

Core Competence Building to avoid Processes Losses

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Topics: Process Development for Sustainable Environment – Cleaner production

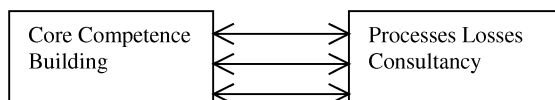
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Non-Renewable resources finishing (by inventory or geopolitical causes) and greenhouse phenomena cause implementation of losses reduction program in industry. This Program is drove by competitive and productivity international patterns. Some losses are related to water, steam, nitrogen and energy, then, utilities. Raw material loss is important and must be analyzed using procedures execution investigation. Other important factor to pay attention is losses caused by corrosion, erosion and fatigue of materials driving to study equipment and processes failure: corrective, emergencies and preventive studies. Methodology presented by this paper use academic and technical knowledge in routine operation aspects to decrease process losses: design development based on cleaner technology, utilities and raw material follow-up statistic to avoid losses, corrosion process management, mathematical procedures to predict situations, statistic process control maintenance, production control and procedures analyzes done by operation team looking for decrease risks in industrial universe. This methodology application has expected results like: increase of team productivity with positive results, raw income increase and better company image to stack-holders.

Methodology

Industry must construct abilities and applying them to prevent losses of process. It is carried in the execution of the tasks and control of the processes using appropriate techniques and verifying the effectiveness in losses reduction. Thus, methodology is divided in two parts: the construction of ability and the application of techniques and methods to minimize the losses through consultancies and technical services.

Figure 1 – Processes Losses



Core Competence Building

Current productivity in Industry is not satisfactory platforms in competitiveness terms, having as to improve through abilities in losses of process. The conventional work of engineering in the area of control of processes does not take care of the vision of losses of process being necessary to incorporate specific techniques and methods to improve the results: statistics of processes; operational reliability; simulation of processes;

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integration of energy and mass with data reconciliation; engineering designs for process and waste treatment (source and end of pipe); follow-up and process and production control; task planning.

Abilities and Competences to be bred need related methods of process analysis with action in operation of the plant using mathematical, statistical techniques and data reconciliation. It is initiated learning with knowledge of statistics for continuous and intermittent Process, through theories in follow-up and statistical control of processes. It must be incorporated information on increase operational, process, equipment, managerial, human and organizational reliability. To incorporate this multidiscipline inventory of knowledge is difficult, being necessary to carry through tests during normal operation being searched its validation. The possible reality is important to carry through simulation to verify the indication statistics how much to revise procedures.

The works to optimize process streams that influence in generation of residues and wastewater demand ability and competence to be developed of integration of mass and energy with data reconciliation (focus in the wastewater and thermal exchange).

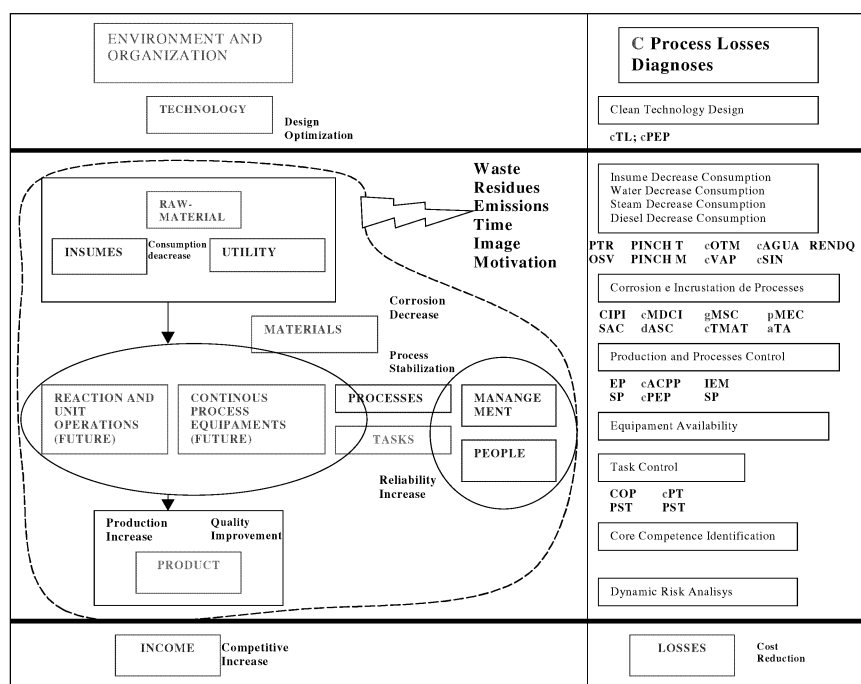


Figure 2 – Consultancies and Training em Process Losses

Clean Production Design

Although Industrial Complex already has dominated own Technologies, new environment requirements, using time of equipments and the renewal of engineers and operators (at job) in such a way demand projects in the wastewater and residue treatment area include source solutions. These projects search to remove strange materials in waste streams, decrease their generation of liquid and solid residues, preventing fugitive emission in valves, pipe and pumps.

