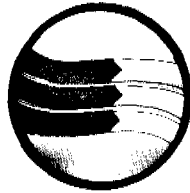


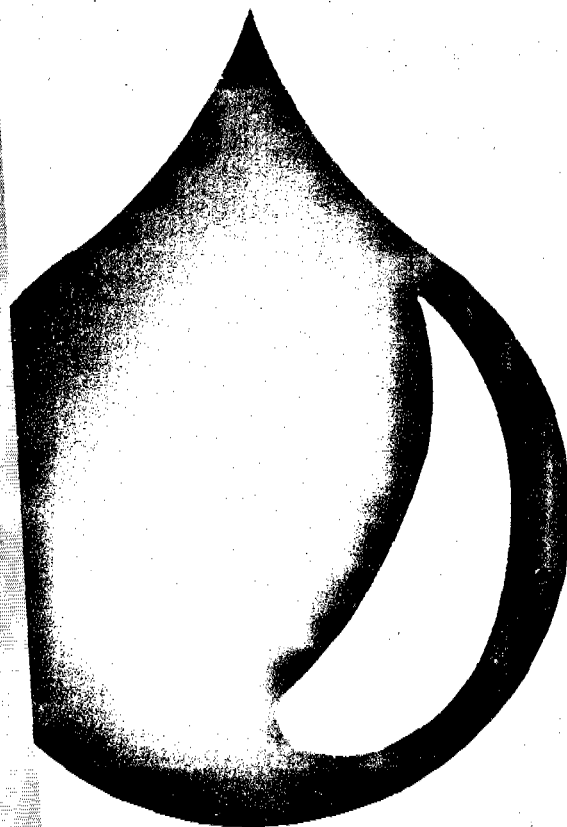
KINGDOM OF MOROCCO  
NATIONAL OFFICE  
OF POTABLE WATER



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# WATER CONSERVATION STRATEGIES



In view of the scarcity of water resources in the country, the high demand of water and the impact of the 1981 drought in Morocco, ONEP (the National Office of drinking water) has launched an anti-water wasting campaign.

The present file includes three documents :

- The first one gives an overview of the issue and is a basis to think about adopting a national water-saving strategy.
- The second one tackles the specific case of searching leaks in drinking water distribution networks both in terms of methodology and repairing.
- The Third one is a synthesis report presenting the methodology to follow to conduct a public education and awareness campaign through various media.

The report includes an illustration on films produced by ONEP.

**WATER SAVING**

## Introduction

For the public, saving water means carrying out some technical formula and abiding by some deprivations. At the operators and public authorities level, it is necessary to go beyond this idea.

The present introduction is meant to heighten people awareness to the gravity of this problem by drawing attention not only to the advantages and the need to spare water but also on the various actions undertaken to achieve this goal.

This paper does not pretend to set forth a miracle-solution (which does not exist), nor does it pretend to give a thorough description of the existing remedies. Its is merely an attempt to give as exhaustive as possible a list of causes and origins of squandering as well as actions to imagine or to undertake to alleviate the problem.

Its objective is to present a background to think about adopting, in the team, a national strategy for water saving. It aims, in the short run, that the orientation of projected studies be well-defined or at least as clear as possible.

## 1. Interest and necessity of water saving

### 1.1. Water resources are limited

1. Water resources are limited : The most recent estimates say mobilisable capacities in Morocco amount to some 21 billion cubic meters of which 16 billions from surface and 5 billions from underground water.

2. In 1980, 8 billion m<sup>3</sup> were used, distributed as follows :

Agriculture : 7.5 billion m<sup>3</sup> (or 94 %)

Drinking water : 0.3 billion m<sup>3</sup> (or 3.7 %)

Industry : 0.2 billion m<sup>3</sup> (or 2.3 %)

Total : 8.0 billion m<sup>3</sup>.

According to present prospects, regularised water volumes might amount to 14 or 14,6 billion m<sup>3</sup> (2/3 of the overall capacity) by year 2.000, while demand could be more or less the following :

Agriculture : 12.0 billion m<sup>3</sup> (or 83 %)

Drinking water and industry : 2.5 m<sup>3</sup> (or 17 %)

3. The above figures show that balance can be reached by year 2.000 between water demand and supply.

However, need is continuously increasing (7 to 8 % average increase per year in drinking water) and in the medium term, the problem of resources will emerge on the national level ; recent sectoral studies show that the problem of resources is already appearing in some of the country's provinces.

### 1.2. high cost of water wasting

4. The cost of water wasting is very high both for the individual and the community as it entails :

- bad exploitation of existing investments ;
- early scheduling of new investments ;
- abnormally high exploitation costs.

All these have an impact on water prices and consequently on the country as a whole.

### **1.3. Need for optimal use of water**

5. As needs of water develop, important efforts are needed for resources mobilisation, on the human, material and financial scales.

6. Optimal mobilisation of resources requires planning of resources and a policy of resources affectation closely related to the general policy of economic development of the country.

7. Among means to implement this policy ; campaigning against water squandering remains a priority. It has obvious economic advantages in the short term and it will prove a vital necessity in the medium term. It is, thus, important to urgently avail oneself with the means required.

8. To illustrate the present document, we can quote the conclusions of a seminar held by ANAFID and AIPC on June 13 and 14, 1980 in Rabat :

"Because of the importance of future needs and the increasingly high cost to meet these needs, seeking maximum efficiency in water resources mobilisation and in the repartition of the resource should be the permanent concern of town planning.

Also, optimum use of water should be sought ; struggle against squandering and quality and quantity degradation of water resources should be conducted at all levels and in the frame of a general mobilisation of all those interested in water, planners and users. It is high time to know that water issue is everybody's. It should no longer be the problem only of technical departments in charge of mobilisation, repartition or distribution to become the concern of all involved departments (planning, agriculture, industry, energy, equipment, health, interior, justice, housing), which requires a perfect coordination within the administration in addition to permanent consultation with consumers. It is thus a real awareness that is needed for various participants in water issues, awareness that should prepare them to set forth solutions up to problems as they are and as they will be in the future.

## **2. Planning and optimum use (abstracts of the seminar cited above)**

9. Water, a scarce resource, expensive and vital in all sectors should be used and managed with the maximum efficiency at all levels : dams reserves, draining channels, distribution networks, consumption sites.

10. A policy of discipline and rigor should be set up to achieve an optimum use both at the quality and quantity levels avoiding squandering and resources degradation. The following themes are part of this vision.

11. Mastering mobilisation, use and distribution techniques at the equipment and use levels.

These techniques, often of a foreign conception, should be well assimilated and adapted to Moroccan context.

12. Seeking and developing new techniques appropriate to the Moroccan specific context : weather, economic development, human, material and financial means.

13. Extension of the field of mobilisable water resources : pumping in sheets of water infiltrated in stream banks, using brackish water in irrigation, recycling of streamings water (seen up to now as a normal loss) through hills balancing.

14. Extend the field of water need covering through recycling of used water : reuse of residual water of irrigation or purification waters either directly or indirectly by re-loading of sheets, reprocessing urban, household and industrial used waters.

15. Recycling industrial waters. In most cases, in the industrial sector, water constitutes a convenient and uncostly vector of discharges that are often unused raw materials (and even dissipated energy). Internal recycling of water and raw materials is to allow the end to this double squandering.

16. The discharge of urban used waters is a waste of water and a source of pollution. After a scanty treatment, they may constitute, through the creation of purification bassins (lagunage) or manuring, a fertilizing contribution for the agricultural neighbouring lands. They may contribute, if certain precautions are taken, to the loading of ground waters.

17. In terms of quality, any risk of deterioration, then the minimization of water ressources is to eliminate.

18. Irrational or arbitrary exploitation of ground waters is likely to lead to irreversible deterioration of the ressource if sea water in coastal areas invade these waters.

19. Pollution of all sorts and origins (natural, artificial, perpetual, periodical or accidental) may result in an irreverssible deterioration or in prohibitive treatment costs.

### **3. Saving water in the agricultural sector.**

20. By 2000, agriculture will use 83 % of its mobilized ressources to meet its needs. That means that a policy of saving water will be a matter of priority by mastering water in agriculture.

21. The problem of saving water in the agricultural sector is studied in particular by the A.N.A.F.I.D. The main conclusions reached at the seminar "water Ressources in Morocco" already cited in paragraph 8, are mentioned hereafter.

22. "The strategy of saving water must be considered on various levels from conception to management".

23. At the level of the resources mobilization :

a. Defending and rehabilitating soils giving way to :

- Spreading water rise by reducing streaming ;
- Raising deep infiltrations allowing a reloading of ground waters and a more assured mobilization of ground ressources.

b. Increasing the number of little dams (hill balancing)

24. At the level of feeding and distribution :

a. Reducing losses by infiltration, which requires the water and proofing of transport works.

b. Reducing losses, which requires an efficient system of regulation : the installment of reserves in open canals and dynamic or hydromecanic regulation systems.

c. Policy of sustained maintenance.

d. Rational management based on meteorological forecasting, a bulletin of local cultivations, knowing of the needs of cultivations in water, water deficiency of plants.

25. At the level of the plot

In a policy of saving water, many interdependant factors must be taken into consideration - some of these factors are :

- a judicious development of the soil ;
  - a network of irrigation that is well adjusted to local conditions ;
  - a well adapted material of irrigation ;
  - a convenient environment ;
  - a sufficient training of staff ;
  - appropriate techniques of cultivation.
- The main means of saving water at the level of the plot are :
- appropriate techniques of irrigation ;
  - meeting the real needs of plants in water ;
  - a rational management of irrigation water by making appropriate release at adequate times ;
  - fixing a price for irrigation water, which would encourage users to make a rational use of it ;

– the two first means have been the subject to studies and experimentations since the beginning of the fifties and have given very satisfactory results.

