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# Assessment of Environmental Programs at Baker Hughes Centrilift Division of Colombia during the First Six Months of 2009 in Bogotá Headquarters to Ensure Verification and Compliance

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**Abstract :** This paper focuses on the Assessment of environmental programs at Baker Hughes Centrilift Division of Colombia during the first six months of 2009 in Bogotá headquarters to ensure verification and compliance by identification of company's environmental programs, assessment and planning of improve actions. The methodology analyses applied was to obtain secondary, qualitative and quantitative information. It was found that it had been made activities related to environmental issues, like solid waste management, hazardous/special waste, savings and efficient use of energy and environmental training. Rating Matrix and Environmental Programs Management taken present the concepts of the Colombian Technical Guide GTC 93 (2003) realized the assessment of the action, design by the identification of weak points within each program by facilitating the identification of aspects to improve. The matrix allows you to categorize the discoveries into three skill levels. According to the results in the Matrix, is possible exalting the environmental actions in a Rank of excellence. However, is necessary obtain the continuous functions and jobs in environmental topics, diffuse the functioning of environmental programs to the employers, and the form of help since it workplace the environmental actions. Fortify the Avoid and Efficient Used of Energy Program for it ranking of 64/78 and respect of environmental training program to make stand out by have one solid structure with a ranking of 69/78 for which is recommended fomented the used of software system.

**Key Words:** Assessment, environmental, solid waste, Matrix.

## Introduction

Currently, companies incorporate in their production processes programs for improvement and environmental impact reduction, some out of conviction or compliance with legal requirements that allow them to easily access the market. Regardless of the motive, in Colombia is changing the organizational structure of companies projecting to achieve an institutional environmental well-being.

Baker Hughes of Colombia is a company dedicated to providing services for the oil sector. The activity it's developed in field areas (Neiva, Villavicencio and Yopal) and at the administrative level in the city of Bogotá. The company is conform by seven divisions responsible to offer products and services ensuring quality and excellence in all stages of oil exploration. Evaluation of environmental programs applied to the Division of Centrilift, its activity is to produce and manufactures electric submersible pumping systems, progress cavity pumps with downhole motor, horizontal pumps and variable speed drives.

The evaluation was conducted in the administrative area to strengthen environmental management developed allowing ensuring verification, visualize the improvement in the mode of action, identifying specific problems or failures that can be address later.

## Methodology

This article is based on an environmental project presented in May 2010 as a grade work. The work consisted in analyze an environmental report that collects environmental activities within the company from November 2008 to May 2009. Environmental information is quantitative, secondary and qualitative. This work was developed in four basic steps explained below:

### First Stage. Bibliographical Review

For this review were taken into account themed books for solid waste management, related documents in the website of Ministry of Mines and Energy, the Environment Department, Decrees and updated normativity according to Colombian legislation. It was necessary to consult previously the legislation in force for the implementation of environmental programs at the national level, allowing contextualizing the normativity to the situation of the company.

### Second Stage. Identification of Environmental Programs

The identification of environmental programs in force in the company, was conducted through an initial review of the environmental activities consisted in: the organization of the information, according to the methodology PDCA for Plan, Do, Check and Act, described in Colombian Technical Standard NTC-ISO 14001 (2004), applying this methodology in each program with a micro focus considering environmental programs such as basic and fundamental unit of ENVIRONMENTAL MANAGEMENT SYSTEMS. For each program it's important to apply the following steps:

- a. Planning: in this category, targets and processes necessary are set to achieve the results according to the environmental policy of the organization, described and classified activities that organize and carry out the work plan. NTC (2004).
- b. Implementation: Make and implement the proposed activities to achieve the general objective of the NTC program (2004).
- c. Evaluation: the monitoring and measurement of the processes carried out with respect to the environmental policy and the general objective of each program.
- d. Improvement: take actions to continue improve the performance of the system (environmental program). NTC (2004)

In this way, a recognition of the structure of the environmental programs were obtain taking into account the identification of a defined objective, a measurable goal, assigned resources, management indicators, functions and responsibilities of each program.

