

# EMERGENCY WATER AND SANITATION ASSESSMENT AND ACTION PLAN FOR YEREVAN, ARMENIA

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## **EMERGENCY WATER AND SANITATION ASSESSMENT AND ACTION PLAN FOR YEREVAN, ARMENIA**

Prepared for the USAID Mission to Armenia  
and the Newly Independent States Task Force,  
Office of Emergency and Humanitarian Assistance,  
U.S. Agency for International Development,  
under WASH Task No. 451

by

Terrance M. Rahe, R.S.  
Kenneth C. Choquette, P.E.

May 1993

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## ABOUT THE AUTHORS

Terry Rahe is a registered sanitarian with a Master of Science in Microbiology (and Soil Science) and post-graduate work in environmental health with over 22 years of experience in various public and environmental health positions. Rahe has had extensive international experience including many hands-on assignments in disaster/refugee type situations. Most recently, Rahe has gone on two assignments for WASH including helping to set up the water and sanitation systems for the Kurdish refugee camps in Northern Iraq (as part of the OFDA/DART team), and in Parimarimbo, Suriname, Rahe did an assessment of urban and peri-urban practices for recommendations to prevent the spread of cholera through water, food and sewage. Also for WASH, Rahe is currently the author of a technical note on household-level disinfection.

Ken Choquette has a M.S. in Water Resources (Civil Engineering) with almost 30 years of broad based experience in engineering activities related to water and sanitation. Choquette is currently the Director of Health Engineering for the Iowa Department of Public Health where he directs state-wide activities for a wide range of environmental health programs. Choquette has a solid engineering knowledge of industrial and municipal sewage treatment facilities and public water supplies as well as knowledge of the type of public education campaigns that are effective in promoting public understanding and voluntary compliance in critical environmental health areas. Choquette has also worked extensively overseas including two years in Pakistan, two years in South Vietnam, and a range of short-term assignments in Sudan, Peru, Belize, and Guatemala.

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Albert Kajoyan\*-Yerevan Chief Engineer for Water and Sewage

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Manvel Manzikian-Director of Department of Epidemiology, Ministry of Health

Samuel Mavisakalyan-Deputy Yerevan City Mayor

Valdimir Davidiants, PhD (CDC Coordinator)-Armenian Institute of Health

A. Gomtsyan-Director of State Company for Residential Water and Sewer Services

A.G. Houlyan\*-General Manager of state company for Residential Water and Sewer Services

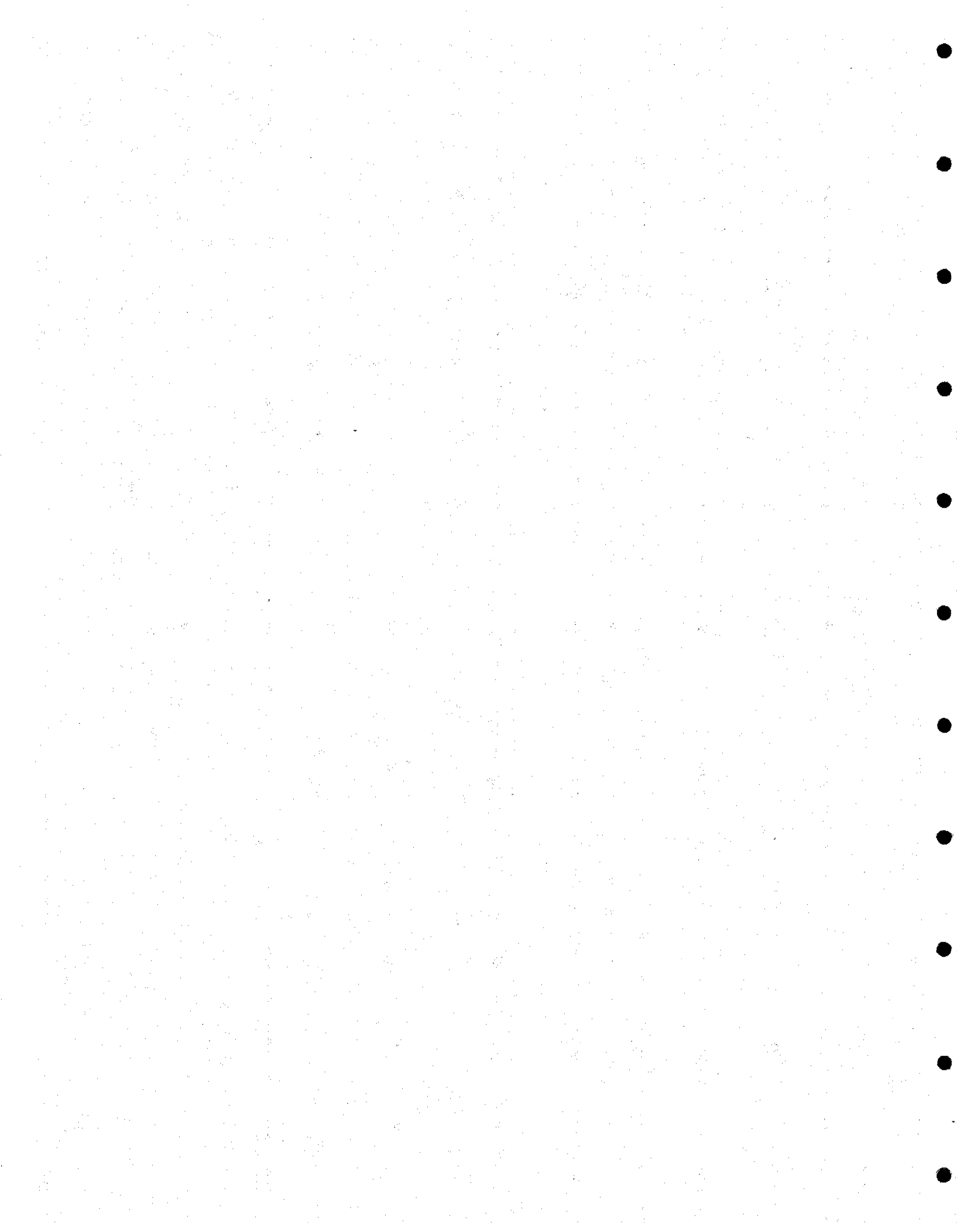
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Albert Jamharian-Chief Operator of the Vandazor Water and Water Systems

Robert McClendon and American University Peace Corps Volunteers.-Director of Peace Corps/Yerevan

Avetick Kdstandian-USAID staff member/Interpreter

\* Key contacts on water and sewage systems.



## EXECUTIVE SUMMARY

At the request of USAID/Yerevan and the Newly Independent States Task Force of the United States Agency for International Development, the WASH Project fielded two consultants to perform a short-term assessment of the water supply and sanitation conditions in Armenia. The Armenian capital city of Yerevan and three other cities with documented waterborne disease outbreaks were evaluated.

Opportunities for short-term remedies to improve conditions relating to water, wastewater, solid waste, health education, and household-level water and sanitation were identified.

Two WASH team members met with city water and sanitation officials from Yerevan, Vandazor, Abovion, and Artashat. Staff members from the Armenian Ministry of Health and PVO/NGOs also provided invaluable input to the assessment project. All government entities in Armenia are struggling to maintain basic public health services in the face of an energy blockade which has left most of the country without any residential heat and water and with electricity for two or less hours each day. Although providing energy to the country's public services is given high priority, in reality, power to run chlorinators, pressure pumps for the water system, and sewage lift stations is unreliable and, when available, delivers low voltages which quickly destroy much of the remaining operational equipment. The disorder (which has overtaken many of the former Soviet Union countries) makes repair and replacement services almost impossible.

Observations made in the four cities lead the consultants to conclude that current conditions represent a high risk to users of the municipal water systems. These risks stem from daily alternating positive and negative pressures, breakage of water systems, the effects of the 1988 earthquake, and deterioration of treatment equipment.

Sewage collection systems are in serious disrepair. As a result, significant quantities of untreated sewage are released under dwellings, on hillsides near housing developments, and into the Razdan River. The combination of leaking water lines, negative line pressures, and significant quantities of sewage released on the ground surface and into the shallow groundwater presents a high risk of direct hand-to-mouth disease transmission.

Solid waste represents less of a threat to health because of the cold conditions which existed at the time of the visit (March).

It is recommended that several short-term actions be undertaken. Chlorination, which operates in cold weather with minimum electrical power, should be provided by USAID to key locations in each water system. Appropriate equipment for repair of both water and sewage disposal systems should be provided. An equipment list with specification and an estimated budget is provided as part of this report.

In addition to providing equipment, it is recommended that communications support and health education activities be undertaken. The development of appropriate and effective health education material in conjunction with the Armenian Ministry of Health will allow the initiation



of two health education campaigns. These would be carried to the public at large in Armenia. An additional emphasis involving existing Peace Corps staff would focus on the highest risk populations in poorer sections of the cities and the refugee populations that live in public buildings such as abandon dormitories and old jails.

Steps to prepare public health officials for an outbreak of waterborne disease are also recommended. In February 1993, the government formed an Emergency Epidemiological Committee. This group should develop a detailed contingency plan and rehearse it. In response to a Ministry of Health request, the Republic Sanitary Epidemiological Laboratory should be reinforced. This laboratory should be provided with materials and equipment to improve the speed with which it can identify the source of an outbreak and subsequently verify that the problem has been resolved. A listing of recommended equipment and specifications was developed for this report.

A two-member project implementation team is recommended to install equipment, train Peace Corp Volunteers, and perform additional household plumbing assessments.

Longer-term recommendations are provided for future consideration and to address the basic infrastructure changes for better design and maintenance of the utilities.

## Chapter 1

# INTRODUCTION

### 1.1 Purpose Statement

The purpose of this activity was to provide an assessment of the safety of Yerevan's drinking water supply and sewage disposal system and to make recommendations for correcting any immediate health hazards (emergency actions). The consultant team was also asked to make recommendations for permanently correcting deficiencies (longer-term actions).

In addition, the team made recommendations for the water and sewer systems serving other areas of Armenia.

The assessment examined municipal water supply systems; municipal sewage collection, treatment, and disposal; health education/public information; household-level water and sanitation use, behaviors, and systems; and municipal solid waste.

The assessment was originally request by the USAID/Yerevan Mission representative Suzanne Olds. The project was also supported by Don Krumm, AID/NIS/TF/EHA, and Dennis Long, AID/NIS/TF/ENV.

### 1.2 Team Composition

On-site investigative, consultative, and evaluative efforts were contributed by Dennis Long (AID/NIS/TF/ENV), Ken Choquette (WASH consultant, public health engineer), and Terry Rahe (WASH consultant, public health sanitarian and team leader). Invaluable support was provided by Avetick Kdstandian, USAID/Yerevan.

### 1.3 Key Contacts

The field assessment team arrived in Yerevan on March 10, 1993, and departed on March 24, 1993. Dennis Long provided guidance and support for the team March 10-17. The assessment team traveled to Vandazor, Artashat, and Abovian where there have been major outbreaks of waterborne disease. Most of the assessment effort focused on the capital city, Yerevan. The team interviewed numerous city and ministry staff members, as well as several PVO/NGO representatives. The assessment team appointments are listed in Appendix A.



Map 1

## Chapter 2

### BACKGROUND

#### 2.1 Setting

The Republic of Armenia has a population of approximately 3.5 million. The population of Yerevan is about 1.5 million. The capital city and the other major cities as well as adjoining republics and countries are shown in Map 1.

Armed conflict between Armenia and its neighbor, Azerbaijan, over the independence of the Karabakh State has resulted in an economic blockade (including fuel, transportation, trade, etc.) and has made it very difficult to provide basic needs. Industries and schools have closed. Electricity and water services are provided 2 to 12 hours per day, on an irregular basis. There is no heat in homes or buildings. The city has a non-operating central hot-water heating system (oil "Mazoot" to hot water) that was designed to heat most of the high-rise residential and commercial buildings of the city. Interruption of the drinking water system occurs on a daily basis.

The country has been under Soviet rule since 1920. In September 1992, following the demise of the USSR, Armenia declared independence with the desire to become a democratic and independent republic. With the economic drain of the continuing war and seriously deteriorated infrastructure, the country is struggling to survive.

Yerevan's population of 1.5 million is served by the city's water and sewer systems. In addition, 500,000 are served in adjacent peri-urban areas outside the city boundary. There are 200 to 300 industrial water and wastewater connections, but due to the embargo/war, only 60 or so are utilizing water from the system. The city is situated at the edge of the Armenian Highlands and lies in a series of hills and valleys with a total estimated elevation drop within the area of 500 m. Lower elevations near the Ararat Valley are approximately 914 m above sea level.

The soil and geological conditions are sandy with rock outcroppings throughout the area. Temperatures range from -20°C to +40°C, with average precipitation of 10 to 20 cm/year. Very dry conditions are experienced during the summer months. The highland areas, including Mount Ararat in nearby Turkey, provide an abundance of artesian and spring sources of water. Armenians feel very strongly about the value of their "pure" water source and the importance of maintaining its quality.

The vast majority of residents in Yerevan live in multifamily high-rise buildings (10 to 15 stories). Refugees and displaced persons from the war in Nagorno-Karabakh have been incorporated into the city's population. They are not separated into "camps" but are placed, when possible, with relatives, in apartments, or are housed in any available public building. In general, refugees living in old dormitories, schools, and miscellaneous public structures such

as jails have lower levels of infrastructure support than the rest of the population. Yerevan also has some communities of long-time residents who live in make-shift housing. In those settings, several families may share a toilet or a water spigot.

## **2.2 Reporting on Epidemiology and Waterborne Diseases**

In December 1992, a new reporting program was initiated by the Armenian National Institute of Health, USAID, and the (U.S.) Centers for Disease Control and Prevention. The newly created Emergency Public Health Information Surveillance System (EPHISS) was, in March 1993, only about three months old. As a result, it is difficult to use newly generated data and to make comparisons with disease incidence levels of six months ago. In addition, some of the parameters cannot be reported at all because the information is not available to the staff.

Field information and written reports from the Ministry of Health and the Institute of Health (CDC Team) reported recent outbreaks of diarrheal illnesses and hepatitis. In particular waterborne disease outbreaks have been reported in early 1993 from smaller communities in Armenia (Abovion, Artashat, and Vandazor, where seven children died). These communities are served by municipal water and sewer systems. The reports specifically conclude that the outbreaks were due to contamination in the water systems (Appendix B).

Data for the Yerevan area show no reports of actual outbreaks in 1993, but the Ministry of Health feels it is likely that waterborne illnesses have increased and are likely to continue to increase if water, sewerage, and other living conditions don't change.

Nationwide reports for 1991 and 1992 do not show alarming trends in increased disease rates. These data do show high rates in some waterborne disease categories such as hepatitis A (Appendix C). Trends in diarrheal diseases appear to show peaks in the spring (March) and fall months (August/September) (Appendix D).

The normal function of the microbiological and chemical (chlorine, etc.) labs in investigation of cases is limited due to lack of lab facilities, material, and funding. Irregularity of energy and lack of heat are major concerns of the Ministry for maintaining its disease surveillance. On February 10, 1993, the government formed an Emergency Epidemiological Committee under the State Minister of Health. A report of the EPHISS for March 1993 is contained in Appendix E; it gives a dramatic picture, through data and narrative, of the health and nutritional status of the population.

## Chapter 3

### OBSERVATIONS/FINDINGS

#### 3.1 Municipal Solid Waste

##### 3.1.1 Description

The solid waste collection and disposal system is based on the placement of various collection containers throughout the community. These containers are emptied into collection trucks for transport to disposal. Although large quantities of waste are not evident in the streets, it is not necessary to look far to observe solid waste accumulations which provide food and shelter for rodents. Commercial high-rise buildings which contain 20 to 30 families have a garbage chute designed to dump into a collection box of one cubic meter. These boxes were designed to be hydraulically dumped into the collection vehicle for transport to disposal.

##### 3.1.2 Observations

Fuel and repairs required to operate collection vehicles are limited. In two weeks of traveling through the streets of Yerevan, the consultants observed only three collection vehicles in operation. The vehicles were in marginal condition and needed extensive repair. Compactor equipment was seen on one vehicle; the hydraulics were inoperable, however, and the rear gate was fastened open to allow collection personnel to shovel waste into the vehicle. The collection system was designed around the standard cubic meter collection containers. Equipment for mechanical loading of these containers was not evident. Crews were observed dumping the containers into the street and shoveling the contents into the collection vehicle by hand.

Many of the communal garbage collection systems are inoperable or unattended. As mentioned above, many of the multiple family high-rise buildings were designed with a garbage chute which emptied into a cubic meter steel box. Many of the boxes are missing and the space had been filled with garbage discharged from the chute. Residents reported that the smell during summer months was unpleasant and that the chutes were cleaned only infrequently.

Public collection receptacles located along the major streets were full; only minor amounts of trash were observed outside of these municipal containers. These containers are distinguished from the cubic meter boxes in that they are located along streets and are used by pedestrians and frequently by adjacent home owners.

Residents were observed collecting leaves and yard trash and disposing of it by open burning. These observations were made during the spring snow melt and appeared to represent customary practices among the residents of Yerevan.

Some of the multistory commercial buildings were observed to have minor accumulations of waste behind the buildings and near the designated trash pickup points. Putrescable garbage was not apparent in this waste.

Rodent vectors were not observed by the investigators; however, homemade rat traps were observed for sale in local markets. Rodent infestations were widely reported by residents and PVO/NGO staff.

Epidemiological evidence does not suggest an increase in disease associated with rodent vectors. Typhus incidence rates are stable and do not appear to be increasing dramatically (see Appendix C). Ministry of Health officials stated that the onset of warmer weather will lead to increased rodent populations, due to increased availability of food and cover and decreased garbage pick up caused by the energy blockade.

## **3.2 The Municipal Water Supply System**

### **3.2.1 Description**

Yerevan's water supply has two sources: mountain spring/galleries which provide 2,000 liters/second (l/sec.) and artesian wells (some "flowing" wells) which provide the remaining 4,050 l/sec. to supply the area. Total amount is 6,050 l/sec. The galleries and well fields are located in four separate areas 20 to 25 kilometers (km) outside the city limits. The flow rates are based on very limited meter readings and the attached 1992 "Mission Erevan," French report (Appendix F).

Treatment is liquid (gas) chlorination only. The two principal spring areas provide about 30 percent of the flow. The remaining flow is provided through the 20 or so tubewells located outside of the city.

Water flows through pumping stations (or points of interception) to eight "administrative" zones. Further distribution is through 14-15 ground reservoirs to the points of use (see Map 2; and Appendix F).

There is the general impression that city and State officials are telling the public to boil the water before drinking, etc. No official written statement could be identified.

### **3.2.2 Observations**

#### **Spring/Galleries and Wells**

- Spring houses were somewhat deteriorated but water shed areas were fenced and provided with security officers and resident operators (See Photos 1 and 2).
- 50 to 70 l/sec submersible pumps are used in the 100-200 foot 10 in.-steel-cased wells. Voltage fluctuations and numerous off-and-on cycles are experienced by the



Տ.Պ. (20km south)



operators. Some wells/pumps were out of service. Repairs are being made but only limited parts were reported as being available.

- No well seals were found on most of the well casings (See Photos 9 and 10).
- There was no evidence of low-voltage protection devices. (If they were available, the pumps would still not run due to the continual low voltage fluctuations.) Written reports show an average of 45 cycles in the power source. It is believed that line sources are designed to provide 50 cycles at 240 volts.

#### Pump Stations and Chlorination Reservoirs

- There are 14 sites outside the city at pump stations or points where collection lines from the gravity systems converge.
- According to Mr. Kajoyan, liquid (gas) chlorinators are located at most of these points. The four chlorinators which were observed were old and deteriorated (See Photo 11). Mr. Kajoyan pointed out that his operators had difficulty maintaining operation, especially in below-freezing conditions. He requested assistance in replacing them.
- Eight 3,000 hp/centrifugal pumps power the two largest pump stations and provide capacity of 4,060 l/sec. One of the pumps was out of service. Repairs of motors and pumps are provided on site (See Photo 12). The station operator and Mr. Kajoyan expressed the need for chlorinators and material for "rewinding" electric motors. (Note: The operator told of a General Electric motor which has been operating without repair since 1947.)
- Low voltage and power surges were problems for maintenance of pump efficiency.

#### Main Feed Lines and Reservoirs

- Steel water lines of 100 to 150 cm diameter convey water to the eight "zones" within Yerevan. These lines, particularly those from the large pumping stations in the south, are laid through areas of very shallow groundwater. Leaks were observed in the lines (See Photo 13). Mr. Kajoyan pointed to the difficulty of repairing such pipes without underwater welding equipment.
- The 14 reservoirs generally are located at higher elevations but do not provide the pressures necessary for the many newer high-rise residential buildings (Photos 23 and 24). Reservoir vents were broken at some sites (See Photo 14). Actual interior conditions could not be observed, but reservoir deterioration and leakage were observed and also were reported by field operators. One reservoir near the prison was out of operation because of high water loss.
- Mr. Kajoyan reported up to a 30 percent loss due to leakage throughout the system. The French Report (Appendix F) indicates it may be much higher.

- No chlorinators were observed at reservoir locations, but Mr. Kajoyan agreed they would be good locations to boost chlorine residuals to residential areas.

#### Distribution Lines to Residential Areas

- Leaking distribution lines were observed at various locations. (See Photos 13 and 31). Mr. Kajoyan reported that many of the mains are in poor condition and need replacing.
- Raw sewage was noted flowing from a number of manholes and cascading down hillsides from broken service lines in the Massive housing area where water lines were located. (See Photos 15 and 18).
- Service lines to the buildings were reported to be leaking and broken. Waterline leaks were observed at several service connections to homes and high-rise buildings.
- Inside pipe corrosion is a problem particularly in lines that carry "soft" water from spring sources. Mr. Kajoyan asked for ideas on how to reduce pipe corrosion. The team said it would provide information on "in situ" methods. Technical information was given on corrosion control (pH and saturation index)—more information was promised by the consultants.

#### Plumbing in Buildings and Water Pressure

- Based on inspection of plumbing in a hotel and a converted dormitory (for refugees), waterlines were broken, shower hoses were used in conjunction with bathtubs, and vacuum breakers on flush closets were not present.
- In many cases, individual high-lift pumps are provided for buildings to maintain pressure in the 8 to 10 stories. As power failures, water service interruptions, or mechanical breakdowns occur, negative pressures are often experienced.

#### Drinking Water Quality

- Source water was very clear and no odors were experienced (See Photo 3). The spring water is "soft." Mr. Kajoyan reported there were problems with interior pipe corrosion.
- Bacterial monitoring records were not observed. There appears to be no reliable laboratory equipment facilities available.
- At times there are chlorine residuals, but current records could not be located. It was stated that maintenance of residuals was a problem. "Orthotodine" was available but appeared to be considerably aged.

(Mr. Kajoyan attempted but couldn't obtain a sample to determine if there was a residual in the water at his office. When he saw there was no water, he quoted a "famous" Russian, saying: "I am like a shoemaker without shoes.")

