Alarm management

José Herbaux

Why ?

- Most control centers have between 100 and 200 standing alarms.
- During upsets, some alarms were not noticed.
- General feeling : “our alarm system isn’t right”

Content

- Alarm philosophy
- Bad actors treatment
- Advanced techniques
- Systematic approach
- Results
- Conclusion

Alarm philosophy

- "Principles for implementation and management of control system alarms"
- Alarm = Signal that console operator is required to intervene in process operation to correct a condition in the unit. Expected time available for response and likely consequences of not responding will determine alarm priority.
- Alert = Operator guide, no intervention required. Watch out for wrong use.

Alarm philosophy (cont.)

- **Objectives :**
  - Notify operators of events required more focused attention
  - Help to prioritize response, minimize escalation
  - Guide operator towards most appropriate response

Alarm priority determination

- **Evaluation of each configured alarm (can be more than one per tag)**
  - What happens when the operator does not react ?
  - Take into account other subsequent alarms

Alarm priority determination

	Low impact		Moderate impact		High impact	
Personal safety	light injury	40	disability	50	severe or death	60
Environmental	fallout w/o Shut Down	30	fall out with Shut Down	40	major/regulatory	50
Production	10 – 100 K$	20	100 K$ – 1 M$	30	> 1 M$	40
Mechanical	< 10 K$	10	10 – 100 K$	20	> 100 K$	30

Alarm Priority	**Weight**	**operator response time (min.)**
LOW	40 - 80	60
HIGH	80 - 100	15
EMERGENCY	> 100	5

Training

- All operators need to be trained on alarm philosophy
- All changes to be communicated to operators :
    - eg : via loss control meetings or daily instructions

How to start ?

- **Pragmatic approach : look for "quick wins"**
  - Bad actors treatment
  - Advanced techniques

- **Systematic approach :**
  - Huge effort : not possible in start of project.
  - When project has enough momentum : start it

- **Honeywell HiSpec was involved in first phase.**

AMO suite

- Tool which collects configuration data and “journals” of TPS (TDC3000) system
- Data stored in MS Access Database
- Queries : frequency, chattering alarms, standing alarms, duplicate alarms, etc.

Bad actors treatment

Bad actors discussions

- AMO suite lists were used to identify bad actors :
  - Frequency of alarms : mainly this list used
  - Time in alarm
  - Chattering alarms
  - Standing alarms
  - Duplicate alarms

Discussion methodology

- **A checklist is used :**
  - tagname, descriptor, alarmed parameter
  - alarm initiating event, consequences, operator action
  - hazop documentation
  - alarm nuisance characteristic, alarm point setting, alarm deadband, ...
  - recommendations : delete, create, modify, housekeeping,...

Bad actors treatment : example

- **Center x:**
  - +/- 400 alarms discussed (1 week session)
  - resulted in :
    - workorders : 52
    - actions for Process Control Department :
      - modifications of point configuration : 143
      - masking and grouping : 87
    - actions for OSA : 3
    - structural problems 9

Advanced techniques

- **Possible advanced techniques :**
  - Alarm masking
  - Alarm grouping
  - Use of "overviews" instead of alarms : e.g. OSA, MOV's, dedicated screens for upsets, ...
  - Configuration of "systems" : e.g. furnaces, reactors, different operating scenario's, drums, pumps (ampèrage, local/remote, min. flow), sets of controllers on same measurement, controller cascades, ...

Applied advanced techniques

- **Alarm Masking**
  - Interesting on pumps and compressors
  - Indication on the graphic for the operator
  - Link to a logic information graphic
- **Alarm Grouping**
  - Interesting for skids, reactors, furnaces and during shutdowns
  - Indication on the graphic & link to a logic information graphic with bypass possibility
- **Documentation for each implementation is directly accessible in Lotus Notes**

Applied advanced techniques

Why only these techniques ?

- Masking and grouping have direct impact on frequency and on alarm floods in upsets. So this compensates shortcomings of bad actors treatment (works mainly on frequency)
- Limited manpower resources available

Systematic approach

- **First applied on ethylene plant :**
  - all alarms of a “subsystem” discussed :

    various scenarios were discussed, to identify which alarms were needed, determine priority, setting, etc.
  - exercise led by daycontroller
  - executed on all furnaces and C2 splitter

Results : examples

Furnace

	emergency	high	low	total
before	9	184	133	326
after	4	25	71	100

C2 splitter

	emergency	high	low	total
before	34	93	116	243
after	24	67	32	123

Status : active alarms (in normal operation)

	center x	center y	center z
before	300	250	250
after bad actors treatment	200	130	170
after appl. adv techniques and/or system. approach	80	30	20
"real alarms"	30	15	10
instrument problems	50	15	10

- **Remarks :**
  - In normal operation, less than 20 “real” alarms is achievable
  - Instrument problems are the major hurdle to achieve this

