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Executive Committee of
the Interim Multilateral Fund for the
Implementation of the Montreal Protocol

Eighth Meeting
Montreal, 19-21 October 1992

PROJECT PROPOSAL: VENEZUELA

Caracas, 2 September 1992

Dear Dr. El-Arini,

I have the honour to enclose the project "Substitution of CFC by HFC-134a as refrigerant in central air-conditioning equipment" in order to be reviewed by the Fund Secretariat and the World Bank, and for its consideration by the Executive Committee of the Interim Multilateral Fund for the Implementation of the Montreal Protocol, in its next meeting to be held in October.

I also inform you that we have already asked the World Bank to proceed with the technical and financial assessment of the project as well as the formulation of recommendations.

The Ad-hoc Inter-Ministerial Group for the Implementation of the Montreal Protocol of Venezuela has reviewed the eligibility and incremental cost of criteria of the project which is suitable for funding by the Multilateral Fund. Please be aware that estimates of incremental costs for the new equipment, were made considering prices of reference equipment quoted by the suppliers. It was not possible for the Group to obtain a general list of prices of equipment CFC and HCFC on the market, from which we could have compared similar characteristics to the new equipment based on HFC-134a.

Taking into consideration the above, it is possible, after the World Bank's appraisal, that the amounts included in the document we are submitting could have some modifications.

We would appreciate if you could insure that the project, with its annexes and the recommendations by the World Bank and the Fund Secretariat, be presented to the Executive Committee on the date already established.

Accept, Sir, the assurance of my highest consideration.

signed by Eduardo López
Representative of Venezuela to the
Executive Committee of the Interim
Multilateral Fund for the
Implementation of the Montreal
Protocol

Dr. Omar El-Arini
Chief Officer
Interim Multilateral Fund
for the Implementation of the
Montreal Protocol
Montreal, Canada



REPUBLICA DE VENEZUELA
MINISTERIO DE RELACIONES EXTERIORES

Grupo Interministerial Ad-hoc para la Aplicación del Protocolo de Montreal

Caracas, 2 de setiembre de 1992

Apreciado Dr. El-Arini:

Tengo el agrado de dirigirme a usted en la oportunidad de remitirle el proyecto denominado "Sustitución de CFC por HFC-134a como refrigerante en equipos de aire acondicionado central", a los fines de su revisión por la Secretaría a su cargo y por el Banco Mundial y su consideración por el Comité Ejecutivo del Fondo Multilateral para la Aplicación del Protocolo de Montreal en su reunión de octubre próximo.

Le informo igualmente que he solicitado con antelación al Banco Mundial que proceda a la evaluación técnica y financiera del proyecto y a la formulación de las recomendaciones respectivas.

El Grupo Interministerial Ad-hoc para la Aplicación del Protocolo de Montreal en Venezuela ha revisado el proyecto desde el punto de vista de su elegibilidad y de los costos adicionales, encontrando que el mismo calificaría para financiamiento del Fondo Multilateral, a partir de lo cual ha preparado la presentación. Sin embargo, llamo su atención sobre el hecho de que, para la determinación de los costos adicionales correspondientes a los equipos nuevos, sólo se pudo contar con los precios de equipos de referencia cotizados a los solicitantes, no siéndole posible al Grupo obtener una lista general de precios de equipos basados en CFC y HCFC existentes en el mercado, entre los cuales seleccionar para la comparación los de características más similares a los equipos nuevos basados en HFC-134a.

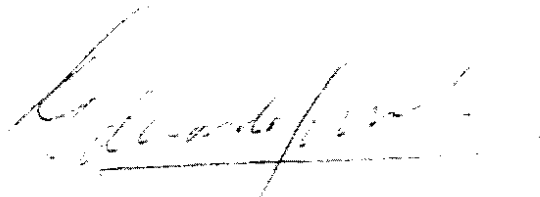
En vista de lo anterior, es probable que la evaluación del Banco Mundial implique algunas modificaciones en las cifras incluidas en la presentación que le remito.

Mucho le agradecería disponga lo conducente a fin de que el proyecto en referencia, con los anexos respectivos y las recomendaciones a ser consignadas por el Banco Mundial y por la Secretaría a su cargo, sean presentados al Comité Ejecutivo del

Fondo Multilateral en la oportunidad señalada.

Reiterándole las seguridades de mi mayor consideración, quedo de usted,

atentamente,

A handwritten signature in dark ink, appearing to read 'Eduardo López', written over a horizontal line.

Eduardo López

Representante de Venezuela en el
Comité Ejecutivo del Fondo Multilateral
para la Aplicación del Protocolo de Montreal

Al Señor Doctor
Omar El-Arini
Jefe de la Secretaría del
Fondo Multilateral para la
Aplicación del Protocolo de Montreal
Montreal, Canadá

COUNTRY	VENEZUELA
SECTOR	Refrigeration and air conditioning (Central air conditioning)
CONSUMPTION IN THIS SECTOR	2,759.9 MT of CFC-12 (Year 1991)
PROJECT TITLE	Substitution of CFC by HCF-134a as a coolant in central air conditioning equipment
DURATION OF PROJECT	18 months from the date of approval
PROJECT IMPACT	Phase-out of 47 MT CFC current, and 200 MT CFC potential
PROPOSED BUDGET	US\$ 1,539,932 (Incremental Cost) US\$ 2,145,176 (Total Cost)
IMPLEMENTING AGENCY	World Bank
NATIONAL COORDINATING AGENCY	Fundación Fondo Venezolano para la Protección de la Capa de Ozono - FONDOZONO

PROJECT SUMMARY

The project consists of the substitution of CFC-12 by HFC-134a in central air conditioning equipment.

It comprises four components: (1) Equipment retrofit; (2) Replacement of equipment, the useful life of which is probably near termination or already terminated; (3) Installation of equipment in new buildings and (4) Technical and financial feasibility studies. In all cases, equipment will be using HFC-134a as a coolant.

In the case of equipment retrofit, all costs are considered incremental.

In the case of new equipment, the difference in cost between the HFC-134a based equipment and the CFC based equipment of comparable performance is considered the incremental cost.

In the case of the feasibility studies, total costs are incremental costs. The project includes retrofitting of 27 units with HFC-134a presently operating on CFC-12, the installation of seven new units based on HFC-134a, and five feasibility studies for retrofitting and replacement of

equipment based on controlled substances.

PROJECT NAME

1. Substitution of CFC by HCF-134a as a coolant in central air conditioning equipment.

SECTOR DATA

2. The national consumption of CFC-12 is 3,340 MT per year, of which 2,760 MT are used in refrigeration and air conditioning (1991 data), which represents 82.6% of the overall CFC-12 consumption level. It is estimated that one half of the air conditioning equipment operates on HCFC-22 and the other half on equal shares of CFC-11 and CFC-12.

PROJECT DESCRIPTION

3. This project is designed within the framework of the Venezuelan strategy for phasing-out the production and consumption of ozone depleting substances (ODSs). It is based on the following elements:

- i. Venezuela is primarily an importer of ODSs based equipment which originates mainly from developed countries.
 - ii. Eighty percent (80%) of the national level of ODSs consumption is concentrated in the refrigeration and air conditioning sector.
 - iii. Venezuela is a producer and net exporter of ODSs, especially CFC-11, CFC-12, HCFC-22 and R-502, which are widely used in refrigeration and air conditioning.
4. The first circumstance entails a great deal of dependency on and sensitivity to the international market, with a possibility that, at short and medium term, the external offer of ODSs based equipment and parts will decrease and the offer of equipment operating on definitive substitutes will increase. This would suggest that in order to prevent supply problems a speedier schedule than that provided in the Montreal Protocol for Article 5 countries should be adopted for phasing-out ODSs.
5. The second element obligates assigning the highest priority to the substitution of ODSs in the refrigeration and air conditioning sector, which is where consumption concentrates and, therefore, where there is an increased vulnerability with regard to external supply. This is also where significant results in the phasing-out of the ODSs can be achieved more quickly.

6. The third element implies that, in order to avoid de-industrialization, production and export of new substitutes of ODSs should be undertaken. In view of the fact that the main utilization of the ODSs in Venezuela is in coolants, the choice of the substitute(s) must be orientated towards substances that are used as coolants also, and that are definitive substitutes and are commercially available. HFC-134a meets these conditions and is, according to the December 1991 Report of the Committee on Technical Options for Refrigeration, Air Conditioning and Heating, the new substitute with the greatest prospects in this area.

7. Based on the above, the *Ad-hoc Interministerial Group for the Implementation of the Montreal Protocol in Venezuela*, which is the predecessor of FONDOZONO, jointly developed with producers and users of ODSs, a programme that contemplates, among other things, the installation of a plant for the production of HFC-134a, both for the local market and for export, and the focusing of the efforts, at the domestic level, on the refrigeration and air conditioning sector.

8. For the installation of the HFC-134a plant, there already exists a preliminary agreement with a local manufacturer of ODSs, *Productos Halogenados de Venezuela C.A. - PRODUVEN*, and with two of its shareholders, *Petroquímica de Venezuela S.A. - PEQUIVEN*, and *ATOCHEM*, of France. The technical and economical feasibility study has already begun. It is expected that the plant be in operation by the end of 1997 or beginning of 1998, with an initial installed capacity of 5,000 to 6,000 MT per year.

9. The action plan in the refrigeration and air conditioning sector is based on the market situation and its probable evolution, the coolant producers' and users' plans, the technological alternatives available and, in development, the cost efficiency of the various available alternatives and the control measures in force internationally and in the process of adoption. These factors clearly point to two fields in which concurrent initiatives must be deployed at short and medium term:

- i. Control of leakage in the operation, and reduction and elimination of wastage in the manufacturing and maintenance of ODSs based equipment.
- ii. Retrofitting and replacement of ODSs based equipment with equipment that operates with definitive substitutes.