- Many users noted cloudiness in water (red/brown). One hotel water sample record showed high iron content.

#### Management of the Yerevan Water System

- Operators and technical staff were quite knowledgeable and experienced.
- Monitoring records and routine bacterial and chemical testing were not provided.
- Salaries were equivalent to \$10 to \$60 per month.
- Ministry of Health field staff, the city's water system employees, and the State Company for Residential Water and Sewers Company staff were not expected to coordinate activities. The agencies have overlapping duties in terms of operations, responding to complaints, and investigating outbreaks.
- Water service metering and enforced fee collection do not exist. Monthly water service cost is around 15 rubles (5 cents) per month, and users are not really expected to pay.
- Large excavating equipment and pipe materials were present on site. Mobil equipment for detecting leaks and excavating hard-to-get-at areas was not available.

#### Other Communities

- Mr. A. G. Houlyan, of the Residential Water and Sewer Co., reported very similar lack of adequate chlorination and equipment in the smaller communities. He specifically identified the need for technical assistance in areas such as corrosion control and leak detection.
- The inspection of the sand filtration plant at Vanadzor revealed inadequate electric power and inoperable chlorinator.

#### Detection and Control of Waterborne Disease Outbreak

- The newly created Emergency Public Health Information Surveillance System (EPHISS) shows drastic increases in disease rates over those reported six months earlier. For example, Hepatitis A is shown as having a 357 percent increase from six months ago. Diarrheal illness shows only a modest 9.9 percent increase over six months ago (Appendix E).
- In the event of a waterborne disease outbreak in the city of Yerevan, the Republican Sanitary Epidemiological Laboratory and the Yerevan Regional Sanitary Laboratory will be critical to the early microbiological detection, characterization and control. The

Republican Sanitary Epidemiological Laboratory is located in the capital city of Yerevan. This laboratory is responsible for all verification work when waterborne disease is suspected. This is the critical facility relied upon to identify the source of water contamination and subsequently to verify that the source has been eliminated.

- The Republican Sanitary Epidemiological Laboratory has only minimal water testing capacity due to equipment, power, and reagent shortages. A visit to the laboratory demonstrated that the absence of electrical power left only one small kerosene-heated incubator in operation. There were no similar sources of refrigeration present. The ambient air temperatures make such refrigeration unnecessary at this time. Increasing spring temperatures will make refrigeration more important to laboratory operation. (As an interesting aside, the comment was made that staff members did not want to use kerosene refrigeration because it was viewed as a step backwards into the past.)
- The Ministry of Health stated that both sanitary laboratories in Yerevan have generator power supplies. Presently, the lack of suitable fuel to power the generators makes them of limited use. It is believed by laboratory personnel that in the event of an outbreak, the laboratory power would be of such importance that they would be able to maintain 24 hour operational status.
- Time lapses between water sample receipt and analytical results are viewed as a serious problem by the Ministry of Health. There were continued requests for an "Express Method" to be used in the microbiological evaluation of drinking water. Both the Most Probable Number and Membrane Filter methods are used for testing water. Only a single membrane filter device was observed in the Republic Sanitary Epidemiological Laboratory. This device is capable of processing only one water sample at a time.
- A clear plan describing the roles of each government agency in the event of a waterborne outbreak was not observed. An Emergency Epidemiological Committee was formed on February 10, 1993, and is administered by the Minister of Health. In spite of this there does not seem to be a clear set of steps to be taken in the event of a waterborne disease outbreak. The roles of the various parties such as the water department and the sanitary authorities are not clearly delineated. None of the parties indicated that any practice or dry-run exercises had taken place.

### **3.3 Municipal Sewage Disposal System**

#### **3.3.1 Description**

A very large sewage treatment plant, which covers 50 acres, serves Yerevan and the nearby areas.

General design:

- Grit removal/primary settling;

- Secondary activated sludge and clarification and
- Tertiary chemical treatment and chlorination prior to discharge to Razdon River (25 km south of the City).

The current design capacity is 600,000 cubic meters/day. There is a new construction plan to increase capacity to 750,000 cubic meters/day. Major reconstruction has been stopped due to the current situation in Armenia. All parts of the city are reported to be sewered. With the exception of one smaller lift station, all sewer lines flow by gravity to the plant. A very large chemical plant is also connected to the sewer system.

### 3.3.2 Observations

#### Treatment Plant

- The eight bar screen units with mechanical cleaners were not operating due to mechanical and electrical problems.
- The aeration tanks were all shut down. Most appeared to have not operated for some time. Air diffusers were deteriorated and corroded (See Photos 16 and 17).
- Hypochlorinator was not operational.
- Sludge was being transferred to large sludge drying beds.
- The sludge dehydration/heat treatment system was not operating.
- Electricity was only available a few hours each day.

#### Sewage Plant Bypassing

- According to Mr. Kajoyan and the plant operator, approximately 50 to 60 percent of sewage is bypassed to the river.
- The plant effluent quality is 100 mg/l BOD and 45 mg/l TSS. Mr. Kajoyan reported no downstream water supply users.

#### Laboratory—Sewage Disposal Plant

The laboratory was not in full use; there was only limited activity. Equipment was outdated and the lab director asked for sources of new equipment and chemicals.

#### Sewage Collection System

- The only pump/lift station was not operating. Sewage was bypassing to the Razdan River which runs through Yerevan.

- Broken and leaking sewer lines were observed at various locations within the city. Raw sewage discharges from manholes were seen at various locations. (See Photos 18, 19, and 22).
- Sewage was cascading down the high slopes next to a large high-rise residential area "Massive" which houses approximately 100,000 people (See Photos 15, 18, and 20). The flow (estimated at 1,000 to 2,000 gal/min ) from the broken lines was entering the open stormwater system which leads to the river. A resident stated that many of the lines were purposely broken in order to irrigate small gardens located on the terraces nearby. Many old lines leading down the slopes had deteriorated due to age and erosion/instability of the soil.
- Wastewater was also noted flowing from privies in the more dilapidated areas of the city. Privies were plugged due to lack of water for flushing. In one instance, the basement area of a residential high-rise was flooded with raw sewage from frozen and building drains.
- Similar conditions existed in Vandazor where a city sewer overflowed into a temporary housing (refugee) area. This overflow was directly associated with a dysentery outbreak that resulted in the death of four children.
- Every operator spoken to indicated a strong need for detecting equipment and excavating tools to find and repair broken pipes and unplug sewers. As the frost leaves the ground, evidence of line breakage is anticipated by the city.

### Management

The chief operator and others were very well trained and demonstrated a high level of technical knowledge. They listed the problems they have and asked for more information on U.S. methods. **They stated (very graciously) that there have been a number foreign "experts" visiting them, but they have never received any response to requests.**

### 3.4 Household Level Water and Sanitation

- Household water and sanitation duties are shared by all members of the family. Where there is a working member (husband or wife), the other family members pick up the responsibilities of the employed member. It was also reported that some employees leave work during the day to take advantage of periods when running water or power is available.
- Sanitary conditions at the household level are greatly complicated by the general lack of energy. Many sections of the city have running water for only two hours each day.
- Electrical power is available for approximately the same duration but not at the same time.

- Automatic washing machines are totally unusable. In even the most expensive neighborhoods, all laundry must be done by hand. A considerable amount of time is spent doing laundry since residents are forced to wear four or more layers of clothing for warmth.
- Many families consist of two professionals and both are expected to work each day.
- Carrying water from areas with water to areas without it is a common event. The unusual aspect of this observation in Yerevan is that this statement may apply to both the horizontal and vertical plain. It is frequently necessary to transport water from a nearby location by bucket. The location may be five floors below, five blocks away, or both.
- Some standpipes were observed which reportedly provide running water for communities on a continuing basis. Other locations, such as an apartment in a high-rise, were reported to receive running water only on rare occasions.
- All families store water through various means. When water is on, it is reportedly allowed to run continuously until it stops.
- The types of temporary water storage which are employed are both wasteful and increase the potential for contamination of the water being utilized by households. Water storage methods vary widely. The worst conditions were observed in the refugee housing. Refugees located in the "Abandoned Polytechnical Dormitory" in Yerevan stored water in any device that would hold water; few of these containers could be covered. The water came from the only spigot, located within the communal toilet facility. The residents expressed to Red Cross officials their need for materials with which to pipe water out of the toilet facilities. All water was stored in the open hallway where adults passed to and from their rooms and children played to escape from the cold temperatures.
- In middle-class professional neighborhoods, water was stored in plastic containers and buckets. The buckets were stored in the bathtub, which is of limited usefulness under these conditions. Again the location and nature of storage represents a significant risk of contamination in the household even if clean safe water is delivered by the municipal water system. Hotels were observed to store water in bath tubs where shower hoses lay submerged at all times. These hoses were not connected to a vacuum breaker or backflow prevention device.
- Some areas of the city are more heavily affected by the shortage of water than others. Both the geographic location of the residence on the water system and the height of the home or apartment above the service main affects water availability. In some areas, the time of day during which water is available is reported to be regular and relatively predictable.
- Government officials indicate that nearly all of the city's residents have a connection to both the municipal water and sewage disposal system. Site visits in poorer

residential sections indicate the existence of community sewage disposal (or communal toilets) facilities, separate from the houses. At some of these facilities, water must be carried to them to flush the waste into the municipal system.

- Many of the connections to individual houses or multiple family high-rise apartments have been broken by freezing weather. The sewage at these locations spills directly from the house plumbing onto the surface of the ground under the structure.
- Within the city of Yerevan, water and sanitation problems of refugee households are very similar to those of the non-refugee community. Refugees are distinguishable from the non-refugee community in that some of them inhabit public buildings which were not designed for full-time residential use.
- Outside the city of Yerevan, the conditions faced by refugees and those left homeless by the December 1988 earthquake are more difficult, and the water and sanitation issues are critical. Much of the damage to the basic utilities within these communities remains. Water and sewer lines are still broken. Basic household water and sanitation conditions in these communities are even more disparate than the ones described above.
- The large disease outbreak which occurred in Vanadzor took place in a temporary housing area where residents live in shipping containers with no running water or individual sewage disposal facilities. This housing area was established in a public park near the center of the city after the devastating earthquake in 1988.
- Several sources in the health community expressed concern about food-borne illnesses related to lack of refrigeration for food storage. The Ministry of Health pointed to the country's traditional reliance on refrigeration and current lack of energy as a potential source of health problems. Their concern stemmed from knowledge of both current levels of household sanitation and institutional and commercial food handling practices.
- Sewage and water lines in the individual building utility spaces are frequently disconnected due to breakage from freezing. This creates a condition where sewage waste from broken plumbing can dump directly onto the water lines, which may also be damaged. Efforts to repair plumbing are limited by the availability of repair parts and a feeling that resources will only be wasted unless there is a way to prevent the reoccurrence of freezing next winter.



## **3.5 Health Education/Public Information**

### **3.5.1 Description**

Health education is managed by the Ministry of Health, Republic of Armenia. The emphasis of health education in past years has been on diseases that one would expect to find in a highly industrialized country. Materials presented but the Director of Epidemiology within the Ministry of Health included such subjects as sexually transmitted diseases, alcoholism, tuberculosis and the identification if insect vectors. Most of the materials were printed on "newspaper" grade stock without art work. Several items from the French National Health Education program were displayed as examples of material that people would read. These examples were printed in glossy paper in color. Each piece showed evidence of artistic layout and contained illustrations which reinforced the message. Examples of the existing health educational materials are included in Appendix H.

### **3.5.2 Observations**

- Local extension of health education occurs through the local polyclinic.
- There were reports of announcements that had been given in the past over the local radio stations. Ministry staff voiced skepticism about both radio and television as appropriate media since individuals had access to power only infrequently and on a rotating basis.
- Handouts delivered through the polyclinic or used in the newspapers would be more useful. Several different newspapers currently operate in Yerevan. One of these is considered to be the "official" paper and two others were described as opposition papers.
- UNICEF has an element in its 1993-94 Country Programme Recommendation for Armenia. Item number 35 specified the development of a health education program which included the development of Facts of Life messages which would be distributed through educational institutions, training seminars, teachers and media. The item indicates that UNICEF will fund training seminars to facilitate the development of appropriate communication strategies (see Appendix I).
- Peace Corps has a staff of six educators in Yerevan, some of whom have expressed a willingness to work as health trainers. The Peace Corps also has a group of small business advisors/volunteers who have expressed a willingness to work with the city in stabilizing rates. These personnel are currently working as teachers in several of the institutes within Yerevan. Two of the volunteers were contacted. Sueko Kumajai teaches English at the Yerevan medical institute and Randy Clawson teaches English at the Armenian Agricultural Institute. These two indicated that they were confident that they could help in health education efforts if they were provided with the appropriate materials and given fundamental health education training.

- **The Ministry of Health expressed a belief that newer more attractive health education materials would be more effective. They requested technical assistance in developing more effective health education materials.**

## Chapter 4

# CONCLUSIONS

### 4.1 Solid Waste Management System

- Epidemiological information does not suggest that solid waste management (or lack thereof) is the most significant source of disease.
- Solid waste problems were found in some communities which are affected by refugee populations and or extreme poverty.
- Most residential areas, in particular the multistory apartment units, have some degree of solid waste problem.
- The solid waste collection and disposal system is operating at minimal level. The observed solid waste problems will become critical within the next six months. Disease incidence can be expected to increase with the onset of spring weather.
- Solid waste problems are heavily dependent upon energy in the form of fuel to operate transport vehicles. Service levels will reflect the availability of energy and repairs.
- Energy and repair parts are the only meaningful short-term interventions suggested. The potential for individual action by residents exists, but the extent to which this could be effective in multiple-family dwellings is uncertain.

### 4.2 Water System

- The water source provides good quality water. Surface protection from groundwater contamination is provided for the spring sources and infiltration galleries.
- The conditions and deficiencies observed, particularly within the distribution system, present a high risk of contamination and subsequent health effects. Drinking the water without taking precautions presents unnecessary risks to health. Specific conditions that clearly indicate high risk are as follows:
  - Although very few bacterial and chlorine monitor records were observed, clear indications are that coliform bacterial contamination is occurring and chlorine residuals are not adequately maintained to disinfect the drinking water. The risk of fecal contamination is high.
  - The intermittent supply of electricity and the lack of 24-hour, continual pumping (with resultant negative water pressure throughout all distribution lines) are likely to allow sewage and other contamination to continue to enter the water supply.

An additional increased risk of contamination exists due to the many observed sewer line breaks and raw sewage surface discharges in and around homes, dwellings, and buildings on the water lines. (Underground water lines are leaking and are situated next to the sewer lines.)

- There is a risk of contamination and back-siphoning from plugged toilets and bathing facilities on the upper floors of the high-rise building/housing complexes. This risk is due to reduced water pressure and the likelihood of backed-up toilet facilities from limited flushing.
- Overpumping of the city water mains by the buildings' lift pumps adds to the likelihood of pulling contamination into the drinking water from the shallow groundwater.
- Water losses are very high and metering of water is difficult with the facilities and management provided. A systematic leak detection and repair program would substantially reduce water losses and increase water pressure and the availability of water. Special note: it is critical to permanently correct the back-siphoning/water-pressure problems, but the problems can't be corrected immediately.
- Broken water lines, low pressure and lack of water quality monitoring/chlorine residuals were also observed to be serious problems in the other communities outside of Yerevan. For example, the chlorinators for the city of Vandazor were not operating because of equipment failure and the absence of repair parts.
- Additional equipment in the Republican and Yerevan regional laboratories would facilitate the early detection and analysis of any waterborne disease outbreak.
- A clearly understood, well rehearsed contingency plan which describes the leadership, roles, and responsibilities of the various government departments in the event of a waterborne disease outbreak in the city of Yerevan does not exist.
- Strong differences in the seasonal pattern of Salmonellosis/Shigellosis and Viral Hepatitis in 1992, suggests that those diseases may not be spread through the same mechanism (Appendix G).
- Although a lower risk for contamination, the wells (artesian) that were not sealed at the top of the well casing should be better sealed and protected from flooding in the low-level areas and from any accidental spills from lubricating oils, etc. The operators were told of the possible contamination, but no correction is expected until materials become available.
- The water source provides good quality water. Surface protection from groundwater contamination is provided for the spring sources and infiltration galleries.

### 4.3 Sewage Disposal System

- There is a high risk of exposure to disease organisms, especially for children, from direct contact with raw sewage found on the ground surface in many of the residential and commercial areas. This is considered to be a risk equal to that represented by contaminated drinking water.
- The exposure problem extends through many residential areas and within some of the high-rise residential buildings. The same high risk rating can be applied to other communities in Armenia.
- The sewage is coming in contact with drinking waterlines which, as noted earlier, are subject to negative pressures and backflow conditions.
- It is difficult for the cities to make repairs for many reasons. Having up-to-date tools would allow a significant increase in sewer line repairs. Availability of pipe materials is limited but not the major factor. The limited amount of electricity is also a factor, but with more alternative-powered, equipment sewers could be repaired without electricity. (Appendix J contains a list equipment needs jointly prepared with Mr. Kajoyan.)
- The sewage treatment plant is in poor condition. Raw sewage bypasses and discharges to the river outside of city, loading the river heavily (same for the other cities visited). Public exposure to disease organisms, however, is not as great as from contact with untreated sewage nearer to residential areas. There were no downstream drinking water uses reported.
- According to reports, there is considerable direct recreational water contact in the in-city portion of the river and in the large lagoon connected to the river. Although these are upstream from the plant discharges, there are significant untreated sewage bypasses entering into the contact areas. During the hot summer months, as water contact activities increase, significantly increased health risk will occur.

### 4.4 Water and Sanitation

- The groups at highest risk of waterborne disease in the City of Yerevan are the poorest communities, those who must haul water to flush outside fixtures and refugees who are living in public buildings not designed for full-time occupancy.
- Food-borne diseases will become a greater risk factor in warmer weather as improper food storage temperatures become common in residential, commercial, and industrial facilities.
- Many of the resources necessary to carry out an effective household-level water and sanitation program for the most exposed groups already exist in Yerevan, but they will require support and organizational focus.

- The damage caused by the freezing of water and sewage lines under buildings creates a serious potential health risk to the occupants of the buildings and the neighboring communities.

#### **4.5 Health Education and Public Information**

- Additional health information needs have arisen due to the shortage of energy throughout Armenia. These needs include information about diseases associated with and effects of reduced levels of service in water, sewage disposal, and solid waste.
- The Ministry of Health has a strong desire to develop new educational material about the health risks associated with the lack of customary energy levels.
- Many of the resources necessary for an effective health education/public information program are already present in Yerevan and need only strengthening and organizational focus.

## Chapter 5

### RECOMMENDATIONS

The following recommendations are listed within each action plan in priority order. Each recommended program is followed by a suggested implementation plan. The implementation plans may be modified, amended, or delineated based upon changes in Armenia. Careful consultation with USAID/Yerevan should precede implantation of all action, program, and implementation plans. In general, items which assure chlorination of the water system have the highest priority.

#### 5.1 Solid Waste Action Plan

The only intervention which appears feasible for solid waste-related disease transmission is education and action at the household level. Energy is critical to the operation of the solid waste system and it must have the assigned priority.

##### 5.1.1 Short-Term Program

###### *Recommended Program: Solid Waste Health Education*

It is recommended that health education materials be developed which are specific to the increasing solid waste disposal problem.

###### *Implementation Plan*

These health education materials would be developed as part of the communications assistance program recommended under household water and sanitation.

###### *Recommended Program: Energy Prioritization*

Energy priority should be given to operating the existing solid waste management collection vehicles.

###### *Implementation Plan*

The City of Yerevan should assign high priority to the energy required for the operation of public health facilities. The current USAID Energy Team should support this concept in its ongoing analysis of energy priorities for the city of Yerevan and Armenia.

### **5.1.2 Long-Term Recommendations**

#### *Recommended Program: Fees for Service*

Service fees should be established which assure the continued operation and maintenance of the solid waste collection and disposal services within the city of Yerevan and throughout Armenia.

#### *Implementation Plan*

Implementation of this recommendation should occur as part of the rate-setting activities related to other municipal services (see water system rate setting recommendations, Section 5.2.2).

#### *Recommended Program: Solid Waste Program Assessment*

A complete review of the solid waste collection, transportation, and disposal system should be undertaken. Massive capital investment in the existing system by the city of Yerevan may not be warranted. Limited observations made as part of this study indicate that the existing system is capital, labor, and energy intensive.

#### *Implementation Plan*

No implementation plan is proposed at this time.

## **5.2 Water Supply Action Plan**

The object of this plan is to minimize the potential for transmission of waterborne disease through the city water system. Maintenance of chlorine residuals and the repair of leaking pipes are considered to be of paramount importance.

### **5.2.1 Short-Term Program**

#### *Recommended Program: Chlorination and Repair Equipment for Water System*

##### Capital Equipment Assistance

- Chlorinators to replace the deteriorated and non-operating units at 14 "source stations." An additional 9 chlorinators (5 mobil units) are needed for the 9 reservoir/water regions (two units for 25 to 50 kg per hour, and 21 units for 10 to 15 kg per hour).



- 25 field kits for measuring free residual to help assure maintenance of chlorine residuals through the system.
- Mobil equipment to (1) detect and (2) clean/unplug sewer lines. (Five 15 hp gasoline-powered and one electric-powered units for cleaning/unplugging and 6 detecting units.)
- Equipment to cut into streets in order to repair broken water and sewer lines (12 gasoline-powered "jack" hammers, two electric and five concrete/asphalt saws).
- Equipment to weld/repair (underwater) the broken large diameter pipes (one welding unit).
- A short-term communications assistance team (2 persons) to support the Ministry of Health in the development of specialized public health information relating to precautions and needs created by the temporary energy shortage.
- Technical support to the city to assure the adaptation of existing water-borne disease contingency plans. This support will be used to adapt the plans to the needs created by the conditions associated with the current energy shortages.
- Additional equipment to strengthen the water-borne disease outbreak capability of the Republic Sanitary Epidemiological Laboratory and the Yerevan Regional Sanitary Laboratory to assure rapid detection and assessment in the event of a waterborne disease outbreak (list of the equipment attached).
- Technical/management support to the city to develop a plan to coordinate and monitor the use and installation of equipment and resource between the appropriate city/state offices.
- Equipment and installation assistance to these communities outside Yerevan; (1) Vanadzor: two 15 kg/hr chlorinators, two chlorine residual test kits, one leak detector and one "jack" hammer; (2) Abovion and Artashat: to each community, one 15 kg/hr chlorinator, two chlorine kits, one detector, and one jackhammer.

#### Technical Support

- Technical/management support to the city to help install and develop a plan to coordinate, monitor, and operate equipment between the appropriate city/state offices. This task is proposed for the team described in Chapter 6.

See Appendix J for a detailed listing of equipment.

### *Implementation Plan*

The listed equipment should be acquired in the United States or Europe. The selection should be heavily dependent upon the durability of the equipment and the availability of repair parts.