26. In terms of management, the A.N.A.F.I.D work group has reached the following conclusion :

“A substantial saving of water will be accomplished at the time irrigation water will not be given when asked for by cultivators (considering the present state of things) but distributed timely to meet the actual needs of water for cultivation. This means that a real management of distributing water must be developed. Planning waterings will be based on a flexible irrigation system, itself based on knowing local needs in water, useful precipitations and the useful conservation of the soil.”

## **Saving drinking water**

27. Though not of the same importance as agriculture, needs in drinking waters are important and urgent. The fact that drinking water represents a small rate of needs at the national level does not justify a less rigorous action in seeking to save water, for what is true at the national level is not automatically applied at the regional level.

A recent study, for instance, has shown that a 15 % profit in yield from a distribution network of a town of about 500.000 population, represents an enormous saving or would allow, by 2000, for necessary resources to create an irrigation perimeter.

## **4. Squandering and savings concerning the consumer**

### **4.1. Origin and causes of squandering**

#### **4.1.1. Concerning particular consumers**

28. The usual way of thinking and the way of living.

For the country-man, water is a natural propriety ; consequently, freethis mentality that has been transposed in to newly urbanized towns, does not help to combat squandering.

29. Leaks after the conception of water meters.

They may be due to :

- the bad conception of internal installments ;
- their dilapidation ;
- bad maintenance.

30. Inadequate sanitary and household appliance.

Likely to result in leaks or over consumption.

31. Excessif pressure on the network.

That allow for the apparition of leaks, deteriorates equipments and results in over consumption.

#### **4.1.2. Concerning industry operators**

32. Besides the causes mentioned above, the use of water is a convenient and uncostly vector of industrial discharges.

#### 4.1.3. Concerning collective installments

Absence of awareness among people that for what is onerous for the collectivity is also onerous for individuals ; i.e. : the management of public standposts.

#### 4.2. Recommendations to fight water-wasting

34. Prompt a collective awareness : The water issue is everybody's concern.
    - a. Information campaigns on water saving.
    - b. Campaigns to sensitise people to the need of repairing internal leakage;
  35. Improvement of internal installations.
    - a. Create means to have existing norms and rules respected.
    - b. Improve Plumbing rules to fight water squandering in internal installations.
    - c. Standardize sinks and lavatory flushes mechanisms.
    - d. Conduct a study with the collaboration of professional organisations and manufacturers on the making and functioning of household fittings concerning water consumption.
  36. Actions at the distributor's level.
    - a. Limit service pressures at the subscriber's place, either through action at the network level or by including pressure-reducers when connecting.
    - b. examine the interest of creating, at the distribution level (ONEP, Agencies), sanitary plumbing services that will, when required by the customer, interfere in internal installations "after counter".
  37. Actions at the prices level.
- Several studies were conducted on the dissuasive role of pricing to fight water wasting.
38. Actions at the industrialists' level.
    - a. Carry on research to modify industrial means to reduce water consumption.
    - b. Set forth regulation or incentive to promote generalisation of equipment recycling in industry facilities with high water consumption.
  39. Actions at the administrations and town councils' level.
    - Closely follow up evolution and decomposition of consumption (in particular management of public standposts). Water consumption in public administrations and services stand for about 34 % of urban consumption.
  40. In general

Examine research conducted and measures taken in other countries, eventually in the frame of international organisations (AIDE, UADE, WHO etc.)

### 5. Wasting and saving at the distributor's level

#### 5.1. Origins and causes of water squandering.

41. Squandering at the distributor's level can be ascribed to two main reasons :
  - A bad check of consumption standposts (clandestine connections). Although water distributed this way is not always squandered, there will be a short fall that operators will have to account for in the balance sheet.
  - Leakages in the network which has several reasons.



42. An investigation by the british water industry helps locate the leak and know its causes. Rates listed below are not necessarily valid for moroccan networks but can direct research.

43. Leakage localisation (investigation carried out in 43 european towns).

- Main feeders : 9.7 % (rates ranging between 3 and 4 %)
- Distribution networks : 54.3 % (rates ranging between 19 and 78 %).
- Tanks management : 3.3 % (rates ranging between 0 and 11 %)
- Connections : 32.7 % (rates ranging between 0 and 58 %)

44. Main causes of leaks :

- earth movement ;
- channels erosion ;
- traffic (heavy vehicles) ;
- high pressures ;
- road works ;
- old pipes ;
- low temperature ;
- defective pipes (manufacturing) ;
- defective joins ;
- bad installation techniques.

## 5.2. Installation returns

45. The best indicator of squandering in distribution networks is returns. Several definitions of the network returns were elaborated and similar indicators defined. Listing the definitions might be interesting.

46. In Morocco, the best definition allowing for a figures approach of the issue is no doubt the ratio quantity of water billed for customers (noted on their counter) and the quantity of water delivered at the network of counters (accordingly set in the feeders downstream or upstream).

47. The returns obtained this way is indeed a technical - financial return that includes both the costumers and financial return. It simultaneously stands for the technical quality of the network and the quality of customers management.

48. Knowing the technical return of the network and following up its improvement require :

- a perfect knowledge of the network ;
- mastering the customers' management ;
- mastering countering problems.

## 5.3. Preliminary measures.

Measures to be applied in a given network depend on the present state of the network management. An idea of possibles operations is given below :

49. Knowledge of the network

- Mapping out the network with all the facilities : division floodgates, draining, fire hydrants and public standposts ;
- Work out a network plan at 1/1000 on the basis of cadaster presented in boards.
- Work out a floodgates plan with numbers of gates and a notebook of gates where each knot is drawn up in the 297 x 210 size.
- Work out a connection directory drawn at 1/200 from stitchings on the pipe to the counter completed with related technical and administrative information.

50. Customers' management

- Elaborate questionnaires that can be processed by computer.
- Delivering points identification (reports of the geographical location at the plots level, replacement of defective counters, technical information on the state of installations).
- Process the questionnaires in computer to compare with the existing file, any anomaly in the file will be rejected by the computer.

- Identification of costumers whose files were rejected and conduct an investigation.
- Close temporarily connections belonging to irregular customers.
- Register useless counters and definitely close the corresponding connections in time-span to be agreed upon.

#### 51. Metering

- a. For large counters (feeders' counters, network counters, squares counters).
  - the need to work out a general counting policy (type of counter, management) ;
  - the need to have, at least at the national level, a testing bench for large diameter counters ;
  - expect, as much as possible, possibilities of counters references on the spot, when making installations.
- b. For small - caliber counters (costumers counters), there exist in general testing benches ; it is however important to carefully examine the following points :
  - choice of the counter type, volum counter or speed counter (often less precise in small flows but easier to maintain). A number of criteria should be taken into account such as the quality of distributed water ;
  - systematic policy of maintenance, check up and renewal of counters ;
  - organisation of the counters' reading : duration, frequency and check up.

#### 5.4. Improvement of the technical returns.

52. Improving the technical returns of a water distribution network is first of all to fight leaks at various levels :

- at the level of network conception (preventive action) ;
- at the level of manufacturing the network (preventive action) ;
- at the level of the network global management ;
- at the level of leaks detection ;
- at the level of existing leaks detection.

53. At the network conception level :

- Limiting pressures by creating floors of distribution or setting pressure reducers ;
- more generally, studies on networks' optimisation.

54. At the network manufacturing level :

- Choice of materials taking into account the nature of soil and carried water ;
- Check the manufacturing norms in the firms ;
- Controlling and checking the norms in pipes' setting (elaboration of CPS type, using skilled workers to control the works)

55. At the level of the networks' general management :

- Using a centralized system of information and command mainly helps :
  - influence consumption by modulating pressures on the network ;
  - manage at best reservoirs ;
  - reduce damages ;
  - limit leaks in the network and in the customer's internal installations.

It can be deduced that setting up an adequate pressure zone and an automatic control enabling to modulate pressures in the network with a satisfactory service will help spare 6 to 10 % of the overall consumption, which is a very important fact for a big city.

The technological environment does not all the time help apply these means, which are relatively sophisticated. Thus, simpler means should be thought of :

- inspection of reservoirs ;
- setting pressure - reducers in the network ;
- setting pressure - reducers in the costumers' place.
- systematic investigation in uncontrolled consumptions, (for example forbidding or limiting lavatory flushes in draining networks, valves on fire - hydrants).

56. At the level of leakage detection :

- a. The choice of a method to control leaks should take into account technical and economic factors, in particular :
- the importance of leaks ;
  - the interest of reducing the leaks ;
  - Costs of various methods of detection.

57. b. There are five main methods of detection :

1. Checking pressures.

Reducing pressures diminishes the flow of existing leaks and prevent new ones.

2. Passive detection.

Only evident leaks noticed by a visible flow or by consumers' complaints can be located and repaired.

3. Systematic investigation.

Specialized teams systematically visit the network appliances to check the pipes.

4. Follow up consumption by sectors.

The network is divided into sectors and consumption in each sector is measured and followed : when there are abnormalities, investigations are conducted.

5. Night counting.

Night counting by sectors and an investigation on night consumption often give precise indications on the network state.

6. Compositing method.

Consists of using simultaneously the various methods listed.

