

Cognitive and Organizational Ergonomics in the Transition of the New Integrated Center of Control of an Oil Refinery: Human Reliability and Administration of Changes

Sandro Artur Buso; Lucy Mara Baú; Magda Puquirre; Carolina Marcon Passero; Érika Lye Ogasawara; Marcos Cesar Bianchi



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

Petrobras Around the World



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012



Location: Araucária – Paraná - Brazil
Capacity: 31.000 m³/day Started in 1977 with 20.000 m³/day
Total Area: 10 million m²
Current Units: Atmospheric and Vacuum Distillation Propylene
 Solvent Deasphalting Fluid Cracking Catalytic
 MTBE Hydrodesulfurization



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

Cognitive Ergonomics (Human Reliability)

- The cognitive ergonomics is concerned with mental processes, such as:
 - perception, memory, reasoning and motor response, how it affect interactions among people and other elements of a system (IEA, 2000).
 - relevant topics include the study of mental workload, decision making, skilled performance, human computer interaction, stress and training as they relate to projects involving humans and systems.



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

Cognitive Ergonomics (Human Reliability)

- Dougherty and Fragola (1998), mention the rate risk due to human activity in some industries:
 - Nuclear Industry: between 50% and 70%
 - Petroleum Industry: 70%;
 - Aviation Industry: 50%.



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

Organizational Ergonomics

- Concerns the optimization of socio technical systems, including its organizational, policies and processes structures. Relevant topics include communications, resources management, work project, temporal organization of work, teamwork, participatory project, new work paradigms, cooperative work, organizational culture, networking organizations, telework, and quality management.



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

Organizational Ergonomics

- The organization of the work involves at least six interdependent aspects, namely:
 - Division of tasks in time (temporal structure, schedules, production rhythm) and in space (physical arrangement);
 - Systems of communication, cooperation and interconnection between activities, actions and operations;
 - Ways of establishing routines and procedures of production;



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

Organizational Ergonomics

- The formulation and negotiation of requirements and standards of performance, including the systems of supervision and control;
- The mechanisms of recruitment and selection of people for the job;
- Training and capacity methods and job training.



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

MATERIALS AND METHODS

- The field of the study comprised a deterministic sample of operators of the production, transfer and storage area, totaling 111 operators, who moved from their physical and operational premises to the new Head Office of the Integrated Center of Control, divided into 5 groups. The survey was carried out between August 2009 and January 2011



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

MATERIALS AND METHODS

- The stages of the study comprised two phases:
 - Before:** contact with the areas for data collection; application of a census with the operators' profile; AC – Concentrated Attention – test; ITRA – Work and Disease Risks Inventory; structured psychological interview; films on the desktop activities.
 - Afterwards:** feedback to the management, supervisors and operators; implementation of actions resulting from the finding and confirmed as required correction demands; new application of the ITRA.



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

Concentrated Attention (CA)

CA	TOTAL	%
Much Upper	11	10%
Upper	15	13,5%
Upper Average	35	31,5%
Average	41	37%
Lower Average	7	6,2%
Lower	2	1,8%
Total	111	100%



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

ITRA - 1st Scale - Physical, psychological and social problems

BEFORE					AFTER						
Average	1st Factor - Physical Damage				Average	1st Factor - Physical Damage					
2.14	Critical	Disease Presence	Severe	Critical	Bearable	2.09	Critical	Disease Presence	Severe	Critical	Bearable
		3	9	7	21			4	4	11	20
		7,32	21,95	17,07	51,22			9,76	9,76	26,83	48,78
Average	2nd Factor - Psychological Damage				Average	2nd Factor - Psychological Damage					
1.36	Bearable	Occupational Disease Presence	Severe	Critical	Bearable	1.35	Bearable	Occupational Disease Presence	Severe	Critical	Bearable
		3	2	3	32			4	2	4	29
		7,32	4,88	7,32	78,05			9,76	4,88	9,76	70,73
Average	3rd Factor - Social Damage				Average	3rd Factor - Social Damage					
1.80	Bearable	Occupational Disease Presence	Severe	Critical	Bearable	1.60	Bearable	Occupational Disease Presence	Severe	Critical	Bearable
		3	7	4	26			4	2	6	28
		7,32	17,07	9,76	63,41			9,76	4,88	14,63	68,29