Once acquired the material should be shipped into Armenia. Safe storage can be provided by the Red Cross or the medical distribution staff of Project Hope. Receipt and storage of these materials can be facilitated by USAID/Yerevan and the Armenian Assembly of America, Gassia Apkarian, director. The International Federation of the Red Cross (Stuart Willcuts) has secure storage that was developed in response to the Red Cross efforts related to the earthquake relief in 1988.

A public health engineer or equivalent person with extensive experience with chlorinator operation, installation, and maintenance should be selected to assist the city of Yerevan in the implementation of this task. The full scope of duties for this individual are listed in Chapter 6.

### *Recommended Program: Technical Support and Equipment for Epidemiological Laboratory*

- Technical support to the city to assure the adaptation of existing water-borne disease contingency plans. This support will be used to adapt the plans to the conditions associated with severe energy shortages.
- Additional equipment for the Republic Sanitary Epidemiologic Laboratory and the Yerevan Regional Sanitary Laboratory to assure rapid detection and assessment in the event of a waterborne disease outbreak (list of the equipment attached as Appendix J).

### *Implementation Plan*

Modification of existing contingency plans and oversight of acquired laboratory equipment would be carried out by a public health sanitarian/nurse who is familiar with contingency planning and laboratory procedures. Other responsibilities for this team member are outlined in Appendix J. Lab materials would be acquired, shipped, and stored with the chlorinators and other equipment.

### **5.2.2 Long-Term Program**

Many of Armenia's water and sewage related health risk problems cannot be solved on a short-time basis. Permanent corrections will come about only when the basic energy resources are resupplied and basic government program planning is implemented. The following are interim planning and technical actions that USAID should initiate as soon as possible. (The communities asked for this assistance.)

**Recommended Program: Technical Assistance for Efficiency and Water System Hazard Reduction**

- Help establish a plan to put in place and systematically manage an enforceable fee-for-water service to recover operational costs. **Support and encourage the Peace Corps/Armenia business management program at the American University to provide water and sewer management officials throughout Armenia with assistance in developing a plan to:**
  - Establish and promote laws for private ownership and maintenance of housing facilities
  - Provide technical assistance and incentives for owners to upgrade and maintain good plumbing systems.
  - Systematically improve sewer and water connections to housing units.
  - Obtain and install water meters and develop a system for meter reading and meter repair.
  - Systematically collect fees and encourage conservation of water.
- Identify a course of action to correct design and maintain the water supply and sewage system in the following areas: leak detection, corrosion control, sealing/wellhead protection, cross-connection control, electrical/surge protection of pumps, upgrading of rivers and water recreation areas, etc.
- Assist the City and Residential Water and Sewer Company in their quest to identify new, hands-on, practical technology to improve the efficiency of design and operation. Emphasize corrective action based on understanding of health effects and health hazard reduction.
- Provide an opportunity for appropriate water/sewage system/epidemiology (technical/management) staff to visit operating systems in the United States with a balance of representatives from Yerevan and other cities such as Vanadzor, the Residential Water and Sewer Company, and the Ministry of Health.

It is clear that the Armenians responsible for the water and sewer systems know what has to be done to address the pressing problems. They don't want handouts. They want our encouragement and support to go along with our technical assistance. Mr. Houlyan, Mr. Kajoyan and the sewage plant operator made statements that they have been disappointed when other visitors didn't follow through. The consultant team hopes they don't say the same about this assessment and these recommendations.

### **5.3 Action Plan for Emergency Repair of the Yerevan Sewage Disposal System**

The objective of this action plan is two-fold: to convey the waste out of the city of Yerevan, minimizing surface exposure of the population; and to minimize leaks into the shallow groundwater and into leaking water lines.

#### **5.3.1 Short-Term Program**

*Recommended Program: Equipment for Repair and Maintenance of Sewer Lines*

- Mobil equipment to (1) detect and (2) clean/unplug sewer lines (6 gasoline-powered units for cleaning/unplugging and 6 leak detecting units). Equipment to cut into streets in order to repair broken sewer lines (12 gasoline-powered jackhammers, 1 concrete/asphalt saw) to be provided to the city of Yerevan.

#### *Implementation Plan*

This action plan would be implemented in the same manner and by the same team as described in Chapter 6. The equipment is listed in Appendix J.

#### **5.3.2 Long-Term Needs**

Note: See Technical Assistance for Efficiency and Water System Hazard Reduction (5.2.2) Staff Sharing Proposal. This recommendation calls for an exchange of sewage treatment and disposal staff.

### **5.4 Household-Level Water and Sanitation Action Plan**

The objective of this action plan is to provide effective materials to the Armenian Ministry of Health to use in conducting a household water and sanitation program. Immediate input to the Ministry to develop effective and appropriate materials is a necessary precursor to initiation of a program.

#### **5.4.1 Short-Term Needs**

*Recommended Program: Communications Support for Development of Appropriate Materials for Household Water and Sanitation*

A short-term communications support project to assist the Ministry of Health in developing a public information program to address the temporary conditions created by the energy blockade and the integration of refugees into communities in and around Yerevan. The main media focus would be newspapers. Handout materials for distribution through polyclinics should also be considered. These materials are considered critical to interventions described in the Health Education/Public Information Action Plan.

*Implementation Plan*

USAID should provide a contract for health communications technical assistance services in support of the Ministry of Health. These services should include the development of published information instructing citizens about the correct methods to use in the storage and disinfection of water, solid waste disposal, treatment of simple diarrheal diseases and other topics judged appropriate by the team, USAID/Yerevan, and the Ministry of Health. Some topics such as the use of oral rehydration salts may be assigned specifically to UNICEF or CARE because of their extensive experience with these areas.

#### **5.4.2 Long-Term Program**

*Recommended Program: Rehabilitation of Household Water and Sewage Disposal Plumbing*

A program should be developed to assure the connection of residential structures to the municipal water and sewage disposal systems.

*Implementation Plan*

The primary obstacle to the implementation of repairs to these systems is the reported lack of materials and the lack of heat/energy that can be relied upon to prevent future breakage. There appears to be two options for implementing these repairs.

- **OPTION ONE:** Develop a materials list and facilitate a materials drop which includes all necessary parts and materials to repair the plumbing connections for a fixed number of multiple family cooperative buildings. A USAID team would facilitate repair of the specified number of units by government housing workers.
- **OPTION TWO:** USAID/Yerevan could facilitate the development of a materials list and the acquisition of the necessary repairs by the City of Yerevan. This would involve importing parts through the blockade. Short-term engineering/public health support

to USAID/Yerevan would be required to plan and initiate the program. Yerevan city staff would be utilized to implement the repairs.

This repair project is critical to the control of communicable diseases within the city of Yerevan. Under normal conditions this task would receive the highest priority. At present, no action on this task is recommended until a reliable source of heat or other mechanism to prevent freezing and pipe breakage is identified for these buildings. The original building design used the heat of the hot-water heating system to prevent freezing and breakage of the plumbing in the utility space below the buildings. Unless a method can be devised to prevent the drain plumbing from freezing and breaking again, it will be futile to continue to make repairs.

*Recommended Program: Relocation of Refugee Populations  
Currently Living in Substandard Housing*

Refugee populations should be relocated out of the temporary housing which is judged to represent the greatest risk to their health. A systematic study of facilities should identify populations in need of relocation.

*Implementation Plan*

Many of the facilities in question had been abandoned at the time that the refugees moved in. These locations should be reviewed by the City of Yerevan and the Ministry of Health, UNHCR officials, Red Cross staff, and others, as judged necessary. Public health maintenance in these facilities is impossible; acceptable levels of household water and sanitation could be maintained only at great cost.

## **5.5 Action Plan for Health Education and Public Information Needs**

### **5.5.1 Short-Term Program**

*Recommended Program: Health Education/Public Information Focus  
on High Risk Communities*

A health education/public information program which focuses on the highest risk populations in the City of Yerevan should be initiated. These populations would include (but would not be limited to) refugee communities in public buildings such as schools and old dormitory facilities and areas of dilapidated housing such as the one near the Divin hotel. This program should take advantage of the existing resources of the city and Ministry of Health as well as other expatriate groups operating within the city.

### *Implementation Plan*

USAID should explore the possibility of providing a short-term public health educator to train the existing Peace Corps education volunteers now located in Yerevan. This trainer would also assist in initial program development with the Peace Corps volunteers. (See Public Health Engineer/Sanitarian team description in Chapter 6.) Public health educational materials will also be provided as part of the short-term communications support effort recommended under the household water and sanitation section.

### *Recommended Program: Update of Waterborne Disease Outbreak Plan*

USAID should facilitate modification of existing Emergency Waterborne Disease Outbreak Contingency Plans to incorporate the conditions created by the current energy blockade. These planning activities should (as a minimum) include representatives from the Yerevan Water Department, the Ministry of Health (epidemiology), City of Yerevan Mayor's office, and the Centers for Disease Control/Yerevan. This intervention should include a practice event involving all key parties.

### *Implementation*

Implementation will be accomplished as one of the tasks assigned to the proposed Public Health Engineering/Sanitarian team (see Chapter 6).

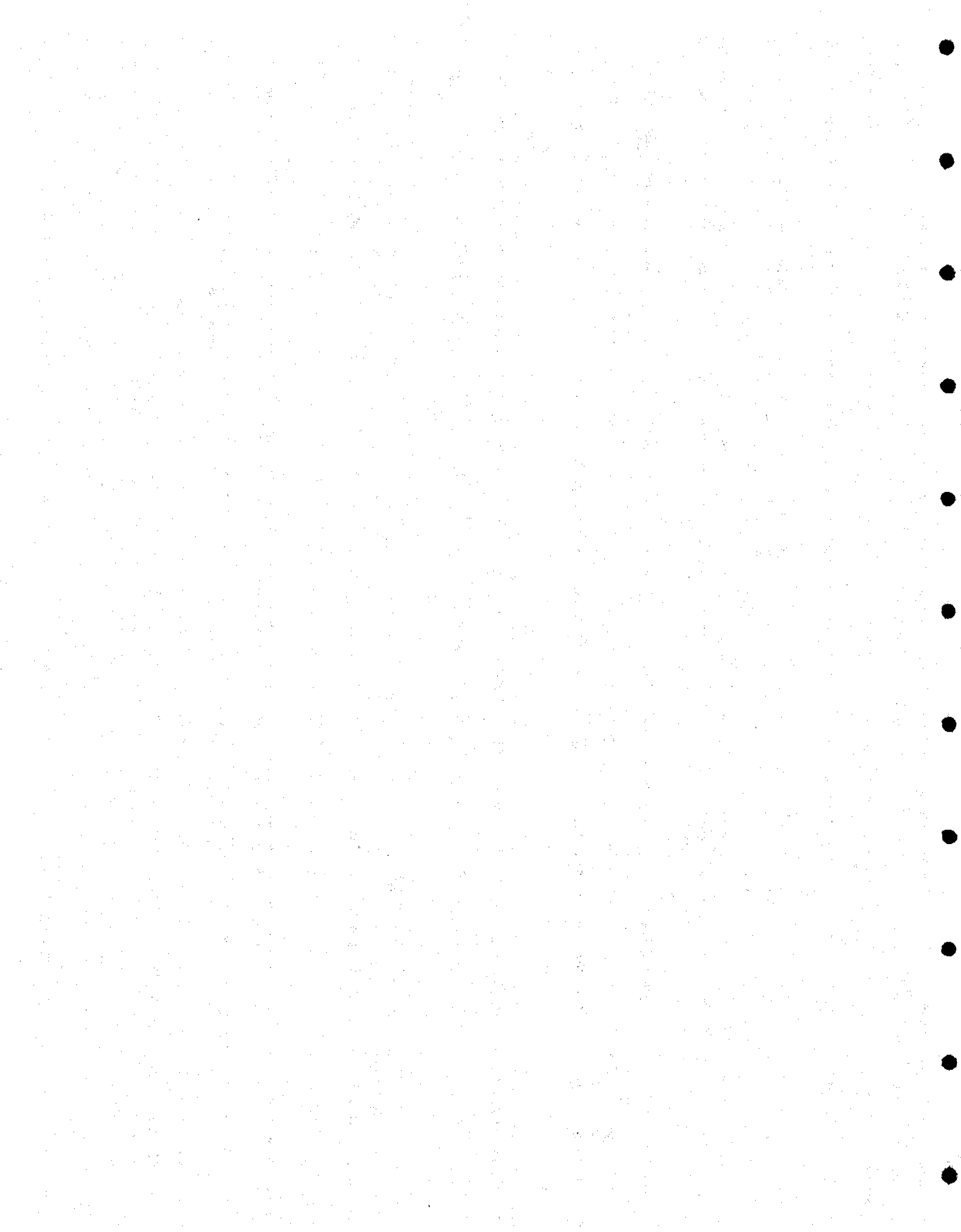
## **5.5.2 Long-Term Program**

### *Recommended Program: Reassessment of Needs*

After six months of operation, the Peace Corps staff should assess the needs of the public health outreach program. Additional resources may be necessary at that time and/or the focus of public health effort may require amendment.

### *Implementation Plan*

The Peace Corps program, the Yerevan Regional Sanitation staff, the Ministry of Health, and USAID/Yerevan would co-author a brief report to USAID/Washington outlining needs for change in the program.





## Chapter 6

### PROPOSED IMPLEMENTATION TEAM STAFF DUTIES

#### Public Health Sanitarian/Engineer Team

##### Duties of Public Health Sanitarian/Nurse/Doctor

- Facilitate modification/development of the waterborne disease outbreak contingency plan for Yerevan.
- Facilitate the installation and staff training necessary for the utilization of the laboratory equipment recommended as part of this report (Appendix J).
- Provide technical support as needed to the Communications Support team. (This may not be necessary given the high level of support available from the Ministry of Health.)
- Provide initial public health education orientation (24 hours) for Peace Corps Volunteers who will teach special health education classes in the highest risk Yerevan communities.

##### Duties of Public Health Engineer

- Implement recommended equipment support to Vanadzor, Abovian, Artashat and Yerevan Water Department (chlorinators). Coordinate with various government staff to assure proper installation, operation, and maintenance of equipment listed in Appendix J.
- Provide technical management support to the City of Yerevan to develop equipment and water quality recordkeeping capacity.
- Assess housing plumbing needs and implementation methodology. This would result in a report recommending steps to be taken for technical and logistical support within the next eight months.

It is estimated that the tasks outlined above will require four to six weeks to complete. Each team member would require language skills or a translator. Selection of individuals must emphasize both transfer and reinforcement of skills in Armenia. The focus must be on assisting the Armenian staff in solving their own immediate problems. It is also critical that the individuals chosen carefully deal with the sensitivities of the three agencies responsible for addressing the water, sewer, and public health recommendations in this report.



1. Spring catchment area

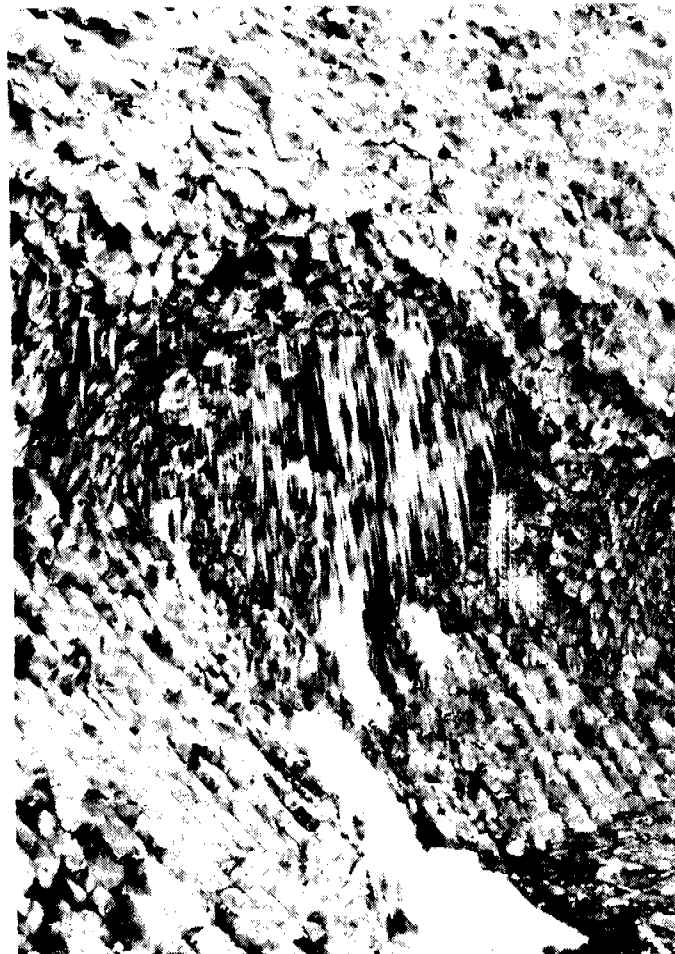


2. Spring house security



3. Good water at spring sites

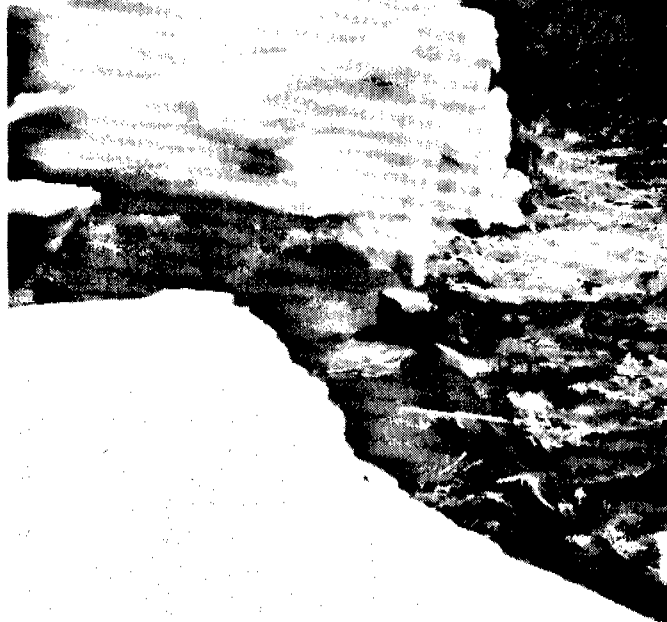
4. Basalt geological formation at spring sites