58. In important centers, creating a special service of detection of leaks and improvement of the networks' returns is often a beneficial operation.

59. Program of channels renewal.

Programs of network renewal (often included in extension programs) also help improve returns ; replacing a pipe should take into account several criteria : frequency of the damage, role of the pipe, its diameter, materials, water quality, soil quality, its location, etc.

## 6. Squandering and saving at the producer's level

### 6.1. Return

60. Like for distribution, return is the best indicator.

The technical return is in this case easier to identify provided that the fundamental problem of counters by high - caliber counters is settled (C. F51 a)

### 6.2. Squandering and saving

61. Squandering can take place at the level of water resources, processing and draining. The resources problem was dealt with more generally in Chapters 2 and 3.

62. At the processing level, one should avoid wasting by optimising various possible adjustments and mainly :

- reagents' measures ;
- apparatus purification ;
- filters washing.

63. For large processing centers, even after optimisation of processing, discharges are considerable and it is necessary to study the possibility of a new processing and reuse of the discharges (cf. Bouregreg).

64. For draining pipes, problems are the same as for large feeders of distribution networks. The same techniques will help improve the returns, teams of detection of leaks should periodically pay visits.

65. The creation of a service in charge of controlling and improving returns of processing stations at the national level should be thought of.

## **7. Summary of measures to save drinking water.**

66. We will mainly deal below with measures of saving relating to drinking water (ch. 4, 5, 6) with the exception of those related to resources and agriculture which should be subject to specific study. We will only summarize main orientations, we will refer to corresponding chapters for details and measures.

Legislative Action : standardization of regulations

- rules of art : reconsidering and updating existing laws.
- standardization of sanitary equipment and facilities.
- lists of measures taken in other countries.

The actions may be taken with the collaboration of international organisations and in Morocco under the supervision of the supreme council of water.

68. Actions at the level of studies

- Taking into account the "saving" criteria in studies :
  - regional masterplans : re-use of used water... ;
  - masterplans of distribution networks : optimization of networks and of pressure conditions
  - recycling water discharged by large stations of processing ;
  - recycling industry discharges.

69. Indirect actions by the operator (General management)

- mastering networks' know ledge ;
- mastering customer's management ;
- mastering counting problems.

70. Direct action by the operator

- Conduct studies in low - income cities to identify measures of restructuration and renewal likely to rapidly improve returns ;
- Organise specific services in charge of improving returns and launching campaigns to detect leaks.

71. Actions with the users

- Sensibilisation and information campaigns.

## **8. Measures Programming**

72. Simultaneous actions can and should be undertaken at all the levels listed above because some of these measures have a long-term impact.

73. It is necessary first of all to adopt a policy of water counting : this pre - requisite is necessary to follow up technical return of installations.

74. A study conducted in each city or installation will help set priorities taking into account the present situation : One will chose firstly actions which help get a rapid increase of returns and thus a rapid paying off of the measures' cost.

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**DRINKING WATER NETWORK :  
LEAKAGE DETECTION ASPECTS**

# WATER CONSERVATION STRATEGIES

## Foreword

As a general rule, both current and future discrepancies arising between the water needs and the available water assets compel the decision makers to seek maximum optimization policies concerning asset mobilization and distribution.

As the needs in water develop, increasing efforts become compelling to ensure mobilization of the assets through increasing human, infrastructural and financial involvement, along with tight planning and rigorous distribution of the assets in synchronization with the overall policy of economic development.

One of the means to achieve these aims is the fight against water waste. This is considered as a priority which represents, in the short run, a quite obvious economical plus, and in the medium run, is bound to turn into a strategic necessity.

Although the needs in drinking water are not of the same caliber as those for agricultural purposes, there should be no justification for any policy that would not be just as rigorous in the drive towards water conservation, given – on the one hand – the production transportation and distribution costs, and, on the other hand, the necessity to answer the needs when the assets are scarce.

The drive towards water conservation strategies can be two pronged, namely :

- water waste control at the consumer level,
- the improvement of the water transportation and distribution means yield.

Although it is true that the improvement of the leak proof quality of the transportation and distribution systems is essentially of a technical aspect, waste control at the level of the consumer is achieved through a set of technical, tariffing and sensitizing actions.

Within the framework of water conservation strategies the National Drinking Water office (ONEP) undertook a number of simultaneous actions :

1. A media – based information campaign aimed at sensitizing the consumer and triggering a collective awareness of the issue.
2. A tariffing strategy for the purpose of bringing the consumer to avoid any excessive consumption.
3. A technical action aimed at upgrading the yield of the drinking water distribution networks.

The following section highlights the various steps undertaken by the office in order to bring about an improvement of the transportation and distribution networks.

# I. LEAKAGE CONTROL AT THE LEVEL OF THE DRINKING WATER NETWORKS

Leakage detection is at the heart of every technical action aiming at upgrading the yield of any transportation and distribution system. It is, however, tied to the following variables :

- the identification of a methodology of leaks detection,
- the setting up of an organization stemming from the adopted methodology,
- metering control and updating of the network plans.

Before developing the above given points, it is worth recapitulating the various types of leakage :

## 1.1. Apparent leaks

These leaks are mostly due to :

- technical leakage : reservoir over spill, draining, faulty handling, cleaning,
- valve leakage, air chamber leakage, fire hydrant and sewage flush ;
- mains breakage, alongside with obvious water presence on the surface in the immediate vicinity of the detectable leaks,
- standpipe waste : water is free of charge, lack of care taking.

## 1.2. Non Obvious Leakage

These leaks constitute the major part wasted water causes at the level of the network. They are essentially due to the following :

- highly concealed leakage seeping from the mains unnoticed, due to permeable soil ;
- leakage at the level of the meters : flow rate lower than the onset starting front rate, clogged, broken on faulty meters,
- connection tap leakage due to faulty connection or to corrosion.

It should be noted that for obvious leakage cases, their control largely rests in the hands of the operating staff vigilance most of the time, and depends on the rapidness of leakage information transmission and repair actions. In the field personnel action is of major importance and is to be intergrated into daily management tasks.

Concerning the non obvious leakage instances, planned actions-such as leakage detection campaigns undertaken following technical ratios- are trusted with special teams.

It is worth noting that more often than not, the fight against water waste has a curative aspect only ; whereas leakage prevention should be the rule. Preventive action should be considered at the following levels :

- conception : selection of mains according to service pressure, quality of the transitting water and the nature of the soil.
- laying works : compliance with the regulations pertaining to the prescribed laying techniques and joints preparation.
- operation : analyzing regularly the evolution of the rations.

This brief recall allows for a better preparation to a rational action of leakage detection and control which could be liable to bring about a high level of yield.



# LEAKS REPAIR WORKS



## II. IDENTIFICATION OF A METHODOLOGY

In addition to the production and sales of water to distributing customers – water distributing Local Utilities – distributing agencies takes care of the management of the water distribution to more than one hundred centers with a total of more than 190,000 subscriber.

The national towns supplied and managed by the agency are characterized by their average size (1,000 to 14,000 subscribers) and their geographical disparity.

These two characteristics compel the Agency to adopt a methodology ensuring maximum optimization of the leaks detection and control campaigns in terms of cost effectiveness.

Methodology identification was based on the following criteria :

Assuming that leakage occurrences are evenly spread over a given network and that repair costs are irrelevant to leakage flow rate ( as they are rather linked to the types of materials, the mains diameter and the nature of the top soil layer or subsoil), it is noticed that the cost of a campaign is proportional to the linear lengths of inspected sections by the leaks detection team (duration of the detection action) and to the number of repairs carried out throughout the totality of the network. The leakage flow rates remain highly variable.

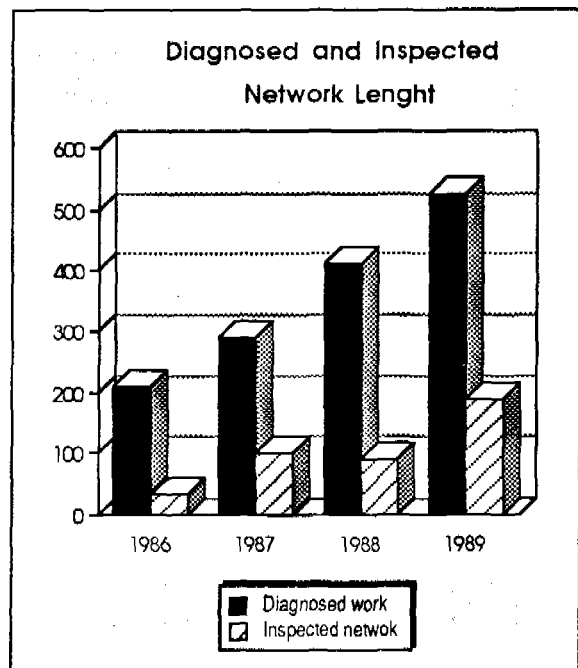
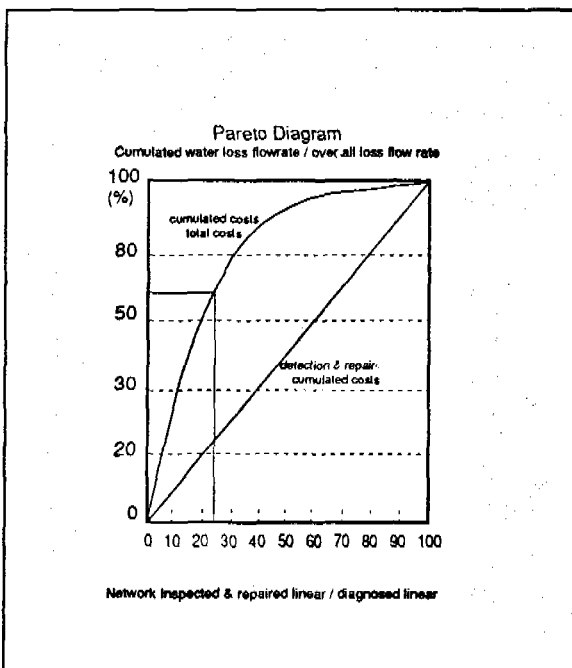
For a given leakage flow rate reduction rate, optimization consists in minimizing intervention costs by looking for the network sections where the leaks flow rates per length unit are the most important.

