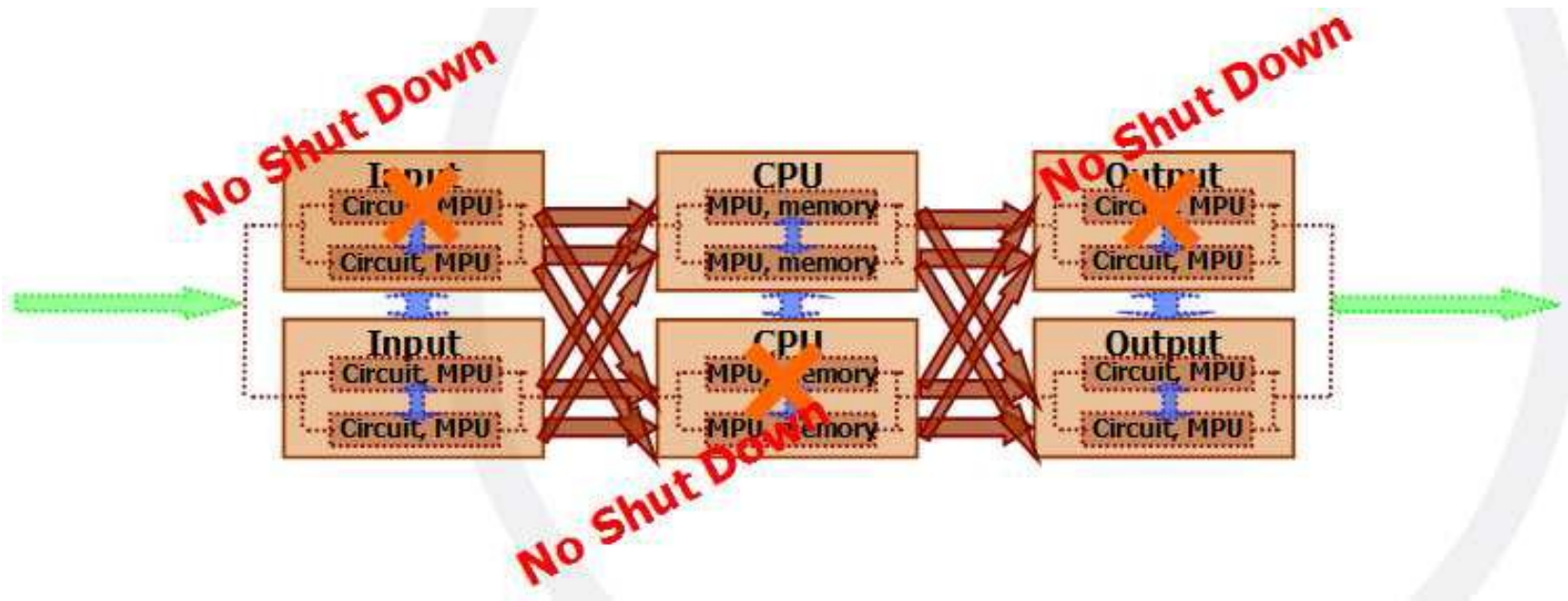
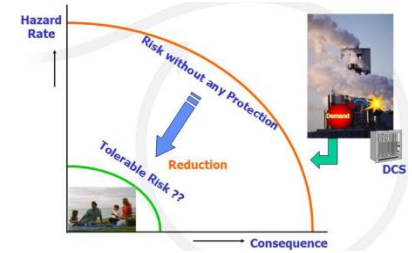
Yokogawa – structura redundanta