Most of continuous Processes operates with high load and have operational parameters in a specific picture of stability. The biggest problems that occurs involving contamination of effluent are on fluctuations in the productive process. Thus nor always the solutions of end-pipe solve completely instantaneous and high contaminations. Operation area is involved in diagnosis of the problem in the exit of the industrial Plant through profile of the wastewater and identification of its generating at source. As normally the problem occurs after the meeting of some causal chains is necessary to carry through work of Audit wastewater and indications of contribution, to focus measurements in contaminating products into abnormal chains. From this moment the problem can be generated at separation operations while sizing, the process while chain composition or in the operational procedure. The solution for the problems can be in the changing of operational parameters, procedures review or including new equipments.

Quality and Process Statistic Follow-up

Specific works Production Systems can be carried through, consultants, searching to reach the stabilization of processes. After the stabilization of industrial plant, service of process follow-up is carried through normal activities using techniques as SPF/ SPC³. The Study of the origin of process oscillations including variables is initiated by SPF on the basis of daily pay-chosen operational parameters. For this analysis inquiries in the shift and the process are made. The reading of trends of the control graphs, the analysis of studies of correlation between analytical operational and changeable parameters allows the identification of the causality with the possibility to develop tests in normal operation. The study and the Standardization of Process and Production Systems depend on physical environment, cultural aspects of the team and managerial systems of quality. Therefore, closed packages as managerial systems or software are not directly applicable. The applicability of these systems depends on the time, or kind of operator and industrial plant.

Corrosion Process and Utility Management

It is important to initiate Corrosion and Utility Training Program with general subjects equalizing language and making possible identification of critical systems. Many industrial plants use as raw material acids in its installations being, therefore, necessary to define premises for Design, Operation and Process of Acid Systems in the Chemical and Petrochemical Plants. Being thus, the stockage, the draining, the removal of heat, and other subjects are important to be analyzed in training. The Systems of Utilities have direct relation with the Subject chemical Corrosion and the efficiency of the Operations and reactions. To initiate the activities in the area of Utilities it is suggested to start the quarrel with methods and techniques to define Cooling Tower Performance. This equipment is responsible for water consumption in the Industry and can be reusable used water, being, therefore, important to know as to analyze the performance of the Towers of Cooling. Another subject of extreme importance to diminish the consumption of energy in the Industry is the improving of Steam and condensed Systems distribution and use of. It is known that the loss of saturated steam is raised arriving high values (25%) and search solutions to diminish this critical problem.

Finishing, it is important in such a way to transfer knowledge through specific courses on Pinch Technology in thermal exchange and wastewater areas. The use of mathematical methodologies optimizes the search for solutions even so, the field research can bring resulted more applicable.

³ Statistic Process Follow-up and Control

Procedures to Avoid Human Error

There are Procedures that evaluate: environments (organizational, social and economic) where the task is carried through, operating type of operator and operation team in job, the technology/product involved at process, the form with that the task is carried through (stages, tools, signals) and the variability of these factors that initiate influence in the human error. The material aspects can more easily be analyzed by the causal relation in the questions of equipment and products allowing that if it constructs mapping of processes and facilitating the agreement for the worker of the actions to be carried through. The main problem is in the intrinsic fluctuation of the human behavior and its relation with environments: social, economic, natural, occupational and organizational. Guidelines, reports and manuals written in transportation and energy segments in United States and United Kingdom announce that human behavior is main responsible for not the geographic and time repeatability of cited techniques.

Maintenance Statistic Follow-up and Management

Maintenance activity process equipment involves technology, management and procedures. The availability of equipment is resultant of steady process in compatible load in accordance with design or with viable operation conditions. Maintenance technician must know the function of the equipment in process and evaluate causes of failures to be corrected. Thus, the equipment return in maintenance depends on the adopted level of priority, of the availability of parts for replacement, of the analysis of imperfection of the equipment in the process, of the analysis of effectiveness of the carried through service. Systems of management of data base in the maintenance are essential for description register and to facilitate next interventions in the equipment.