A pilot experience of leakage detection has clearly concluded to the fact that 80% of the leaks are spread over 20 % of the overall length of the network.

Starting from measurements of the flow rates during the night time of network sector and section, it is possible to identify quite accurately the spatial distribution of the leaks and therefore to detect them by use of electronic amplifying instruments.

This type of action can therefore reduce the leakage detection campaign for a given yield objective.

The following graphs concern a four year period showing the part of the network where leakage detection was carried out by leak noise correlator in comparison with the length of the diagnosed network :



### III. LEAKS DETECTION LOGISTICS

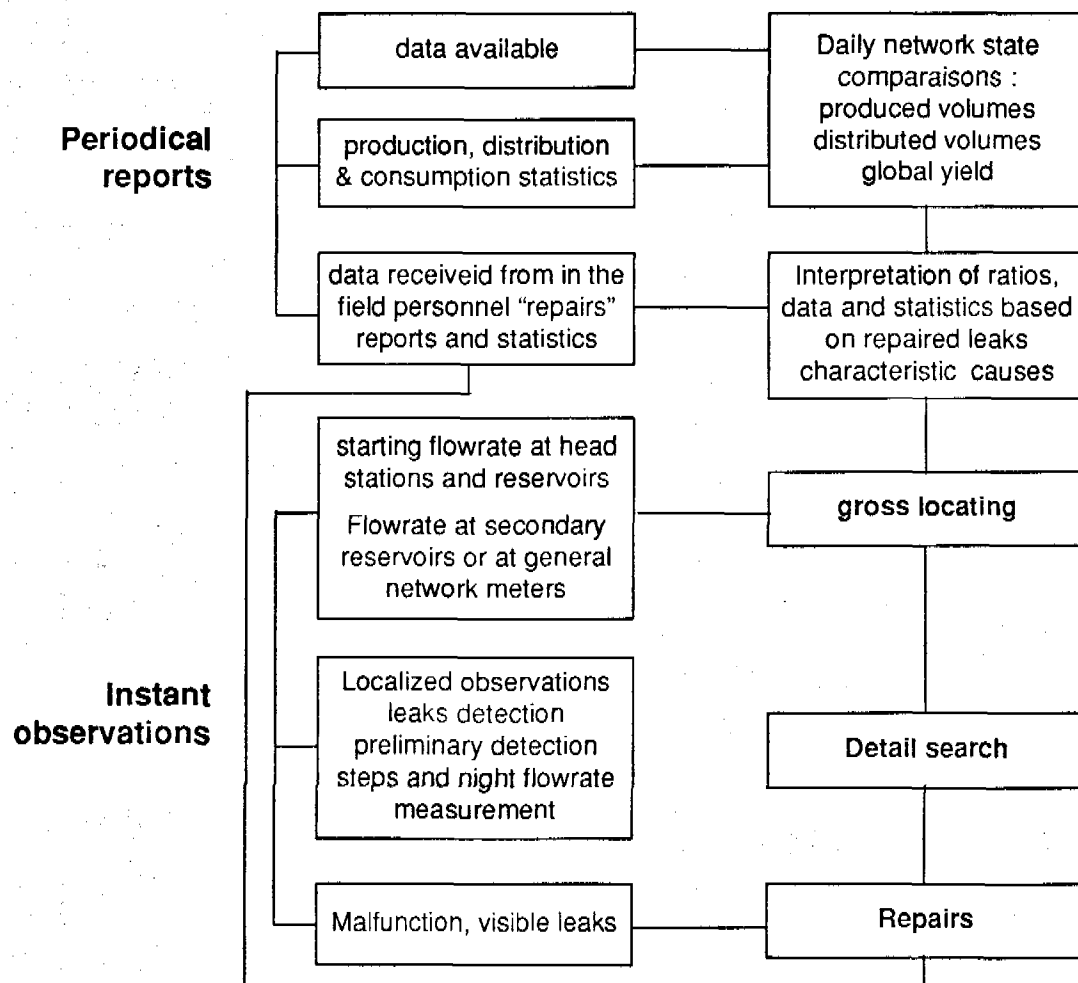
The setting up of such a methodology required the creation of eight leak detection teams comprising two specialized technicians each.

these mobile task teams cover a whole set of networks and are equipped with the following gear :

- 1 hydrant key detector,
- 2 mains detectors,
- 3 leak sensors,
- 2 manographs,
- 1 night flow rate meters,
- 1 leak noise correlator.

The leakage detection program is set up according to the observations and data received. The following flow chart sums programmed leakage detection action.

#### Information processing and leaks detection flow chart



## IV. NETWORK PLAN AND METERING

### 4.1. Network plan

One of the pre-requisites to any planned leakage detection action is the updating of the distribution network plan. This constitutes in fact the preliminary phase to any serious analysis and network plan drafting.

This means that the updating of the network plans is to be a rigorous task and the verifications to check the tightness and quality of the valves should be conducted with utmost accuracy.

It is worth noting that the leakage detection teams effectively contribute in the network plans updating tasks : they are directly concerned with these documents which are part of their tool package.

### 4.2. Metering

Any yield assessment (supply, distribution and overall yield ) can be undertaken only through a sound metering control.

At the production and distribution levels, metering verifications are conducted through potting or by means of spillways, or else by referring to the pumps charts. The frequency of pump charts data collecting is daily and any abnormal metering discrepancies are quickly tracked down.

Concerning the billing policy (i.e. billing the subscribers ' ), the office has adopted a monthly meter reading frequency in order to identify any faulty meters and to proceed to eventual replacements.

Moreover, all the water volumes lost should be identified and estimated (accidental mains breakage, draining, fire fight action, even when these estimations lack precision, they nonetheless provide with means of assessment. For the purpose, it is required that estimated volumes and the bases for these estimations are to be noted upon each intervention.

## V. CONCLUSION

Network yield should always be a major concern for the managing personnel in order to ensure at least an average of 80 % control by acting mostly along two lines : on the one hand, action should be undertaken on the causes of leakage, and on the other hand concern should be given to reducing the time lap between the occurrence of a leakage and the action taken to remedy it.

A leakage detection campaign should always be followed by an assessment phase in order to size up the amount of recuperated water. It is worth noting at this stage that major repair works carried out on aging networks lead to a build up of pressure which may in turn generate more leaks. This entails the necessity to conduct regular controls at short intervals.

A spin off of the leaks detection campaigns is that they feed reliable data which is used in calculations and simulations of network functions and projects, thereby leading to potential improvements in the drinking water supply schemes.

Finally, technical action aiming at improving water transportation and distribution systems is obviously part and parcel of an overall scheme for the fight against all forms of drinking water loss and waste which is itself one of the facets of contributing to water conservation policies.



**Campaign of public  
Sensitization to Water Economy**

## 1. Forward

Drought that our country has undergone since 1981 has prompted awareness of public authorities to the need of defining a strategy for a rational use of water and to set forth a global action plan meant to save water in all its uses.

- At the level of dams management.
- At the level of sheets where it is necessary to better know sheets and conduct simulation studies.
- At the agricultural level (irrigation system, management of water conveyance fittings in rural areas...).
- At the agricultural level (irrigation system, management of water conveyance fittings in rural areas...)
- At the level of drinking water : action toundertake at the level of the producer, distributor or consumer.

The issue of saving drinking water was thus addressed in a general frame which encompasses all sectors of use and wich also lies within the framework of UNDP financed project R. A. B/80/011 relating to water resources in north African countries.

Concerning drinking water, ONEP has undertaken several actions to reduce as much as possible water squandering. In this context, technical, financial, administrative and educational decisions were made. This paper is aiming at defining the methodology to be followed for the launching of education and awareness campaign through various means (T.V, radio, public notices, mailing etc).

## 2. The Role of Information in Water Economy

Water saving is possible, such is the strating point which should guide any action in this field ; J. K. Romm notes, thus, that in Tunisia which is a country similar to ours in many respects, it has been possible to obtain a 25 to 37% saving on drinking water.

Quantity of water strictly needed by people for drinking and hygiene is relatively small (some dozens liters per inhabitant and per day), consumption of drinking water is marked by some elasticity.

During the drought that raged in England and the wales in 1975-1976, consumption of industrial and drinking water was reduced to 30 and 50% according to regions without causing great disturbances for consumers. For the wessex water authority, the overall economy on consumption was of 30%, of which 9.9% (i. e nearly 1/3 of the overall economy) was ascribed to public action following a well-conducted information campaign, while regulation measures (e. g barring watering) and technical measures are behind the remaining water savings.

*Let's first note that if a public sensitization action is relatively easy at a time of exceptional drought, in particular in our country where the public mind still remembers the image of lethal drought for people and animals, it is certainly more difficult to explain to consumers in normal time that they should save water « on grounds That a reservoir (that few people will see) is almost empty or that the level of a sheet (that nobody will see) is to low. ».*

It is thus necessary to convince people in normal time that drinking water is scarce and precious and that water potabilization being expensive, drinking water squandering should be prevented.