### Third Stage. Evaluation of the Environmental Programs Of The Company.

#### a.. Rating Matrix of the environmental programs.

To make the matrix it was chose the most relevant Moncada´s report (2009) to evaluate and improve environmental programs. It proceeded to do the matrix design for the evaluation of environmental programs based on the concept of strategic planning being defined as "an approach and systematic objective to making- decision- in an organization" and "Relational Matrix of Structural Analysis or Vester Matrix "which makes evident interactions of dependence and mobility between the different identified variables. Territorial Strategic Planning Course (2009) taking into account the data and results of the initial report of the first stage. The matrix comprises qualifying item (poor, fair, good), prioritization of item (high, medium, low), the rating of the programs (poor, fair, good) and the final rating of the matrix that is equivalent to the sum of the grade obtained for the programs (poor, fair, good).

- Classification of items: to do the evaluation of the environmental programs, it established basic items that allow the classification of compliance and applies a frequency categorization for the items

- 1) No, Never, Poor.
- 2) Regular, occasional, medium and
- 3) Yes, completely, always.

To obtain the score of the qualified item for all the programs, columns establish the following rating ranges:

1-3: Poor; 4- 6: Acceptable; 7 - 9: Excellent.

Below in Table 1 is explained the qualified items;

**Table 1- Description of Qualified Items.**

Item	Description
A.	Has the program definite objective?
B.	Are the objectives and the goals of the programs, quantifiable?
C.	Are the objectives consistent with the environmental policy?
D.	Is there knowledge and diffusion of the environmental policy inside the company?
E.	Have they consider the legal existing requirements for the development activities?
F.	Has the company assigned resources for the execution activities?
G.	Are the functions, responsibilities and authority define and documented?
H.	Are the identified formation needs in relation with the environmental aspects?
I.	Are the education and training give to satisfy internal environmental needs?
J.	Is there a procedure, documented and implemented to satisfy aspects and/or environmental needs?
K.	Has the company consider clients suggestions and complaints related to environment?
L.	Has the high management consider actions to do environmental improvements?
M.	Are the arrangements relate to environmental finds do on time?

N.	Is the information on the present environmental state disseminate and communicate?
O.	Does it do a quarterly periodic review about program function and management (annual)?
P.	Does the employees used the software systems to suggest and/or provide changes related to the environmental management?
Q.	Has done the disclosure of the environmental programs functionality?
R.	Have the activities independent continuity of the hierarchy changes done?
S.	Are there procedures to approve or disapprove the acquisitions of technology that minimize or control the generated environmental impact?
T.	Have employees knowledge on the consequences that generate to the environment the activities that they realize?
U.	Is there an environmental training plan implemented with the different environmental issues?
V.	Is it an estimated about the generated and return costs for the execution of the owner activities of the environmental programs?
W.	Is there information for personnel about the practices that contribute for an optimal development of the programs?
X.	Are the issues commensurate in the trainingsagree with the environmental impact generated in each office?
Y.	Do the HSE personnel solve the duties and questions related to environmental issues communicated?
Z.	Is the peoplestimulate to take part activelyineach of the environmental program?

Prioritization of the items: is necessary to determine an order and work plan regarding to the most relevant faults within each program. The following explains the different categories that can be classified the items evaluated.

High priority: The items considered with high priority are all those that have a repetitive rating with one (1), bearing in mind that management has not been the most diligent and urgent action is necessary to take on.

Average priority: The items considered with medium priority are all those that have a grade in the repetitive matrix with 2, indicating that the management by item has been done in part but must be improved and complete.

Low priority: The items considered with low priority are all those that have a rating in the matrix with three (3), indicating their correct and normal functioning.

#### **b. Order of Action:**

Each of the priorities has a specific order of execution explained in the High, Medium and Low Priority Interrelation Diagrams.