Production Control and Procedures Analyses

Procedures and Tasks evaluation are considered important in the same way that works in human being reliability for the competitiveness in the industry. The knowledge of the productive process and the state waited after the execution of the task allows to analyze incoherencies and to correct incorrect forms to operate industry.

Process Losses Consultancy

The industry trend are to control processes for framing critical quality variable into band of 99,95% between allowed limits (max and min), or either, Six Sigma. At the same time where, programs of cleaner production if multiplied, programs of social responsibility and responsible performance for the industry if they become necessity to answer to society complains. The necessity of framing product and process variables is followed of necessity to diminish human errors in the execution of the task in the industry. Thus, losses of process do not summarize the aspects of: losses of materials, losses of patrimony, losses of time (accident), losses in the product quality, difficulties of fulfillment in the stated period, losses of image of the company (accidents and labor law actions), losses of invoicing due reduction of price in the product (quality, stated period) or due to selling losses and with removal due the occupational illnesses. The Human Reliability being brings an element of important loss and that is intangible, low the motivation generating human errors that provoke all the losses above cited. Or still the incorrect form to proceed in the routine from the operation generating low productivity without apparent visualization provoking expense excess from energy and not framing from indices from consumption in general.

This Consultancy Program in Process Losses is detailed in following scheme: Justifications to act with losses of process, also in the direction of measuring losses to compensate investments; specific characteristics for type of Industry better to describe

aspects differentiated for technologies in the chemistry areas, oil and cellulose; definition of Consultancy Program in itself detailing stages of: data collection, results measurement, Losses diagnosis, validation of programs to prevent the loss for type; general concerns on Task Analysis; Standardization Program in Losses of Process; Picture of Industry with the implementation of Process Loss Program.

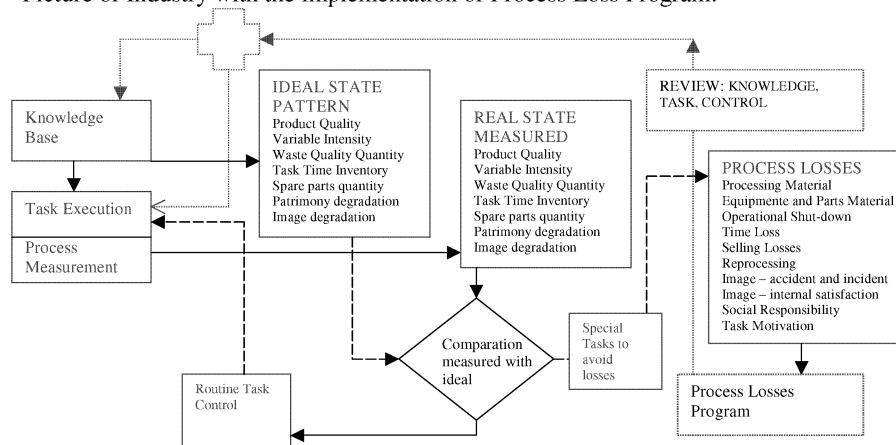


Figure 3 – Process State and Losses Program

Process Knowledge and Data Collection

Production is responsible area for carrying through the transformation of materials in finished products. It is where it circulates the main possibilities of losses of process. Engineering gives the technological support so that it is possible to execute the intended transformation. The statistical studies and quality control are part of this area. The HSE⁴ areas congregate attendance concerns to voluntary requirements (ISO⁵) and legislation related with occupational and environment aspects. In Commercial area it is congregated the result of the works of the Production with the Technological base of Engineering and with rules and standards established for HSE. This result is the delivery of finished products and services for customers. In this way, any errors in these areas have the possibility to appear as not conformity in the product. To make the machine to function, independent of automation level, operator role is important in all sectors being essential for election, allocation, training and communication in the Company. The existence of the Company if must to a previous Vision of the owners and the desires pass to be carried through with the project, assembly, operation and, delivery of the product finished to the Customer. The institutional area relations involve the creation of the resultant organizational culture that result in company image.