10. Controlling leakage and wastage is technically and financially feasible for most refrigeration and air conditioning equipment. The action plan contemplates the establishment and dissemination of procedures for the recovery and recycling of coolants, the improvement of draining systems and their operations, the introduction of parts that prevent leakage, the utilization of filling systems that minimize wastage in the manufacturing of equipment, and other procedures recommended by the Technical Options Committee and other relevant institutions and agencies. These programmes have already begun in Venezuela under the auspices of the *Ad-*

hoc Interministerial Group and FONDOZONO and the cooperation of the United Nations Development Programme (UNDP), the United States Environment Protection Agency (USEPA) and other agencies. It is estimated that the reduction of ODSs emissions by these means can be significant (initially, between 25% and 35% of the ODSs consumption in the sector). However, this method has a serious limitation in that it does not eliminate the use of ODSs in a definitive manner.

11. The retrofitting and replacement of equipment is a method of definitive elimination of ODSs and of phasing-out their consumption at short and medium terms. In Venezuela, two areas have been identified, in which retrofitting and replacement are technically and economically feasible immediately or at a very short term, such as vehicle air conditioning and central air conditioning.

12. The introduction of air conditioning equipment in vehicles with technology based on HFC-134a is expected in Venezuela by 1994, as reported by car manufacturers to the *Ad-hoc Interministerial Group*. The Group has considered that, since the current ODSs based equipment are almost totally manufactured or assembled in the country, the Multilateral Agreement should provide the funding for plant conversion in order to produce HFC-134a based equipment instead of financing the manufacturers or buyers of vehicles. With regard to retrofitting of the existing number of vehicles, the Group has considered preferable to wait until the technology is sufficiently developed and costs are known before adopting any decision. In the meanwhile, preference is being given to the control of leakage and wastage in existing equipment through a network of CFC-12 recuperation and recycling and the holding of training courses for the issue of competence certification to shops, a project that is being implemented through bilateral cooperation with the USEPA. At the equipment manufacturing level, a programme for the introduction of parts that prevent leaks and for the control of wastage at filling will be implemented.

13. In central air conditioning the plan differs according to the type of ODSs utilized, as it is explained below.

14. For the equipment that operates on HCFC-22, which is about 50% of all existing equipment, the provision is only for the control of leakage and wastage in the operation and maintenance, whereas retrofitting and replacement are not considered for the time being as short and medium term alternatives that could be supported with resources from the Multilateral Fund.

15. For CFC-11 based units, which is about 25% of the existing equipment, it's provided that, in addition to the control of leakage and wastage, the drainage operations and systems be improved. The retrofitting is not being considered in view of the fact that the available substitute (HCFC-123) is also harmful to the ozone layer, there is a possibility that it will soon become a controlled substance, and has also proved to be toxic. It is foreseen that the replacement be carried out by equipment based on definitive substitutes, HFC-134a being advisable if and when it shows advantages as compared with other available alternatives with

zero ozone depleting potential (ODP).

16. For CFC-12 based units, the other 25% (approximate) of the existing equipment, it is planned, in addition to the control of leakage and wastage, to retrofit to HFC-134a if and when the technology is available at a reasonable cost as compared with the replacement cost, and there are assurances of extending considerably the useful life of the equipment.

17. When retrofitting is not possible or advisable, whether because it is costly as compared with the replacement of equipment, or because the added useful life is not significant, or there is no technical feasibility, the *Ad-hoc Interministerial Group* has opted for a recommendation to replace by HFC-134a based equipment whenever it is more advantageous as compared with other zero ODP alternatives. This criterion is also applied to equipment for new buildings.

18. For the retrofitting or replacement cases referred to in paragraphs 15 through 17, the existence of commercially available technology at reasonable costs has been identified, both for reconversion from CFC-12 to HFC-134a for certain equipment and for new HFC-134a based equipment.

19. This project, as stated in paragraph 3, falls within the framework of the policies outlined in the above paragraphs, which summarize the considerations adopted by the *Ad-hoc Interministerial Group* and FONDOZONO in formulating the Country Programme of Venezuela that will be presented in due course to the Executive Committee of the Multilateral Fund.

20. The project is made of four basic components:

- i. Retrofitting of CFC-12 based equipment with HFC-134a, which will have, after retrofitting, a probably extended remainder of useful life.
- ii. Replacement of CFC based equipment, the useful life of which is about to end or has already ended, by new HFC-134a based equipment.
- iii. Installation of HFC-134a based equipment in new buildings.
- iv. Technical and financial feasibility studies for retrofitting or replacement of CFC based equipment so that zero ODP coolants can be used.

21. The retrofit option has been chosen when it is technically feasible at a reasonable cost as compared with the price of new equipment and it is warranted by the probable useful life so added by retrofitting.

22. The replacement option has been chosen when retrofitting is not feasible, whether due to technical reasons, or because the equipment is broken down or near to break down, or because the retrofit cost is very high as compared with the price of new equipment and the probable useful life remaining is not very significant, so that it is more appropriate the discharge of such equipment and its replacement by new, HFC-134a based equipment, with the qualification that

it offers some advantages as compared to other zero ODP solutions.

23. The new installation option is applicable to buildings which are in the planning or construction process and the design of which requires central air conditioning systems. They will be equipped with HFC-134a based units with the qualification that this option offers some advantage over other solutions not using ODSs.

24. The technical and financial feasibility study options are provided for those institutions that have identified the existence of central air conditioning equipment or projects which can incorporate coolant substances with no ODP and that do not have the technical or financial capacity to proceed with such studies by themselves.

25. The project beneficiaries are both public and private institutions, especially in the health area, such as hospitals and medical establishments, in which there is a large number of central air conditioning units which have selected on the basis of their willingness to use HFC-134a in their central air conditioning, in spite of their recent introduction in the international market and the Venezuelan one in particular, as well as on their intentions of eliminating the ODSs in other usage, such as firefighting systems and sterilizing equipment and, lastly, because of the difficulties they would have to face to undertake such projects without the support of the Multilateral Fund, as they are in general social welfare institutions. The individual recipients and their respective subprojects are listed below.

26. *Instituto de Prevención Social del Médico (IMPRES)*. This is a not-for-profit foundation of the medical profession, created under the Law for Medical Practice. In their head office building, situated in Caracas, there is a central air conditioning system, with approximately 540 ton cooling capacity (CC), which is equipped with two CFC-12 based units. One of them, a Westinghouse PE079 PE4239 centrifugal type model, can be retrofitted with HFC-134a at a reasonable cost and with a considerable extension of its probable useful life. The other equipment is out of order and has suffered major damage which, according to the relevant technical study, indicate the advisability of its withdrawal. This equipment will be replaced for a McQuay centrifugal type model PEH063K which uses HFC-134a as a coolant. In this manner, IMPRES would be equipped with a standardized HFC-134a based system. IMPRES does not have the financial capacity to carry out this project, unless the inherent incremental costs for retrofitting the existing unit and for the adopting the HFC-134a based alternative for the new unit are covered by resources from the Multilateral Fund.

27. *Centro Médico Docente La Trinidad (CMDLT)*. This is a private, not-for-profit foundation that provides medical services to all sectors of the population. The head office of CMDLT, situated in outskirts of Caracas, has a group of three buildings. The first one is a diagnostic orientation centre equipped with a 115 ton CC central unit, Westinghouse centrifugal type PF050 model, operating on CFC-12 and which, according to the technical study, was installed 17 years ago and is in acceptable condition. The second building is destined to the laboratories and specialized services and is equipped with 340 ton CC central unit, Westinghouse centrifugal type PE320 PE3602 model, which also operates on CFC-12, has been installed 15 years ago and, like the previous one, is in an acceptable condition. The third building is a hospitalization unit

currently under construction, the design of which includes a central air conditioning system with an approximate cooling capacity of 1,500 tons, and for the operation of which the original planning was to acquire three Carrier, centrifugal type, model 19DK78 units, that operate on CFC-11. The building group is equipped with its own refrigerated water system for the cooling of all the central air conditioning equipment units. The *CMDLT*, after consultation with the *Ad-hoc Interministerial Group*, agreed to reformulate the project on the basis of zero ODP alternatives. The reformulation contemplates retrofitting to HFC-134a the two existing units, which is technically feasible and would extend significantly the remainder of the equipments useful life. As to the new equipment, three HFC-134a based, McQuay, centrifugal type, PEH087K models would be acquired. The retrofitted equipment would be reinstalled in the same plant that was designed to house the new equipment. The *CMDLT* is willing to make the change, provided that the incremental costs for the retrofitting of the existing equipment and the change from the CFC-11 option to the HFC-134a option in the new equipment be covered by resources from the Multilateral Fund.

28. *Clínica Atlas, Hospitalización y Servicios, C.A.* This is a private hospital located in Caracas. It has a central air conditioning system with an approximate CC of 540 tons, equipped with three CFC-12 based, Westinghouse, centrifugal type, model PF050 PF4007 units, which can be retrofitted to HFC-134a at a reasonable cost and the useful life of which can be extended considerably. The *Atlas Clinic* is prepared to proceed to the retrofitting if the incremental costs are covered by support from the Multilateral Fund.

29. *Instituto Venezolano de los Seguros Sociales (IVSS).* This is a state agency that provides medical services to salaried workers covered by mandatory social security insurance. The agency has twelve hospitals, located in different cities within the country, which have central air conditioning systems based on CFC. The *IVSS* is in the process of being restructured, as a result of which it cannot bear the burden of new financial commitments, so that the Restructuring Commission has put aside the possibility of acquiring new air conditioning equipment and has favoured the extension of the probable useful life of existing equipment by means of retrofit if this is technically and financially feasible and provided that the incremental costs can be covered by support from the Multilateral Fund. An initial study on this subject identified the existence of 21 equipment units operating on CFC-12, located at 7 hospitals, the retrofit of which is feasible and advisable. These 21 units, all centrifugal, are model PE 200 PE3642 made by Westinghouse.