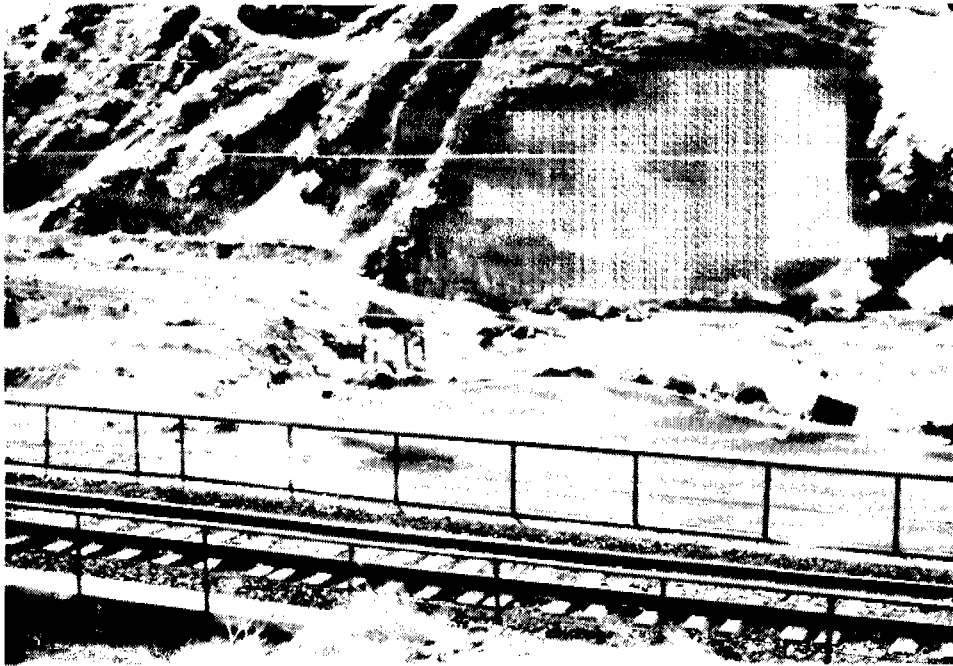




5. Geological Basalt formation at spring sites

6. Artesian pressure - flowing artesian well

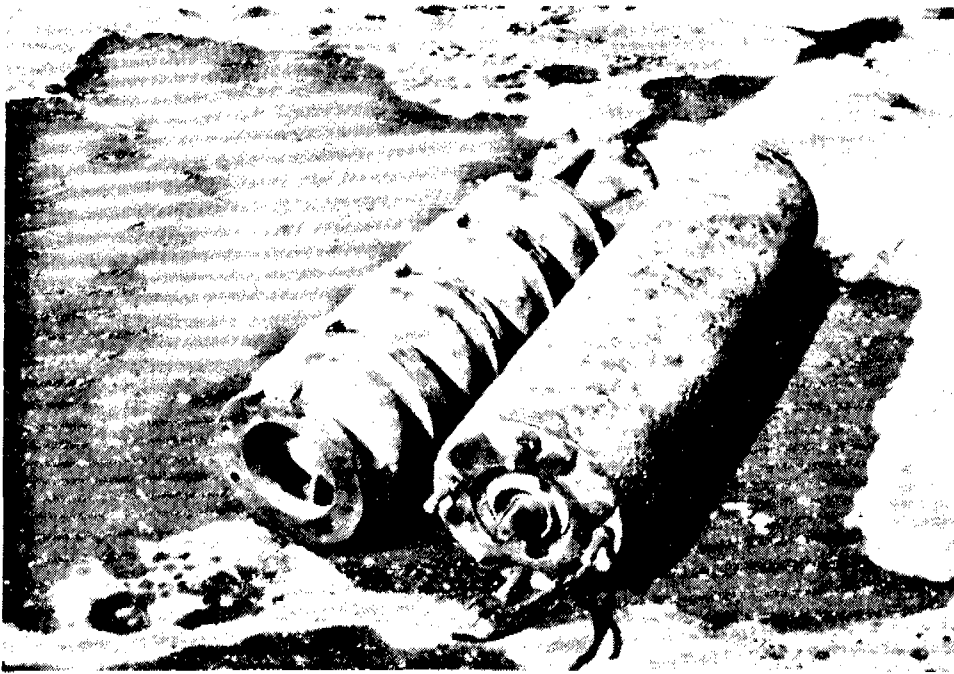




7. Water supply intake near Vanadzor



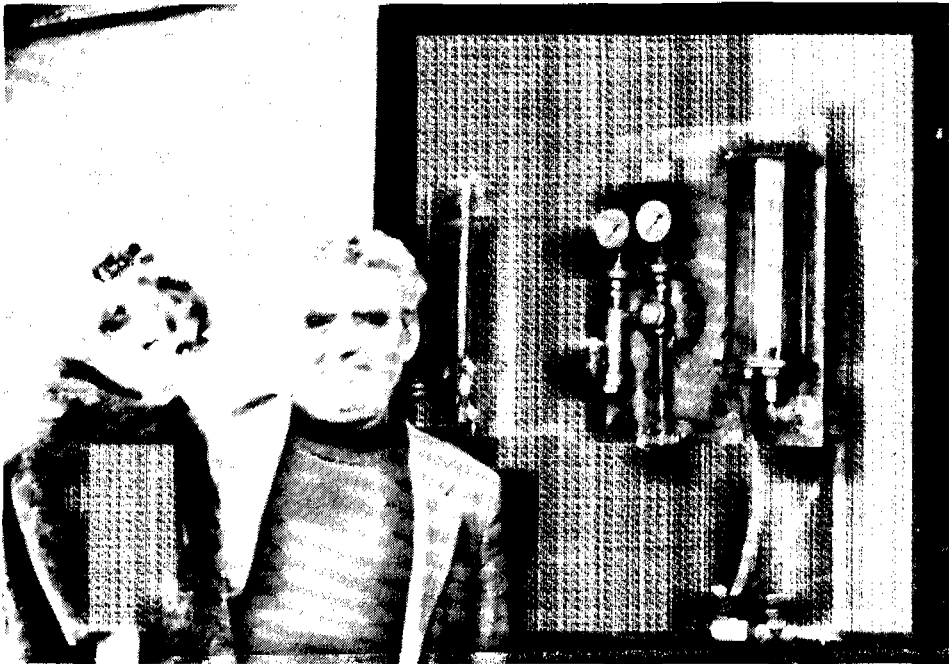
8. Roadside water station near Vanadzor



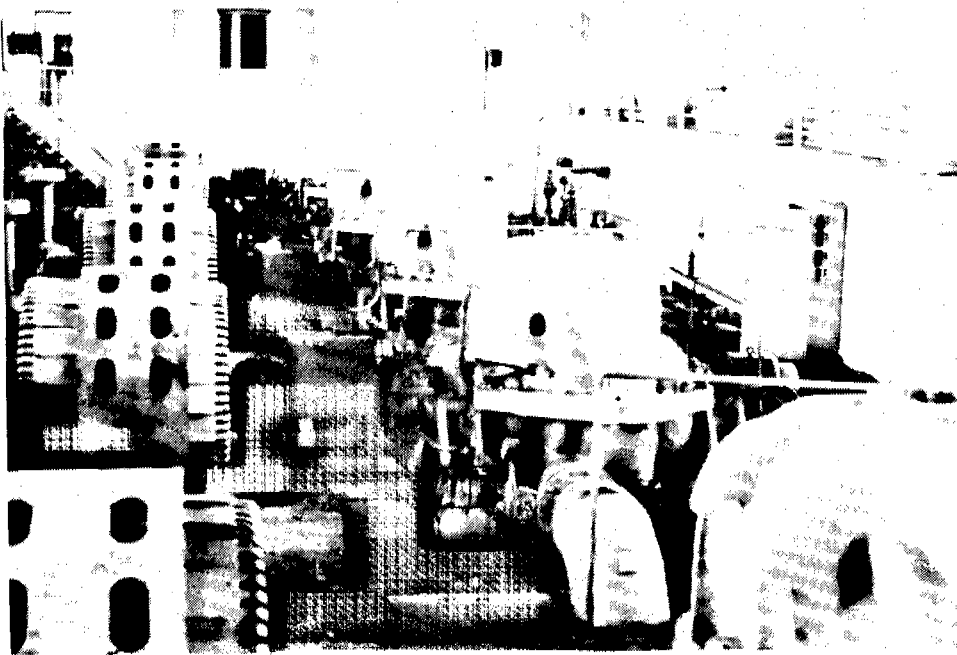
9. Well pumps out of service



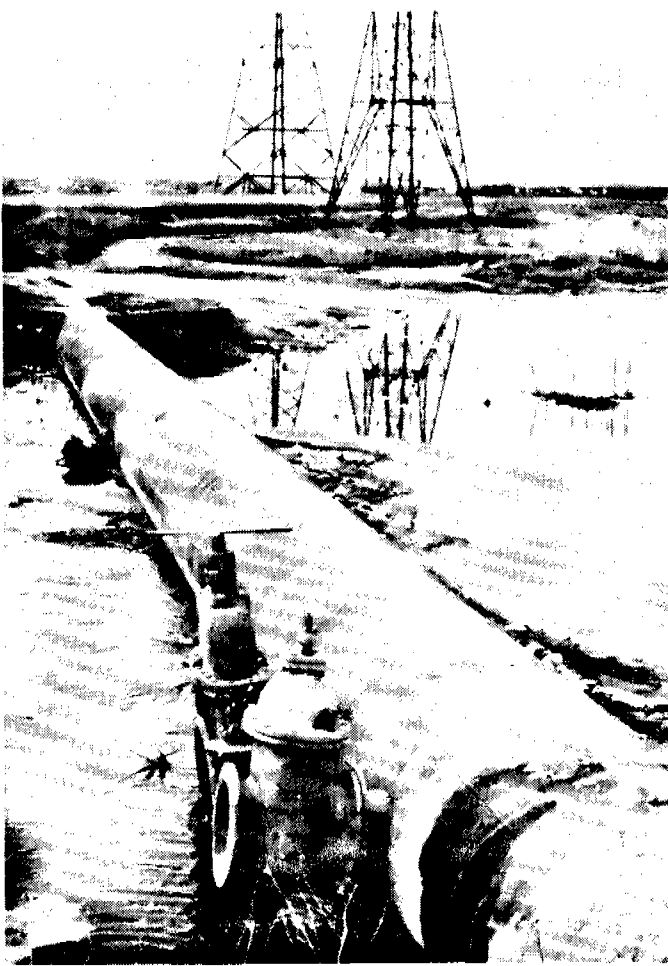
10. Wells not sealed



11. Water plant operator. Chlorinator - one not operating



12. 3000hp pumps



13. Large liner leading to city reservoir. (Note leak in line)

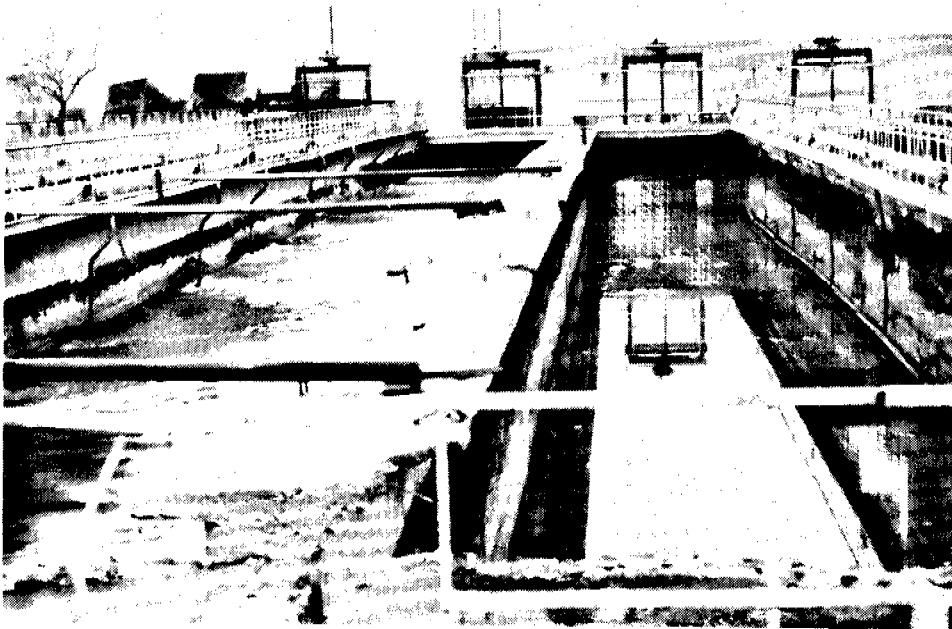


14. Broken vent on large city reservoir, Yerevan

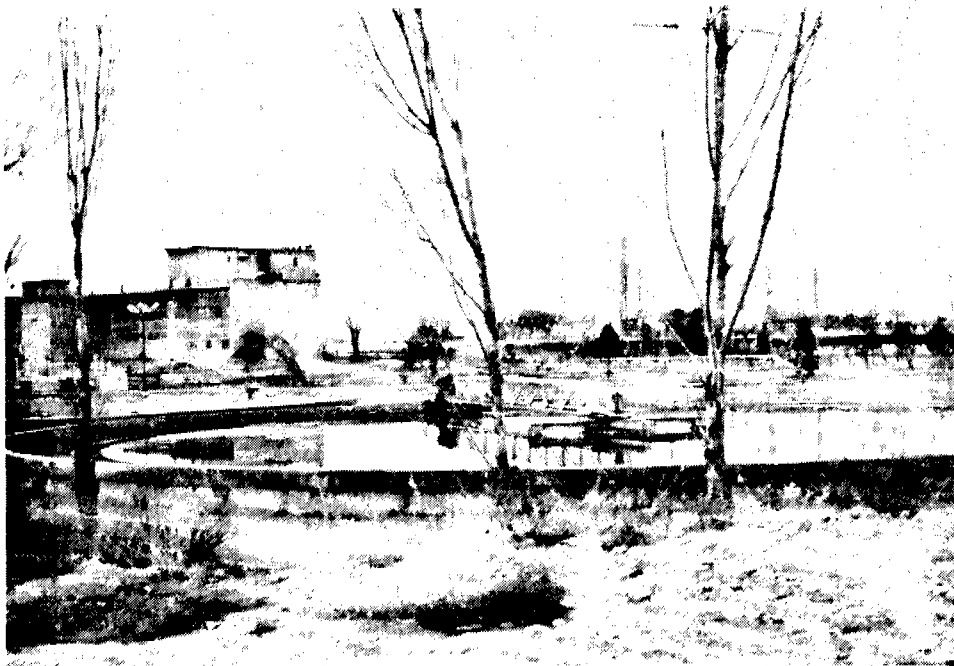




15. (right) Raw sewage (lower middle) flowing past waterlines. (Note typical housing high rise and tenants gather wood from hillside)



16. Deteriorated aeration tank at sewage plant



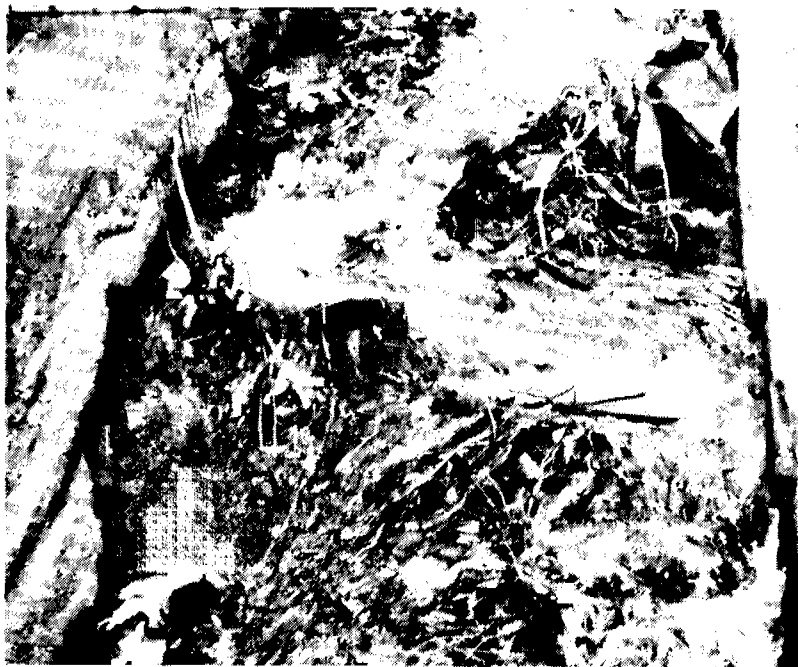
17. Clarifying skimmer not rotating



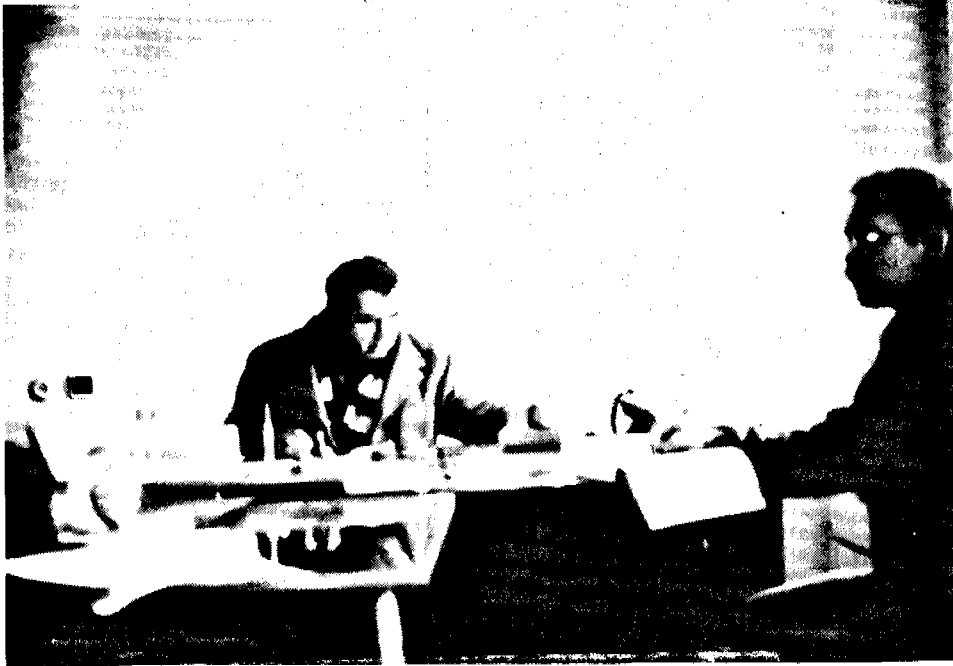
18. Sewage cascading down hill side  
(at feet of Suzanne Olds, U.S.AID/Yerevan Mission Head)



19. Broken sewer liner near "Massive"



20. Raw sewage in storm drain near "Massive" housing area



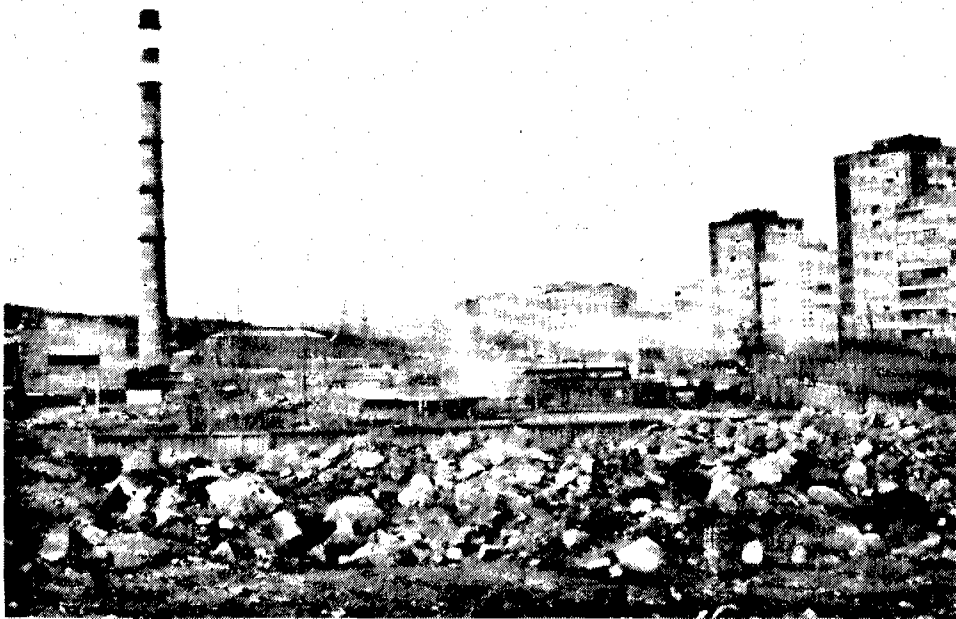
21. Terry Rahe (on right) recording information from Vanadzor Regional Lab.



22. Raw sewage flowing from manhole/plugged sewer near DeVin Hotel



23. Housing units (two types - highrise and single family - highrise is more typical)



24. One of 13 boiler units (not operating) which is designed to heat the city



25. Tomb of family lost in 1988 earthquake - near Vanadzor



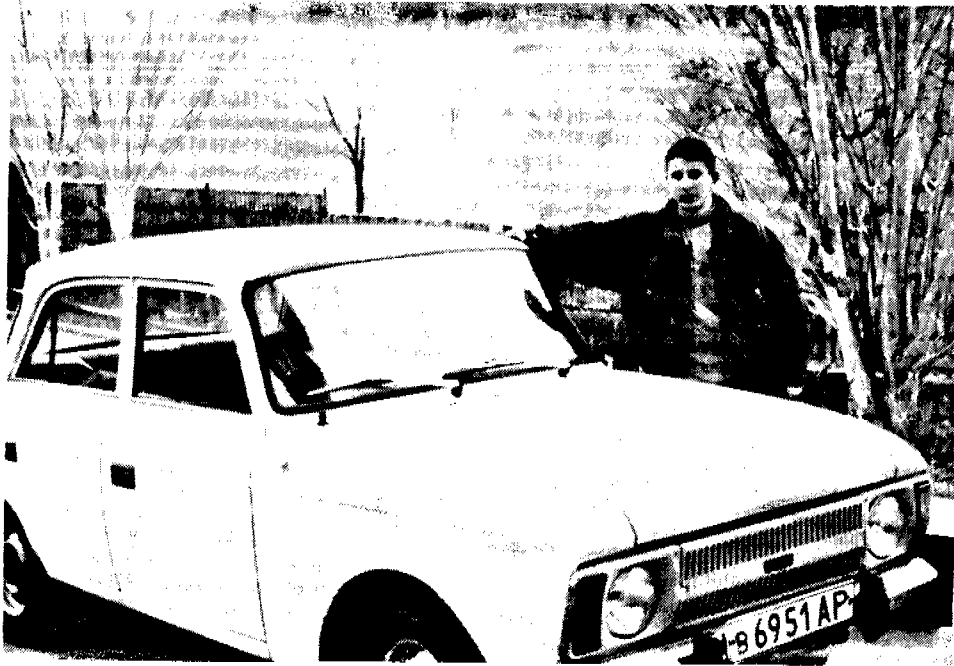
26. First step to privatization. Local carrying grain to new water powered well



27. Filler up - self service - no service stations in Armenia



28. Road to Vanadzor

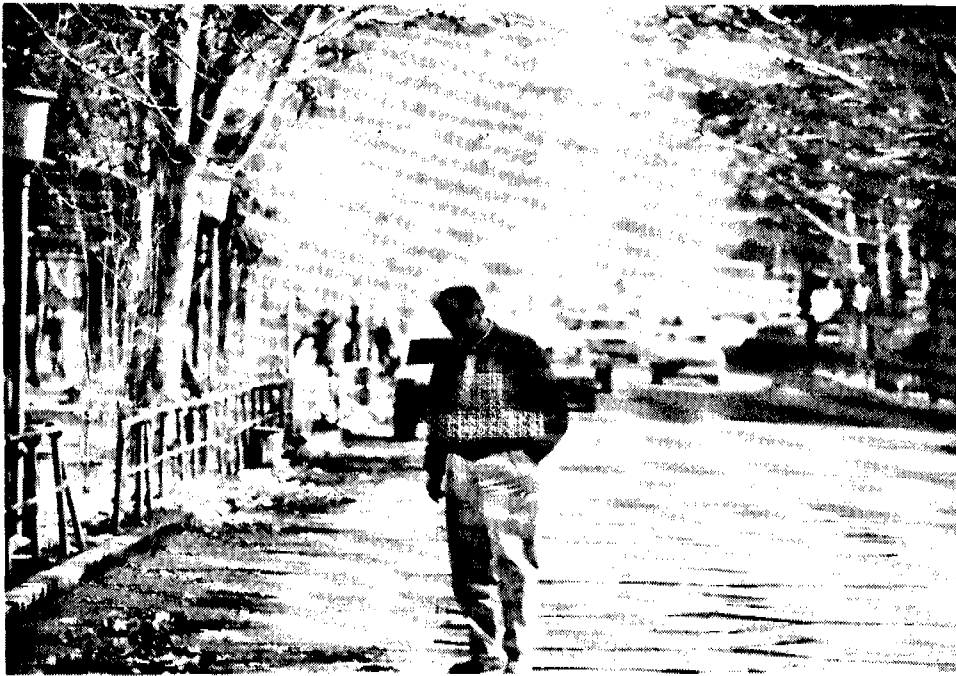


29. Taxi - David



30. The WASH team





31. Kenneth Choquette inspecting one of many water main breaks in Yerevan and other Armenian cities and towns.

**Appendix A**

**SCHEDULE OF MEETINGS**

**SCHEDULE OF MEETINGS - WATER AND SANITATION TEAM**

<u>Team Member</u>	<u>Meeting</u>	<u>Date</u>	<u>Time</u>	<u>Phone</u>
Dennis Long Terry Rahe Kenneth Choquette	Armenian Assembly Gassya Abkaryan	3/11/93	14:00	560-674
Dennis Long Terry Rahe Kenneth Choquette	Ministry of Economy	3/11/93	15:00	526-266
Dennis Long Terry Rahe Kenneth Choquette	CDC Dr. Valdimir Davidiants CDC Coordinator	3/11/93	16:00	271-825
Dennis Long Terry Rahe Kenneth Choquette	Deputy Mayor Samvel Mavisakalian	3/12/93	11:00	584-282 66-09
Dennis Long Terry Rahe Kenneth Choquette	Armenian Assembly General meeting with PVO/NGO representatives (CDC, Peace Corps, Armenian Red Cross, Armenian Relief Cross, CARE)	3/12/93	16:00	560-674
Dennis Long Terry Rahe Kenneth Choquette	Ministry of Health Chief Physician (Sanitation), Dr. Ararat Mkrtchian	3/12/93	17:00	565-849 51-65
Dennis Long Terry Rahe Kenneth Choquette	Field trip to Vanadzor	3/13/93	9:30	
Dennis Long Terry Rahe Kenneth Choquette	Field trip to the water springs together with water supply officials	3/15/93	9:30	
Dennis Long Terry Rahe Kenneth Choquette	CDC	3/15/93	16:00	
Dennis Long Terry Rahe Kenneth Choquette	Minister of Ecology and Environmental Safety, Mrs. Carineh Danielian	3/16/93	10:00	65-34 67-09

<u>Team Member</u>	<u>Meeting</u>	<u>Date</u>	<u>Time</u>	<u>Phone</u>
Dennis Long Terry Rahe Kenneth Choquette	Artashat Local Council Mr. Thadevosian	3/16/93	15:00	60-87
Kenneth Choquette	Field trip to artesian wells in Ararat valley with A. Kajoyan	3/17/93	9:00	
Terry Rahe	Meeting with MOH with the sanitation officers	3/17/93	10:00	
Terry Rahe Kenneth Choquette	Meeting at the Mayor's office together with energy team	3/19/93	11:00	
Terry Rahe	International Federation of Red Cross and Red Crescent Societies Stuart Willcuts Visit refugees in Yerevan Public Buildings	3/19/93	14:00	
Terry Rahe	Manvel Manzikian Ministry of Health Director Dept. Epidemiology re laboratory needs	3/22/93	9:30	
Terry Rahe Kenneth Choquette	Manvel Manzikian Ministry of Health Director Dept. Epidemiology Site visit to city reservoir & sewer line repair	3/22/93	14:30	
Terry Rahe	Ara Babloyan Minister of Health Republic of Armenia	3/22/93	16:00	
Terry Rahe Kenneth Choquette	Arben Ghoulyan General Manager State Company for Water and Sewage and Eduard Mesropian, Director Water Supply Office of Science & Technology (PURE)	3/23/93	11:00	
Kenneth Choquette	Ken Ayars, Peace Corps Volunteer American University	3/23/93	10:00	
Terry Rahe Kenneth Choquette	Suzanne Olds USAID/Yerevan (Debriefing)	3/23/93	14:30	

Terry Rahe

Manvel Manzikian  
Director of Epidemiology  
Ministry of Health (Debriefing)

3/23/93

15:00

**Appendix B**

**1993 DATA ON WATERBORNE DISEASES**

Waterborne outbreaks of Diarrheal diseases have taken place in Armenia during January and the beginning of February of 1993 in town Vanadzor (Kirovakan), Artashat district and Abovian district.