Results Measurement

There are measured different results in: Production including Operation, Maintenance and Management; Process and Design Engineering; Occupational and Environment area - HSE; Commercial area; Personal Area; Institutional area business-oriented or relations. In this classification of areas they are considered: Strategically areas, business-oriented and the Advertising due to possibility to create new businesses and to

⁴ Healthy, Safety and Environment

⁵ International Standard Organization

keep the lucrative enterprises from managerial decisions. Involved areas are considered as End Activity, areas of: process including the quality; production including operation and maintenance, beyond the area of people who analyze the motivation and involvement of worker in the execution of the task. As Support areas are considered occupational and Environmental Area that evaluates the risks of accidents and of incidents that impacts worker, patrimony and environment; beyond the area of Engineering of Projects. In global terms, some results enclose all the company, amongst these can cite: minimization in generation of waste streams; improvement of the finished product quality measured for the amount of lots inside of conformity; average increase of the load and the continuity of the industrial plant increasing, therefore the production and diminishing the consumption indices.

Process Scanning

Mapping of process abnormalities is based on the registers of signals of not conformity or signals that indicate intermediate states for not conformity. These signals are detailed and confirmed from interviews with leaders of shift team and from the interpretation of the productive process. Building of MEA⁶ and the others techniques of data processing and diagnosis are detailed in the Stabilization of Processes Methodology (new book). The extracted facts of the shift book and the analyzed variable from the process and of the production go to indicate probable causality for problems. Some factors that contribute for the construction of the loss of process can be interpreted of erroneous way being classified as false or anticipated factor in relation to the logic of problem. The facts can not be in the form explicated, or visible, being constructed from inferred hypotheses of the data and the occurrences registered in the shift book. Valley the penalty to stand out that much omission in the register of occurrences exists due to the "protections" of the shift in relation to the staff. Beyond the omission the delayed effect of the problem of process with the shift working with low level in the process vases to transfer the problem of low quality and high consequence I recycle for the following turns that are without option. The construction of the MEA is based on relationship of data from specific criteria learned during the study of the process and the interviews with representatives of the operation. After the map to be prepared, enters in action the ability in inferring not visible events in the production area, process, management and people. This necessary inference to be validated using the statistics. The inference on the causal nexus of the abnormalities is made using the knowledge base, the registered mental map through alternative and resultant flowcharts of the chain of abnormalities composed for operational factors (facts occurred and visible or, presumptions and not visible).

Process Losses Diagnosis

Processing information includes quantitative techniques that they process given qualitative and making possible the construction of the Causal Nexus for the occurrence of operational Failure that generates the Loss of Process. The Mapping of the abnormalities and the correlation between descriptive and numerical data define which are the functions of the operational factors. It is important to emphasize that to arrive itself at the causal nexus the possibility of operational factors is important to define the process states being shown to signal for the existence of the imperfection, in contrast of that, the local culture technique indicates, therefore, already promising new working standards in the production. The analysis of the raised and processed data goes to indicate an action program to be validated in the field. Initially, after the indication followed of process variable to be measured and of the changes to be carried through,

⁶ Abnormal Events Map

the interpretations, relations and correlations are concluded and indicate which the best actions to be validated and which can be forgotten. The Audits confirm the necessity of follow and accomplishment of changes in variable, procedures and standards. Still in relation to the causal nexus, the paper of the man is evaluated and it influences it of the organization on the problems that involve losses of process. We remember that the subject human reliability is future book object to be launched. For each specialty it is made specific Diagnostic indicating Program of action in multiple areas and whose order depends on the priority in terms of Losses of Process. Thus, remembering that the resultant Diagnostic of this work are: Process, Production, Environmental and Occupational and, People. These Diagnostic will be validated through: of the index and results follow-up, of confirmation of the Team of production, the review of procedures and standards, tests for verification of the benefits in the change. With this the Analysis of the task in terms of results will be made and is initiated it last phase of this methodology: Standardization of Program for Losses of Process with concerns on the Task and future Scenes of the Industry with new States of Process established (goal: Six sigma). Before the techniques of diagnostic valley the penalty to stand out that, all the methodology follows the procedural line indicating that, the data to be collected and the form of collection of data also depends on the types of technological system technician, of the type of social system and profiles of workers, beyond the organizational and social-economic changing. The main techniques that will be described below and that they compose the Diagnosis for Losses of Process are: analysis of the causal nexus, interpretation of the variable process, preparation of program of interventions searching to diminish variability, analysis of the organizational influence and human being on the losses of process and audit in the production to confirm the relation between resultant action /variable.

Results

Os resultados esperados com o desenvolvimento da competência a cerca de perdas de processo em termos de conhecimento e de investigação quanto causalidade e o programa de ações para evitar perdas são de larga amplitude. A metodologia apresentada neste paper tem boa possibilidade de atingir o sucesso, pois valoriza a base de conhecimento do operador de turno além de investir no capital intelectual.