C11: Safety process

3. Arhitecturi Safety Process

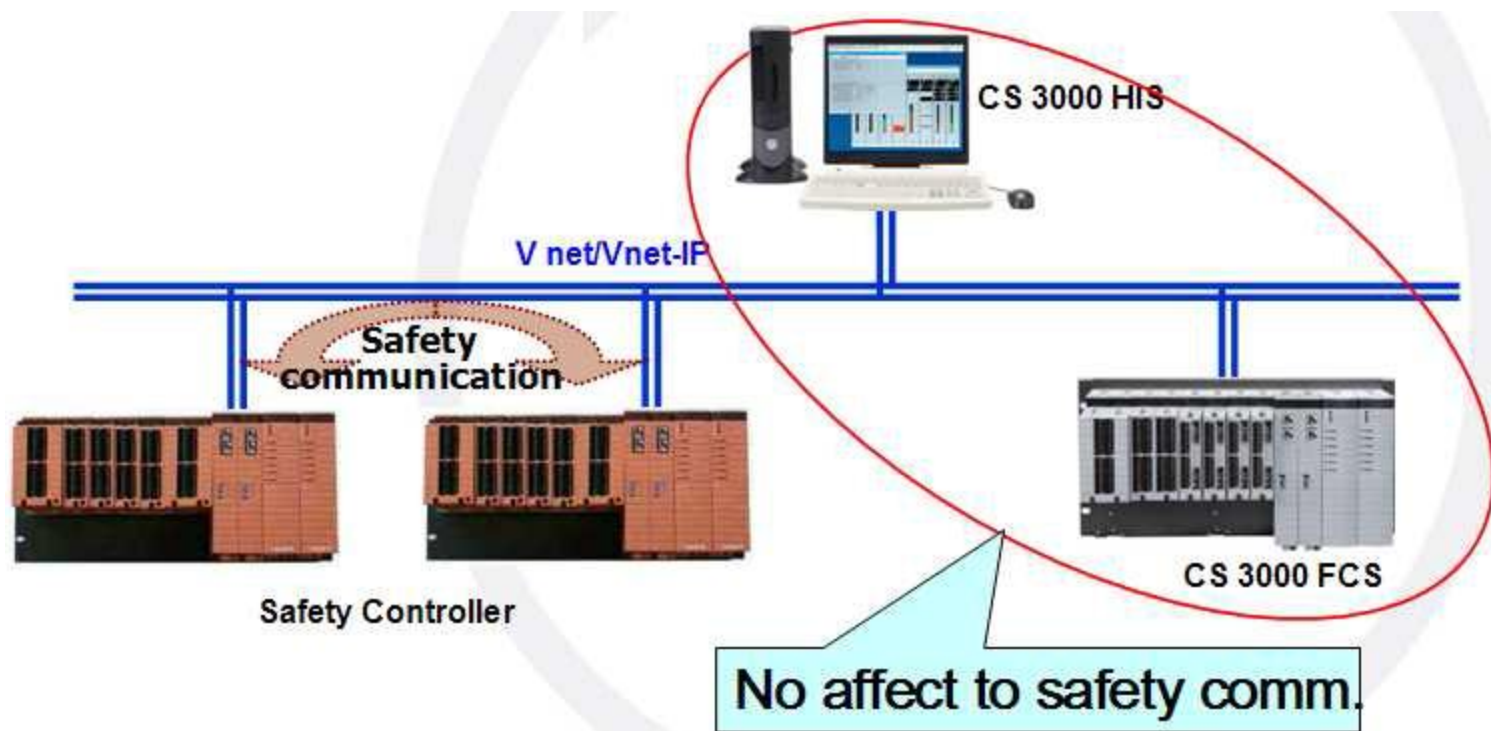
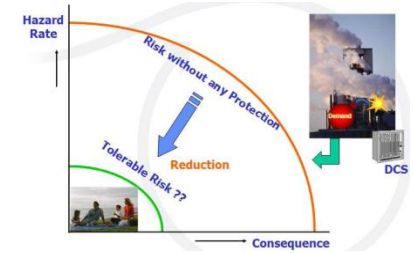
Yokogawa – structura redundanta