Since the 02.02.93 cases of Hepatitis A.were detected in Vanadzor in the rayon of sewage water seeping into water supply.

02.02.93- 9 cases (6 children)

03.02.93- 3 cases (2 children)

04.02.93- 8 cases (4 children)

08.02.93- 4 cases (no children)

All cases of outbreaks are caused by water pollution.It is indicative by epidemiologic situation.The first 4 cases of 29.12.92 in Vanadzor had bacteriological stimulator:

Flexner 2A and Newcastle.On the 08.01.93 the same stimulator were detected in the drinking water. This indicates the conduction of stimulator throw water.

	Vanadzor	Artashat	Abovian
Population Thousand	177,1	76,3	66,8
Outbreaks date	29.12.92	18.01.93	21.01.93
Number of cases of diarrheal diseases:			
-total number	406	103	23
-children	225	47	8
-Shigellosis			
Bacillary dysentery -ICD-90041	24	8	1
-Typhus abdominalis-ICD-9002.0	--	--	13
-Other diarrheal diseases	212	96	-
Hospitalized			
-total number	116	35	26
-children under 14 years old	74	30	2
Number of drinking water tests	323	76	105
Number of not satisfying results	117	26	19
The condition by the 8th February	Is continuing	The last case registered 05.02.93	The last case registered 01.02.93

BY KPHISS

**Appendix C**

**TOTAL DATA ON MORBIDITY, 1991 AND 1992**



**TOTAL DATA ON MORBIDITY 1991**

**BY EPHISS**

No. *	DISEASE AND CODE **	TOTAL NUMBER	RATE 100000 POP.	INCLUDIN G CHILDREN BEFORE 14 YEARS	RATE 100000 POP.
1	Enteric typhus 002.0	29	0.81	10	0.28
2	Paratyphus A,B,C 002.1-3,9	7	0.19	3	0.08
3	Salmonellosis 003	1914	53.55	1708	47.78
4	Shigellosis 004	1306	36.54	871	24.38
5	Inc.Culturally proved	799	22.35	548	15.33
6	Carriers of Shigellosis V02.3	27	0.76	3	0.08
7	Yersiniosis 027.2	30	0.84	26	0.73
8	Diarrhea caused by fixed bacterials 005.0,2-4,8,9;008	1568	43.87	1467	41.04
10	Acute Intestinal infectious caused by unfixed aetiology 005.9	3598	100.66	3052	85.38
11	Tularemia 021	1	0.03	-	-
12	Siberian Ulcer 022	2	0.06	-	-
13	Brucellosis 023	624	17.46	70	1.96
16	Whooping-cough 033	327	9.15	318	8.90
17	Parahooping-cough 033.1	296	8.28	288	8.06
18	Meningococcal infectious 036	26	0.73	25	0.70
19	Tetanus 037	1	0.03	-	-
22	Polio 045	3	0.08	3	0.08

23	Measles 055	192	5.37	155	4.34
26	Viral hepatitis 070	3963	110.87	2399	67.11
27	Including hepatitis A 070.0,1	3314	92.71	2242	62.72
28	Including hepatitis B 070.2,3	602	16.84	151	4.22
31	Mononucleosis 075	4	0.11	2	0.06
32	Mumps 072	811	22.69	765	21.40
40	Leptospirosis 100	3	0.08	2	0.06
41	Cough 465	336852	9423.75	191070	5345.36
43	Influenza 487	37848	1058.83	14515	406.07
44	Tuberculosis 010-012,018-PART	272	7.61	12	0.34
45	Syphilis 090-097	42	1.17	-	-
46	Gonorrhoea 098.0,1-3,6-8	355	9.93	3	0.08
47	Scab 113.0	144	4.03	79	2.21
48	Pediculosis 132	18156	507.85	16937	473.83

\* The number is corresponded to the line number of state report form 1.

\*\* Disease code is given in accordance with ICD-9.

TOTAL DATA ON MORBIDITY 1992

BY EPHISS

No . *	DISEASE AND CODE **	TOTAL NUMBER	RATE 100000 POP.	INCLUDING CHILDREN BEFORE 14 YEARS	RATE 100000 POP.
1	Enteric typhus 002.0	49	1.34	10	0.27
2	Paratyphus A,B,C 002.1-3,9	-	-	-	-
3	Salmonellosis 003	1494	40.94	1324	36.28
4	Shigellosis 004	1801	49.36	912	24.99
5	Inc.Culturally proved	979	26.83	525	14.39
6	Carriers of Shigellosis V02.3	40	1.10	9	0.27
7	Yersiniosis 027.2	28	0.77	18	0.49
8	Diarrhea caused by fixed bacterials 005.0,2-4,8,9;008	936	25.65	847	23.21
10	Acute Intestinal infectious caused by unfixed aetiology 005.9	4163	114.09	3122	85.56
11	Tularemia 021	2	0.05	1	0.03
12	Siberian Ulcer 022	5	0.14	-	-
13	Brucellosis 023	787	21.57	113	3.10
16	Whooping-cough 033	95	2.60	94	2.60
17	Parahooping-cough 033.1	83	2.27	82	2.25
18	Meningococcal infectious 036	26	0.71	24	0.66
19	Tetanus 037	1	0.03	1	0.03
22	Polio 045	1	0.03	1	0.03

23	Measles 055	46	1.26	36	0.99
26	Viral hepatitis 070	3740	102.50	2201	60.32
27	Including hepatitis A 070.0,1	3197	87.62	2074	56.86
28	Including hepatitis B 070.2,3	497	13.62	110	3.01
31	Mononucleosis 075	3	0.08	1	0.03
32	Mumps 072	261	7.15	241	6.61
40	Leptospirosis 100	-	-	-	-
41	Cough 465	235554	6455.48	135824	3722.3 3
43	Influenza 487	18738	513.52	8293	227.27
44	Tuberculosis 010-012,018-PART	232	6.36	12	0.33
45	Syphilis 090-097	45	1.23	-	-
46	Gonorrhoea 098.0,1-3,6-8	367	10.06	3	0.08
47	Scab 113.0	486	13.31	261	7.15
48	Pediculosis 132	15976	437.83	14602	400.18

\* The number is corresponded to the line number of state report form 1.

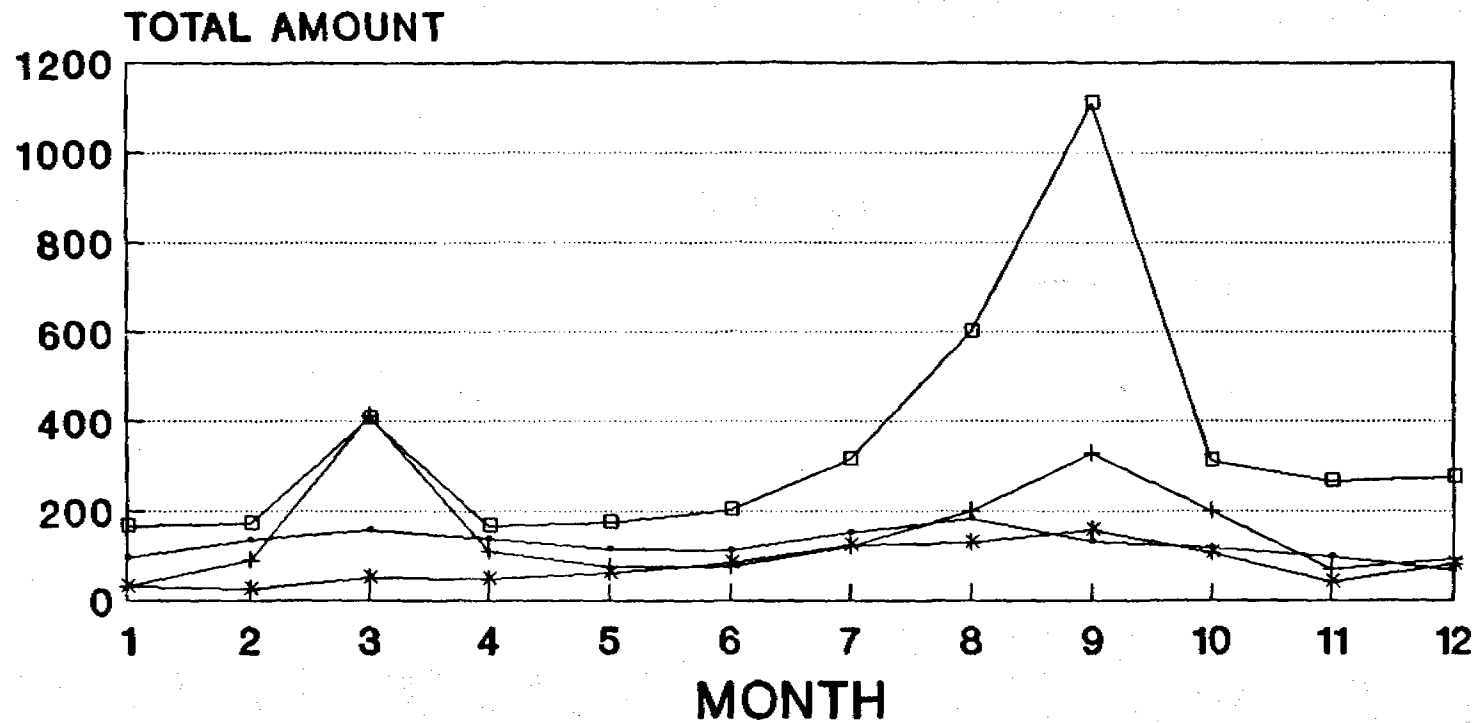
\*\* Disease code is given in accordance with ICD-9.

**Appendix D**

**INCIDENCE OF DIARRHEAL DISEASES IN ARMENIA, 1992**

# DIARRRHEA DISEASES

## ARMENIA 1992



—•— Series 1    —+— Series 2    —\*— Series 3    —□— Series 4

SER1-SALM. SER2-SHIG. SER3-FIX.BACT.  
SER4-UNFIX.BACT.

**Appendix E**

**THIRD ARMENIAN MONTHLY PUBLIC HEALTH REPORT, MARCH 1993**

ARMENIAN NATIONAL INSTITUTE OF HEALTH  
USA AGENCY FOR INTERNATIONAL DEVELOPMENT  
USA CENTERS FOR DISEASE CONTROL AND PREVENTION

EMERGENCY PUBLIC HEALTH INFORMATION SURVEILLANCE SYSTEM

March 01, 1993

Dear Sirs,

This is the third Armenian Monthly Public Health Report (AMPHR February 1993, No.3). The Monthly Report includes the main indicators which can help to objectively define the state of Public Health in Armenia and provide assistance to Public Health services, Social and State organizations, etc.

The information represented in the Monthly Report is a result of original research and surveys done by the project team and contains independent and objective data.

The Monthly Report will be delivered to all concerned organizations and individuals without limit and free of charge.

We inform that EPHISS team has prepared for publishing supplements of AMPHR on the issues of Market indicators, Communicable Diseases, Refugees etc. We'll start the publishing from the March of 1993. The requests for getting the supplements and AMPHR can apply to the project office.

Faithfully,

Project Director  
Dr. Vladimir Davidiants

*V. Davidiants*

American University of Armenia (AUA)  
#37; Marshal Bagramian av. 40,  
Yerevan, 375011  
Republic of Armenia  
Tel. 271825

CDC  
Jeane Smith  
1600 Clifton Rd N.E. Atlanta  
G 04  
Atlanta, Georgia 30333  
Ph 404-639-2395  
FAX 404 639-3645

Encl. Armenian Monthly Public Health Report .

*Institute of Public Health  
National Institute of Health  
49/4, Komitas ave, Yerevan,  
375051, ARMENIA*

*Director.*



**EMERGENCY PUBLIC HEALTH INFORMATION SURVEILLANCE SYSTEM  
ARMENIAN NATIONAL INSTITUTES OF HEALTH  
ARMENIAN MONTHLY PUBLIC HEALTH REPORT**

FEBRUARY, 1993, No.3

Category	Six Months Ago	Last Month	This Month (February, 1993)	% Change from 6 Months Ago
<b>PEDIATRIC <sup>1</sup></b>				
Birth Rate/1000 pop	-	-	18,0	-
% of Low Birthweights	-	6,4%	7,5%	+17,2%
% < 80% weight/heighto	-	0,8%	0,6%	-25%
% < 70% weight/heighto	-	6,1%	8,6%	+41%
% Breastfeeding at 4 mos.	-	73,3%	94,5%	+28,9%
% Breastfeeding at 1 year	-	-	19,0%	-
<b>ADULTS <sup>2</sup></b>				
<b>Pensioners <sup>3</sup></b>				
% Weight Loss >5kg	-	20,1%	12,9%	-36,2%
% Diet Worse than last month	-	69,5%	73,7%	+6,1%
% Cut Size of or Skipped Meals	-	89,8%	76,3%	-15,1%
Avg. Total Household Monthly Income(rbl.)	-	1555	3823	+145,7%
<b>MARKET INDICATORS</b>				
Market Basket (rbl./\$) <sup>4</sup>	8015(42\$)	32400(63\$)	44420(70\$)	+454%(+66,7%)
Official Minimum Salary(rbl./\$)	600(3,2\$)	2000(3,9\$)	2000(3,2\$)	+233%(0%)
Petrol 20 L (rbl.)	500	8000	7000	+1300%
Rubles/dollar	190	515	630	+232%
<b>MORTALITY</b>				
Crude Mortality Rate/1000 pop	6,5	-	6,5	0%
Infant Mortality Rate/1000 pop	17,9	-	-	-
<b>MORBIDITY <sup>5</sup></b>				
Diarrheal illness	13,07	13,26	14,36	+9,9%
Tuberculosis	0,41	0,44	2,03	+395,1%
Brucellosis	2,06	1,78	1,34	-34,9%
Polio	-	-	-	-
Hepatitis(viral)	4,0	15,46	18,28	+357%
Hepatitis A	2,85	13,89	10,9	+282%
Measles	0,11	0,3	0,55	+400%
<b>REFUGEES <sup>6</sup></b>				
% Weight Loss ≥5 Kg	-	71,2%	61,7%	-
% Without Fresh Water	-	27,6%	36,7%	-
% Without Access to Health Care	-	55,2%	65,0%	-

1) Pediatric researches were conducted in 10 polyclinics in all 8 districts of Yerevan. The research embraced 827 children before one year. % change from one month ago.

2) The information on adults is being collected from the survey of 40 pensioners which were randomly chosen from 400 pensioners' survey in November-December 1992.

3) % change from one month ago.

4) Data is collected on the cost of basket of food items for a family of 2 adults and 2 children.

5) Rate/100000 pop., and it is summarized from overall data. Data collected Dec., Nov., Aug. 1992.

6) The information on refugees is given on the basis of pilot research of 112 refugees in the city of Yerevan, in Stepanavan and Ararat districts.

## COMMENTARY

The situation in today's Armenia is still critical. The continuous blockade, energetic crisis, scarcity and frustration of financial resources, paralyzed economy have resulted in deep crisis in the republic.

The schools and preschool institutions remain closed, the electric transport and several TV stations do not actually work, none of the cultural institutions is functioning. The apartments are not heated at all, the electricity is provided for only two hours a day. Due to low temperature in the apartments, 73% of the refugees examined by project team in February displayed symptoms of cough and cold. By the same reason, disastrous cut off of trees goes on, which may result in ecological catastrophe.

Irregularity in energy supply brings to interruptions in water supply and damage of the sewage system. Personal hygiene procedures are very difficult to follow. 30% of the examined refugees in February displayed symptoms of diarrhea.

Percentage of low weight infants has increased by 17% in comparison with the previous month, which certifies unsatisfactory feeding of mothers during pregnancy. Decrease of "weight - height ratio by 70%" causes even more alarm (quantity of such children increased by 41% during the last month and now makes almost 9% of the total number).

The birth rate decrease by 17% in comparison with 1st of January 1991 and systematic increase of tuberculosis morbidity are adequate reflections of the situation. 80% of the examined refugees have not more than two meals a day.

Lack of facilities, material and financial resources hamper the activities of municipal services, sewage system, fight with stray animals and rodents. Due to lack of electricity, the normal functioning of micro-biological laboratories, which control the environment and drinking water conditions, as well as investigates the morbidity cases and the carriers, is being hampered.

Everything mentioned above has aggravated the epidemiological situation in terms of contagious diseases. Outbreaks of diarrhea, internal typhus and hepatitis, caused by pollution of the drinking water, have taken place in several regions of the country (Vanadzor, Abovian, Artashat). By the decree of the government from Feb. 10, (# 31), the Emergency Anti - Epidemiological Committee under the leadership of Minister of Health A. Babloian has been formed.

At the same time, increase in measles morbidity can be ascribed to the seasonal increase of the disease. Though, low indices per 100 000 of population speak of effective vaccination of children. Under grave social - economic conditions in the country it was made possible both thanks to vaccine aid of some countries (USA, France, etc.). the same can be said of absence of polio cases.

Side by side with this, decrease in brucellosis morbidity has been noted. High prices for dairy products has automatically reduce the consumption. So, cheese, highly consumed in the past, cost 1000-1500 rubles with minimum monthly salary of 2 000 rubles. The epidemiological surveys of the team showed, that 87% of the

surveyed pensioners did not consume cheese because of the high prices.

The health conditions are also affected by continuous hyperinflation of ruble as a result of unstable financial and economic situation in the country ( in 6 months the inflation rate made 230%). With minimum salary of 2 000 rubles, the market basket in February made 45 000 rubles for a family. The bread is supplied in limited quantity of 200 - 250 grams a day per person (the least physiological margin), and the price has increased by 50%

Effective February, 1, the food prices increased drastically. It has its immediate impact on the poor layer of he society - pensioners and others.

So, 74% of the surveyed pensioners stresses increasing malnutrition in the last months; in 77% of the cases people starved due to the lack of food. In general, 87% of the surveyed pensioners do not have enough money to purchase necessary food products, and as a result, in February 70% did not eat meat, 16% - butter, 40% - sugar, 84% - eggs, 87% - cheese. About 13% of the surveyed pensioners lost in weight 5 kg or even more during the last month .

70% of the surveyed refugees lost in weight 5 kg during the last year. 35% do not have food supplies, 45% have one week food supplies, 42% are selling their personal belongings to buy food.

\* \* \*

EPHISS CDC/ANIH USAID project thanks for help and assistance in gathering data and taking part in project activities:

Armenian Minister of Health	Dr.A.Babloian
Deputy Minister for Maternal Care	Dr.V.Demirchian
Deputy Minister for Sanitation and Epidemiology	Dr.A.Mcrtchian
Director of State Sanitation and Epidemiology Station	Dr.P.Dilbarian
Yerevan City Department of Health	Dr.A.Sargisian
Chief Doctors of polyclinics	J,Hovanesian,A.Arakelian, H.Harutunian,V.Karapetian, N.Hovanesian,S.Muradian,E.Sargisian.

The Provost & Vice-President of American University of Armenia	Dr.G.Gibson
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The Staff of American University  
of Armenia.

Sincerely,

Project Director  
Dr.Vladimir Davidiants

**Appendix F**

**FRENCH REPORT ON YEREVAN WATER SYSTEM**

**MISSION EREVAN - ARMENIE**

**du 18/11 au 25/11/92**

# SOMMAIRE

## GENERALITES

Situation politique actuelle  
Conflits au KARABAGH  
Moyens de communications  
Economie du pays  
Ressources Energétiques

## ORGANISATION DU SERVICE DES EAUX

Organigramme du Service des Eaux  
Zones administratives  
Matériel affecté par zones  
Matériel de recherches de fuites  
Ressources d'eau  
Traitement d'eau potable  
Débit d'eau potable distribué dans la ville  
Débit d'eau brute destiné à la zone industrielle  
Débit d'eau potable distribué hors de la ville  
Tableau des débits disponibles et des débits distribués  
Principe de fonctionnement hydraulique de la ville  
Patrimoine du réseau  
Tableau récapitulatif des appareils de mesure de débit  
Réseau d'assainissement  
Station d'épuration  
Priorité pour réorganiser le Service des Eaux  
Documents emmenés de France  
Informations diverses  
Annexes

## **GENERALITES**

Dans le cadre d'un protocole d'accord d'assistance technique signé entre le Maire de Marseille et le Maire de EREVAN, la S.E.M. a confié à M. YEPREMIAN la mission d'évaluer les ressources d'eau et le patrimoine du réseau de distribution d'eau potable et d'assainissement de la ville de EREVAN.

### **Situation politique et économique actuelle**

Fin 1920

Soviétisation de l'Arménie

21 Septembre 1991

Indépendance de l'Arménie

Le recensement effectué dans les années 84/85 dénombre :

- \* ARMENIE : 3.544.700 habitants
- \* EREVAN : 1.245.800 habitants

Actuellement, on estime à 1.500.000 habitants la population de la capitale (réfugiés du KARABAGH).

Le pays est enclavé : au nord par la GEORGIE, à l'ouest par l'AZERBAIDJAN, au sud-est : par l'IRAN, au sud-ouest par la TURQUIE.

### **Conflits au KARABAGH**

Cette province peuplée à 80 % d'arméniens demande son rattachement à l'Arménie. L'état de guerre qui existe n'est pas soutenu officiellement par le gouvernement arménien. Cependant, cette situation est en grande partie à l'origine du blocus que subit l'Arménie.

### **Moyens de communication**

Il existe actuellement un vol charter par semaine, entre PARIS et EREVAN (Aéroflot). Les voies d'accès par route et chemin de fer sont fermées. (risque de pillage par les pays riverains).