30. *Congreso de la República.* This is the National Congress, the central organ of the National Legislative Power, the administrative building of which, located in Caracas has a central air conditioning system equipped with three centrifugal units, which have been in use for some 15 years and are CFC-12 based Westinghouse made, model PEW550W units with a cooling capacity of 550 tons each. According to the technical study, one of the units is out of order and has suffered major damage and the two others are in a precarious condition, it being feared that the whole system can break down at any moment. The study advises not to make any repairs, due to the high cost, the difficulties in obtaining spares and the added useful life would be short. On the other hand, retrofitting is neither feasible at a reasonable cost nor advisable, because of the same reasons as for repairing. Based on the above, the study recommends the withdrawal of the three units and replacement by new equipment of similar capacity. The Congress has

analyzed various options, including one based on an HFC-134a system. After consultation with the *Ad-hoc Interministerial Group*, the Congress resolved to favour this option, because of environmental criteria and the understanding that the Multilateral Fund would cover the incremental costs. Due to the risk of system breakdown, the Congress, with the consent of the Interministerial Group, proceeded to the pertinent negotiation with the preselected supplier and the initial work for the installation is currently in progress. The new equipment consists of three centrifugal type McQuay units, model PEH087, with a CC of 540 tons each, operating on HFC-134a. The *Ad-hoc Interministerial Group* has given prominence to this subproject, particularly because of the impact that the example of the National Congress, the prime national institution of the country, will have at the public awareness level for taking the lead in the installation of central air conditioning equipment based on new substances of zero ODP.

31. The *Ad-hoc Interministerial Group* has been exploring the possibility of incorporating other institutions into the programme. So far, discussions have been initiated with the *Fundación para el Mantenimiento de la Infraestructura Médico-Asistencial para la Salud Pública (FIMA)*, a not-for-profit state agency which is a branch of the Department of Health and Social Security (MSAS). *FIMA* is responsible for equipping and maintaining hospitals and other medical service institutions under the MSAS. Its scope extends to 200 hospitals across the country, most of which have central air conditioning systems based on CFC-11, CFC-12 and HCFC-22. *FIMA* does not have the capacity to undertake a study on the use of ODS and the costs and feasibility of their replacement by itself, both for cooling/air conditioning and sterilization/fire fighting, a task that should rather be carried out by external consultants. The Group has identified some other institutions in a similar situation, and with which it has initiated some discussions. The Group considers that it is necessary to undertake a programme for the support of technical and economical feasibility studies which may comprehend them and provide the basis for the preparation of new projects in the area of central air conditioning.

32. In all cases of replacement, the applicants have agreed with the *Ad-hoc Interministerial Group* that the withdrawn equipment will be dismantled and discarded, even though it may have some useful life left, in order to ensure that the placing of the equipment out of service is definitive.

33. The project has been designed as the initial phase for eliminating the CFC from central air conditioning equipment in Venezuela and its short term objective is to freeze the existing controlled substances based equipment and to begin the reduction process. Its successful implementation would stimulate substituting in other institutions and companies, which is expected to favour an increase in and diversification of the supply, both for retrofitting and for new equipment operating without ODSs. The *Ad-hoc Interministerial Group* has been informed by other manufacturers such as York, Trane and Carrier about the development of alternatives and the beginning of alternatives marketing as well as of their interest for introducing them to the Venezuelan market. In this event the Government could, during the forthcoming year, issue a set of rules forbidding the equipping of new buildings with units operating with controlled substances. This would be appropriate in view of the fact that a reactivation of construction has been observed in the large buildings sector, and without such rules there could be a significant increase in the number of new equipment operating on controlled substances. This, in turn,

would increase the long range total incremental costs of substitution. A further set of rules would extend the prohibition to the case where there is replacement of the equipment withdrawn from existing buildings. The medium term primary objective is to reduce to a minimum the utilization of controlled substances in central air conditioning systems. A secondary objective is to eliminate the production of CFC-12 for these uses, since the requirements of the equipment that would remain in operation would be met through the reutilization of the CFC-12 recovered from the equipment placed out of service or retrofitted. Such requirements would be reduced to a minimum by means of programmes for the control of leakage and wastage in the operation and maintenance of the equipment.

PROJECT SCHEDULE

34. The duration of the project is estimated to be 18 months from the date of approval.

35. However, in the strategy of the Government the scope of the project is wider than that of the initial phase. In effect, in this presentation the projects included are only those which are in an advanced stage of design, or the implementation of which has already begun, such as that of the National Congress, where the state of the equipment made the substitution imperative in order to avoid the imminent breakdown of the air conditioning system. In the course of the implementation of the first phase of the project new cases will be dealt with and they will be submitted one by one to the World Bank as the feasibility studies are completed. The existing number of equipment units is estimated to be about one thousand, of which approximately 25% operate on CFC-12. Of these, it is estimated that only a third, or about 80 units, could be retrofitted or replaced to operate on zero ODP substances. It is expected that, in most cases, the incremental costs should not exceed US\$ 500,000 and, accordingly, they could be approved directly by the implementing agency. In any case, the Government has included in the Country Programme of Venezuela a programme for the retrofitting, replacement and installation of central air conditioning systems with longer duration to be presented, in due course, to the Multilateral Fund. It is within this framework that this project has been placed.

THE EXPECTED OUTCOME

36. The implementation of this project will make possible the retrofitting of 27 CFC-12 based equipment units to a HFC-134a operation, as well as the incorporation of seven new equipment units that will operate on HFC-134a.

37. This will allow the elimination of both CFC-12 in 31 equipment units retrofitted or replaced and CFC-11 as an option for three new equipment units. The elimination amounts to approximately 47,000 kilograms of the CFC-12 contained in the equipment placed out of service or retrofitted. The potential consumption of ODSs that will be avoided will amount to 200,000 kilograms, equivalent to the coolant that would be required until the year 2010 if no retrofitting, replacement or new installation were done.

38. Moreover, it is expected that the implementation of the project will stimulate new retrofitting, replacement and installation of central air conditioning equipment units operating with definitive substitutes of the CFC, as well as the diversification of the such equipment in the local market. In this manner, the number of the existing ODSs based central air conditioning equipment would be frozen at the current levels and be subsequently reduced.

39. It is also expected that the successful implementation of the project would allow the Government to promulgate rules preventing the installation of central air conditioning equipment which operates with controlled substances in new buildings. These rules would further include the cases where equipment had to be replaced in existing buildings.

40. Finally, the successful implementation of the project would make it possible, at medium term, to reduce to a minimum the production and consumption of CFC-12 for central air conditioning facilities, since the requirements of the equipment in operation would be handled with the CFC-12 recovered from the equipment placed out of service or retrofitted.

BUDGET

41. The total cost estimates for the project amount to US\$ 2,145,176, of which US\$ 1,539,932 are incremental costs, as per the following breakdown:

<u>Item</u>	<u>Quantity</u>	<u>Total Cost Est.</u>	<u>Incremental Cost Est.</u>
New equipment	7 units	986,816	381,572
Retrofit	27 units	1,128,360	1,128,360
Subtotal	34 units	2,115,176	1,509,932
Feasibility studies	5 units	30,000	30,000
Total		2,145,176	1,539,932

42. To estimate the incremental costs the following factors were considered. In the case of retrofit units the CIF La Guaira price, as well as installation labour costs, was taken into account for the spare parts that must be replaced so that the retrofitted equipment can operate on HFC-134a. Any costs for repairs or improvements that are not indispensable for the retrofit were excluded, as they would be covered by the owners of the equipment. Custom brokerage and the cost of transport to the site were included in the estimate, as well as any per diem related with work to be undertaken outside Caracas. The cost of the HFC-134a for the retrofitted equipment was added and the value of the CFC-12 recovered, estimated at 80% of the market price for new coolant, was deducted. The resulting total was considered an incremental cost, as no such expense would have been incurred if there had not been any retrofit.

43. For the new equipment, that with a similar capacity and performance operating on CFC, was used as a preliminary reference. The information was extracted from quotes presented to the owners of the equipment by various distributors, as the *Ad-hoc Interministerial Group* could not obtain data on a broad range of makes, models and prices from the manufacturers. The prices, FOB Miami or CIF La Guaira, as presented in the respective quotes of CFC based equipment, were subtracted from the prices quoted for the HFC-134a based equipment, including the cost difference of the coolants. The resulting value represents the incremental cost, made only of the price differential for the new equipment, including the HFC-134a, as compared to the reference price of the preliminary equipment, including the CFC. Any expenses to be incurred by the buyer for either type of equipment were excluded. The difference between the total cost and the incremental cost will be absorbed by the institution that purchases the equipment.

44. Two schedules with more detailed figures on both total and incremental costs are included in the annex.

45. A figure of US\$ 300.00 per day/person was used for the feasibility studies and it was estimated that a total of 5 studies at 20 days/person per study would be undertaken by local consultants.

46. The cost effectiveness of the project has been estimated to be US\$ 32.8 per kilogram of phased-out CFC, a figure consistent with the average in the sector. If the required reduction of the CFC consumption to the year 2020 is included, that figure decreases to US\$ 6.2 per kilogram. In evaluating the cost effectiveness the *Ad-hoc Interministerial Group* took into account the priority of this sector in the Venezuelan strategy and the reduction of the total cost of substitution that, due to the project, will be possible to achieve at medium and long term.

ARRANGEMENTS FOR IMPLEMENTATION

47. The project will be implemented through the World Bank. The national co-ordinator of the project will be FONDOZONO.

48. The equipment quotes are all for the same make, as at the time of developing the project only one company was providing quotes in Venezuela for HFC-134a based equipment of the required tonnage. This company, which is so far the only authorized distributor in Venezuela for the American manufacturer of the equipment, has quoted the prices of the latter and will carry out all the planned work. Moreover, there are indications that other distributors plan to bid in the near future for HFC-134a based equipment. It should be noted that this is the first equipment based on HFC-134a to be installed in a country that operates under paragraph 1 of Article 5 of the Montreal Protocol.

49. For the financial agency function the *Interministerial Group* suggests an ad-hoc agreement allowing the World Bank to make the disbursements directly to the beneficiaries or to the supplier, through a private bank.

INSTITUTIONAL FRAMEWORK

50. With Government approval, issued through FONDOZONO, the World Bank would subscribe individual agreements in which ad-hoc arrangements would be included for disbursements with each beneficiary.