- Programs Qualification: is the sum of the rating items, to qualify environmental programs the following score ranges are handled; 1 - 26: Poor; 27-52: Acceptable; 53-78: Excellent.

- Total Score Matrix: is the sum of the rating programs, as the following ranges can be; 1-78: Poor; 79-156: Acceptable; 157-234: Excellent.

**Fourth Stage. Proposal for Improvement and Management for Environmental Programs of The Company.**

Comparison Chart of Environmental Management: It proceeded to identify critical points within environmental programs according to the results of the above matrix, classifying areas for improvement in low, medium and high priority. According to the grade obtained considering 3 the highest score obtained for each of the items evaluated with efficiency equivalent to a low priority and 1, being the lowest qualification that each item can obtain, equivalent to a high or urgent priority to be solved.

Defining the points to be improved, a comparative work plan was design, reflecting what had been doing before the evaluation and what would done to improve the items that presented faults in the matrix performed.

**Results**

**Table 2. Qualification Matrix of the Environmental Programs**

PROGRAMA \ ITEM		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	PUNTAJE PROGRAMA	POR
		a.	MANEJO DE RESIDUOS SOLIDOS CONVENCIONALES Y ESPECIALES	3	3	3	3	3	3	3	3	3	3	2	3	3	2	2	1	1	3	2	2	2	3	3	3	3	68
b.	AHORRO Y USO EFICIENTE DE ENERGIA	3	3	3	3	3	3	3	3	3	2	2	2	3	2	2	1	1	3	2	2	2	1	3	3	3	64		
c.	CAPACITACIONES AMBIENTALES, COMPETENCIAS Y CALIFICACION DEL PERSONAL	3	3	3	3	3	3	3	3	3	2	2	2	3	2	2	3	1	3	2	3	2	3	3	3	3	69		
<b>PUNTAJE POR ITEM</b>		9	9	9	9	9	9	9	9	9	7	6	7	9	6	6	5	3	9	6	7	6	7	9	9	9	201		

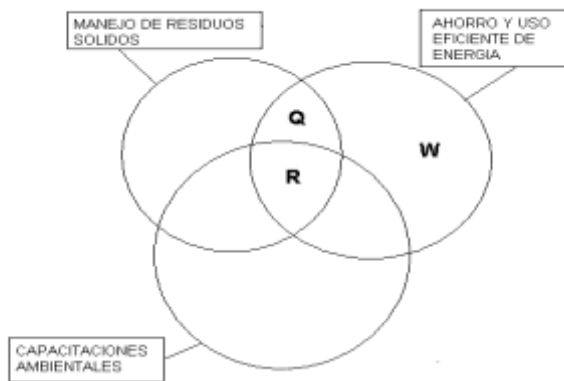
  

DESCRIPCION CALIFICACION DE ITEMS	1= No/Nunca/Deficiente																2= Regular/Ocasional/Medianamente																3=Si/Completamente/Siempre															
rango columna-Puntaje del item	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	PUNTAJE MATRIZ TOTAL	GESTION																				
1 - 3= Deficiente	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	26																					
4 - 6 =Aceptable	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																						
7 - 9 =Excelente	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																						
	3																																															
rango por fila-Puntaje del programa	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	52																					
1- 26 = Deficiente	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																						
27-52 =Aceptable	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																						
53-78=Excelente	6																																															
Rango Puntaje Gestion Matriz Total	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	78																					
1-78 = Deficiente	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3																						
79-156= aceptable	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3																						
157-234= Excelente	9																																															

## Discussion

Qualification Matrix of the environmental programs can prove the most important findings within the internal structure and operation of environmental programs, with the Q, R and W items categorized in a high priority or urgent solution.