C11: Safety process

3. Arhitecturi Safety Process

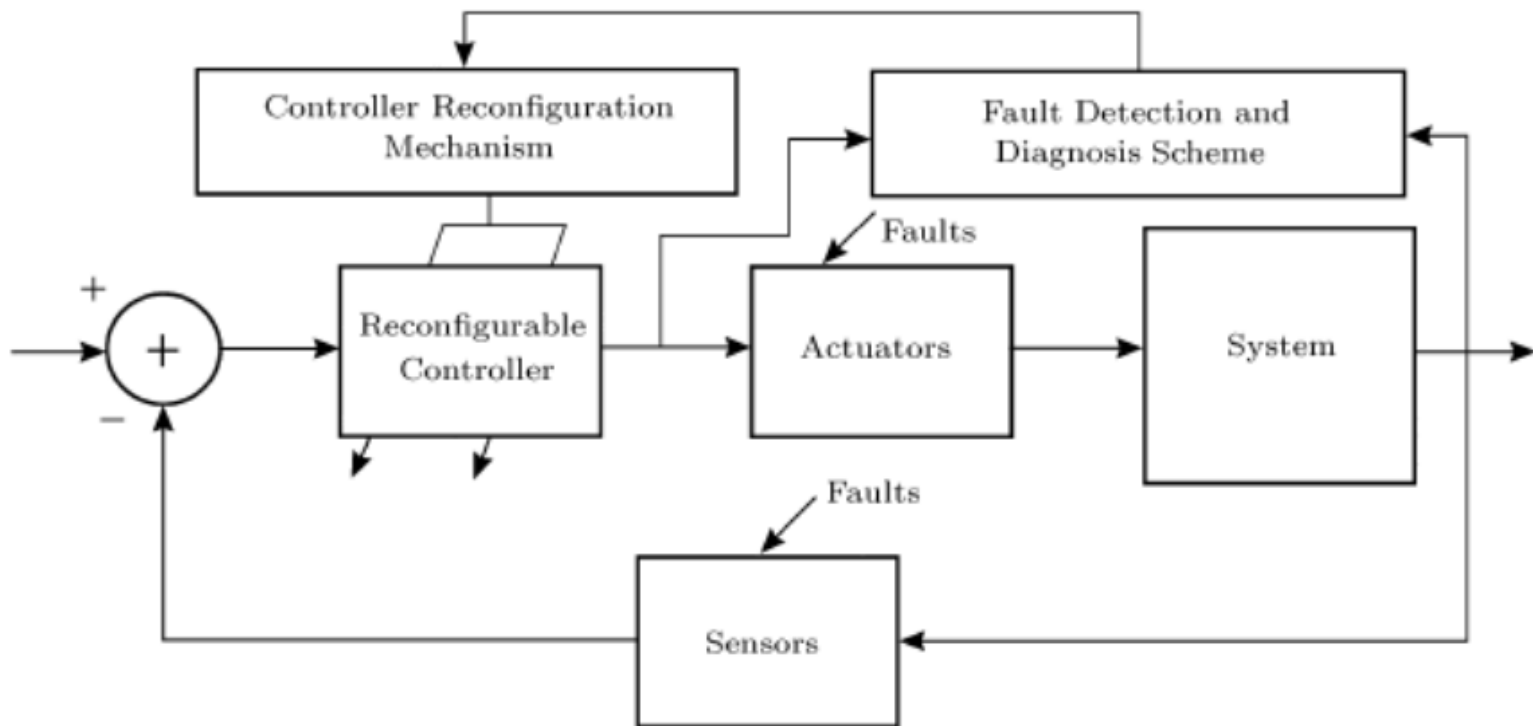
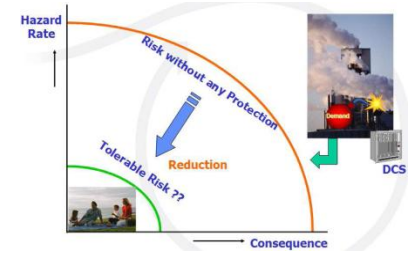
Yokogawa – structura redundanta