Quelques associations (MSF, aide humanitaire, etc...) affrètent parfois un avion et font parvenir des médicaments et des vivres.

## **Economie du pays**

Du fait de la difficulté d'acheminer du matériel, du pétrole et du gaz, les usines ne fonctionnent pas. Seuls les hôpitaux et les boulangeries (fabriques) sont alimentés en énergie et en eau. Certains produits de consommation, notamment l'essence, proviennent essentiellement de la contrebande.

L'inflation est importante. La monnaie en circulation est le rouble.

Le 18/11/92 : 1 dollar US valait 350 roubles

Le 25/11/92 : 1 dollar US valait 450 roubles.

Le SMIG est de 1.200 roubles mensuels qui permettent d'acheter en cette période 90 oeufs.

## **Ressources énergétiques**

Il existe dans la plaine de l'ARARAT une centrale nucléaire du type TCHERNOBYL, construite en 1984. Fin 1989 elle a été mise à l'arrêt suite au tremblement de terre qui a eu lieu.

Il existe des centrales hydroélectriques qui fonctionnent en utilisant les eaux du lac SEVAN (100 Km de EREVAN).

Leur activité a été ralentie car les eaux du lac ont baissé de 17 m.

Les économies d'énergie imposent des coupures de courant de 12h par jour, ce qui paralyse les activités de la capitale.

Seul, le Métro échappe pour le moment à ces restrictions.

## ORGANISATION DU SERVICE DES EAUX

Les systèmes d'adduction, de traitement, de distribution, de facturation de l'eau potable ainsi que la collecte et le traitement des Eaux usées sont gérés par l'Administration de production et exploitation Eau et Assainissement", qui dépend de la ville d'EREVAN.

Le Siège du Service des eaux regroupe la direction administrative, la direction technique, le service informatique, (gestion des abonnements, statistiques diverses, etc...)

La ville est découpée en 8 zones administratives, à chacune des zones est affecté du personnel administratif et technique qui a pour mission la maintenance du réseau (réparation) et la facturation.



**ZONES ADMINISTRATIVES RESPONSABLES DE LA GESTION DE L'EAU**

N°des zones	Nom des zones	Nbre usagers par zone	Q. l/s moyen par zone	Long Cond. des zones en Km	Pers.affecté administ/tech	Volume des réservoirs des zones/M3
1	CHENGAULT	165.000	2.100	216,6	10/117	41.500
2	EREGOUNI	170.000	1.600	274,6	11/110	21.500
3	SPANTARIAN	89.800	830	189,6	7/97	4.500
4	ARAPKIR	189.600	1.960	276,8	10/131	30.000
5	CHAHOUMIAN	202.200	1.530	163,0	11/97	27.400
6	MACHTOTS	152.000	1.460	271,9	9/12	68.000
7	MIASMIKIAN	84.400	840	169,4	10/110	29.500
8	KHERHERTAIN	302.000	1.650	330,3	13/171	22.500
<b>TOTAL</b>		<b>1.355.000</b>	<b>11.970</b>	<b>1.937,2</b>	<b>81/945</b>	<b>244.900</b>
REFUGIES:		1.500.000				

Organigramme du Service des Eaux

GOUVERNEMENT > MAIRIE

DIRECTION GENERALE DU SERVICE DES EAUX

Sce Administratif  
Mr GRIGORIAN

+ Sce Informatique

Sce Technique  
Mr GAJOYAN

8 zones administratives  
chargées du fonctionne-  
ment de la maintenance  
du réseau

Station d'épuration

Surveillance, entretien des  
réservoirs, Station de pompage  
des feeders

Entretien  
réseau

Encaissement  
des  
Redevances d'Eau

## RESSOURCES D'EAU

L'alimentation de la ville est assurée par le captage des sources (15) ou puits artésiens situés parfois à 60 km.

Le débit moyen des eaux est de 18.000 l/s.

13.000 l/s sont pompés par des stations de refoulement.

5.000 l/s parviennent gravitairement à la ville.

## TRAITEMENT DE L'EAU POTABLE

Ces eaux étant parfaitement limpides sont simplement chlorées à l'entrée des réservoirs par du chlore gazeux 0,3 à 0,5 mg par litre.

## DEBITS D'EAU POTABLE DISTRIBUES DANS LA VILLE

Les débits d'eau ont été mesurés à l'aide de débitmètres ultra sons, les valeurs ont été confirmées par réempotages et dépotages des réservoirs.

Débit d'eau total : 11.970 l/s

Répartition des débits:

Besoins Industriels	2.277 l/s
" communaux	2.846 l/s
" des usagers	6.847 l/s

## COMMENTAIRES

*La consommation des usagers à EREVAN est importante : 395 litres/jour par tête, alors qu'en France la consommation est comprise dans la fourchette 60-200 l/j/hab autour d'une moyenne de 100 l/j (voir annexe).*

## DEBIT D'EAU BRUTE DESTINE A UNE ZONE INDUSTRIELLE

Dans le Sud de la ville une zone industrielle est directement alimentée par une source (lac bleu). Le débit est de 2.200 l/s.

**DEBIT D'EAU POTABLE DISTRIBUE HORS DE LA VILLE**

La banlieu consomme environ 1.600 l/s.

**TABLEAU DES Q DISPONIBLES ET DES Q DISTRIBUES**

Q. l/s disponible		Q. l/s DISTRIBUES				
Q en l/s des sources		Q. l/s distribué dans Centre ville		Q. l/s distribués dans banlieu		Industriels
Pompage	Gravitaire	Industriel	Communal	Usagers	160 hameaux	
13000	5000	2277	2846	6847	1600	2200
18.000		11.970		+	1.600	+ 2.200
		15.770				

### **Gravitaire**

Le point de captage étant à une altitude supérieure à la ville permet d'alimenter certains réservoirs gravitairement.

### **Pompage**

Le point de captage est situé à une altitude inférieure à la ville, la différence de niveau pouvant atteindre 500m. Il a été installé deux stations de refoulement sur le même réseau.

**Station 1er degré:** installée au niveau du captage,

**Station 2ème degré:** installée à une côte intermédiaire entre le captage et le réservoir.

### **Distribution**

Les réservoirs ne sont pas placés aux points les plus hauts, ce qui ne permet pas d'alimenter les édifices hauts gravitairement. Il a été installé des "pompes de cours" (1000) qui pompent directement dans le réseau et alimentent un groupe d'immeubles. Il existe des "brises charge" sur les réseaux qui alimentent des quartiers ayant une différence d'altitude importante par rapport au réservoir (50 à 80 m), ensuite des pompes de cours permettent à l'eau d'atteindre les étages supérieurs. Ce système de distribution permet d'obtenir un plan piezométrique très bas dans les réseaux.

### **NOTE**

Le découpage administratif de la ville en huit zones ne correspond pas aux zones hydrauliques. Ainsi 1 réservoir installé dans une zone peut alimenter également une partie de réseau qui est sous la responsabilité d'une autre zone.

Par ailleurs, il n'existe pas de maillage entre les réseaux issus des différents réservoirs.

**Canalisations :** l'ensemble des réseaux est en acier et en fonte. La longueur totale des réseaux est de 1.937 Km.

**Conduites adduction**

Canalisations qui acheminent l'eau brute des sources jusqu'aux réservoirs.

**Conduites de distribution**

Réseau principal.

Ensemble des canalisations issues des réservoirs.

Réseau des cours.

Ensemble des canalisations secondaires qui sont issues du réseau principal et qui sont équipées à l'origine de pompes qui surpressent le réseau des cours afin de permettre à l'eau d'atteindre les derniers étages des édifices hauts.

**Age du réseau**

L'absence d'archives n'a pu permettre d'établir la datation du réseau, cependant, on peut considérer le réseau d'EREVAN comme un échantillonnage complet du réseau Français (patrimoine évalué en 1989) dont l'extrapolation peut être considérée comme fiable.

**Réseau Français 558.000 Km en 1989**

**Réseau d'EREVAN**

2% du réseau était construit avant 1900		
	soit 11.160 Km	38,74
3% entre 1900 et 1920	soit 16.740	58,11
10% entre 1920 et 1940	soit 55.800	193,70
10% entre 1940 et 1955	soit 55.800	193,70
22% entre 1955 et 1965	soit 122.760	426,14
45% entre 1965 et 1980	soit 251.100	871,65
8% entre 1980 et 1989	soit 44.640	154,96

Une chronologie dont il faudra tenir compte lorsque le temps sera venu d'élaborer le nécessaire et inévitable programme du renouvellement.

<b>Cond. Adduction</b>	<b>Cond. distribution</b>		<b>TOTAL</b>
586,7 Km	Réseau principal 730,3Km	Réseau des cours 620Km	1.937 KM

#### **Equipement du réseau**

Des cheminées d'équilibre sont installées sur chacun des départs des réservoirs (purge d'air - évite le fonctionnement en dépression).

Nombre de vannes sur l'ensemble des réseaux : 8.495

Nombre de bouches d'incendie " " : 1.522

#### **Appareil de comptage**

Il existe 24 débitmètres ultra sons et 1 diaphragme sur les conduites de refoulement et sur certains départs des réservoirs. 14 sont en état de fonctionnement, 10 sont hors service.

#### **En projet :**

7 débitmètres à installer sur les conduites de départ non encore équipées d'appareils de comptage.

#### **Branchements :**

Les branchements sont généralement en acier et sont soudés sur les conduites en acier, ou avec 1 collier à lunette pour les tuyaux fonte. Il existe un RV enterré à l'origine du branchement.

Nombre de branchements: 43.961 - Pas de compteurs sur les banchements des usagers.

## Répartition des branchements

BRANCHEMENT PUBLIC				Brt. usagers	TOTAL
Industriels	Communaux	Enseignement	Chaufferie		
2.820	397	403	341		
3.961				40.000	43.961



**TABLEAU RECAPITULATIF DES APPAREILS DE MESURE DE Q**

EMPLACEMENT	TYPE APP.	MARQUE	Diam.cond.	En fonct.	H.S.
<b>Station pompage ARARATIAN</b>					
3ème étape 1ère conduite	Ultrason	Russe "AKOUSTRON"	1000		X
3ème étape 2ème conduite	ultra son	Russe "AKOUSTRON"	1000		X
3ème étape 3ème conduite	ultra son	Russe "AKOUSTRON"	1000		X
4ème étape 1ère conduite	ultra son	Russe "AKOUSTRON"	1000		X
4ème étape 2ème conduite	ultra son	Russe "AKOUSTRON"	1000		X
<b>Station pompage GUETACHENE</b>					
Cond. d'amenée	ultra son	Russe "AKOUSTRON"	?		X
<b>Station pompage ARZNI</b>					
1ère conduite	ultra son	Russe "AKOUSTRON"	900	X	
2ème conduite	ultra son	Russe "AKOUSTRON"	800	X	
<b>Réservoir LAC BLEU</b>					
Départ	Diaphragme	Russe	1200	X	
<b>Réservoir ERTETS</b>					
1ère conduite amenée	Ultra son	Russe	1000	X	
2ème conduite amenée	Ultra son	Russe	1000	X	
1ère conduite départ	Ultra son	Russe	800	X	
2ème conduite départ	Ultra son	Russe	800	X	
<b>Station pompage KHARBERT</b>					
1ère conduite amenée	Ultra son	Russe	800	X	
2ème conduite amenée	Ultra son	Russe	800	X	
<b>Station pompage ARINDJ</b>					
Conduite amenée	Ultra son	Russe	400	X	
<b>Station pompage DZORAGHPURE</b>					
Conduite amenée	Ultra son	Russe	400	X	
<b>Station pompage TSARAVAGHPURE</b>					
Conduite amenée	Ultra son	Russe	400	X	

EMPLACEMENT	TYPE APP.	MARQUE	Diapl. Coff.	En Funct.	...
<b>Station pompage ERGUESS</b> Conduite amenée	Ultrason	Russe	400		X
<b>Station pompage KATNAGHPURE</b> 4ème cond. près brise charge	VENTURI	Russe	800	X	
<b>Station pompage ARARATIAN</b> 2ème étape	ultra son	Russe	1200	X	
<b>Station ARZAKAN GUMUCH</b> Village ZOVOUNI	Ultra son	Russe	800		X
Village NOR GUEGHI	Ultra son	Russe	800		X
<b>Réservoir VERIVE DAVIJACHENE</b> Conduite Aparan	Ultra son	Russe	800		X
<b>Station pompage CHOR CHOR</b>	Ultra son	Russe	500		X

### PROJET DEBITMETRES à INSTALLER

<b>RESERVOIR LOUKACHINE</b> 1ère conduite amenée	Ultra son		1000		
2ème conduite amenée	Ultra son		1000		
3ème conduite amenée	Ultra son		1000		
ARARATIAN 3ème et 4ème étape					
<b>Réservoir ABOVIAN</b> Amenée conduite GANNI	Ultra son		700		
<b>Réservoir MHOUP</b> 2ème Conduite KATNAGHPURE	Ultra Son		900		
<b>Réservoir ARINDJ</b> 3ème conduite KATNAGHPURE	Ultra son		900		
<b>Réservoir MARACH</b> Conduite amenée	Ultra son		500		

## **Réseau Assainissement**

Le réseau d'assainissement est du type séparatif. Les industriels doivent traiter les eaux avant de les rejeter au collecteur. 90 % de la ville est équipée d'un réseau Assainissement. La longueur totale du réseau est de 1.200 KM.

## **Station d'épuration**

La station utilise le procédé biologique. Elle est prévue pour traiter 600.0 m<sup>3</sup> jour:

- 60 % du volume traité provient des rejets ménagers
- 40 % " " des rejets industriels.

La capacité de traitement est très insuffisante. Le volume d'eau distribué, usagers + industriels est de 15,770 m<sup>3</sup>/s, soit 1.362.528 m<sup>3</sup>/jour.

La ville d'EREVAN a entrepris la construction d'une autre station sur le même site dont la capacité de traitement sera de 750.000 m<sup>3</sup>/jour.

## **Normes de la station**

Besoin biologique d'oxygène < 15 mg/l

Concentration des particules en suspension < 15 mg/l

Concentration des ions d'hydrogène 6,5 à 3,5

Température de 6 à 30 °

L'humidité de la boue < à 85% après essorage (vacum)

" " < à 50 % après séchage.

**MATERIEL AFFECTE PAR ZONES  
POUR REPARATION CANALISATIONS**

N° des ZONES	NOM des ZONES	M A T E R I E L			VEHICULES DEPANNAGE TRANSPORT
		Compresseur	Pelle mécanique	Voiture soudure + Grpe électrog.	
1	CHENVAVIT	0	1	1	2
2	EREGOUNI	0	1	1	3
3	SPANTARIAN	1	0	1	2
4	ARAPKIR	0	1	1	2
5	CHAHOUMIAN	1	0	1	2
6	MACHOTS	0	1	1	2
7	MIASMIKIAN	1	0	1	2
8	KHERHERTAIN	0	1	1	4
TOTAL		3	5	8	19

**MATERIEL RECHERCHE DE FUITE**

- 1 CORRERATEUR MICROCORR DK 1000 : en panne  
Batterie ampli HS
- 1 HYDROLUX H 2000 EN PANNE  
Amplificateur électronique manque piles 1,5 v
- 1 HYDROLUX HL 60 s  
Localisation Cond. Métallique Fonctionne
- 1 Détecteur de BAC (SEBA) Fonctionne.

## PRIORITES POUR REORGANISER LE SERVICE DES EAUX

Ce qui apparait en 1er lieu au cours de l'inventaire des installations et du matériel, c'est la vétusté, le manque d'archives (tout se passe oralement), l'absence de règlement.

- Etablir 1 plan directeur des réseaux de distribution
- Créer des plans de réseaux avec des côtes altimétriques des radiers trop pleins des réservoirs.
- Etudier la suppression des "pompes de cours" en augmentant le plan piézométrique (renforcement maillage, etc...)
- Faire installer des compteurs sur les branchements.
- Equiper les feeders de débitmètres.
- Equiper le réseau de ventouses d'appareils de régulation.
- Etablir un programme de renouvellement du réseau et des bits.
- Etudier la mise en place d'un système informatique qui permettra la gestion des abonnements, des factures, etc...Actuellement, le Service des eaux a récupéré du matériel IBM et Russe (usagé).
- Prévoir 1 gestion centralisée.

## DOCUMENTS EMMENES DE FRANCE

J'ai remis à l'adjoint du Maire de EREVAN :

- \* 1 règlement sanitaire départemental
- \* 1 gestion de l'eau (modèle français)
- \* 1 gestion de l'eau en France
- \* des plaquettes SEM (usines, etc...)
- \* des plaquettes Ville de Marseille.

Au Directeur administratif M. GREGORIAN, et à l'ingénieur en chef M. GAJOYAN :

- \* 14 cahiers techniques édités par la Fondation de l'Eau (les pompes centrifuges - recherches et détection de fuites - réactifs de traitement d'eau potable, etc...)
- \* 1 traduction en arménien de la recherche et détection de fuites.

\* \* \*

## INFORMATIONS DIVERSES

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L'Ambassadeur de France à EREVAN, Mme HARTINGIH :

HOTEL RAZDAN EREVAN

Tél: 19.78.852.15.10.95 (ligne internationale)

Fax: ...."..." 15.11.05

demande :

1°) le montant (à la louche) du coût de réhabilitation du réseau, des études, car le ministère des Affaires étrangères dispose d'un budget qui doit être utilisé.

**Prendre contact avec elle.**

Tél GARCIA : 46.95.52.00 -

2°) de lui faire parvenir des documents, par la valise diplomatique, sur la gestion de l'eau, les réglementations, etc...

3°) de prendre contact avec M. GARCIA - consultant à la Lyonnaise des Eaux qui a déjà effectué des missions en ARMENIE.

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**ADMINISTRATION DE PRODUCTION-EXPLOITATION DE L'EAU-  
ASSAINISSEMENT**  
66 A, rue Abovian

EREVAN 375025 - ARMENIE

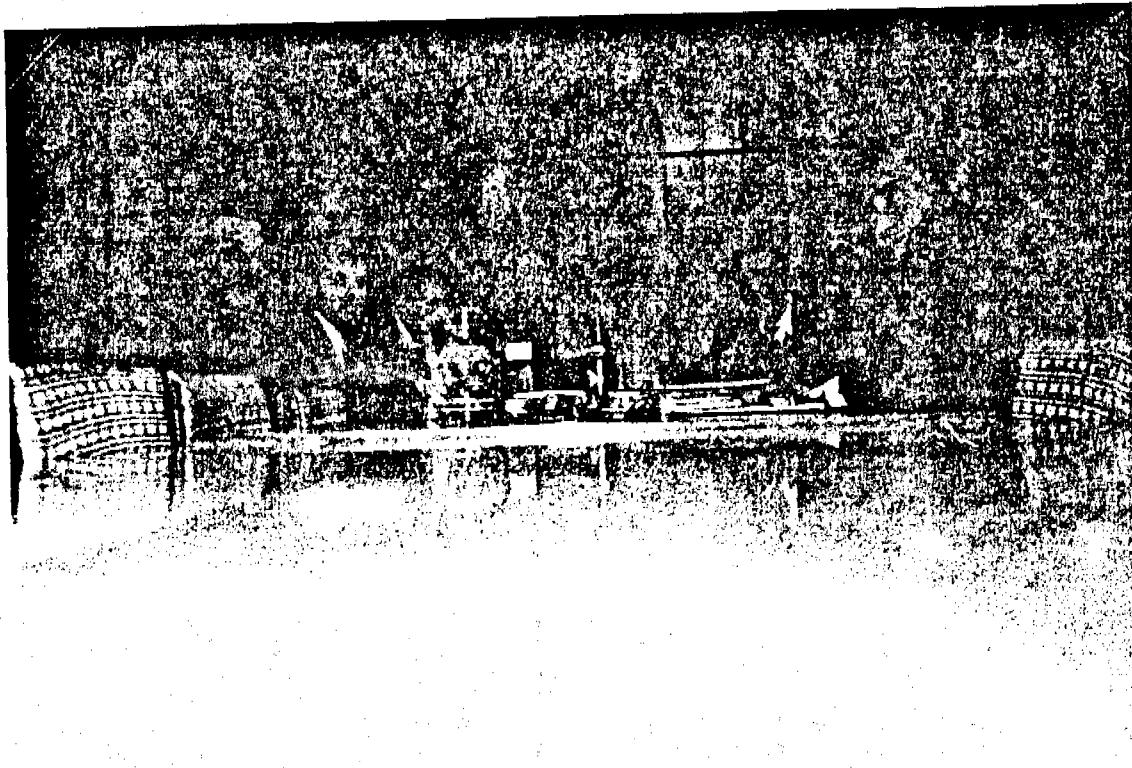
**Chef Administration : M. HOVANES GRIGORIAN**  
Tél : 57.40.48 Bureau

**Ingénieur en chef : M. Albert GAJOYAN -**  
Tél : 57.52.76 - Bureau  
57.52.54       "  
58.38.31       Domicile

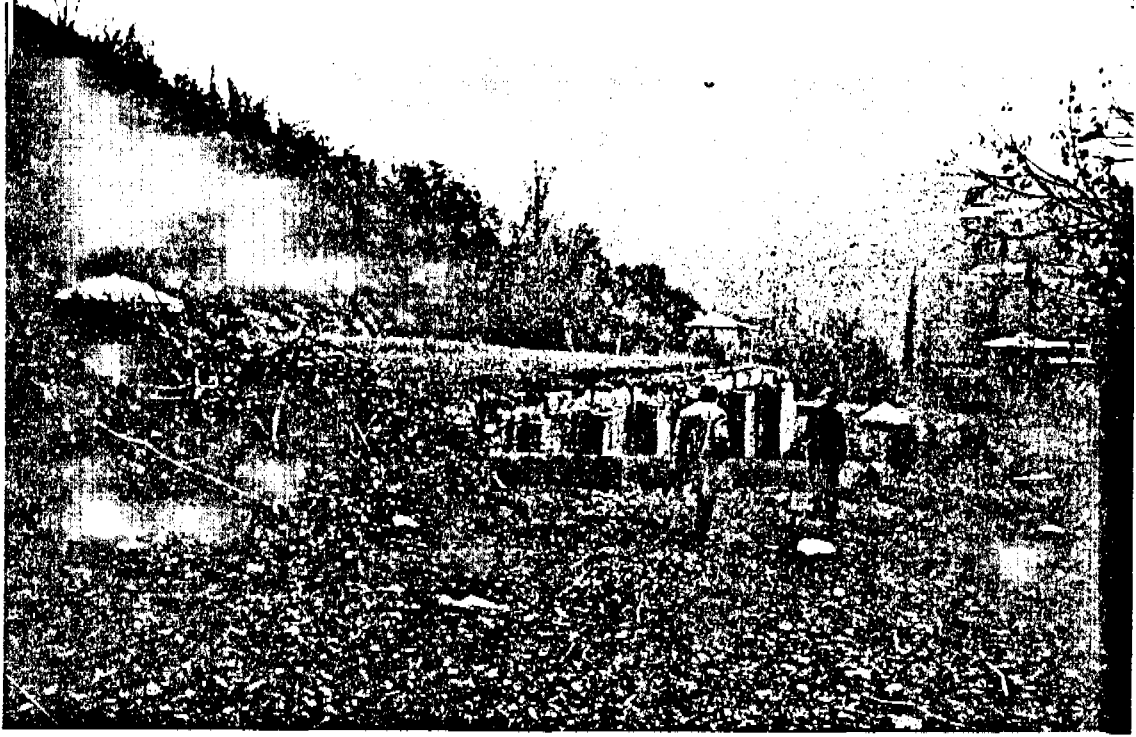
Interprète français (Mairie)  
M. VARTAN  
Tél. Mairie 56.13.13  
Tél. Dom. 27.20.30