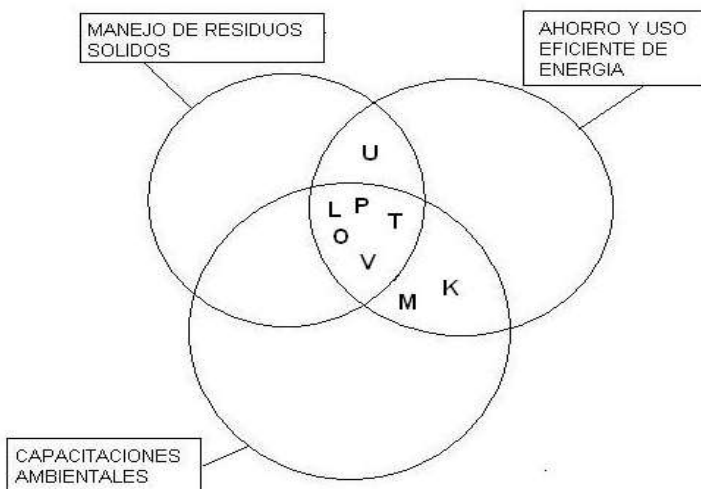
In addition to this prioritization interrelationship diagrams 1, 2 and 3 are performed to allow the demonstrate improvement order or action plan to solve each developed item below;



**Diagram 1. Interrelation Programs with High Priority**

### Order of Action and Analysis.

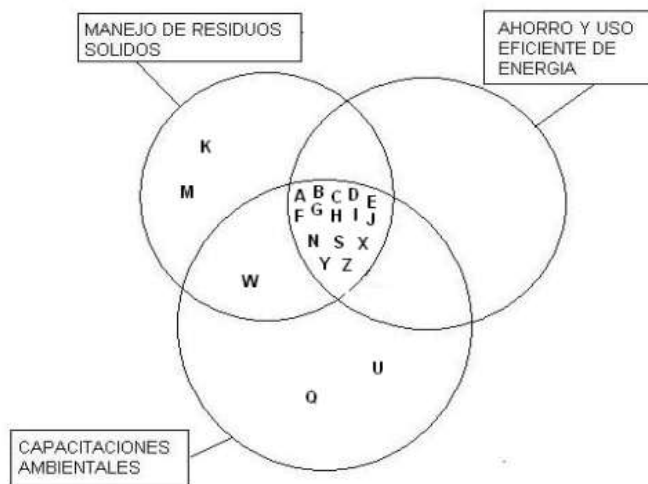
1. Item R: According to the matrix must perform activities to allow continuity of functions and tasks on environmental issues regardless of changes made in hierarchy. This is the primary finding in the matrix of qualification and management of environmental programs.
2. Item Q: Given that the operation of environmental programs is subject to changes in organizational structure should considered as a second fundamental point spread function of environmental programs to the staff and how to support from its work place the environmental management.
3. Item W. Staff should be informed about practices that promote optimal development Program Savings and Energy Efficiency through training that takes into account the energy consumption data vs. Cost, allowing employees to have accurate information regarding the decrease or increase of this resource.



**Diagram 2. Interrelation Programs with Media Priority**

### Order of Action and Analysis.

1. Item L. Senior management has occasionally consider actions to environmental improvements in administrative areas, it is necessary to inform senior management on the need to strengthen administrative areas conducting activities to improve on environmental issues.
2. Item O. According to the results of the matrix is necessary to strengthen the management of quarterly periodic review results regarding to the corporate goal and the operation and management of the programs every year.
3. Item P. Employees to contribute and/or suggest changes regarding environmental management occasionally use software systems. Each staff member knows the handling cards that allow observation to publicize the shortcomings in environmental issues; their use is occasional because administrative areas workers are expose to conditions of lower risk compared with a field worker, so it is consider a normal or routine discovery.
4. Item T. It should deep in training, in the information about the consequences that result from the activities carried out daily.
5. Item V. It should estimate the costs incurred and paid by implementing activities own of the environmental programs, such as marketing of conventional solid waste, the cost of energy consumption, the estimated cost to dictate environmental thematic trainings, etc.
6. Item M. Arrangements are made in time for the environmental findings. This factor is been link to the availability of human and financial resources.
7. Item K. The organization takes into account the suggestions and complaints of customers in environmental matters. This item is in the average prioritization because some of the suggestions expressed by customers are partially realize.