51. The general supervision of project implementation would be handled by the World Bank and FONDOZONO, whereas the supervision of the financial implementation would be carried out by the World Bank and the financial agent selected by the World Bank, with the agreement of FONDOZONO.

TECHNICAL EVALUATION

52. Copies of the technical evaluations carried out by *Wekker & Asociados, Ingeniería C.A.* for the *IMPRES*, by *MIRCA C.A.*, for the National Congress, by *Alfonzo Quiroga, Consultor* for the *Centro Médico Docente la Trinidad* and by *Arista Centri Servicios C.A.*, for the *IVSS* and *Clínica Atlas* are attached.

53. The World Bank will also carry out a technical and financial evaluation to be attached, and on the basis of it the initial figures for the project, could be modified.

NEW EQUIPMENT

INSTITUTION	TRADE MARK AND MODEL NEW EQUIPMENT	QUANTITY	TYPE OF PRICE	UNIT PRICE NEW EQUIPMENT	TRADE MARK AND MODEL REFERENCED EQUIPMENT	UNIT PRICE REFERENCED EQUIPMENT	INCREMENTAL UNIT COST	TOTAL INCREMENTAL COST
IMPRES	McQuay PEH063K	1	CIF La Guaira	77.528	Trane RTHA-300	62.240	15.288	15.288
CONGRESO	McQuay PEH087	3	FOB Miami	152.425	Carrier 19DK78	90.334	62.091	186.273
CMDLT	McQuay PEH087K	3	FOB Miami	150.671	Carrier 19DK78	90.334	60.337	180.011
TOTAL		7		140.974		86.321	54.510	381.572

RECONVERSIONS

INSTITUTION	TRADE MARK AND MODEL	QUANTITY	UNIT PRICE PARTS & PIECES (1)	UNIT PRICE LABOUR (2)	VALUE OF CFC-12 RECOVERED (2) (3)	UNIT COST	TOTAL COST
IMPRES	Westinghouse PE079PE4239	1	48.075	14.382	1.218	61.239	61.239
CMDLT	Westinghouse PE320PE3602	1	33.339	8.769	1.296	40.812	40.812
	Westinghouse PF050CS1218	1	19.969	8.769	277	28.461	28.461
ATIAS	Westinghouse PE050PE4007	3	25.122	14.382	244	39.260	117.780
IVSS	Westinghouse PE20PE3642	21	32.321	10.373	786	41.908	880.068
TOTAL		27	31.685	10.848	745	41.791	1,128.360

- (1) Price CIF La Guaira plus commission of custom broker and transport to the addressee.
- (2) It was considered exchange rate 65 Bs. per 1 US\$.
- (3) Calculated at 80% of its market value.
- (4) Same as incremental cost.

A N E X O 2

REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

 INSTITUTO MEDICO DE PREVISION SOCIAL I.M.P.R.E.S
C-036-92

CONVERSION DE EQUIPO MARCA WESTINGHOUSE PE 079 PE4239

COMPONENTES INTERNOS DEL COMPRESOR

DESCRIPCION	CANT	P.U	P.T
REAR PINION BEARING	1	304,00	304,00
THRUST PUMP SEAL	1	197,00	197,00
THRUST PLATE	1	765,00	765,00
HIGH SPEED SHAFT BEARING	1	214,00	214,00
SHIM	1	43,00	43,00
FRONT PINION BEARING	1	179,00	179,00
SEAL	1	40,00	40,00
"O" RING KIT, H.S.A	1	30,00	30,00
"O" RING KIT, # 273	2	44,00	88,00
"O" RING KIT, # 276	1	61,00	61,00
WHEEL EYE SEAL	1	264,00	264,00
"O" RING, KIT, I.G.V.	1	280,00	280,00
VICTAULIC GASKET 8"	2	136,00	272,00
GASKET SEAL	1	4,00	4,00
MOTOR COVER "O" RING # 391-B	1	43,00	43,00
LOW SPEED SHAFT SEAL	1	346,00	346,00
BEARING, LOW SPEED MOTOR END	1	883,00	883,00
"O"RING # 046-B	4	2,10	8,40
GASKET	1	0,70	0,70
BEARING, LOW SPEED GEAR END	1	880,00	880,00
THRUST	1	545,00	545,00
"O" RING PLUG .88	2	21,00	42,00
"O" RING KIT MOTOR/GEAR HOUSING	1	203,00	203,00
SPIROL PIN KIT	1	184,00	184,00
GASKET VICTAULIC 6"	2	130,00	260,00
GASKET	2	4,00	8,00
FILTER OIL	1	244,00	244,00
"O" RING # 240-B	1	3,50	3,50

SUB TOTAL U.S. \$

6.391,20

UNICOS con el Refrigerante del FUTURO: HFC-134a


ARISTA CENTRI SERVICIOS • McQuay • BarryBlower • JennFan

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REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

LOW SPEED GEAR	1	8.846,00	8.846,00
PINION GEAR	1	5.408,00	5.408,00
OIL	20	62,00	1.640,00
HFC-134a	670	12,26	8.214,20
CONDENSER TUBES	242	59,62	14.428,04

TOTAL U.S. \$ 44.927,44

TOTAL F.O.B. MIAMI U.S.\$ 44.927,44

TRANSPORTE, SEGURO APROX. 1.679,00

TOTAL C.I.F. LA GUAIRA U.S. \$ 46.606,44

NACIONALIZACION:

COMPONENETES			
INTERNOS	6.391,20		
LOW SPEED GEAR,			
PINION GEAR	14.254,00		

	20.645,20	ARANCEL 10%	2.064,52
OIL	1.640,00	ARANCEL 20%	328,00
CONDENSER TUBES	14.428,04	ARANCEL 15%	2.164,20

SUB TOTAL NACIONALIZACION 4.556,72
BASE IMPONIBLE 1 % 367,13

TOTAL NACIONALIZACION 4.923,85
COMISION AGENTE ADUANAL
TRANSPORTE, ETC APROX. 1.468,52

TOTAL ALMACEN CARACAS U.S. \$ 52.998,81
MANDO DE OBRA 14.382,00

TOTAL EQUIPO ARRANCADO U.S. \$ 67.380,81
=====

CARACTERISTICAS TECNICAS

EQUIPO USANDO CFC-12	(1100 LBS)		
CAPACIDAD	304	T.R.	
EVAPORATOR	811	GPM	53.0 EWT
	2	PASS	11.6 FT.PD
			44 LWT
			0.0005 F.F.
CONDENSER	909	GPM	850 EWT
	2	PASS	28.6 FT.PD
	255	KW	0.839 KW/TON
	340	R.L.A.	480/60 VOLT/HZ
			95 LWT
			0.001 F.F.

UNICOS con el Refrigerante del FUTURO: HFC-134a



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REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

EQUIPO USANDO HFC 134 a (670 LBS)

CAPACIDAD	304	T.R.		
EVAPORATOR	811	GPM	53.0 EWT	44 LWT
	2	PASS	11.6 FT.PD	0.00025 F.F.
CONDENSER	909	GPM	85.0 EWT	95 LWT
	2	PASS	19.6 FT.PD	0.00075 F.F.
	255.8	KW	0.841 KW/TON	
	350	R.L.A.	480/60 VOLT/HZ	

NOTAS:

NOTA 1: LA VIDA UTIL PROBABLE DE LA UNIDAD USANDO CFC-12 SERIA DE 5 AÑOS.

NOTA 2: LA VIDA UTIL DE LA UNIDAD DESPUES DE LA RECONVERSION AL HFC-134a SERIA DE 20 AÑOS APROX.

NOTA 3: EL PRECIO ACTUAL DE UN EQUIPO NUEVO DE CARACTERISTICAS SIMILARES USANDO HFC-134a ESTARIA POR EL ORDEN DE F.O.B. MIAMI U.S.\$ 95.000,00 SIN EL REFRIGERANTE

NOTA 4: EL COSTO ACTUAL DEL REFRIGERANTE CFC-12 ES DE Bs. 90,00 POR LIBRA

UNICOS con el Refrigerante del FUTURO: HFC-134a

REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

LOW SPEED GEAR	1	8.846,00	8.846,00
PINION GEAR	1	5.408,00	5.408,00
OIL	20	82,00	1.640,00
HFC 134a	750	12,26	9.195,00

TOTAL U.S. \$ 31.480,20

TOTAL F.O.B. MIAMI U.S.\$ 31.480,20
TRANSPORTE, SEGURO APROX. 964,00

TOTAL C.I.F. LA GUAIRA 32.444,20

NACIONALIZACION:

COMPONENETES			
INTERNOS	6.391,00		
LOW SPEED GEAR,			
PINION GEAR	14.257,00		

	20.675,20	ARANCEL 10%	2.064,00
OIL	1.640,00	ARANCEL 20%	328,00

SUB TOTAL NACIONALIZACION 2.392,52
BASE IMPONIBLE 1 % 222,85

TOTAL NACIONALIZACION U.S. \$ 2.615,37
COMISION AGENTE ADUANAL
TRANSPORTE, ETC APROX. 895,00

TOTAL ALMACEN CARACAS U.S. \$ 35.954,57
MANO DE OBRA 8.770,00

TOTAL EQUIPO ARRANCADO U.S. \$ 44.724,57
=====

UNICOS con el Refrigerante del FUTURO: HFC-134a



**ARISTA
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REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

**CENTRO MEDICO DOCENTE LA TRINIDAD
C-038-92**

CONVERSION DE EQUIPOS MARCA WESTINGHOUSE PE 320 PE 3602

COMPONENTES INTERNOS DEL COMPRESOR

DESCRIPCION	CANT	P.U	P.T
REAR PINION BEARING	1	304,00	304,00
THRUST PUMP SEAL	1	197,00	197,00
THRUST PLATE	1	765,00	765,00
HIGH SPEED SHAFT BEARING	1	214,00	214,00
SHIM	1	43,00	43,00
FRONT PINION BEARING	1	179,00	179,00
SEAL	1	40,00	40,00
"O"RING KIT H.S.A.	1	30,00	30,00
"O"RING # 273	2	44,00	88,00
"O"RING # 276	1	61,30	61,30
WHEEL EYE SEAL	1	264,00	264,00
"O"RING KIT, I.G.V.	1	280,00	280,00
VICTAULIC GASKET DE 8"	1	136,00	272,00
GASKET SEAL	1	4,00	4,00
MOTOR COVER "O"RING # 391-B	1	43,00	43,00
LOW SPEED SHAFT SEAL	1	346,00	346,00
BEARING, LOW SPEED MOTOR END	1	883,00	883,00
"O"RING # 046-B	4	2,10	8,40
GASKET	1	0,70	0,70
BEARING, LOW SPEED GEAR END	1	880,00	880,00
THRUST	1	545,00	545,00
"O"RING PLUG . 88	2	21,00	42,00
"O"RING KIT MOTOR/GEAR HOUSING	1	203,00	203,00
SPIROL PIN KIT	1	184,00	184,00
GASKET VICTAULIC 6"	1	130,00	260,00
GASKET	2	4,00	8,00
FILTER OIL	1	244,00	244,00
"O" RING # 240-B	1	3,50	3,50
SUB TOTAL U.S. \$			6.391,20