Pretende-se atingir os seguintes resultados: (1) Redução de 30% da hora extra, das horas de parada da produção, do custo de re-processo; (2) Redução de 15% da produção de produto off-spec; (3) Recuperação de 30% de clientes perdidos no Mercado; (4) Diminuição de gastos com peças de reposição em 8%; (5) Diminuição de perdas em 20% na reação e no efluente; (6) Diminuição de perdas em 5% nas emissões fugitivas; (7) Aumento de carga em 0,4%; (8) Recuperação de 20-30% nas perdas das utilidades e muitas outras perdas de processo.

Expected results with development of ability and competence about process losses in inquiry and knowledge terms how much causality and the program of action to prevent losses are of wide range. The methodology presented in this paper has good possibility to reach success; therefore it values the base of knowledge of the shift operator besides investing in the intellectual capital. It is intended to reach the following results: (1) Reduction of 30% of the overtime, the hours of stopped of the production, the cost of re-process; (2) Reduction of 15% of the product production off-spec; (3) Recovery of 30% of lost customers in the Market; (4) spare Reduction of expenses with parts in 8%; (5) Reduction of losses in 20% in the reaction and the wastewater one; (6) Reduction of

losses in 5% in the emissions fugitives; (7) load Increase in 0,4%; (8) Recovery of 20-30% in the losses of the utilities and many other losses of process.

Conclusion

A competitividade da Indústria atualmente não se limita somente evitar o impacto ambiental ou diminuir custos ou aumentar lucros. O desafio maior é manter e desenvolver dentro da empresa uma equipe competente e que saiba resolver problema independente do tipo e da época. A Confiabilidade humana e a eficácia na realização da tarefa são os maiores desafios atuais para evitar perdas de processo.

Competitiveness of Industry currently is not limited only to prevent the impact environment or to diminish costs or to increase profits. The challenge biggest is to inside keep and to develop of the company a competent team and that it knows to decide independent problem of the type and the time. The Human Reliability and the effectiveness in the accomplishment of the task are the biggest current challenges to prevent losses of process.

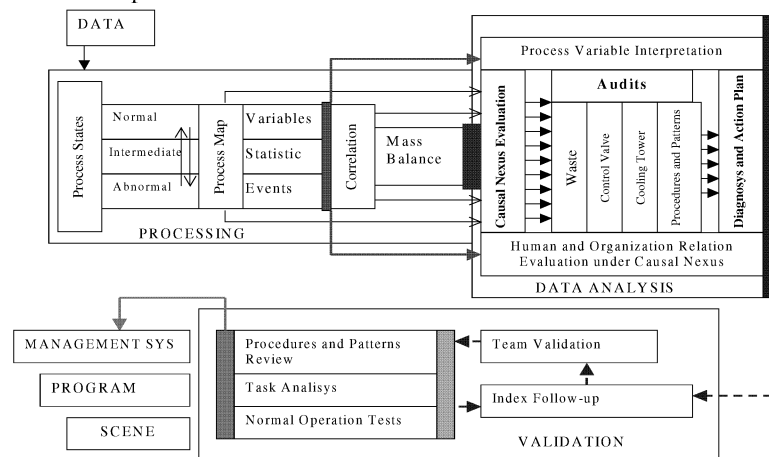


Figure 4 – Methods and Techniques to Losses Control

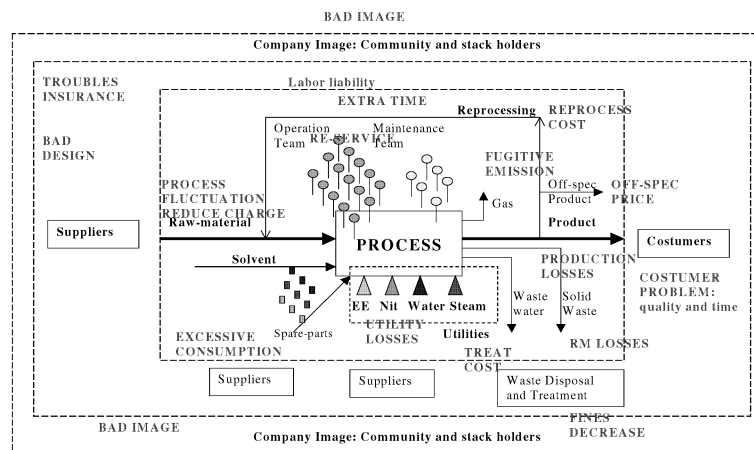


Figure 5 – Results in Process Losses Program