C11: Safety process

3. Arhitecturi Safety Process

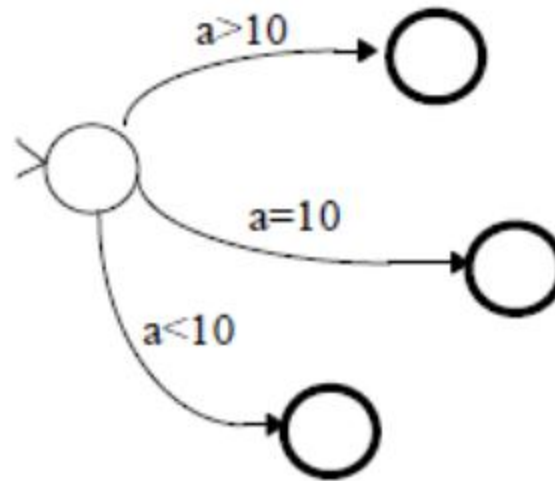
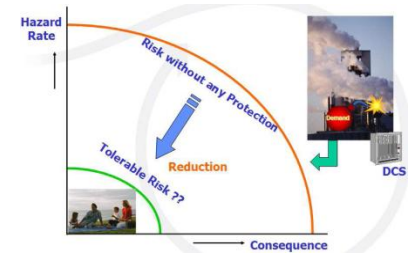
Alte exemple – sistem de reglare
tolerabil la defecte



C11: Safety process

3. Arhitecturi Safety Process

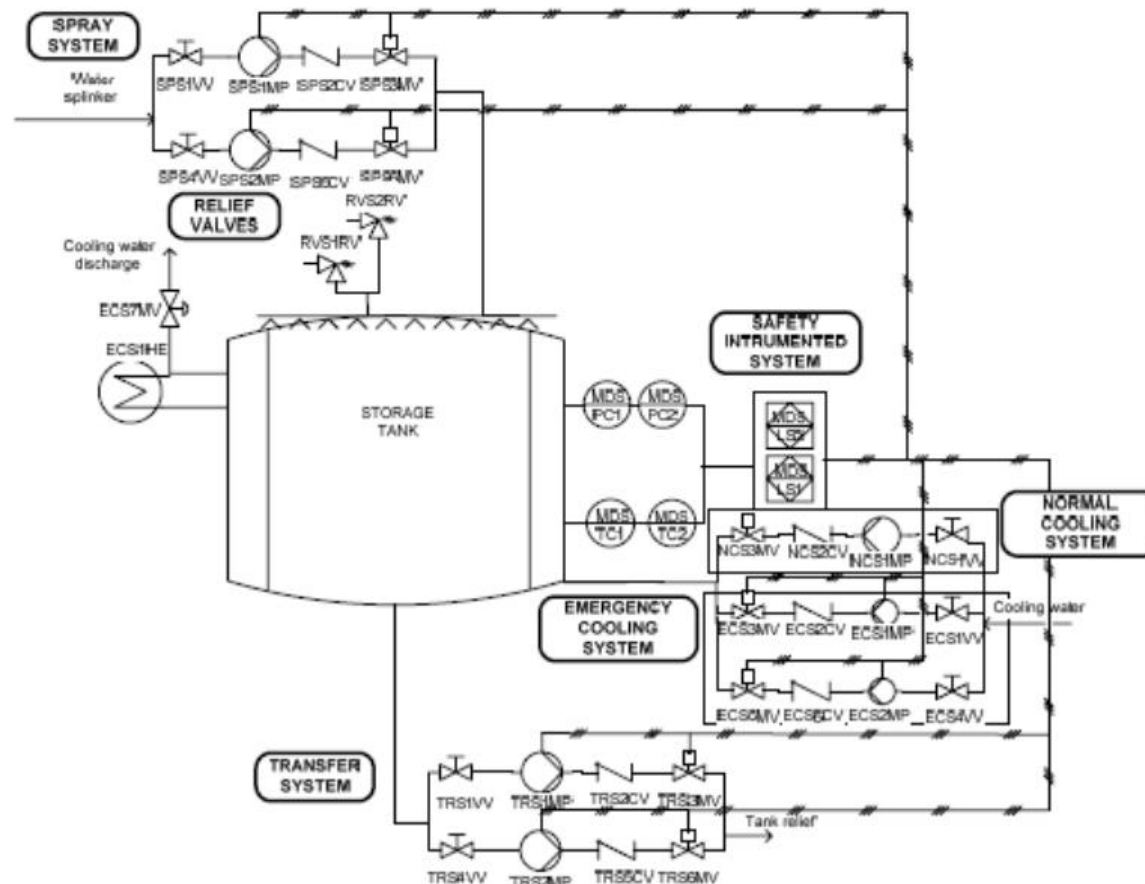
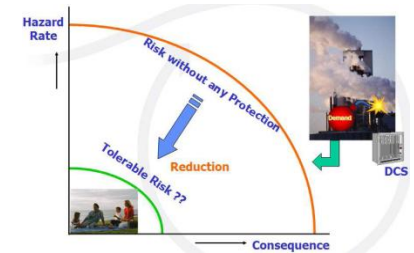
Alte exemple – acoperirea tuturor variantelor