UNICOS con el Refrigerante del FUTURO: HFC-134a

REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

CARACTERISTICAS TECNICAS

EQUIPO USANDO CFC-12 (1170 LBS)

CAPACIDAD	312	TONS			
EVAPORATOR	748.8	GPM	54.0	EWT	44.0 LWT
	2	PASS	7.2	FT PD	0.00050 FF
CONDENSER	922.0	GPM	85.0	EWT	95.2 LWT
	2	PASS	12.8	F.T.P.D.	0.00050 F.F.
	256.0	KW	0.821	KW/TON	
	343	RLA	480/60	VOLT/HZ	

EQUIPO USANDO HFC 134 a (750 LBS)

CAPACIDAD	312	TONS			
EVAPORATOR	748.8	GPM	54.0	EWT	44.0 LWT
	2	PASS	6.6	FT PD	0.00025 FF
CONDENSER	922.0	GPM	85.0	EWT	95.1 LWT
	2	PASS	12.3	F.T.P.D.	0.00025 F.F.
	256.2	KW	0.821	KW/TON	
	360	RLA	480/60	VOLT/HZ	

NOTAS:

NOTA 1: LA VIDA UTIL PROBABLE DE LA UNIDAD USANDO CFC-12 SERIA DE 8 AÑOS.

NOTA 2: LA VIDA UTIL DE LA UNIDAD DESPUES DE LA RECONVERSION AL HFC-134a SERIA DE 20 AÑOS APROX.

NOTA 3: EL PRECIO ACTUAL DE UN EQUIPO NUEVO DE CARACTERISTICAS SIMILARES USANDO HFC-134a ESTARIA POR EL ORDEN DE F.O.B. MIAMI U.S.\$ 95.000,00 SIN EL REFRIGERANTE

NOTA 4: EL COSTO ACTUAL DEL REFRIGERANTE CFC-12 ES DE Bs. 90,00 POR LIBRA

UNICOS con el Refrigerante del FUTURO: HFC-134a



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REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

 CENTRO MEDICO DOCENTE LA TRINIDAD
C-038-92

CONVERSION DE EQUIPOS MARCA WESTINGHOUSE PE 050 CS1218

COMPONENTES INTERNOS DEL COMPRESOR

DESCRIPCION	CANT	P.U	P.T
"O"RING	4	1,80	7,20
"O"RING KIT INLET ASSY	1	74,00	74,00
"O"RING	1	2,80	2,80
THRUST PLATE	1	279,00	279,00
BOLT	1	1,30	1,30
BEARING PINION REAR	1	417,00	417,00
BEARING FRONT HIGH SPEED	1	252,00	252,00
THRUST DISC	1	90,00	90,00
SHAFT SEAL, LOW SPEED	1	280,00	280,00
BEARING, LOW SPEED	2	197,00	394,00
THRUST PLATE	1	152,00	152,00
BOLT 7/16	3	3,00	9,00
SEAL H.S.S.	1	62,00	62,00
BOLT IMPELLER	1	43,00	43,00
WHEEL EYE SEAL	1	206,00	206,00
"O"RING KIT FOR ABOVE ASSY	1	121,00	121,00
MIST ELIMINATOR	1	488,00	488,00
"O"RING NOZLE	2	2,80	5,60
VICTAULIC GASKET 4"	2	71,00	142,00
VICTAULIC GASKET 2 1/2"	1	52,00	52,00
GASKET OIL FILTER	1	1,30	1,30
OIL FILTER	1	164,00	164,00
GASKET OIL FILTER COVER	1	2,20	2,20
GASKET VENTURY ASSY	1	4,00	4,00
"O"RING OIL PISTON	1	3,50	3,50

SUB TOTAL U.S. \$ 3.251,90

LOW SPEED GEAR	1	6.773,00	6.773,00
PINION GEAR	1	4.095,00	4.095,00
OIL	5	82,00	410,00
HFC-134a	360	12,26	4.413,60

TOTAL U.S. \$ 18.943,50

 TOTAL F.O.B. MIAMI U.S.\$ 18.943,50
TRANSPORTE, SEGURO APROX. 440,00

TOTAL C.I.F. LA GUAIRA U.S. \$ 19.383,50

UNICOS con el Refrigerante del FUTURO: HFC-134a


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REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

NACIONALIZACION:

COMPONENETES			
INTERNOS	3.251,90		
LOW SPEED GEAR,			
PINION GEAR	10.868,00		

	14.119,90	ARANCEL 10%	1.412,00
OIL	410,00	ARANCEL 20%	82,00

	SUB TOTAL NACIONALIZACION		1.494,00
	BASE IMPONIBLE 1 %		145,30
	TOTAL NACIONALIZACION		1.639,30
	COMISION AGENTE ADUANAL		
	TRANSPORTE, ETC APROX.		585,00

	TOTAL ALMACEN CARACAS U.S. \$		21.607,80
	MAND DE OBRA		8.770,00

	TOTAL EQUIPO ARRANCADO U.S. \$		30.377,80
			=====

CARACTERISTICAS TECNICAS

EQUIPO USANDO CFC-12 (250 LBS)

CAPACIDAD	120	TONS		
EVAPORATOR	290	GPM	54.0	EWT
	2	PASS	5.8	FT PD
CONDENSER	360	GPM	85.0	EWT
	2	PASS	5.9	FT PD
	108.2	KW	0.901	KW/TON
	152	RLA	480/60	VOLT/HZ
				44.0 LWT
				0.00025 FF
				95.0 LWT
				0.00025 FF

EQUIPO USANDO HFC 134 a (360 LBS)

CAPACIDAD	120	TONS		
EVAPORATOR	290	GPM	54.0	EWT
	2	PASS	5.8	FT PD
	360	GPM	85.0	EWT
	2	PASS	5.9	FT PD
	110.0	KW	0.916	KW/TON
	154.5	RLA	480/60	VOLT/HZ
				44.1 LWT
				0.00025 FF
				94.9 LWT
				0.00025 FF

UNICOS con el Refrigerante del FUTURO: HFC-134a



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REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

NOTAS:

NOTA 1: LA VIDA UTIL PROBABLE DE LA UNIDAD
USANDO CFC-12 SERIA DE 5 AÑOS.

NOTA 2: LA VIDA UTIL DE LA UNIDAD DESPUES
DE LA RECONVERSION AL HFC-134a SERIA
DE 20 AÑOS APROX.

NOTA 3: EL PRECIO ACTUAL DE UN EQUIPO NUEVO
DE CARACTERISTICAS SIMILARES USANDO
HFC-134a ESTARIA POR EL ORDEN DE
F.O.B. MIAMI U.S.\$ 50.000,00 SIN EL
REFRIGERANTE

NOTA 4: EL COSTO ACTUAL DEL REFRIGERANTE
CFC-12 ES DE Bs. 90,00 POR LIBRA

UNICOS con el Refrigerante del FUTURO: HFC-134a



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REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

CLINICA ATIAS
C-063-92

CONVERSION DE EQUIPOS MARCA WESTINGHOUSE PE 050 PE4007

COMPONENTES INTERNOS DEL COMPRESOR

DESCRIPCION	CANT	P.U	P.T
"O"RING	4	1,80	7,20
"O"RING KIT INLET ASSY	1	74,00	74,00
"O"RING	1	2,80	2,80
THRUST PLATE	1	279,00	279,00
BOLT	1	1,30	1,30
BEARING PINION REAR	1	417,00	417,00
BEARING FRONT HIGH SPEED	1	252,00	252,00
THRUST DISC	1	90,00	90,00
SHAFT SEAL, LOW SPEED	1	280,00	280,00
BEARING, LOW SPEED	2	197,00	394,00
THRUST PLATE	1	152,00	152,00
BOLT 7/16	3	3,00	9,00
SEAL H.S.S.	1	62,00	62,00
BOLT IMPELLER	1	43,00	43,00
WHEEL EYE SEAL	1	206,00	206,00
"O"RING KIT FOR ABOVE ASSY	1	121,00	121,00
MIST ELIMINATOR	1	488,00	488,00
"O"RING NOZLE	2	2,80	5,60
VICTAULIC GASKET 4"	2	71,00	142,00
VICTAULIC GASKET 2 1/2"	1	52,00	52,00
GASKET OIL FILTER	1	1,30	1,30
OIL FILTER	1	164,00	164,00
GASKET OIL FILTER COVER	1	2,20	2,20
GASKET VENTURY ASSY	1	4,00	4,00
"O"RING OIL PISTON	1	3,50	3,50
SUB TOTAL U.S. - \$			3.251,90

UNICOS con el Refrigerante del FUTURO: HFC-134a



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REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

LOW SPEED GEAR	1	6.773,00	6.773,00
PINION GEAR	1	4.095,00	4.095,00
OIL	5	82,00	410,00
HFC 134a	315	12,26	3.861,90
CONDENSER TUBE	112	45,00	5.040,00