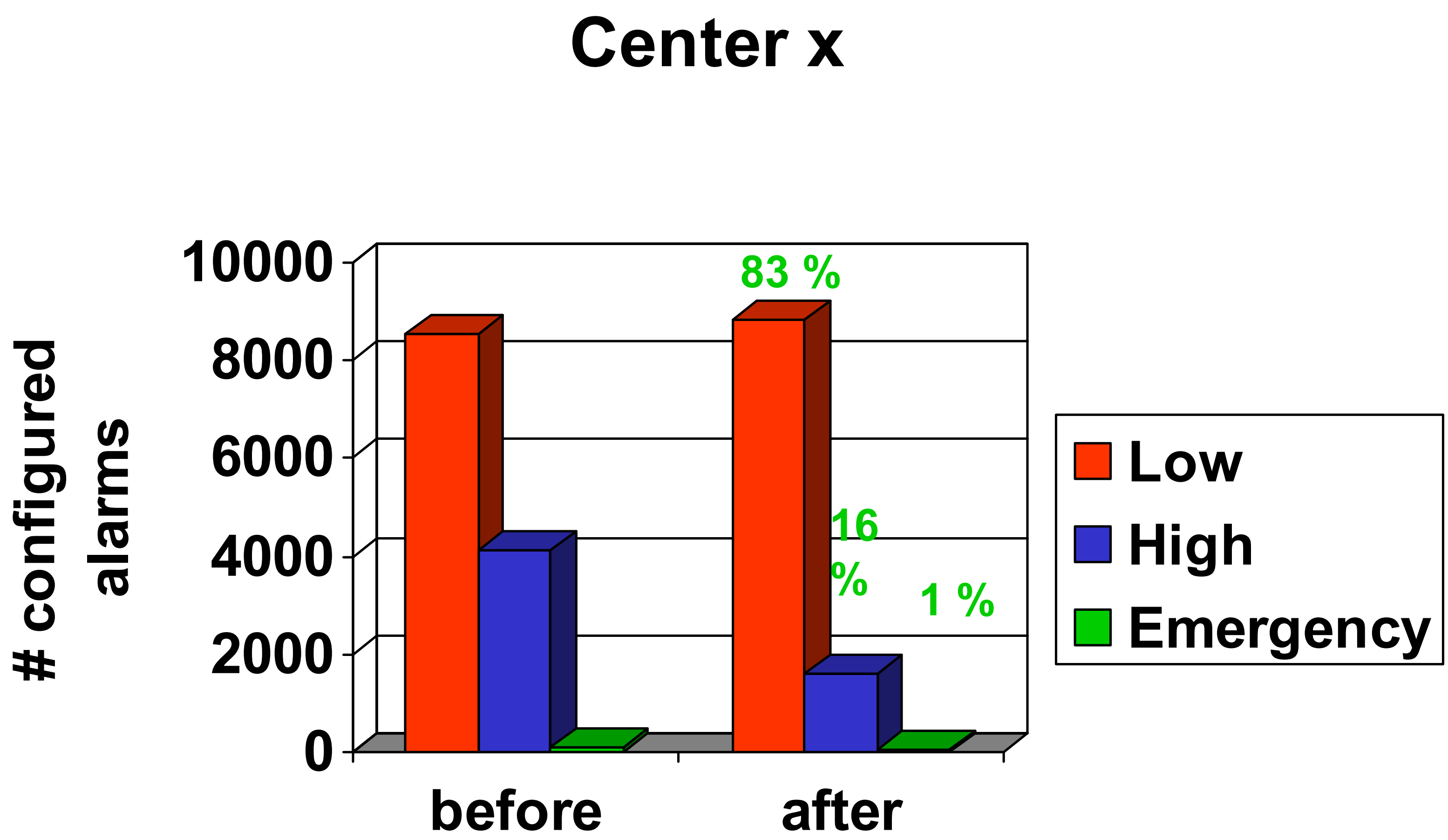
Status alarm frequency (monthly) : center

	before	after
frequency **for operator** (alarm summary)	**19000**	**14000**
total frequency	27000	15000
% of total freq. caused by instr. problems	40%	25%
number of disabled alarms	50	15

- **Remarks :**
  - total frequency is frequency when no disabling would be used
  - most alarms which require instrument repair are disabled

Status : Alarm configuration

Total reduction : 20 % !



Operator alert

- Operator tool, NO alarm system
- Operator can set alert limits on any PV or OP
- Max 100 alerts per center
- Possible applications :
  - filling of vessels
  - warming up of furnaces, reactors
  - etc.
- Implementation details under discussion with operators
- User alert tool of Honeywell under evaluation.

Conclusions

- Significant mentality change made : everybody is cooperating
- Major progress has been made, but …
- Still a long way to go !