C11: Safety process

3. Arhitecturi Safety Process

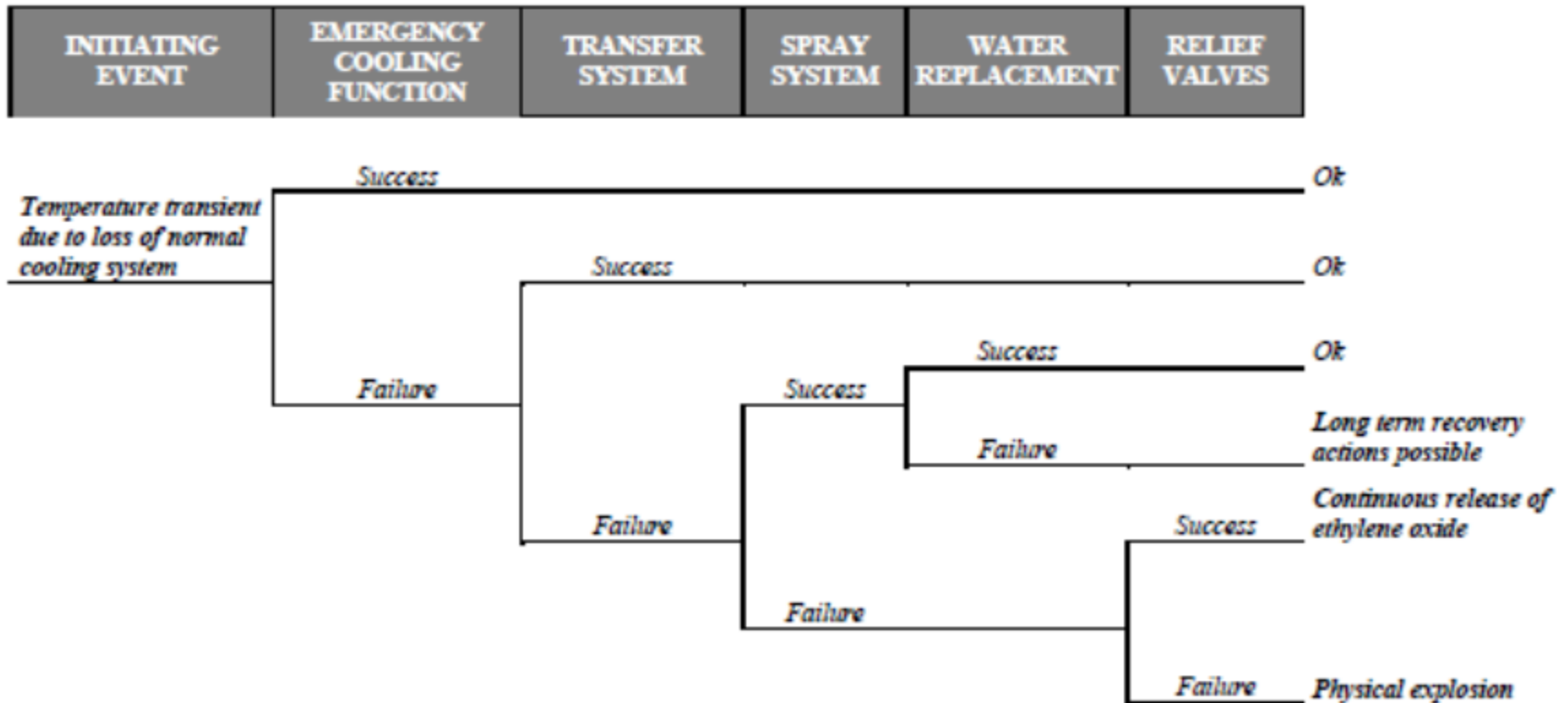
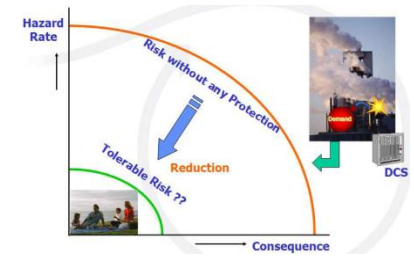
Alte exemple – rezervor pentru etilena