TOTAL 23.431,80

TOTAL F.O.B. MIAMI U.S.\$ 23.431,80
TRANSPORTE, SEGURO APRDX. 960,00

TOTAL C.I.F. LA GUAIRA U.S. \$ 24.391,80
=====

NACIONALIZACION:

COMPONENETES			
INTERNOS	3.251,90		
LOW SPEED GEAR,			
PINION GEAR	10.868,00		

	14.119,90	ARANCEL 10%	1.412,00
OIL	410,00	ARANCEL 20%	82,00
CONDENSER TUBE	5.040,00	ARANCEL 15%	756,00

SUB TOTAL NACIONALIZACION 2.250,00
BASE IMPONIBLE 1 % 243,90

TOTAL NACIONALIZACION 2.493,90
COMISION AGENTE ADUANAL
TRANSPORTE, ETC APROX. 730,00

TOTAL ALMACEN CARACAS U.S. \$ 27.615,70
MANDO DE OERA 14.381,90

TOTAL EQUIPO ARRANCADO U.S. \$ 41.997,60

TOTAL TRES (3) EQUIPOS CE050 CONVERTIDOS U.S.\$ 125.992,80

CARACTERISTICAS TECNICAS

EQUIPO USANDO CFC-12 (220 LBS)

CAPACIDAD	100	TONS			
EVAPORATOR	277	GPM	53.7	EWT	45.0 LWT
	2	PASS	5.3	FT PD	0.00025 FF
CONDENSER	283	GPM	85.0	EWT	95.8 LWT
	2	PASS	5.9	FT PD	0.00025 FF
	92.0	KW	0.920	KW/TON	
	123	RLA	480/60	VOLT/HZ	



ARISTA
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SERVICIOS

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Telrs. (02) 261.14.50 - 261.52.35 - 261.09.61 - Fax 31.2973. Telex: 29861 FONTA V.C.

UNICOS con el Refrigerante del FUTURO: HFC-134a

REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

EQUIPO USANDO HFC 134 a (315 LBS)

CAPACIDAD	100	TONS			
EVAPORATOR	277	GPM	53.7	EWT	45.0 LWT
	2	PASS	5.8	FT PD	0.00025 FF
CONDENSER	283	GPM	85.0	EWT	96.2 LWT
	2	PASS	5.9	FT PD	0.00025 FF
	105.8	KW	1.058	KW/TON	
	142	RLA	480/60	VOLT/HZ	

NOTAS:

NOTA 1: LA VIDA UTIL PROBABLE DE LA UNIDAD USANDO CFC-12 SERIA DE 10 AÑOS.

NOTA 2: LA VIDA UTIL DE LA UNIDAD DESPUES DE LA RECDVERSION AL HFC-134a SERIA DE 20 AÑOS APROX.

NOTA 3: EL PRECIO ACTUAL DE UN EQUIPO NUEVO DE CARACTERISTICAS SIMILARES USANDO HFC-134a ESTARIA POR EL ORDEN DE F.O.B. MIAMI U.S.\$ 50.000,00 SIN EL REFRIGERANTE

NOTA 4: EL COSTO ACTUAL DEL REFRIGERANTE CFC-12 ES DE Bs. 90,00 POR LIBRA

UNICOS con el Refrigerante del FUTURO: HFC-134a

REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

TOTAL F.O.B. MIAMI U.S.\$	30.770,70
TRANSPORTE, SEGURO APROX.	690,00

TOTAL C.I.F. LA GUAIRA U.S. \$	31.420,70

NACIONALIZACION:

COMPONENTES			
INTERNOS	4.110,90		
LOW SPEED GEAR,			
PINION GEAR	16.643,00		

	20.753,90	ARANCEL 10%	2.075,40
	1.640,00	ARANCEL 20%	328,00

	SUB TOTAL NACIONALIZACION		2.403,40
	BASE IMPONIBLE 1 %		223,94

	TOTAL NACIONALIZACION		2.627,34
	COMISION AGENTE ADUANAL		
	TRANSPORTE, ETC APROX.		900,00

	TOTAL ALMACEN CARACAS U.S. \$		34.948,04
	MANDO DE OBRA		10.372,92

	TOTAL EQUIPO ARRANCADO U.S. \$		45.320,96

	TOTAL VEINTIUN (21) EQUIPOS U.S. \$		951.740,16
			=====

CARACTERISTICAS TECNICAS

EQUIPO USANDO CFC-12 (710 Lbs)

CAPACIDAD	198 TONS	54.0 EWT	42.0 LWT
EVAPORATOR	396.0 GPM	31.8 FT PD	0.0025 FF
	3 PASS	90.0 EWT	100.0 LWT
CONDENSER	590.0 GPM	18.9 FT PD	0.0025 FF
	2 PASS	0.800 KW/TON	
	158.5 KW	208/60 VOLT/HZ	
	500 RLA		

UNICOS con el Refrigerante del FUTURO: HFC-134a



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REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

**INSTITUTO VENEZOLANO DE LOS SEGUROS SOCIALES
C-030-92**

CONVERSION DE EQUIPOS MARCA WESTINGHOUSE PE 200 FE3642

COMPONENETES INTERNOS DEL COMPRESOR

DESCRIPCION	CANT	P.U	P.T
VICTAULIC GASKET 6"	2	130,00	260,00
FILTER OIL	1	244,00	244,00
GASKET OIL FILTER/PISTON	2	4,00	8,00
"O"RING OIL PASSAGE	1	0,70	0,70
"O"RING # 418	1	35,00	35,00
"O"RING MOTOR COVER	1	43,00	43,00
SEAL MOTOR SHAFT	1	290,00	290,00
BEARING L.S. MOTOR END	1	904,00	904,00
"O"RING # 458	1	250,00	250,00
BEARING L.S. COMP. END	1	783,00	783,00
"O" RING-OIL PISTON	1	3,50	3,50
SEAL	1	40,00	40,00
BOLT IMPELLER	1	44,00	44,00
VICTAULIC GASKET 5"	2	57,00	114,00
"O"RING KIT MOTOR GEAR HOUSING	1	47,00	47,00
REAR PINION BEARING	1	343,00	343,00
IMPELLER BEARING	1	282,00	282,00
FRONT PINION BEARING	1	290,00	290,00
"O" RING KIT I.G.V.	1	251,00	251,00
SEAL IMPELLER	1	125,00	125,00
PINS	2	0,60	1,20
SUB TOTAL U.S. \$			4.110,90
LOW SPEED GEAR	1	12.075,00	12.075,00
PINION GEAR	1	4.568,00	4.568,00
OIL	20	82,00	1.640,00
HFC-134a	680	12,26	8.336,80
TOTAL U.S.			30.730,70

UNICOS con el Refrigerante del FUTURO: HFC-134a

REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

EQUIPO USANDO HFC 134 a (680 LBS)

CAPACIDAD	198	TONS			
EVAPORATOR	396.0	GPM	54.0	EWT	42.0 LWT
	3	PASS	31.8	FT PD	0.00025 FF
CONDENSER	590.0	GPM	90.0	EWT	100.0 LWT
	2	PASS	18.9	FT PD	0.00025 FF
	162.6	KW	0.821	KW/TON	
	510	RLA	208/60	VOLT/HZ	

NOTAS:

NOTA 1: LA VIDA UTIL PROBABLE DE LA UNIDAD USANDO CFC-12 SERIA DE 10 AÑOS.

NOTA 2: LA VIDA UTIL DE LA UNIDAD DESPUES DE LA RECONVERSION AL HFC-134a SERIA DE 20 AÑOS APROX.

NOTA 3: EL PRECIO ACTUAL DE UN EQUIPO NUEVO DE CARACTERISTICAS SIMILARES USANDO HFC-134a ESTARIA POR EL ORDEN DE F.O.B. MIAMI U.S.\$ 65.000,00 SIN EL REFRIGERANTE

NOTA 4: EL COSTO ACTUAL DEL REFRIGERANTE CFC-12 ES DE Bs. 90,00 POR LIBRA (200 Bs/Kg.)

UNICOS con el Refrigerante del FUTURO: HFC-134a



**ARISTA
CENTRO
SERVICIOS C.A.**

McQuay • BarryBlower • JennFan

202 Av. Campo Alegre, Torre Credival, Piso 3, Ofic. 3-D, Chacao-Caracas

Telfs. (02) 261.14.50 - 261.52.35 - 261.09.61 - Fax 31.2873, Telex: 29861 FONTA V.C.

REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

EQUIPOS NUEVOS

INSTITUTO MEDICO DE PREVISION SOCIAL I.M.P.R.E.S.

1.- COTIZACION N° 028-92 DE FECHA 11-05-92

EQUIPO MARCA McQuay
MODELO PEH-063
CAPACIDAD 252 T.R.

2.- PRECIO EQUIPO	\$ 69.301,00
PRECIO ARRANCADOR	\$ 5.452,00

TOTAL F.O.B.	\$ 74.753,00
TRANSPORTE Y SEGURO APROX.	\$ 2.775,00

TOTAL C.I.F.	\$ 77.528,00
NACIONALIZACION (5% + 1% B.I.)	\$ 4.652,00
COMISION AGENTE ADUANAL APROX.	\$ 775,00
REFRIGERANTE HFC-134a (750Lbs.APROX)	\$ 7.875,00
ARRANQUE Y INSTALACION	\$ 8.244,00

TOTAL ARRANCADO	\$ 99.074,00

NOTAS:

NOTA 1: LA UNIDAD CENTRIFUGA INCLUYE: VALVULA SOLENOIDE DEL ENFRIADOR DE ACEITE Y EL ACEITE SINTETICO.

NOTA 2: EL ARRANQUE E INSTALACION SOLAMENTE INCLUYE LA MANO DE OBRA.

NOTA 3: LA COTIZACION ORIGINAL ERA POR UN TOTAL DE U.S. \$ 106.826,00, DEBIDO A QUE EL ARANCEL EN AQUEL MOMENTO ERA DEL 15%.