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

ITRA – 2nd Scale – Your evaluation about your job context

BEFORE				AFTER			
Average	1st Factor – Division of the Content of the Tasks			Average	1st Factor – Division of the Content of the Tasks		
Critical	Severe	Critical	Satisfactory	Critical	Severe	Critical	Satisfactory
3,54	16	25	0	3,49	12	29	0
	39,0	61,0	0,0		29,3	70,7	0,0
Average	2nd Factor – Physical Environment Quality			Average	2nd Factor – Physical Environment Quality		
Critical	Severe	Critical	Satisfactory	Critical	Severe	Critical	Satisfactory
3,06	6	32	3	2,83	3	32	6
	14,6	78,0	7,3		7,3	78,0	14,6
Average	3rd Factor – Socio/Professional Relations			Average	3rd Factor – Socio/Professional Relations		
Critical	Severe	Critical	Satisfactory	Critical	Severe	Critical	Satisfactory
3,07	4	35	2	2,85	3	29	9
	9,8	85,4	4,9		7,3	70,7	22,0



3rd International Congress on Occupational Health
Caserta, Italy - March 19 - 23, 2012

ITRA – 3rd Scale – Your evaluation about the requirements resulting from your job context

BEFORE				AFTER			
Average	1st Factor – Physical Cost			Average	1st Factor – Physical Cost		
Critical	Severe	Critical	Satisfactory	Critical	Severe	Critical	Satisfactory
3,47	16	25	0	3,20	14	22	5
	39,02	60,98	0		34,1	53,7	12,2
Average	2nd Factor – Cognitive Cost			Average	2nd Factor – Cognitive Cost		
Critical	Severe	Critical	Satisfactory	Critical	Severe	Critical	Satisfactory
4,01	33	8	0	3,80	28	12	1
	80,49	19,51	0		68,3	29,3	2,4
Average	3rd Factor – Affective Cost			Average	3rd Factor – Affective Cost		
Critical	Severe	Critical	Satisfactory	Critical	Severe	Critical	Satisfactory
2,70	2	28	11	2,69	2	28	11
	4,88	68,29	26,83		4,9	68,3	26,8



3rd International Congress on Occupational Health
Caserta, Italy - March 19 - 23, 2012

ITRA – 4th Scale – Positive and negative experiences

BEFORE				AFTER			
Average	1st Factor – Professional Realization			Average	1st Factor – Professional Realization		
Critical	Severe	Critical	Satisfactory	Satisfactory	Severe	Critical	Satisfactory
3,27	6	22	13	2,95	5	14	22
	14,63	53,66	31,71		12,20	34,15	53,66
Average	2nd Factor – Freedom of Speech			Average	2nd Factor – Freedom of Speech		
Critical	Severe	Critical	Satisfactory	Satisfactory	Severe	Critical	Satisfactory
3,76	1	23	17	2,49	1	13	27
	2,44	56,10	41,46		2,44	31,71	65,85
Average	3rd Factor – Experience of Suffering			Average	3rd Factor – Experience of Suffering		
Critical	Severe	Critical	Satisfactory	Critical	Severe	Critical	Satisfactory
2,83	4	28	9	2,60	6	20	15
	9,76	68,29	21,95		14,63	48,78	36,59
Average	4th Factor – Lack of Recognition			Average	4th Factor – Lack of Recognition		
Critical	Severe	Critical	Satisfactory	Satisfactory	Severe	Critical	Satisfactory
2,37	3	19	19	2,01	4	15	22
	7,32	46,34	46,34		9,76	36,59	53,66



3rd International Congress on Occupational Health
Caserta, Italy - March 19 - 23, 2012

RESULTS AND DISCUSSIONS

- The study's target population was the labor force operating the desktops of the production (production, control, supervision and distribution of energy) and transfer and storage areas, totaling 111 operators, who participated in the first phase.
- The second phase comprised 41 operators of the production area; due to internal problems, the transfer and storage areas could not participate, and the utilities area had not yet made the physical transition by the end of the study.



3rd International Congress on Occupational Health
Caserta, Italy - March 19 - 23, 2012

RESULTS AND DISCUSSIONS

- The operators' age varied between 25 and 36 years (31.53%) and 36 to 45 years (36.94%), their average working period for the company being above ten years (51.32%).