**Diagram 3. Interrelation Programs with Low Priority.**

### Order of Action and Analysis.

Most items presented qualified to a score of three (3). The items with this rating are listed below:

1. Item A. Programs have a defined objective. If you comply and in the way that an organization has clear objectives of environmental programs will plus easy to carry them out.
2. Item B. The objectives and goals of the programs are quantifiable. If each program executes its management indicators.
3. Item C. The objectives are consistent with environmental policy. If the policy establishes its commitment to safety operations, the protection of the environment and the valuation of the human being. These must be connected.
4. Item D. There is knowledge and dissemination of environmental policy within the organization. If in the induction to the employees, is explained and reflection is made on the responsibility of the company against the environmental aspects that are generated by economic activity.

5. Item E. The legal requirements in force take into account for the development of activities. If during inspections done, first you take into account the regulations that apply to the situation that arises, type either of environmental alert, or in order to prevent environmental impacts.
6. Item F. The company has allocated resources for the execution of the proposed activities to strengthen each of the programs. If resources are allocated annually exclusively for environmental management.
7. Item G. The roles, responsibilities and authority are defined and documented. If all this information is document, implemented and evidenced in Procedural Manuals according to the position of the employee.
8. Item H. Training needs related to environmental aspects are identify. If the monitoring of the training needs of the workers takes place in the virtual platform called Learklink, allowing to confirm and to handle statistically the data of the employees who take the required trainings.
9. Item I. Education and training is provide to meet internal environmental needs. If, in addition to the Learklink system, workers receive training in environmental issues related to the context or workplace in which they remain.
10. Item J. There is a procedure, documented and implemented to identify environmental aspects and/or needs. If there is a procedure for the qualification of environmental impacts at the operational and administrative level.
11. Item N. Information on the current state of the environment is disseminate and communicated through information published on the Intranet, employees consult information related to the integrated management system.
12. Item S. There are procedures for approval or rejection of technological acquisition that allows reducing, minimizing and controlling the environmental impact, currently the characteristics of the materials used previously analyzed, the assurances given by customers.
13. Item X. The themes dictated in the trainings are in line with the environmental impacts generated at each site. If training has carried out to strengthen the three environmental programs.
14. Item Y. It clarifies doubts and questions regarding environmental issues communicated by staff of Health, Safety and Environment. In addition to the doubts generated in training, questions are handle via mail allowing make the dissemination of information agilely.
15. Item Z. Staff are encouraged to participate actively in each of the environmental programs. If,by incorporating workers in environments in contact with nature, they can strengthen learning, companionship by stimulating knowledge on environmental issues.

In figure 1 conventional and special solid residues management program obtained a score of 68 points of 78, equivalent to 87.18% in compliance activities, the saving and efficient use of energy program obtained 64 points of 78, equivalent to 82.05% of compliance and the environmental training program, 69 points of 78 equivalent to a compliance activities of 88.46%.



**Graph 1. Percentage of Compliance of the Environmental Programs**

The management happens and the basic requirements kept updated for the environmental internal management with the fulfillment of the analyzed issues,. These can change or increase in proportion to the environmental impacts generated by the different productive activities of the organization.



## Conclusions

- Three environmental programs are identified and evidenced that are part of the environmental management of the administrative area. The total rating of the matrix obtained a score of 201 of 234 possible approved points, positioning itself as an excellent score in terms of environmental procedures and programs made during the first period of 2009.
- The environmental training program, skills and qualification of the staff in the matrix classification it was the most structured obtaining a grade of 69/78. It suggests encourage the use of software systems.
- A full-time person, strengthening environmental issues, should constantly promote environmental programs making environmental culture a continuous reality.
- The Savings and Efficient Use of Energy Program scored 64/78. Record the energy consumption and will correct through training the inadequate practices.
- The Conventional and Special Solid Waste Management program earned a score of 68/78. In this program, it is important to spread the objective and the development of the program in the facilities.

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