The action of informing the public falls whitin two related fields :

## **2.1. Information : which consists of motivating**

The public training on this topic of national interest and which might be in the form of :

- T. V and radio programs ;
- Feature stories in national newspapers ;
- Natural science lessons on the matter in primary and secondary schools ;
- Notices (some of which have already been designed).

## **2-2. Advertisement :**

Which normally reminds us of a notion of a maximum profitability but with techniques used in public interest campaigns (energy saving, family planning, etc.).

The use of advertisement techniques should however be preceded by a thorough study on consumer's expectations, motivations and limits so as to work out the most possible performing communication strategy.

To this end, ONEP managing board and a specialized advertiser held on february, 1982 a first meeting during which advertisers were given explanation on the aims of the projected action as well as major constraints to be taken into account while working out the sensitization campaign, namely :

- a. Drinking water is supplied in an unequal manner throughout the country and even in urban areas, the rate of connection is relatively low (45%).
- b. The water bill has no dissuasive impact on consumption (low prices).
- c. Public administrations, a target almost inaccessible by an awareness campaign consume some 34% of the water used in urban world.
- d. Health results achieved by a sufficient water supply quantitatively should be protected.

The advertisers vowed to define, for ONEP, adequate advertising media and a working methodology that takes into account all aspects listed above

## **3. Feasibility of an sensitization campaign**

Aims sought in the first stage are :

- a. To know images linked with water and its saving.
- b. To assess the necessity (and the feasibility) of a campaign for water saving.
- c. To identify incentives likely to prompt non)customers to get connected to the network (social connections).

### **3.1. Working methods**

The main information expected from the pre-study entrusted to the advertiser is relating to the feasibility (At the level of the city of Casablanca) of an sensitization campaign for water saving despite constraints explained in the previous paragraph.

To that end, the target was sub-divided into three categories :

- a. Particular real consumers (those who have drinking water at home) ;
- b. Non Particular real consumers (those who have other supply means) ;
- c. Industrial real consumers (industrialists using drinking water).



The working method was different for each of the three categories :

- With the first category, meetings were held with groups of 100 consumers divided according to sex and to the level of income.
- With the second category, meetings were held with groups of 100 people using public fountains, wells, springs and rivers or buying water from a water saler.

Information was compiled by investigation through questionnaires.

For industrial consumers, 100 technical managers of industrial enterprises from various branches using drinking water were asked questions.

### 3.2. Global results

Results on the necessity, acceptability, adaptation to reality and presumed efficaciousness of an sensitization campaign that the pre-study has reached, concerning the three categories of consumers are summarized in the below table.

Description	saving factors yes	Acceptability of the campaign	adaptation to reality	positive action on population
Real particular consumers	85 %	93 %	78 %	80 %
Non-Real-consumers	79 %	88 %	88 %	86 %
Real industrial consumers	100 %	98 %	93 %	70 %

All categories mixed, we have the following results :

- for saving drinking water : 87.67 %
- favorable to campaign for drinking water saving : 98.60 %
- think this campaign will have an effect on people : 78.00 %

By summarizing information collected, we can also present the image of water as it is perceived, as follows :

- a. Water is scarce and precious, it is necessary to guarantee the future ;
- b. Use it without squandering, you will save money ;
- c. It is an element of national solidarity because water is a form of energy.

*The image of water as scarce and precious is, thus not to be created : It is rather to be promoted.*

*What should be stressed is the quality of water and the cost of its production as well as means to struggle against squandering.*

As for the equation water-hygiene, it appeared that the population targeted by the campaign distinguishes perfectly well between normal and necessary superfluous and excessive use of water.

In this case also, the concept of using all needed water but without squandering is not to be entirely created. It should only be deepened.

An aspect that should be however underlined is the often unjustified image that people who are not connected to the distribution network have on the quality of wells' water.

Concerning industrial consumers, it appeared that two elements are necessary for the success of a campaign in favor of saving drinking water :

- existence of a center where practical advice on implementation of economies adapted to the production line and mastered costs can be obtained.

- water saving should also be synonym to global saving, which depends on water price and the costs of investments needed to obtain a certain level of water economy.

The weak effect of the current price of water is evident in the fact that 25 % of executives, investigated did not know how much water their enterprise consume.

As another global conclusion, we can note that consumers who are more sensitive to the price of water are those who have recourse to water salers (old medina, Derb Ghallef) ; these consumers are charged 30 Dh for each cubic meter of water, which is 50 times the price of drinking water for the social layer.

## 4. Usable Medias

According to the projected territory the campaign is to cover, the medias used are various.

### 4.1. Target A : Overall cover of Morocco

#### 4.1.1. Television

It allows for :

- a thorough cover of the targeted population (there are presumably 12,000,000 T.V viewers in Morocco) ;
- very strong memorisation and identification.

**Disadvantages :**

- impossibility of segmentation of the target ;
- it is an expensive means if no reduction is obtained (As was the case for family planning for example).

#### 4.1.2. Caravaning

It allows for :

- a thorough and/or selected cover ;
- information, education and training ;
- it has the power of T.V in addition to the possibility of re-explaining the message ;
- it corresponds to very strong objectives of regionalisation and/or information.

May be very interesting if the Public Health ministry includes water saving in the health education program (which already uses this means).

#### 4.1.3. Advertising in Radio

It allows for :

- an information action ;
- an interesting memorisation if the messages broadcasted are repeated enough ;
- possibilities of segmenting the messages according to the various targets (by acting on programs' time of broadcast).

**There are two elements that should be taken into account :**

- possible dispersal of the global target as there are several radio stations ;
- the target gets uninterested in this medium when T.V programs start.

#### 4.1.4. Mailing

It allows for :

- access to the real target ;
- avoids dispersal of the information ; it is a new means in Morocco, so it is attractive and enables a direct communication with the consumers. This method has given good results in England during the drought of 1975 - 1976 (1), it is not very expensive.

#### 4.2. : Target B : partial cover - support media

##### 4.2.1. Cinema

- partial cover of a specific target (e.g. : Casablanca).
- its support media for selective and regionalized operations.

**Disadvantages :**

- few movie theaters (205 of which 182 show advertisements ;
- expensive means with a difficult follow up.

##### 4.2.2. Media

- partial cover of the target because of a low rate of circulation (Le Matin Du Sahara et Du Maghreb, newspaper with the strongest print in Morocco only publishes 35,000 copies).
- allows for a partial access to an urban target.
- expensive media per person touched.

##### 4.2.3. Wall Notice

- only allowed in Casablanca and Tangier.
- partial cover of the target.
- very selective information, limited both in time (degradation) and in the message content (which should be short, striking and can only be a reminder).
- possibility of memorising an operational slogan.

##### 4.2.4. Bus Notice

- in some large cities.
- marginal audience.

**N.B. :**

Films may be used at the same time in T.V, cinema and caravaning. It helps act on effects of memorisation of the message, obtain two or three times the impact and get a continuity of the global campaign.

#### 4.3. Choice of the media to be used

The critical study of usable media has led to limiting the choice in the following media :

- television ;
- radio ;
- public notice ;
- mailing.

The use of the media listed above suggests the existence of an edition activity and caravaning as said before might be interesting if the health ministry accepts to include water economy in the themes of its health education campaign.

**Television will have to play the role of the mainstream media in the campaign.**

The National Press can also be used through articles (free of charge) to inform the public in parallel with the campaign.

Additional information on the choice of media are found in the agency report on the strategy of communication.

## **5. Implementation of the sensitization campaign**

The campaign has mainly used the audio-visual support (television). It is composed at a first stage of 10 ads designed for the large public.

In addition, written supports designed for other targets are a useful plus for the objectives sought.

After studying the image and specificities of drinking water and responses of various groups of people to the campaign in favor of drinking water saving while preserving health benefits resulting from its use, we have launched a first campaign in two stages :

- presentation of the campaign symbol ;
- explaining the concept of drinking water.

The film PRESENTATION OF THE SYMBOL has helped locate drinking water. Indeed, a study has shown the phrase in arabic meaning drinking water "Water good for drinking" was confusing and might serve as a support for water from different origins. We have thus shot a 15 second film on the concept of the campaign and to present the symbol of the campaign : two hands holding a water drop falling from a faucet.

The message is simple and clear

*"drinking water is necessary for health use it without squandering it."*

The end of this first film has served as a conclusion for all campaigns, be they visual or in messages.

Of course, ~~our~~ campaign had to be purely informative and in no case it should create an obsession of water shortage or be understood as an obligation not to use water in the legitimate frame of hygiene and food.

Our campaign was indeed perceived as an anti-squandering campaign.

In a second stage we worked on 5 films :

- cars washing (30") ;
- dishes washing up (30") ;
- fixing household fittings (30") ;
- prices (40") ;
- social connections (40").

The three first films were "advice" films which through a funny system, cartoons, compared good to bad use of drinking water in the most classical cases of squandering due to a lack of information. The two other films were based on the dissuasive aspect of pricing (sales price based on portions) and on the social aspect of a connection.

All the films had very good scores of memorisation impact and acceptance.

The rest of our campaign stressed problems relating to aspects of *QUALITY*. It was meant to make the public who uses and consumes drinking water aware of the aspects of quality and processing technics.

For this, three other films were made.

– **Generic** : (Daily use) : through real scenes and animation, this film reminds of the importance of drinking water and the various daily uses underlining the quality aspect in which it reaches consumers.