CARACTERISTICAS TECNICAS

CAPACIDAD	252	T.R.		
EVAPORATOR	600	GPM	54.0 EWT	44 LWT
	2	PASS	16.1 FT.PD	0.00025 F.F.
CONDENSER	750	GPM	87.0 EWT	96.9 LWT
	2	PASS	16.5 FT.PD	0.00025 F.F.
	194.4	KW	0.776 KW/TON	
	205	R.L.A.	440/60 VOLT/WZ	

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**ARISTA
CENTRI
SERVICIOS C.A.**

2da. Av. Campo Alegre, Torre Credival, Piso 3, Ofic. 3-D, Chacao-Caracas

Tel: 1021-261.14.50 - 261.52.35 - 261.09.61 - Fax 31.2973, Telex: 29861 FONTA V.C.

UNICOS con el Refrigerante del FUTURO: HFC-134a

REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE

EQUIPOS NUEVOS

CONGRESO DE LA REPUBLICA

1.- COTIZACION N° 046-91 DE FECHA 15-09-91

EQUIPO MARCA McQuay
MODELO PEH-087
CAPACIDAD 540 T.R.

2.- PRECIO EQUIPO \$ 127.825,00
PRECIO ARRANCADOR \$ 7.500,00
ARRANQUE DE LA UNIDAD \$ 4.800,00

TOTAL F.O.B. \$ 140.125,00

TRES (3) EQUIPOS TOTAL F.O.B. \$ 420.525,00
TRANSPORTE Y SEGURO APROX. \$ 12.125,00

TOTAL C.I.F. \$ 432.650,00

NACIONALIZACION CON EXONERACION \$ 4.206,00
COMISION AGENTE ADUANAL \$ 3.505,00
REFRIGERANTE HFC-134a (1005Lbs.C/U) \$ 36.900,00
INSTALACION \$ 63.077,00

TOTAL ARRANCADO \$ 540.338,00

LA UNIDAD CENTRIFUGA INCLUYE: EVAPORADOR Y CONDENSADOR DE 250 PSIG, VALVULA SOLENOIDE DEL ENFRIADOR DE ACEITE Y ACEITE SINTETICO.

CARACTERISTICAS TECNICAS

CAPACIDAD	540	T.R.		
EVAPORATOR	1290	GPM	53 EWT	43 LWT
	2	PASS	17.7 FT.PD	0.00025 F.F.
CONDENSER	1585	GPM	82 EWT	91.9 LWT
	2	PASS	20.9 FT.PD	0.00025 F.F.
	378.2	KW	0.70 KW/TON	
	540	R.L.A.	460/60 VOLT/WZ	

UNICOS con el Refrigerante del FUTURO: HFC-134a



**ARISTA
CENTRI
SERVICIOS C.A.**

McQuay • BarryBlower • JennFan

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261.14.50 - 261.52.35 - 261.09.61 - Fax 31.2973. Telex: 29861 FONTA V.C.

REPUESTOS ORIGINALES Y SERVICIOS AUTORIZADOS CHILLERS-WESTINGHOUSE
EQUIPOS NUEVOS

CENTRO MEDICO DOCENTE LA TRINIDAD

1.- COTIZACION N° 022-91 DE FECHA 23-07-92

EQUIPO MARCA McQuay
MODELO PEH-087
CAPACIDAD 505 T.R.

2.- PRECIO EQUIPO \$ 127.062,00
PRECIO ARRANCADOR \$ 7.500,00
ACCESORIOS VARIOS \$ 5.329,00

TOTAL F.O.B. \$ 139.891,00

TRES (3) EQUIPOS TOTAL F.O.B. \$ 419.673,00
TRANSPORTE Y SEGURO APROX. \$ 12.500,00

TOTAL C.I.F. \$ 432.173,00

REFRIGERANTE HFC-134a (980Lbs.C/U) \$ 32.340,00

LA UNIDAD CENTRIFUGA INCLUYE: EVAPORADOR Y CONDENSADOR
DE 250 PSIG, VALVULA SOLENOIDE DEL ENFRIADOR DE ACEITE
Y ACEITE SINTETICO.

ACCESORIOS VARIOS: CPC, PC Y SOFTWARE

CARACTERISTICAS TECNICAS

CAPACIDAD	505	T.R.		
EVAPORATOR	1200	GPM	54.1 EWT	44.0 LWT
	2	PASS	15.5 FT.PD	0.00025 F.F.
CONDENSER	1500	GPM	85.0 EWT	94.7 LWT
	2	PASS	13.1 FT.PD	0.00025 F.F.
	337.1	KW	0.667 KW/TON	
	465	R.L.A.	480/60 VOLT/WZ	

UNICOS con el Refrigerante del FUTURO: HFC-134a

A N E X O 3

WEKKER & ASOCIADOS, Ingeniería C. A.

Caracas 06, Agosto de 1.991

Señores :

Administración de Condominio "IMPRES"

Av. Venezuela, El Rosal, Ed. IMPRES

Caracas.

Atención : Lic. Silvana Trotta

Ing. Oscar A. Sutil

Referencia: Visita de inspección a los equipos de Aire Acondicionado de esa edificación

Muy señores nuestros:

En relación a una visita de inspección realizada el día 03-06-91 en compañía de los Ingenieros mecanicos Pedro M. Perez A. (C.I.V. 23.407) y Argimiro José Pinto (C.I.V. 23.153) a los equipos de aire acondicionado de ese edificio, cumplimos con informar a Uds. lo siguiente :

(1) El Chiller que funciona en la actualidad presenta un ruido fuera de lo normal; lo que podría ser indicativo de una falla a corto plazo del mismo, esto se agrava dado que es el único que se encuentra operativo.

(2) La segunda unidad se encontraba "Abierta" y desarmada en casi todos sus elementos mecánicos.

(3) Se pudo notar una gran oxidación interna en la carcasa del Chiller.

(4) Un impulsor, del sistema interno de recirculación, está dañado por desgaste mecánico (¿Falla de rolineras?) lo que hace presumir fallas de balanceo y/o desgaste interno del aparato.

WEKKER & ASOCIADOS, Ingeniería C. A.

(6) Se nos informó que el intercambiador tenía por lo menos (2) tubos condenados.

(7) Al no suministrarnos el "Libro de Vida" de la unidad dañada, no pudimos determinar con más exactitud la secuencia histórica de fallas en esa unidad.

En base a lo anteriormente descrito queremos comentar a Uds. lo siguiente :

(a) Las unidades de refrigeración de este tipo, son Blindadas, o sea, que están diseñadas para que la atmósfera exterior no llegue a su interior, ya que la humedad atmosférica al emulsionarse en el refrigerante altera las características del mismo produciendo daños en las mismas.

(b) Cuando una unidad de este tipo se abre por motivos de mantenimiento o reparación, deberá ser por lapsos muy cortos de tiempo, y al cerrarla deberá efectuarse un tratamiento de eliminación de humedad interna, tal como se hace con "todas" las compresores de refrigeración. En su caso, la unidad ha estado abierta por periodo de tiempo indeseable, y NO se tomó ningún tipo de previsión para que el alto índice de humedad, reinante en la sala de máquinas, no contaminara el interior del mismo; esto ha causado una oxidación muy grande en el interior del aparato.

(c) El estado de oxidación interna que presenta actualmente la unidad, haría necesario el uso de un tratamiento químico muy profundo, a base de ácido fosfórico o equivalente.

(d) Dado lo extenso de la oxidación: este tratamiento, la posterior eliminación del ácido y el subsecuente desecado de la unidad "NO" pueden garantizar el que no queden residuos de

WEKKER & ASOCIADOS, Ingeniería C. A.

óxido o de ácidos dentro de la unidad los cuales en muy pocos meses dañarían la unidad, los controles y/o las válvulas de forma irreversible.

(e) Dado el desgaste general observado, al efectuarse una reparación de esta unidad habría que sustituir casi todos los elementos rotatorios de la misma, más parte de los estacionarios, tales como: los tubos condenados, algunos soportes de ejes y receptáculos de rolineras. Los repuestos para la misma habría que importarlos directamente del fabricante, o de un distribuidor autorizado en Miami o N.Y. ya que los mismos no se encuentran disponibles en el país, ni existe en el mismo un representante con una existencia mínima de repuestos.

Todo lo que precede nos ha llevado a las siguientes conclusiones en relación a su equipo:

(I) No es posible que empresa o persona pueda garantizar de una forma responsable la reparación del chiller dañado; por este motivo la relación Costos/Beneficios de una reparación no representará una inversión rentable para el "IMPRES". La reparación de un equipo, en tan malas condiciones mecánicas, no pasará de ser un paliativo momentáneo costoso, siendo casi seguro que se requerirán de nuevas reparaciones a corto plazo y a alto costo.

(II) Consideramos que es más rentable dar por perdida esta unidad, y destinar el dinero que habría que invertir en una reparación a la sustitución inmediata de la misma por unidades similares, o del tipo reciprocamente equivalentes; estas últimas son mas duraderas, fáciles de operar y mantener y tienen la facilidad de obtención de la totalidad de sus repuestos en el país.

WEKKER & ASOCIADOS, Ingeniería C. A.

(III) La sustitución de la unidad deberá efectuarse con premura, ya que la que opera actualmente requiere urgentemente de un mantenimiento total, para evitar que pueda sufrir un daño mayor, y que todo el edificio quede sin aire acondicionado.

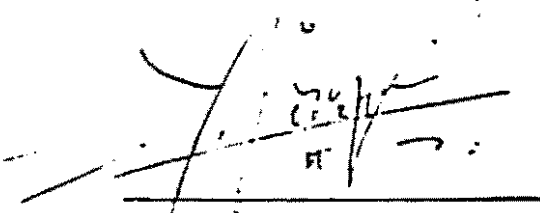
(IV) La sustitución del sistema de enfriamiento de aire a agua consideramos que debería estudiarse con mucho detenimiento, si bien es cierto que este sistema, (el enfriado con aire), tiene una serie de ventajas sobre el actual, habría que estudiar el costo de los cambios que involucra su sustitución. Estos cambios involucrarían tanto la parte mecánica como eléctrica y de la red actual existente. Es indudable que para el proyecto de un nuevo edificio sería lo más aconsejable, pero en una edificación terminada y funcional, los cambios que acarrearía esta sustitución serían muy grandes, onerosos y traumáticos.