C11: Safety process

3. Arhitecturi Safety Process

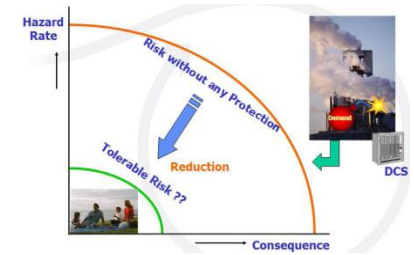
Alte exemple – rezervor pentru etilena – arbore evenimente



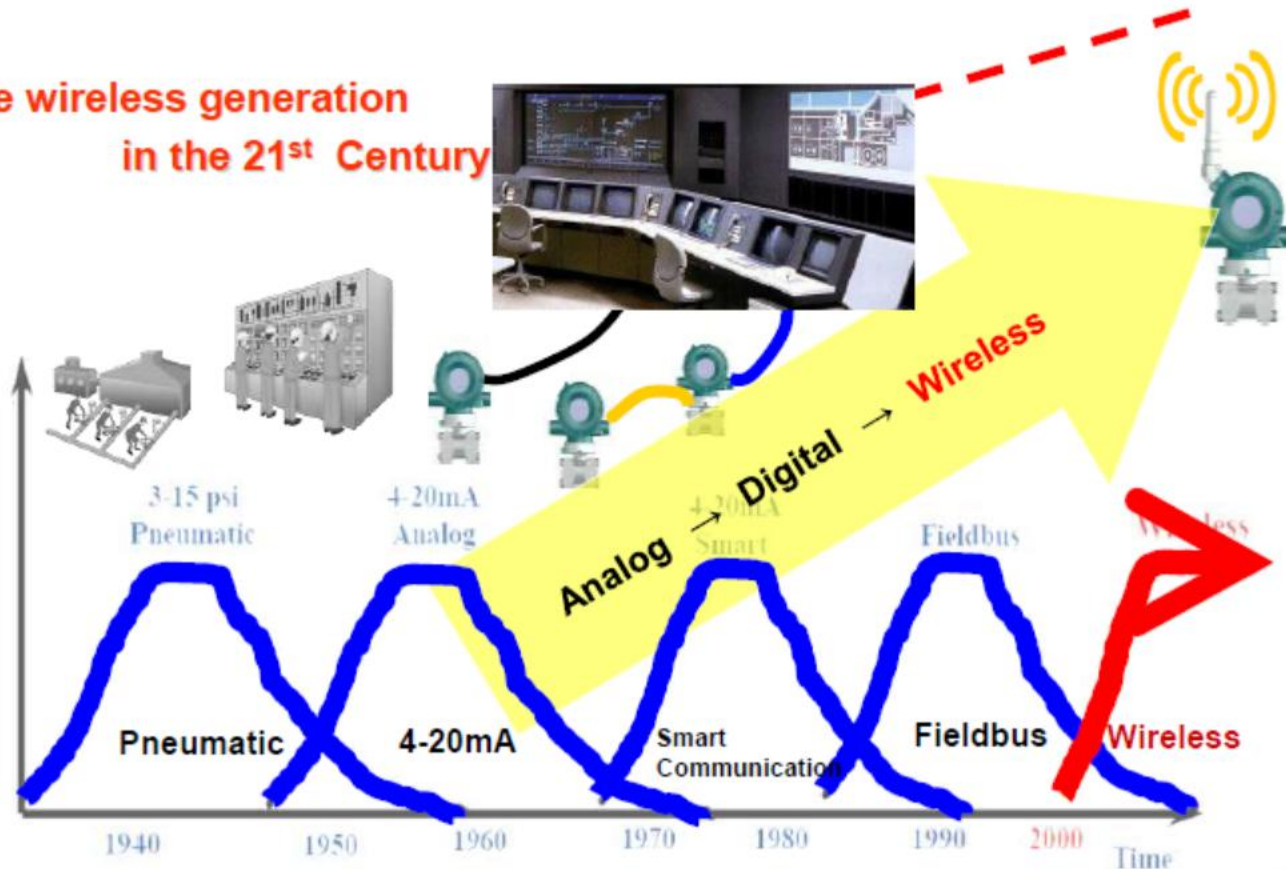
C11: Safety process

4. Alte exemple

Alte exemple – standardul IEC 62734

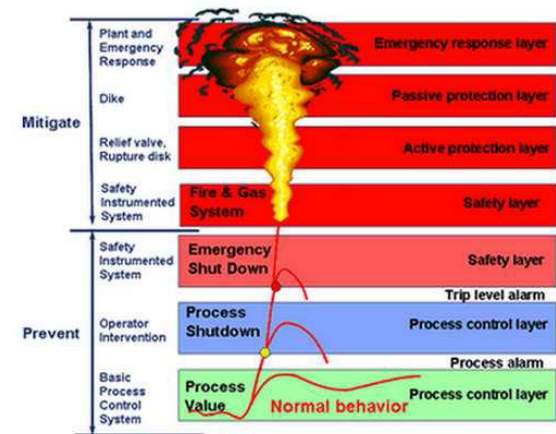
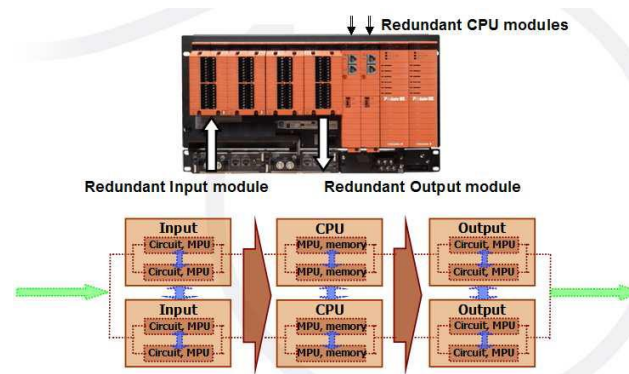
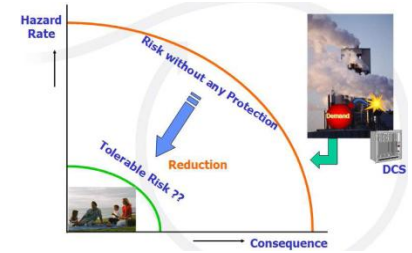


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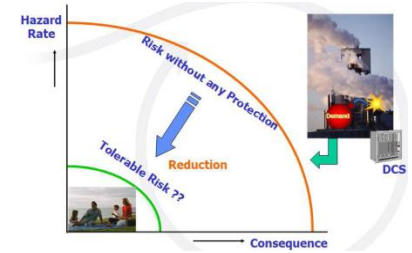
Etc....



- end -

C11: Safety process

Utile:



<https://www.yokogawa.com/library/videos/training-videos/process-control-and-safety-systems-w-yokogawas-jan-debreet-2015-arc-industry-forum/>

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