– **Processing techniques** : This film explains, in a simple means, through cartoons and real scenes, the processes of processing and the control of quality undertaken during the operation.

– **Scientific means of control** : made by through real scenes, this latest film shows means used in the ONEP Laboratory of control of waters' quality to secure, in an efficient and sure manner, quality in various stages of production and distribution whatever is the origin of the resource.

## 6. Conclusions

Provided that a global policy to fight squandering of drinking water is adopted and provided that the cost, relatively high, is accepted, a campaign to make the public aware to water economy, the strategy of which has already been defined, is usefully integrated in this policy both to make people aware on the importance of drinking water and as a means to reduce the demand of drinking water.

When carrying out the campaign, a special attention was granted for this campaign not to reduce health effects of drinking water supply (rather seek to increase them).

Since 6 years, our action was mainly one of information for all the citizens. We use mostly cartoons as it is a very appreciated means which helps convey all our message in a funny way and without dramatizing.

This information was at the same time in the form of analysis information on technology and prices and in the form of practical information, an aspect difficult to obtain and vulnerable because of the population wasting of water resources.

It will help distinguish between drinking water and all other types of water because it is the only with a *LABEL QUALITY*, an agreement for health authorities.

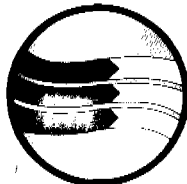
At last, this campaign is to be continued with prompting people awareness to pollutions and their incidence on waters likely to be used for people's food.

This campaign is destined to all the public who uses and consumes drinking water, other actions are necessary to complete its efficiency.

– The creation of a body to advice industrial consumers on water saving means adapted to each enterprise.

– Conduct a general investigation to identify main sources of drinking water squandering both at the production level, the distribution network and the consumers.

– Nominate a "Mister Water Economy" who will be a skilled executive knowing perfectly the field of drinking water to secure a follow up of the awareness campaign, a task that will rule out any administrative responsibility while permanent disponibility is a needed requisite to succeed in having good contacts with the media.



## SENSITIZING CAMPAIGN TOWARDS DRINKING WATER SAVING

**T**he National Drinking Water Office (ONEP) is a public organization in charge of the planning of the sector, the production of drinking water, and its distribution, as a manager, upon request of the Communes. It also assumes shared responsibility for the control of the pollution of the water liable to be used for human consumption in coordination with the relevant authorities.

The various aspects inherent to water saving are linked to the types of consumers. Concerning drinking water, ONEP has undertaken a number of technical, financial, administrative and educational measures aiming at maximum control of water wastage. The present brochure introduces the Public Sensitizing Campaign towards drinking water saving.

Following a picture study and the consideration of the specificities of drinking water as well as the reactions of different groups of people to the idea of launching a campaign in favor of drinking water saving while preserving all the benefits linked with its use.

Obviously, it was important that our campaign was only an informative one and could in no way because for any possible mass psychosis on water shortage, nor could it be interpreted as an invitation to refrain from using water for the legitimate of hygiene and nutrition requirements.

The campaign was indeed perceived as an anti waste one.

The campaign has mostly focused on the audio visual support (television). It has been made up in the first stage of a 10 large-audience targeted commercials.

In addition, provisions have been made for written support which is an appropriate supplement towards the objectives in mind.

The 10 commercial headings

N°	Designation	Duration
1	Introducing the logo	15"
2	Water is a rare commodity	45"
3	Car cleaning	30"
4	Washing up	30"
5	Households installations repairs	30"
6	Pricing	40"
7	Social connections	40"
8	Daily use	50"
9	Treatment techniques	55"
10	Scientific control means	60"

### CONCLUSION:

We have been focusing on the aspect of public information for 4 years now. The approach used is the use of cartoons most of the time as this means seems to be quite popular and allows for the dissemination of the messages while dedramatizing them.

These messages convey content information on the technologies used and the prices and practical information and tips on how to use this rare resource which is also difficult to secure and quite vulnerable because of the dangers it incurs from the effects of pollution on the water resources.

This will help differentiate between drinking water and the other types of water, as it is the only one to have a QUALITY LABEL, guaranteed by the health authorities.

The target of the campaign is to carry on sensitizing the population to the issues of pollution and its consequence on the water liable to be used for human consumption.

The following drawings and photographs outline the content of the 10 commercials. Follows also a brief summary of each film.



# INTRODUCING THE LOGO

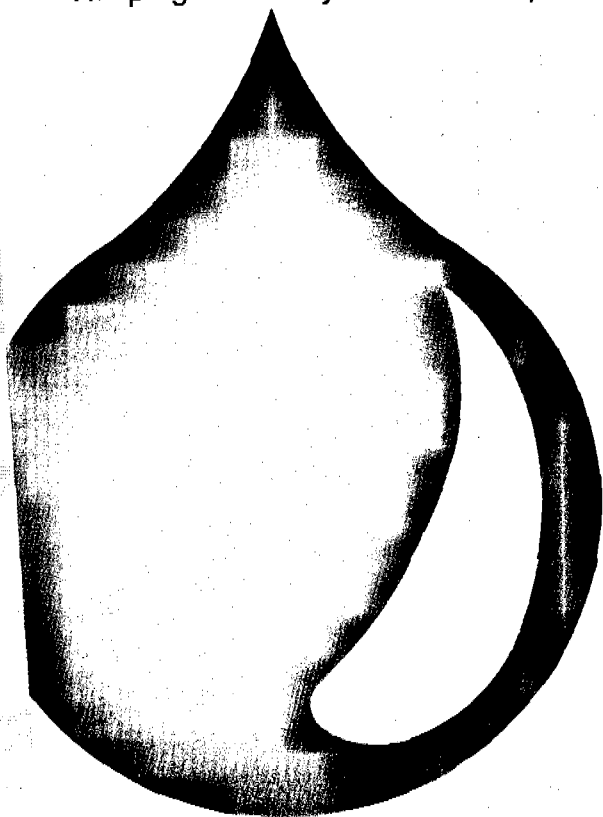
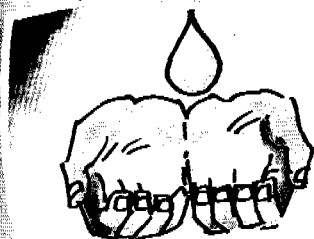
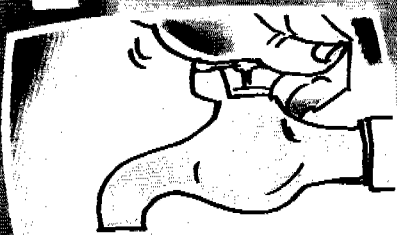
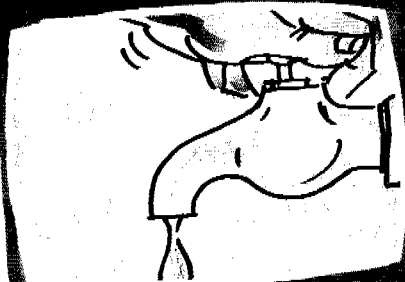
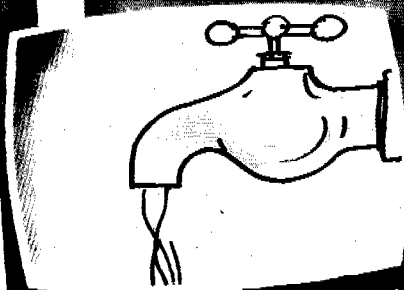
15"

**T**his film has helped situate the concept of drinking water . In fact, the study has shown that the Arabic equivalent for drinking potable water is: "water fit for drinking". This was cause for confusion in that it was seen as referring to any water of any origin. We, therefore , have proceeded to the shooting of a 15 second film explaining the concept behind the campaign and introducing the Logo: two cupped hands ready to catch a drop of water falling from a tap.

The message has been both simplified and clarified:

***"Drinking water is essential to good health: use it sparingly".***

The end footage of this film has been used as a signature to all of our campaigns be they visual or scripted.



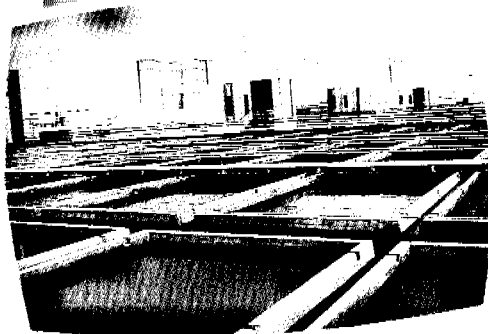
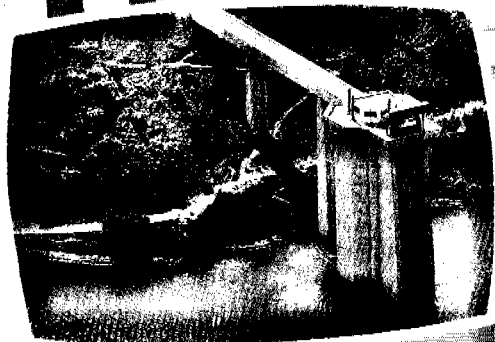
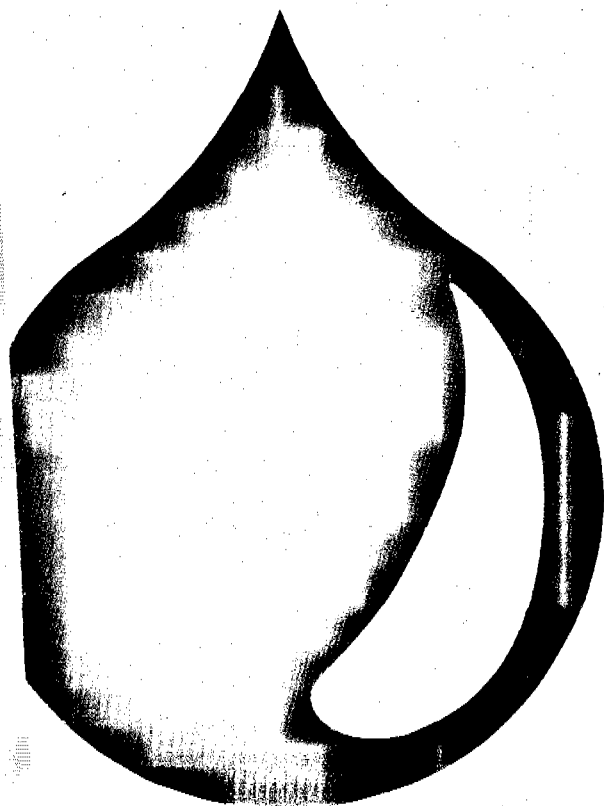
# WATER IS A RARE COMODITY

45"

**T**he film "*Explanation of concept of drinking water*" aims at introducing in a synthetizing way the whole of the treatment processes required for water potabilization.