(V) La sustitución de las unidades centrífugas por reciprocantes también deberá ser objeto de un acucioso estudio, ya que involucraría cambios en la instalación dentro del cuarto de máquinas, tanto a nivel mecánico como eléctrico.

Sin más a que hacer referencia, y quedando a sus ordenes para cualquier aclaratoria al respecto:

Por :

Wekker & Asociados, Ingeniería C. A. :



Johnny De Wekker Vegas

Caracas. 18 de Febrero de 1.990

Señores: DIRECCION GENERAL DE
PERSONAL, BIENES Y
SERVICIOS.

Atención: Dr. Ulises Capella

Muy Señor nuestro:

Refiero la presente a su atención por dos razones que estimamos graves.

Primera:

La necesidad perentoria y urgente de obtener su autorización para realizar de inmediato la reparación a fondo de las TORRES de ENFRIAMIENTO con el fin de tratar de obtener una mayor eficiencia en las condiciones de condensación de los Chiller, las cuales se encuentran en estado crítico.

ESTE TRABAJO CONSISTE EN LO SIGUIENTE:

- a.- Irenaje de la columna de agua
- b.- Tratamiento químico con desincrustante (1600)
- c.- Vaciado de columnas.
- d.- Eliminación de sedimentaciones.

Deseo explicarle que la realización de estos trabajos es de carácter urgente e inaplazable ya que las condiciones de operación actuales de los Chiller son extremadamente forçadas agravando la delicada situación mecánica que los mismos tienen y que es de su conocimiento.

Como le indique iniciando este informe deseáramos su autorización para paralizar el Sistema de Aire Acondicionado el día Jueves de la presente semana, con el fin de realizar estos trabajos EN UNA DE LAS TORRES (el sistema cuenta con tres), el Jueves 28 del presente mes se haría el tratamiento a la segunda TORRE , y el Jueves 7 del próximo mes se le haría a la tercera de las TORRES.



AIRE ACONDICIONADO Y REFRIGERACION

Para concluirle esta primera parte Dr. Capella, me permito recordarle que estas Torres de Enfriamiento tienen mas de quince años operando consecutivamente, y no creo necesario detallarle el estado mecánico de las mismas sino significarle que estas trabajan con agua, y este liquido combinado con aire es un formidable corrosivo.

La segunda parte para lo cual solicito su atención trata de los Chiller.

En reciente revisión efectuada a los mismos obtuvimos el siguiente resultado:

CHILLER N° 1

a.- Fuera de funcionamiento.

b.- El intercambiador COOLER tiene mas del 10% de sus tubos rotos lo cual obliga a tenerlo fuera de funcionamiento.

CHILLER N° 2

a.- Operando a su máxima capacidad.

CHILLER N° 3

a.- Cojinetes, Sellos y Empacadura fuera de rango operativo y con máximo desgaste.

b.- Perdida de 40 kilos de F-12 mensual (esta perdida se produce por su botón de seguridad)

c.- Perdida de aceite en la bomba

Las consecuencias de los puntos expuestos anteriormente son las siguientes:

Amperaje nominal que debe ser de	450 AMP
Consumo actual:	560 AMP

Demanda que se le puede solicitar al Chiller en estas condiciones máximo 50% de su capacidad.

Si quisiéramos exigir al Chiller un mayor rendimiento subiría el amperaje a extremos intolerables

Consecuentemente podemos anticiparle que esta unidad DIFÍCILMENTE PODRÁ SOBREPASAR LOS DOS MESES DE VIDA ÚTIL.

Dada la gravedad de lo expuesto anteriormente, solicito de usted, y del Presidente de la Comisión Dr. Marsicobetre, una reunión en la Sala de Maquinas con el fin de que puedan constatar físicamente la gravedad del caso.

Ruego a usted su atención a los problemas a los cuales me he referido, con el fin de que se tomen las medidas oportunas para evitar las consecuencias que se ocasionarían en caso de colapsar el Sistema de Aire Acondicionado lo cual en apariencia esta muy cercano.

Le doy las gracias anticipadas por la atención que estoy seguro ha prestado a este informe, que por lo demás forma parte de los servicios que la empresa a la cual represento debe prestarle a nuestro soberano Congreso Nacional.

Atentamente,

C. García Mariño

Caracas. 18 de Enero de 1.991

INFORME TECNICO DEL SISTEMA DE
AIRE ACONDICIONADO DEL EDIFICIO
SEDE DEL CONGRESO

COMPOSICION DEL SISTEMA

a.- El sistema Central esta formado por 3
ENFRIADORES CENTRIFUGOS MARCA WESTINGHOUSE
Modelo pe-W-550W los cuales tienen una
capacidad "Nominal" de 550 Toneladas de
refrigeración.

b.- Máxima capacidad instalada.
Evaporador: TC520 - 500 TONELADAS
Condensador: KB482 - 482 TONELADAS
Capacidad tolerada: 500 TONELADAS

c.- Dos torres de enfriamiento para la
condensación de los CHILLER'S.

d.- Seis bombas para la circulación del agua.

e.- UNIDADES DE MANEJO DE AIRE

Cant.	Capacidad	Descripción	Marca	Modelo
04		U.M.A		
		Mezanina.		
		P.B y		AHH-
		Nivel 4	Westinghouse	150-MA
06		U.M.A		AHH-
		Niveles 1,2,3	Westinghouse	236GDF
20		U.M.A		
		Niveles del 1		
		al 20. Edifi-		AHH-
		cio Tribunales	Westinghouse	236GDF

POSIBILIDADES DE VIDA UTIL

Independientemente del estado general de los enfriadores, resulta difícil la obtención de repuestos en unidades de este tipo las cuales fueron instaladas hace aproximadamente 15 años. Adicionalmente estos enfriadores trabajan con freon 12, producto este costoso, difícil de obtener y pronto a desaparecer del mercado internacional.

Las unidades están definitivamente en condiciones de operación precarias:

- CHILLER 1.- Parado por falta de repuestos.
- CHILLER 2.- Los rodamientos principales del compresor centrífugo deben ser sustituidos de urgencia. su estado actual indica que en cualquier momento este se estrangulara produciendo una parada por largo periodo de tiempo.
- CHILLER 3.- Operando a su máxima capacidad, puede debido al esfuerzo, presentarse una avería lo cual dejaría el sistema sin posibilidades operacionales.

Como el punto de significación mas relevante hay que considerar que estos equipos no tienen mas que 15 años de vida útil, y estos en este caso ya han sido cumplidos.

Como puede entenderse por la sencilla explicación anterior el sistema esta operando en crisis. las temperaturas de entrada de agua y salida no nos producen el diferencial suficiente que permita el enfriamiento de los serpentines de todas y cada una de las unidades de manejo de aire del edificio.

TEMPERATURA DE ENTRADA: 58°F
TEMPERATURA DE SALIDA: 52°F
RANGO DIFERENCIAL: 6°F

Un sistema de agua helada trabaja con un delta T diferencial de 8 a 10° mínimo y el que nos ocupa esta en 6°F.

De todos es conocido el precario e inseguro suministro de agua en Caracas. y que esto se excluye al Soberano Congreso Nacional. Los equipos instalados dependen de un suministro de agua seguro en caso contrario el sistema no puede ser operado.

NO CREEMOS NECESARIO PROFUNDIZAR MAS LAS OPINIONES TECNICAS QUE INDICAN CLARAMENTE LA CONVENIENCIA DE QUE ESTAS UNIDADES SEAN REEMPLAZADAS.

Aunque la capacidad indicada en el punto "A" es de 550 TONELADAS esta cifra es únicamente nominal dado que este resultado se basa en la combinación COMPRESOR-CONDENSADOR - EVAPORADOR .

Esta combinación se refleja en el punto "E" y el resultado es de 500 TONELADAS.

La instalación fue realizada para la operación simultanea de dos chiller's quedando el tercero en espera haciéndose alternar los enfriadores en forma tal que su periodo útil sea Uniforme.

Caracas 10 de junio de 1992

Señores:
CENTRO MEDICO DOCENTE LA TRINIDAD
Presente.

Att. Ing. Gastón Vera.

ASUNTO: ESTADO DE LOS EQUIPOS DE REFRIGERACION CENTRAL.

De acuerdo con su solicitud, tengo a bien someter a su consideración mi opinión sobre el estado de los equipos de refrigeración central instalados en los edificios Unidad Santa Inés I (115 TR) y Manuel A. Pulido Méndez (340 TR).

Los dos equipos son de marca Westinghouse, con compresores tipo centrifugos, diseñados para operar con refrigerante CFC-12.

UNIDAD SANTA INES I.

El equipo instalado en la unidad Santa Inés I fue puesto en operación en el año 1975 y ha venido trabajando a un regimen de carga parcial de un orden promedio del 90% de su capacidad. La historia del equipo desde su instalación hasta el presente, es indicativo de un bajo nivel de falla, solo ha requerido una intervención mayor ocasionada por una fuga de aceite. El resto de las reparaciones efectuadas han consistido básicamente en reparaciones menores del sistema eléctrico de potencia y del sistema de control. El resto de las operaciones efectuadas han consistido básicamente en lavados periódicos del sistema de tubos del condensador debido a incrustaciones por baja calidad del agua de condensación.

El estado general del equipo es bueno y con una operación de renovación (overhaul), innecesaria en este momento, se le puede extender la vida por al menos un periodo de 10 a 15 años adicionales. Sin embargo, será necesario tomar algunas medidas inmediatas indispensables para mejorar la calidad de la condensación y por ende el

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deposición de incrustación de tipo cálcica.

- 3.-Re-actualizar la totalidad de la red de agua helada actualizando el sistema de control y efectuando un balanceo general.
- 4.-Mejorar los sistemas de filtración de aire, mejorar el sistema extracción de aire y realizar un balanceo general de todo el sistema.

Atentamente



Ing. Alfonso Quiroga