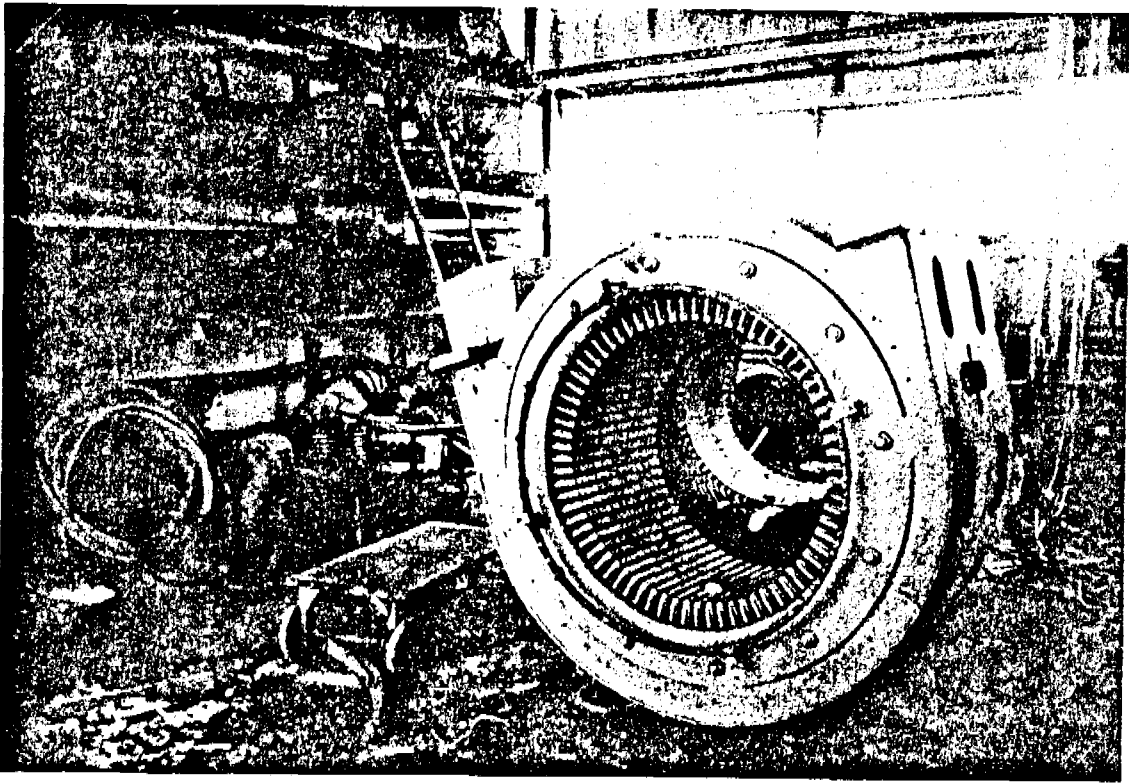
Interprète français (occasionnel)  
M. VANICK ADJEMIAN  
Tél. Dom. 22.40.70

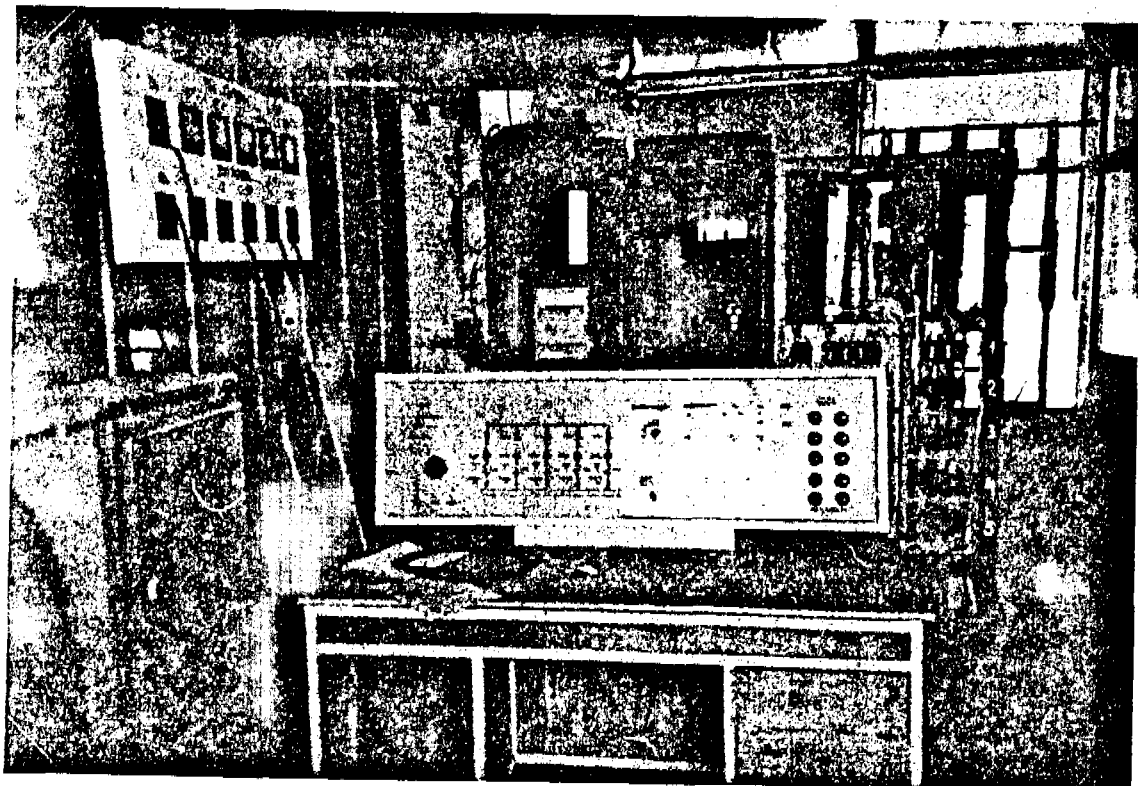
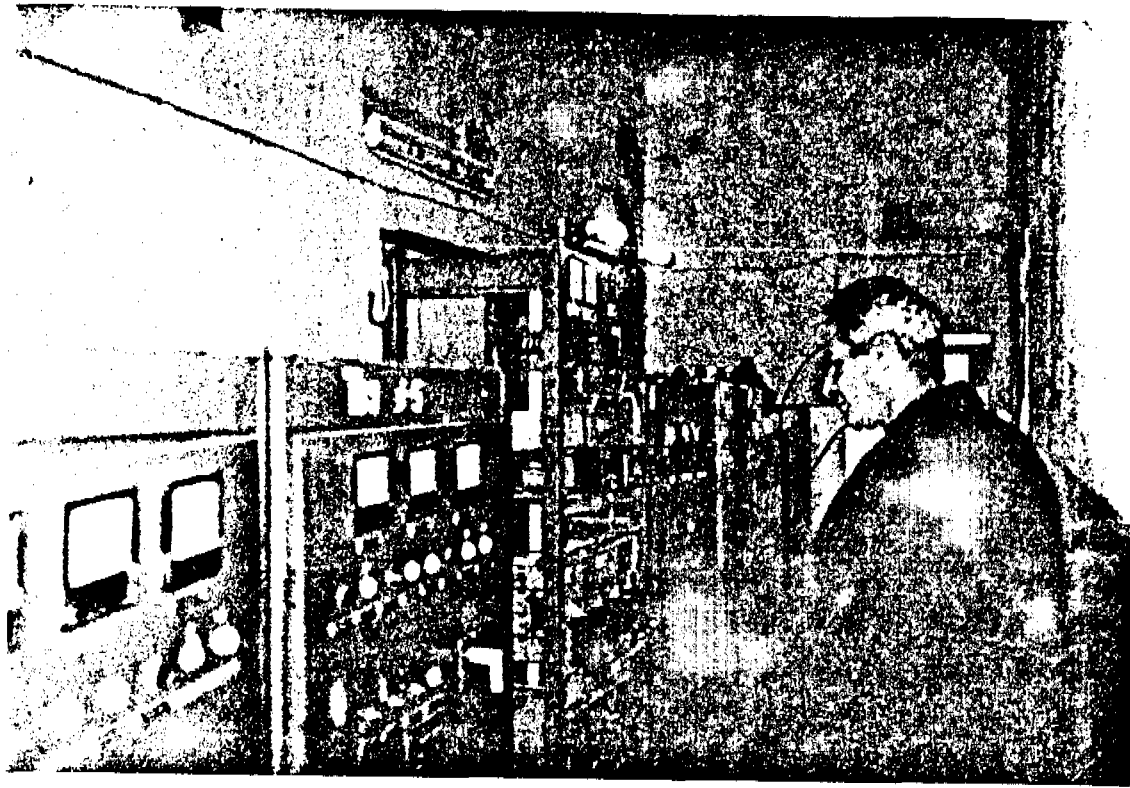
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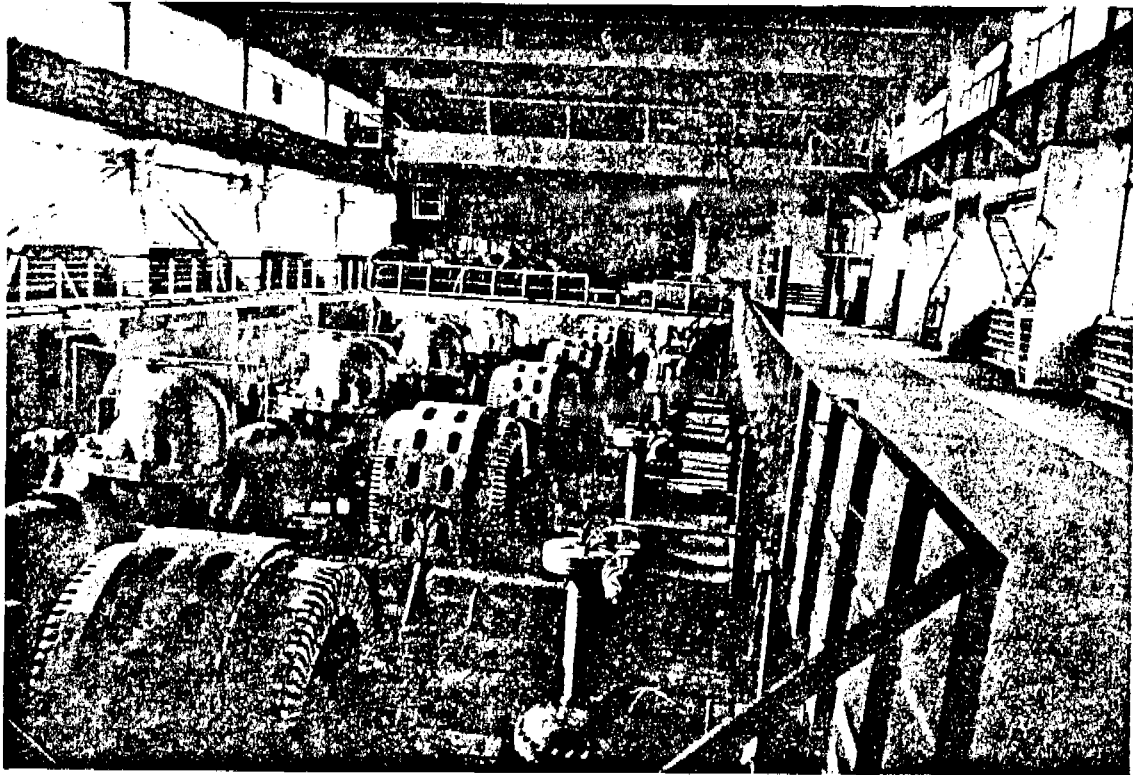
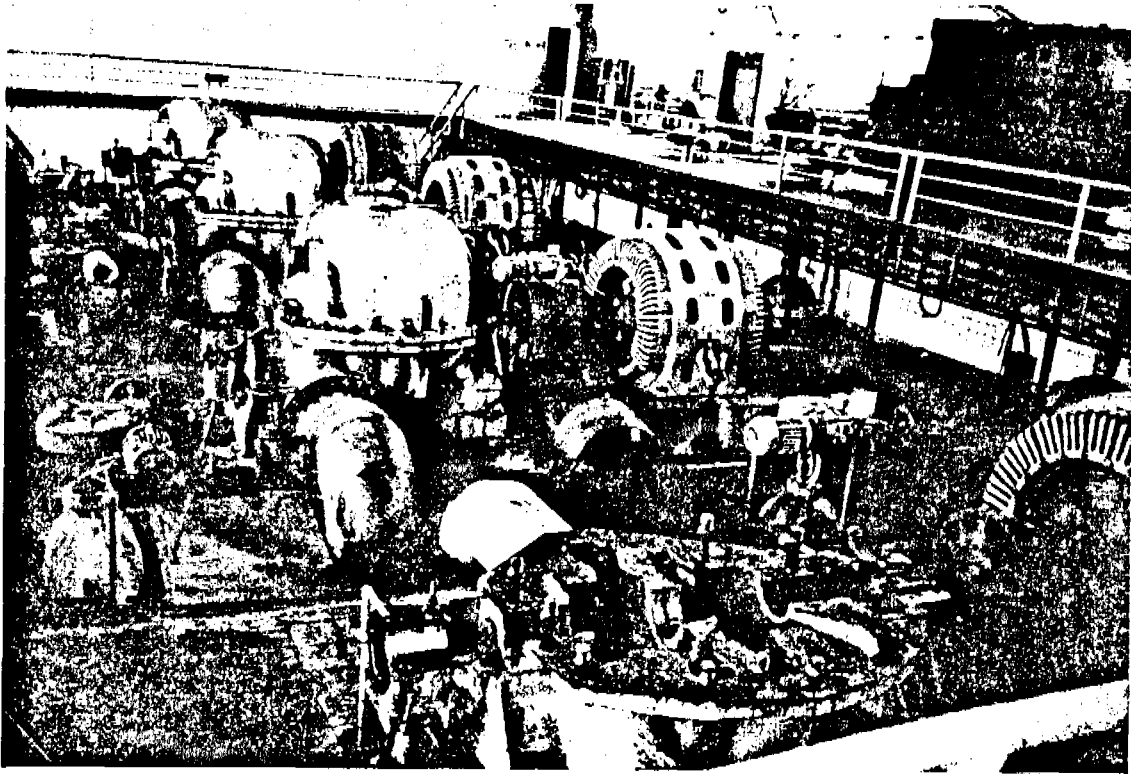


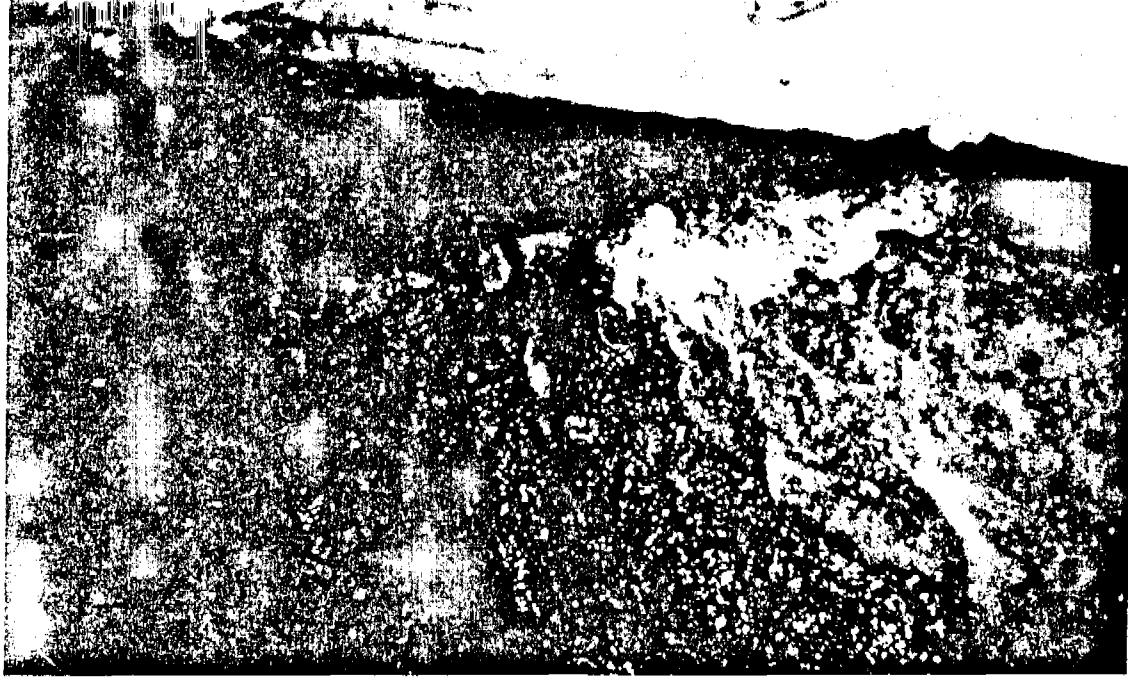








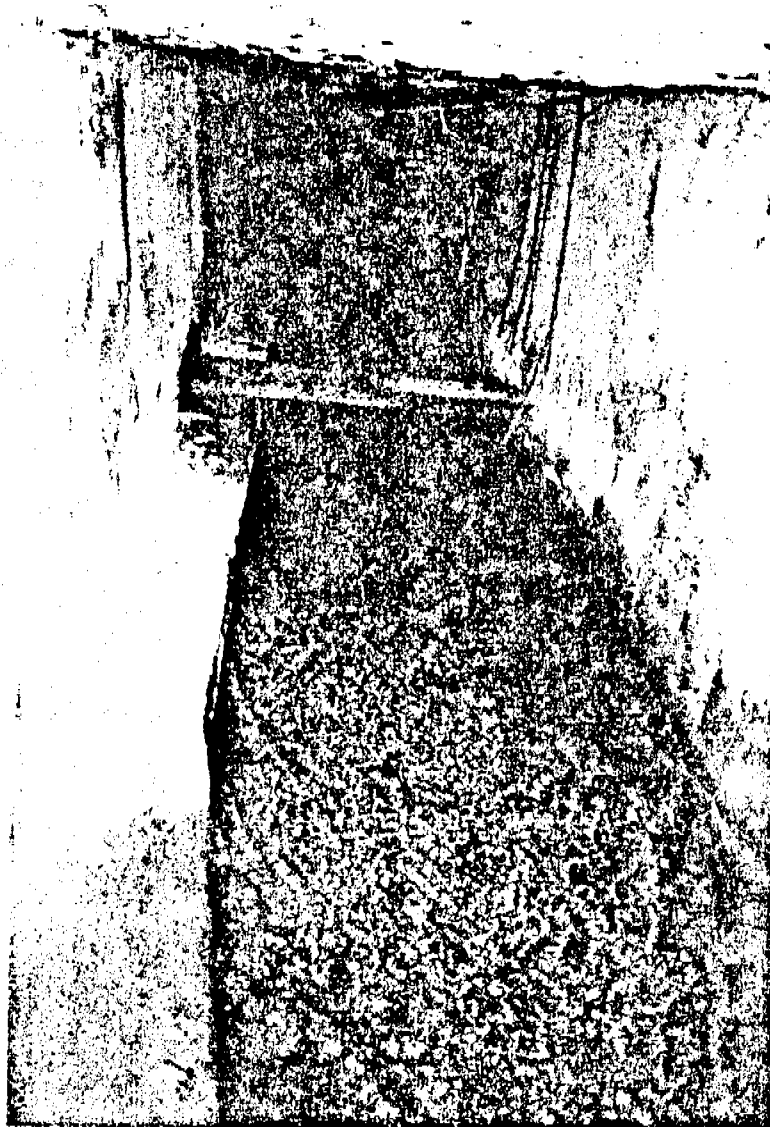




CAPTAGE SOURCE GARNIT



CAPTAGE SOURCE GARNIT .