This film fulfills four function :

- to better frame the concept of drinking water,
- to remind that water is a rare commodity and a difficult one to treat,
- to show that all these treatment processes are time consuming and costly,
- to show that wasting water or using it carelessly amounts to wasting a rare , costly and vital resource.

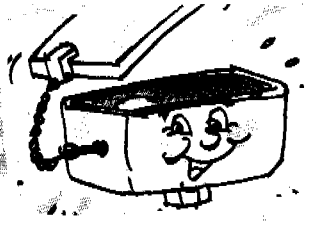
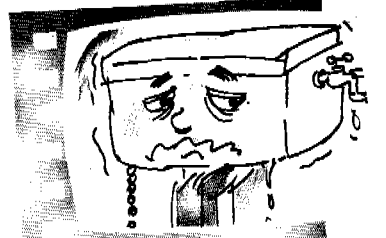
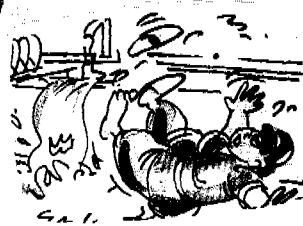
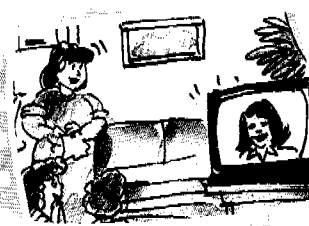
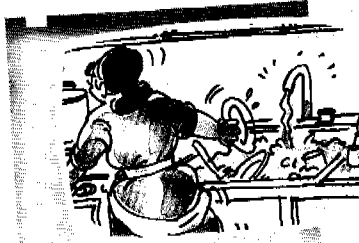
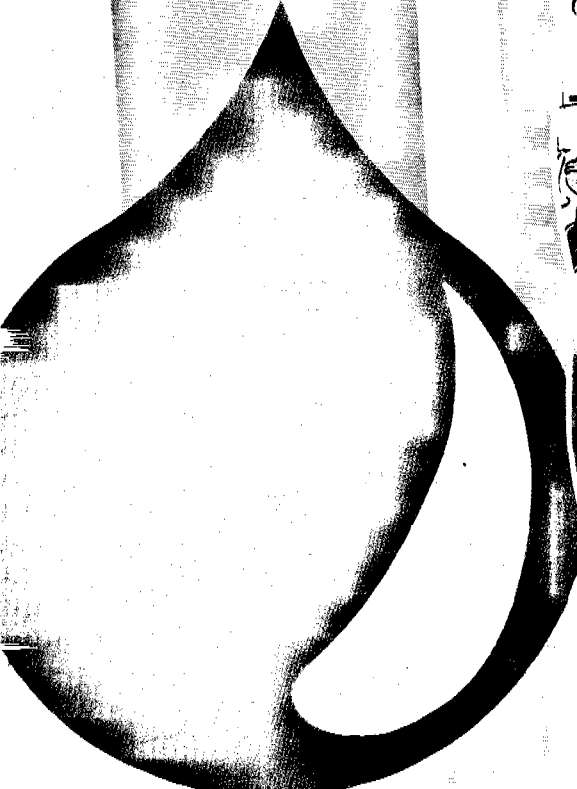
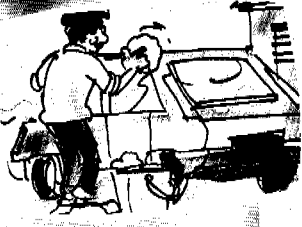
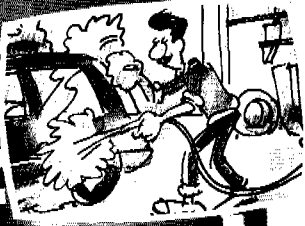




# TYPICALS CASES OF DRINKING WATER WASTEAGE

- *Car cleaning (30")*
- *Washing up (30")*
- *Households installations re-  
pairs (30")*

These three films are "advisory" films. They contrast the right and the wrong approaches to the most common cases of water wasteage due to lack of information trough amusing cartoon sequences.



# PRICING

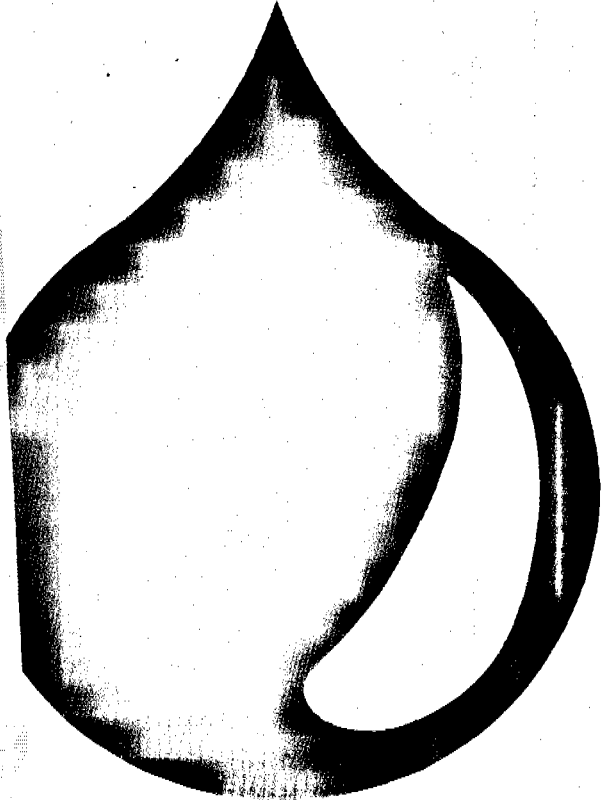
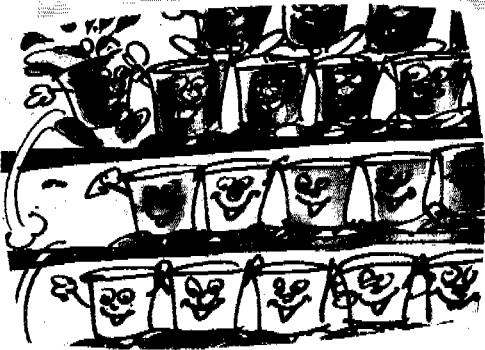
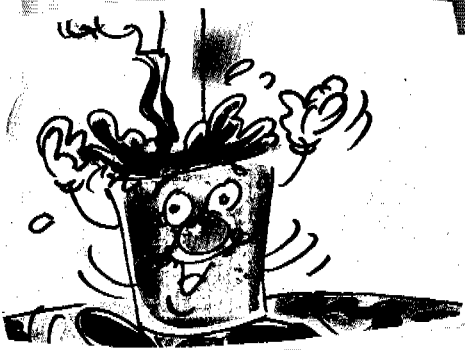
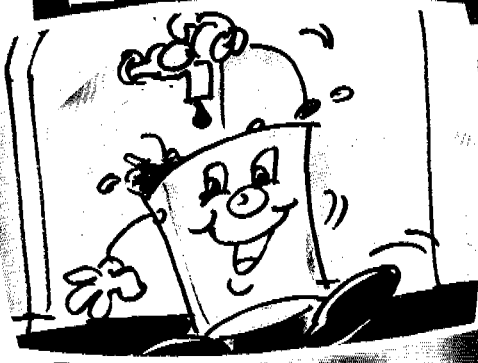
40"

Following information as to the concept, advice to the actual consumers, the issues of cost and wasteage have been dealt-with through **drinking water pricing** in three levels:

- Level A, so called Social Level, where the volume of water used corresponds to the basic needs of a household and wicth price is lower than the real cost price,

- Level B, wicth pricing is almost of the same level as the real cost price of drinking water,

- Level C, for wicth the consumer pays for wasted water.