3rd International Congress on Occupational Health
Caserta, Italy - March 19 - 23, 2012

RESULTS AND DISCUSSIONS

- In both ITRA phases – before and afterwards – little change was observed in the average, but the people migrating from "serious" to "critical" or to "satisfactory" was relevant, as shown in slides.



3rd International Congress on Occupational Health
Caserta, Italy - March 19 - 23, 2012

RESULTS AND DISCUSSIONS

- In the structured interview, demands were registered that had to be addressed in the transition. Such demands originated several managerial actions which were carried out by specific sectors for each one of them.



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

Actions arising from the interviews

SUGGESTIONS	ACTIONS
Lack of adequate training in the information transition	Meeting with the development (responsible for training) and production sectors to clarify more about the stages of transition to the operators
Concern on foreign interference in the new CIC	Classifications to the operators on the blocking procedures of entry of outsiders
Open environment for all teams	Exposure of the plant and stages of accommodation of the groups per working cells and adaptation of the communication
Concern about the noise at the headquarters and field operators	Request to the phonaudiologist for the review of the radio models and forms of communication, with consequent acquisition of a new model, and proposed training for a better form of communication between the operators
Unconformities of the furniture, layout of screens/panels	Adjustments of distribution of cabinets and materials; change in the positioning of the screens of the consoles by frequency of use.
Unconformity in the area access and excessive noise	Correction of access, equipment enclosure and change of the type of noise-canceling, reducing the decibel
Unconformities of the locker room and pantry	Readjustment of the distribution of cabinets, benches and changes in the temperature sensor at the pantry
Increased monitoring and participation of the inspector and manager during the transition	Meetings with managers and supervisors for the findings feedback, with suggestions of a better way of information during the shift scales transition.



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

CONCLUSION

- During this work, the importance was evidenced of the insertion of cognitive and organizational ergonomics in the building project of new facilities for high-complexity activities of a petrochemical company, through the direct involvement of the company's operators in the project and transition process, to value their experience, the indisputable basis for the change and adaptation process, which is focused on the reliability of the processes and products.



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

REFERENCES:

- IEA, 2000, available at http://www.iea.cc/01_what/What%20is%20Ergonomics.html, accessed on: 08. ago.2011.
- HENDRICK, H.W. e KLEINER, B. Macroergonomia, Rio de Janeiro/RJ, Editora EVC, 2006
- DOUGHERTY, EM; FRAGOLA, JR, Human Reliability Analysis, 1998.
- LABOR AND EMPLOYMENT MINISTRY, Order nr 3.214/78, of the Occupational Safety and Health Secretariat, NR 17 – Ergonomics.
- ALCHIERI, J.C. E CRUZ, R.M. Avaliação psicológica: conceito, métodos e instrumentos. São Paulo: Casa do Psicólogo, page 76, 2003.
- MENDES, Ana Magnólia; FERREIRA, M. C. . Inventário sobre trabalho e riscos de adoecimento - Itra: Instrumento auxiliar de diagnóstico de indicadores críticos no trabalho. In: Ana Magnólia Mendes. (Org.). Psicodinâmica do trabalho: teoria, método, pesquisas. 1 ed. São Paulo: Casa do Psicólogo, 2007. v. , pages 111-126.
- MENDES, Ana Magnólia Bezerra ; FERREIRA, M. C. . Validação do Inventário sobre Trabalho e Riscos de Adoecimento (ITRA). In: Congresso Regional de la Sociedade Interamericana de Psicologia, 2006, Havana Cuba. Anais do Congresso Regional de la Sociedade Interamericana de Psicologia, 2006. v. 0. page 1-8.



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

Continuity and Future Actions

- Monitoring of ongoing ergonomic implementations;
- Insert of the experience of operators in the projects and processes for the optimization of new units;
- Continuity in the process of ergonomic training of the workforce to implement the ergonomics culture in everyday activities of the refinery.



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012

Thank you!

Sandro Artur Buso
Health Coordinator

buso@petrobras.com.br

ARAUCÁRIA – PARANÁ – BRAZIL



10th International Congress on Occupational Health
Caserta, Italy - March 18 - 23, 2012