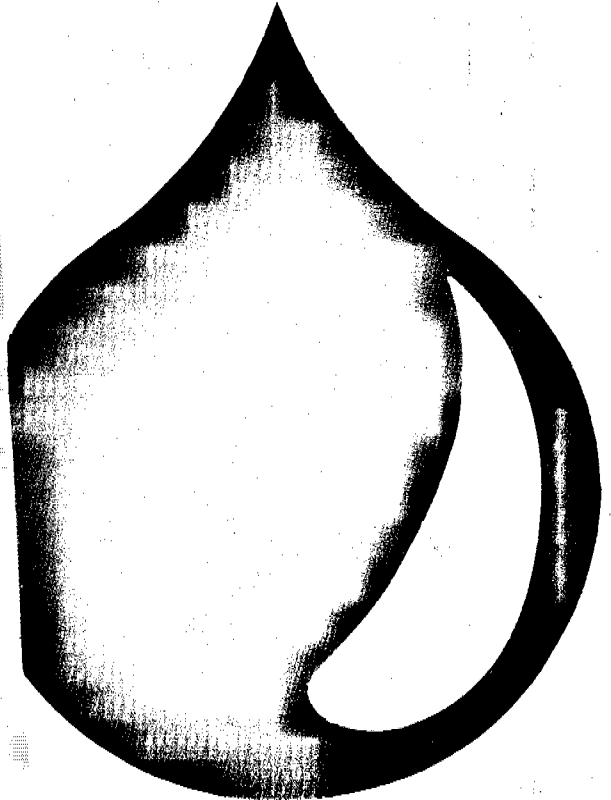
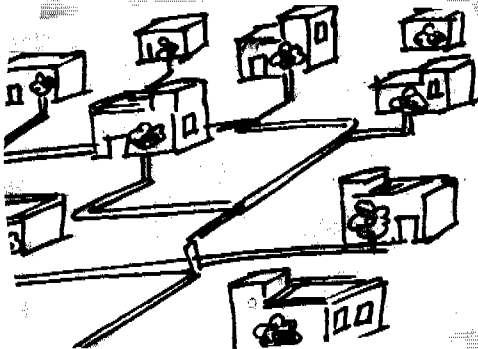
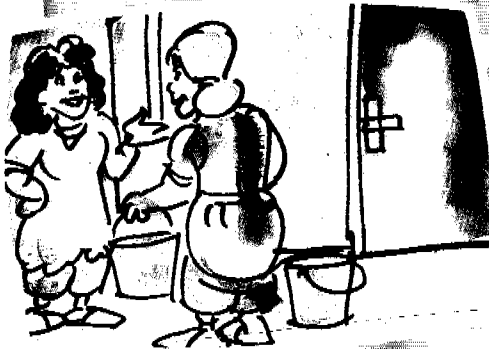
# SOCIAL CONNECTIONS

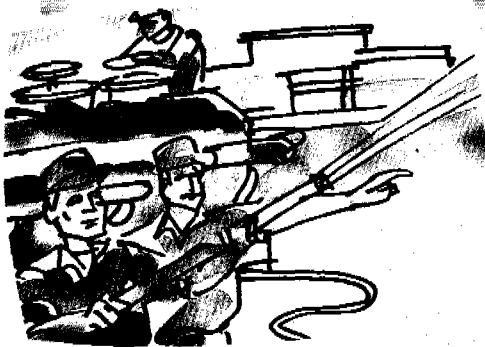
40"

**P**arallel to the water saving campaign, the issue of access to drinking water, a vital factor for the improvement of hygiene and health has been highlighted once tariffing has been explained. A motivating campaign for drinking Water Social Connections has been launched.

This campaign had two objectives:

- To highlight the quality of life achieved through the availability of home water facilities,
- To show the connection is possible once the district is connected to the mains, and, mostly, that connections fees are quite affordable because the State allows for comfortable payment terms to help the citizens.





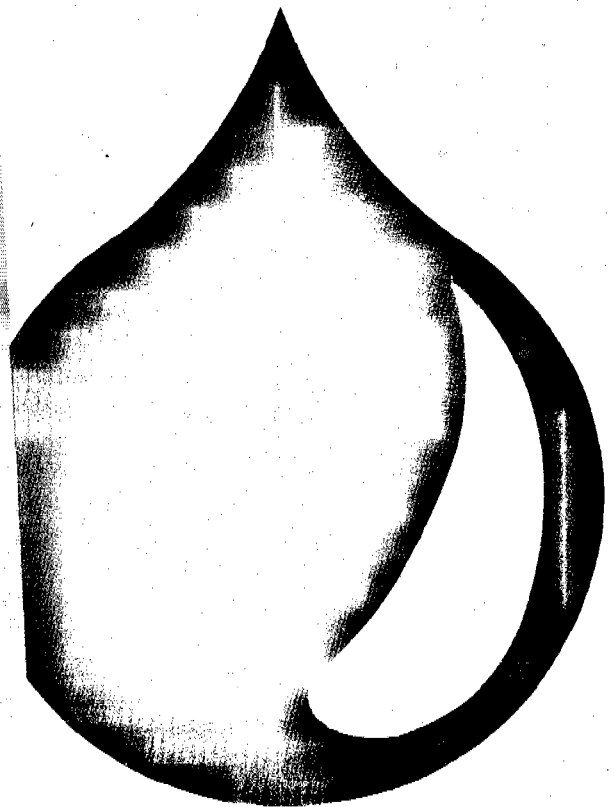
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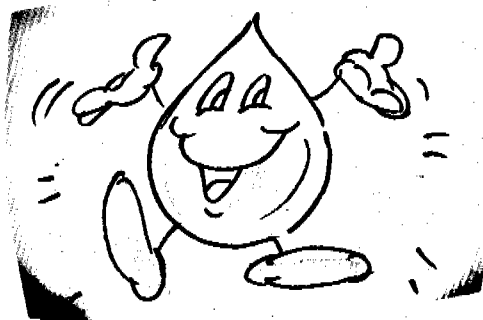
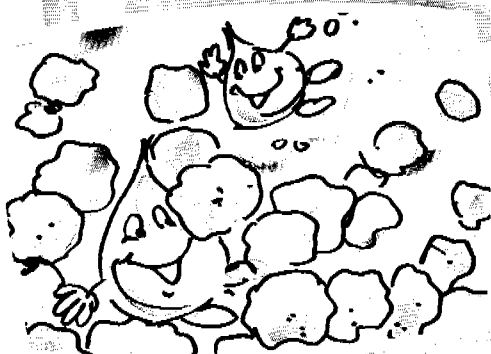
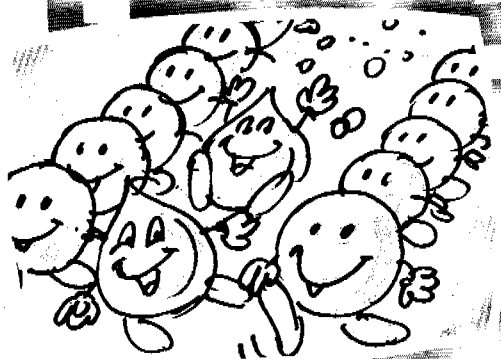
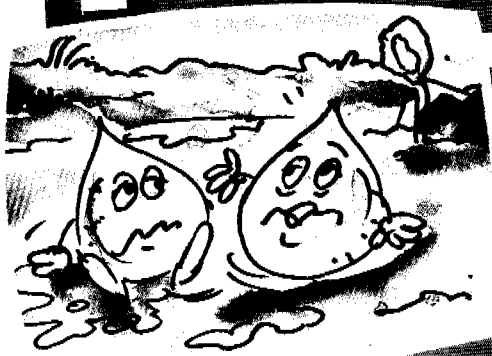
## DAILY USE

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50"

**R**ealized in actual real-life shots and in cartoons, highlighting the importance of drinking water and the daily uses while stressing the qualitative aspects inherent to the water as delivered to the consumer.





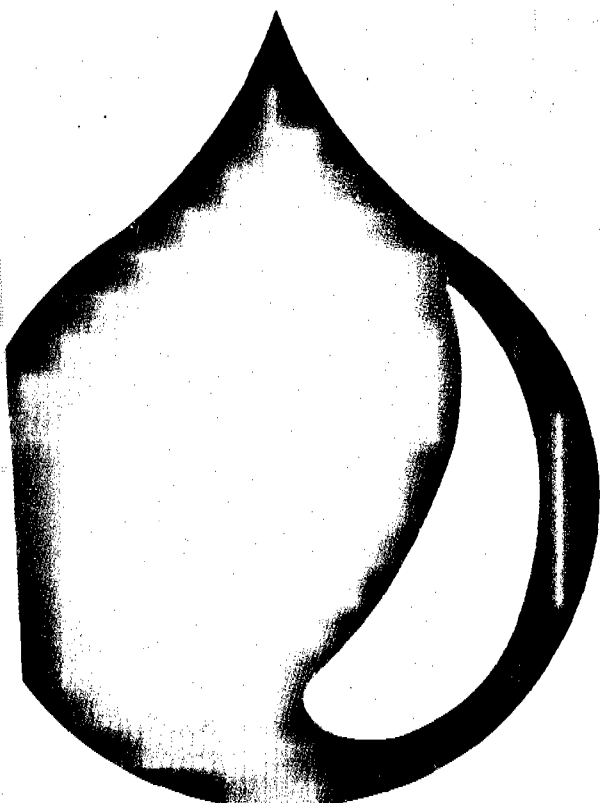
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## TREATMENT TECHNIQUES

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55"

**T**his film highlights in a simple way through cartoons and real-life shots the treatment and quality control processes undertaken throughout the process.





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## SCIENTIFIC CONTROL MEANS

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60"

**P**roduced in real-life shots, this commercial shows the means in use at the level of ONEP water quality control laboratories so as to efficiently insure adequate control throughout the various phases of production and distribution, regardless of the origin of the water.