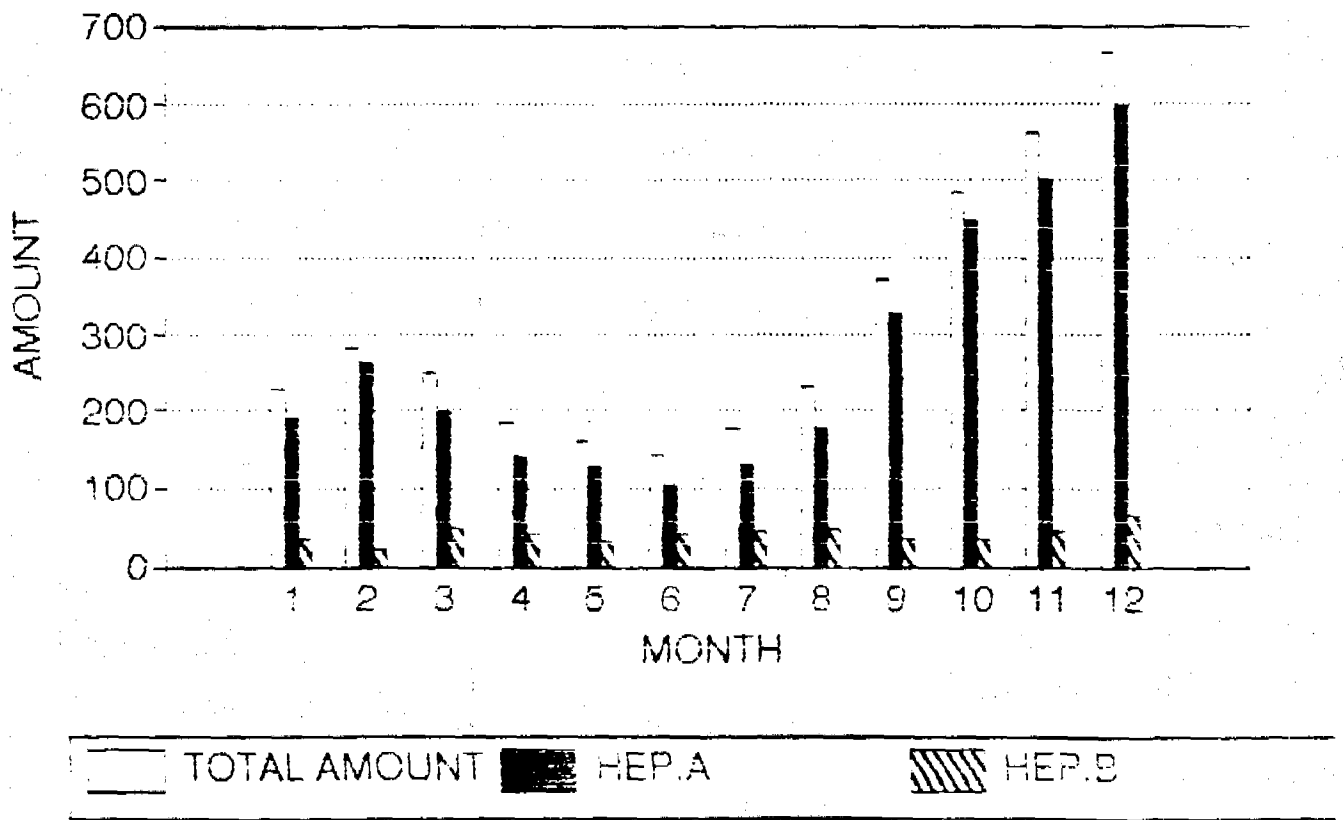


**Appendix G**

**DISTRIBUTION BY MONTH OF VIRAL HEPATITIS, SHIGELLOSIS,  
AND SALMONELLOSIS, 1992**

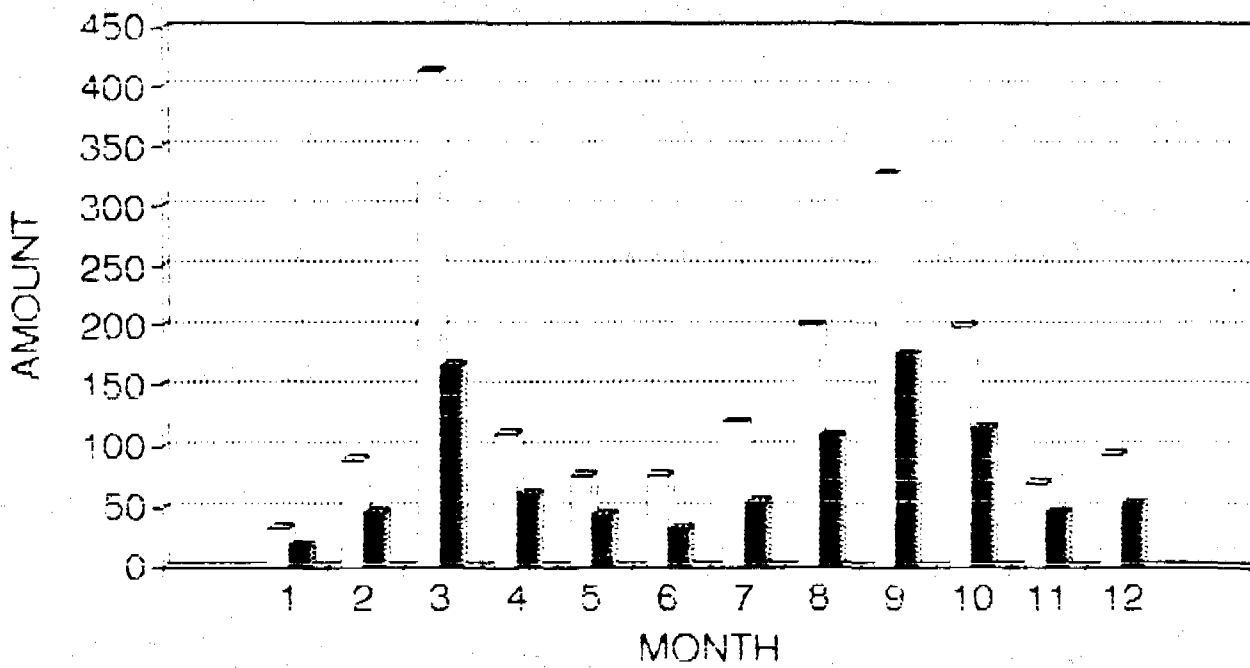
# VIRAL HEPATITIS DISTRIBUTION BY MONTH

## ARMENIA 1992



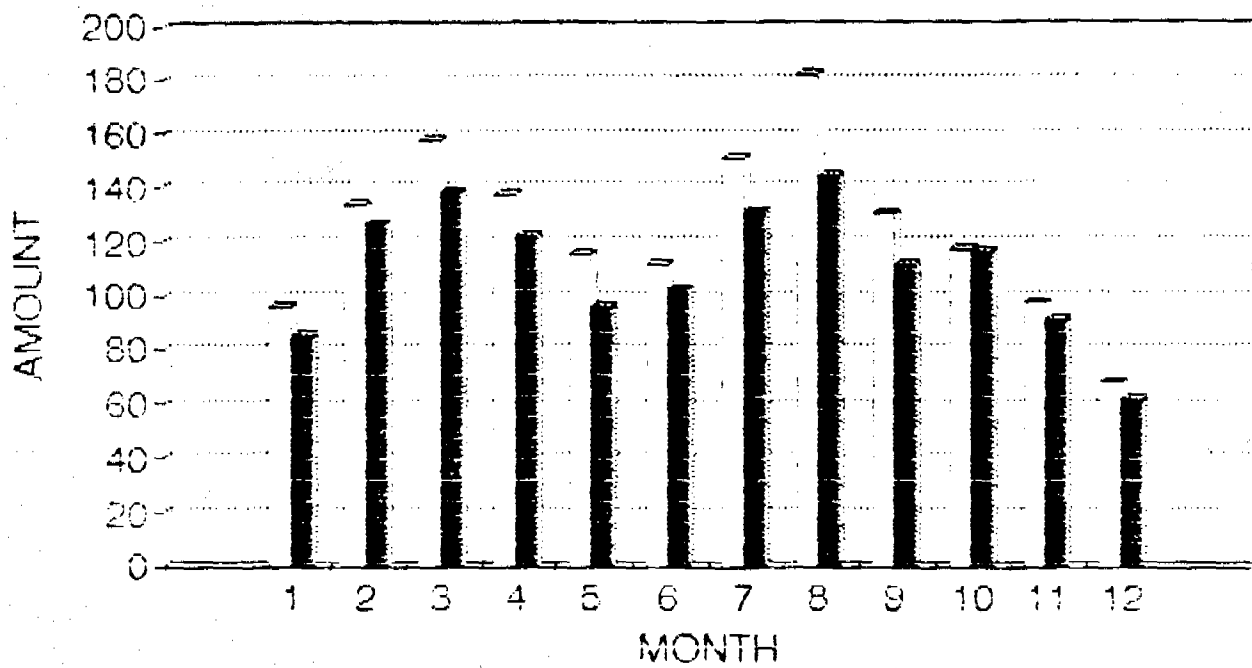


# SHIGELLOSIS DISTRIBUTION BY MONTHS ARMENIA 1992



— TOTAL AMOUNT      ■ CHILD (bef. 14 years)

# SALMONELLOSIS DISTRIBUTION BY MONTHS ARMENIA 1992



— TOTAL AMOUNT      ■ CHILD (bef. 14 years)

**Appendix H**

**HEALTH EDUCATION MATERIALS**

առողջ մարդկանց իրենց վարակումից միայն 6—8 օր հետո, աչիներն՝ երբ հարուցիչները մլակների ստամորսագիբային համակարգից անցնում և կուտակվում են նրանց թրադեղձե-  
րում:

Երբ վարակված մլակը կծում է առողջ մարդուն՝ թքի հետ միասին վարակվողի արյան մեջ են անցնում նշված տենդի հարուցիչները, որոնք և առաջացնում են այդ հիվանդությունը:

Բնության մեջ դեռես չի հայտնաբերվել մի այլ կենդանի, բացի մարդուց, որ ընկալունակ լինի այս հիվանդության նկատմամբ, ուստի վարակի տղբյուրը առայժմ պետք է համարել միայն հիվանդ մարդուն:

Մլակները պապատաշի տենդի հարուցիչները փոխանցում են ոչ միայն մարդկանց, այլև իրենց սերունդներին: Ապացուցված է, որ մլակները ի փեճակի են փոխանցելու այդ վարակը մինչև իրենց երրորդ սերունդը:

Մլակները փոխանցում են նաև լեյշմանիոզ հիվանդությունը: Գրոնով (այլ կերպ անվանվում է տարեկան, պենդենյան խոց, հալեպյան պզուկ և այլն), բացի մարդկանցից, հիվանդանում են նաև որոշ կենդանիներ՝ ափազամկները, դեռնասակյունները և այլն: Մլակներին հաճախ կարելի է հայտնաբերել այս կենդանիների բներում, որտեղ նրանք վարակվում են մաշկային լեյշմանիոզի հարուցիչներով ու դրանք փոխանցում են մարդկանց: Հայաստանում մաշկային լեյշմանիոզի դեպքեր արձանագրվել են Գերեսի, Միսիանի (Մ. Մարգարյան), Ղափանի (Կ. Գեղձունյան) շրջաններում:

Լեյշմանիոզ հիվանդության մյուս ձևը դա ներքին օրգանների (ընդերաչին) լեյշմանիոզն է: Ընդերաչին լեյշմանիոզով հիվանդանում են հատկապես փոքր երեխաները. հիվանդությունը բավականին երկար է տևում ու ծանր ընթացք ունի: Այս հիվանդության տարածման գործում որոշակի նշանակություն ունեն վարակված թափառող շները, որոնց արյունով անվիլուց հետո մլակները վարակվում, ապա փոխանցում են այդ վարակը մարդկանց:

Ընդերաչին լեյշմանիոզն արձանագրվել է Երևան քաղաքում՝ Արարիկի, Նարբ, Ալդեստան թաղամասերում, ինչպես նաև Արովյանի, Հրազդանի և այլ շրջաններում:

Մլակների նախաթևավորված ձևերի դեմ պայքարը տար-

վում է նույն միջոցներով, ինչպես հանձների դեմ, իսկ հասուն մլակների դեմ՝ ինչպես թևավոր մոծակների դեպքում:

## ԼՎԵՐ

Լվերը փոքրիկ միջատներ են, որոնք ապրում են մարդկանց, տարբեր կենդանիների և թռչունների վրա, անվիլով նրանց արյունով: Լվերը ծածկված են մազմուկներով ու խողանիկներով, հարդագեղին կամ մուգ դարչնագույն են: Լվերի մարմնի վրա կան երեք դուչք սաքեր, ընդ որում հետին դուչքը ավելի ուժեղ է դարգացած, որի օգնությամբ միջատը կարող է թռչել 32 սմ հեռու և մոտ 9 սմ վեր: Լվերը իրենց սպիտակադեղնավուն ձվերը դնում են հատակի ճեղքերում, առնետների, շների, թռչունների բներում, թափոններում կամ ուղղակի գետնի վրա: Իր կյանքի ընթացքում լույն կարող է ածել մինչև 450 ձու: Չվաղրելուց 3—5 օր հետո ձվից դուրս է գալիս բավականին շարժուն թրթուրը, որը անվում է զանազան օրգանական նյութերով, ինչպես նաև հատուն լվերի կղանքով:

Թրթուրն աստիճանաբար մեծանալով, վերածվում է հարսնյակի և ապա՝ շհատունացած, իսկ հետո՝ արդեն հասուն լվի: Զարգացման ամբողջ շրջանը, բարենպաստ չեղմաստիճանի պայմաններում (18°), տևում է 3—5 շաբաթ:

Տարբեր տեսակի լվերի կյանքի տևողությունը տարբեր է՝ տափաստանային կրծողների լվերը ապրում են մինչև 1725 օր, մարդու լույն՝ 300-ից մինչև 513 օր, շան լույն՝ 234 օր, առնետների լույն՝ մինչև 100 օր:

Լվերը հեշտությամբ մի կենդանուց անցնում են մյուսին: Մարդկանց, կատուների, շների և տնային այլ կենդանիների վրա հաճախ փոխադրվում են զանազան կրծողների լվեր: Լվերը բարենպաստ պայմաններում անվում են արյունով, յուրաքանչյուր 2 ժամը մեկ անգամ: Արյուն ծծելը տևում է մոտավորապես 10—15 րոպե: Մարդու լույն արյուն ծծելուց հետո առաջին 30 րոպեում արտաթորում է 10—20 անգամ:

Կծելու ժամանակ լվերը իրենց թքագեղձերով արյան մեջ ներարկում են մի հյութ, որն իջեցնում է նրա մակարդունակությունը: Կծած տեղում առաջանուլ են բոր և կարմրու-

ՀԵՍՃ ԱՌՈՂՋԱՊԱՀՈՒԹՅԱՆ ՄԻՆԻՍՏՐՈՒԹՅՈՒՆ  
ՀԱՆՐԱՊԵՏԱԿԱՆ ԱՌՈՂՋՈՒԹՅԱՆ ԿԵՆՏՐՈՆ

Հ Ո Ւ Շ Ա Ռ Ե Ր Թ

ՄԻՎՏԱՆԳԵՔ ՁԵՐ ԿՅԱՆՔԸ

Վերջին տարիներին համայն մարդկության համար ի հայտ է եկել ևս մեկ շարաբաստիկ հիվանդություն ՉԻՊՇ (ձեռքբերովի իմունոդեֆիցիտային համախտանիշ) կամ ՍՊԻՊ-ը, որը զարգանում է սպեցիֆիկ վիրուսից: Վերջինս բնկնելով արյան մեջ, առավելապես ախտահարում է արյան սպիտակ դնդիկները (լիմֆոցիտները), որոնք օրգանիզմի համար կարևոր պաշտպանական օղակ են: Վարակվելով ՍՊԻՊ հիվանդությամբ մարդը դառնում է «անպաշտպան» միկրոբների և ուռուցքների նկատմամբ: Հիվանդությունը զարգանում է դանդաղ և մի քանի տարիների ընթացքում միակ ախտանիշը համարվում է ավշահանգույցների մեծացումը: Հետագայում զարգանում է երկարատև տենդ, առաջանում է ընդհանուր թուլություն, հյուսվածություն, առաջ քրտնարտադրություն, նաև թոքերի բորբոքում, մաշկի թարախային և բշտիկացանային ախտահարում, շարորակ գոյացություններ և սեպսիս (արյան վարակում): Այդ հիվանդությունից ի վերջո մահանում են: Ժամանակակից բժշկությունը անզոր է բուժելու այն: ՍՊԻՊ-ով հիվանդը կենցաղում վարակ տարածելու վտանգ չի ներկայացնում: ՍՊԻՊ-ի հարուցիչը չի փոխանցվում խոսակցության, հագի, փռչտոցի, քրտինքի, մոծակների, ինչպես նաև սննդամթերքի, ամանեղենի միջոցով: Վարակը փոխանցվում է սեռական հարաբերությունների, արյան փոխներարկման, զանազան սրբուկումների ժամանակ: Այն առավել տարածված է արվամուլների (հոմոսեքսուալիստ), թմրամուլների, ալլասերված սեռական կյանք վարողների շրջանում: Քանի որ բուժման համար օգտավետ դեղանյութեր դեռևս չկան, ապա առաջնային խնդիրներից է՝ կանխարգելիչ միջոցառումների կիրառումը: Այսպես.

խուսափել, պատահական սեռական կապերից (հատկապես արվամուլների, թմրամուլների, անկանոն սեռական կյանք վարողների հետ), չօգտվել պատահական, շախտահարված ներարկիչներից, կիրառել անհատական կանխարգելիչ միջոցներ՝ պահպանակներ (պրեզերվատիվ):

ՍՊԻՊ-ի կասկածի դեպքում անհրաժեշտ է առանց հապաղելու դիմել բժշկին կամ ախտորոշիչ կենտրոն:

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Միֆիլիսը, ինչպես այլ վեներական հիվանդություններ՝ սուսանակը, փափուկ շանկեր ստորաբար փոխանցվում են սեռական հարաբերության, հագվադեղձ՝ առատաեռական հանազաբեռով, աչպես՝ համբուրվելու, հիվանդի կենցաղային առաջանները (քաժակը, ցղայը, սպիտակեղենը և այլն) օգտագործելու միջոցով: Կա նաև հիվանդության փոխանցման երրորդ ընկերակցին հանազաբեռ, երբ պատուր վարակվում է սիֆիլիսով՝ հիվանդ մորից՝ ներազանդային կյանքում:

Միֆիլիսի հարուցիչը կարող է ներթափանցել առողջ մարդու օրգանիզմ մաշկի նույնիսկ ամենափոքր, անտեսանելի բերվածվից: Ներթափանցումից 3—4 շաբաթ նետո, մտափի տեղում սուսանում է աչպես կոշված կարծր կամ կոշա շանկը (խոց), որը ունի կարծր երան, կյար և հարթ եզրագծեր, փաշտուն հասակ և մասկարծիր գույն:

Խոցը ջազմա չէ, բար և որևէ անհանգստություն չի պատճառում հիվանդին, ուստի նա ուշադրություն չի դարձնում և չի դիմում բժշկի: Մինչդեռ հիվանդը վարակի տարածման սարբար է շրջապատի համար, իսկ հիվանդությունը շարունակվում է խուրանայ և դասնում է դժվար բուժելի:

Կոշա շանկերի առաջացումից մեկ շաբաթ անց, սպիտակաժանների հարուցած բարբաժման հետևանքով սկսում են մեծանայ (տոշեյ) մատակա աղշահանգույցները: Կոշա շանկերի երեան գալը համարվում է սիֆիլիսի առաջին շրջանի սկիզբը, ուստի անհնապայ աներամեշա է դիմել մասնաղլա՝ բժշկի: Միֆիլիսի վաղաժամ ախտորոշումն ու ժամանակին բուժումը ապահովում են սրագ և վերջնական ապախիբումը:

Վարակման օրից ինը, իսկ կարծր շանկերի առաջացումից վեց շաբաթ անց մարմնի մաշկի ու յորժարադանքների վրա երեան է գալիս առաժամ, վարդացան, որը և հիվանդության երկրորդ շրջանի բնակարանն է: Մի հանի ամիս անց ցանը կարող է կրկին հայանվել (կրկնվող ցան կամ երրորդային կրկնվող սիֆիլիս): Միֆիլիսի երկրորդ շրջանում հիվանդի մազերը բաժվում են՝ սպիտակաժանների քույրը ազդում է մազերի արմատների վրա:

Միֆիլիսի երկրորդ շրջանը տևում է մոտավորապես 1—3 ամսի, որի ընթացքում հիվանդությունը շրմովելու դեպքում կարող է կրկնվել մի կանի անգամ:

Ներքե՛ շպեա՛ է մոտանայ վաղուց հայանի այն դույրը, որ շրմովելու դեպքում սիֆիլիսով հիվանդ մորից, որպես կանոն ծնվում է հիվանդ երեխա:

Միֆիլիսով հիվանդ կանանց հղիությունը հանախի ավարաժում է վիժումով, վաղաժամ ծնեղաբերությունը կամ մեաժամժնությունը:

Գաղտնի սիֆիլիսի կանխարգելման համար կինը հղիության ընթացքում պետ է հանախի կանանց կանսուպացիա, որտեղ և կատուզի նա առողջական վիճակը, կկատարվեն մանրազնին էներություններ:

Միֆիլիս հիվանդություն, նա բուժման և կանխարգելիչ միջոցների մասին կարելի է երկա խոսել, բայց աներամեշա է ընդգծել մի կարևոր հանգամանք. սիֆիլիսի ընթացքի վրա խիստ է անդրադառնում այս կամ այն առիթով հակաբիոսիլիսի լայն կիրառումը: Դրա նետանելով երկարաժգյում

է բաժնված շրջանը, որը ստորաբար տնուս է 3—4 շաբաթ, աղալազվում հիվանդության կրկնական պատկերը:

Հակասիֆիլիսային դեղամիջոցների օգտագործումը տեսլին պայմաններում անգամ բժշկի մասնակցությամբ, շափազանց վտանգավոր է, քանի որ այդ վերջիններս կարող են առաջացնել տարբեր օրգանների բարդություններ, որոնց հայտնաբերումը նետարվոր է միայն բժշկական նիմանակներում կատարվող մանրազնին էներության միջոցով: Չպետ է մոտանայ նաև, որ տեսլին բուժման դեպքում հիվանդի մոտ կարող է առաջանայ կարժեցայ առողջացման վիճակ, որը խիստ վտանգավոր է նա և աչպա՝ շրջապատի համար:

Հիվանդների մեծ մասը նում է վարակի սարբարները, բայց երբեմն անգամայից մարդիկ, բաժնում և աչպախով խոչընդոտում են այդ շաբաթառակի հիվանդության վերացմանը:

Հիվանդները պետ է կաժատացած լինեն, որ իեկեց հիվանդության մասին հայտնած բարբ տեղեկությունները խիստ գաղտնի են պահում, հետևաբար և անխմաա է բաժնեկ այն անմանց, որոնք վարակման պատճառ են կարժել:

Վարակի սարբարների հայտնաբերմանը գուրբերայ հետազոտում են նաև կոնտակտաբերները, հիվանդի նետ շիում անեցողները, և հիվանդության նշանները հայտնաբերելիս անմիջապես ձեռնարկվում է բուժումը:

Վերոնիշայ շաբաթանից միանգամայն հատկանայի է, որ անկանոն սեռական կյանք վարող անմեկն վաղ քե ոչ երբեք են սիֆիլիսով կամ այլ վեներական հիվանդություններով վարակվելու:

Երբեմն մեց հարցնում են՝ «Վտանգավոր է աղոյո՛ք սեռական զուգլամուրյունը, բանի որ երբեմն այս կամ այն պատճառով ամուսենանայր լինում է անենաբին»:

Սեռական զուգլամուրյունը առողջության համար բարբոժին վեաախար չէ, ընդհակառակն անգուսոյ սեռական կյանքը, սեռական սանձաբժակություն է, որ խիստ վեաախար ազդեցություն է բաղնում երարդային համակարգի վրա և հանգեցնում սեռական բուրբության և ձերացման: Միֆիլիսով կարելի է վարակվել նաև համարյա միջոցով: Այդ պատճառով պետ է խոսառակի նաև պատանական համբուրբներից:

Վերը եշվեց, որ վարակը կարող է փոխանցուլ սիֆիլիսով հիվանդի բաժակը, սպանը, սառամի խոզանակը, սամբուլիլա պարագաները օգտագործելու դեպքում:



ГРИПП – ИНФЕКЦИОННОЕ ЗАБОЛЕВАНИЕ.  
ВОЗБУДИТЕЛЬ ЕГО – ВИРУС



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ПРОСВЕЩЕНИЯ  
МИНИСТЕРСТВА  
ЗДРАВООХРАНЕНИЯ  
СССР

АВТОР  
Г. Л. ИВАНОВ

ХУДОЖНИК  
В. А. СТЕПАНОВ

РЕДАКТОР  
О. М. СКАЧКОВА

Л-92782 ОТ 29/VI-82г.  
ЗАК.121 ИНД.240 ТИР 3000  
ОБЪЕМ 2,5 П.Л.

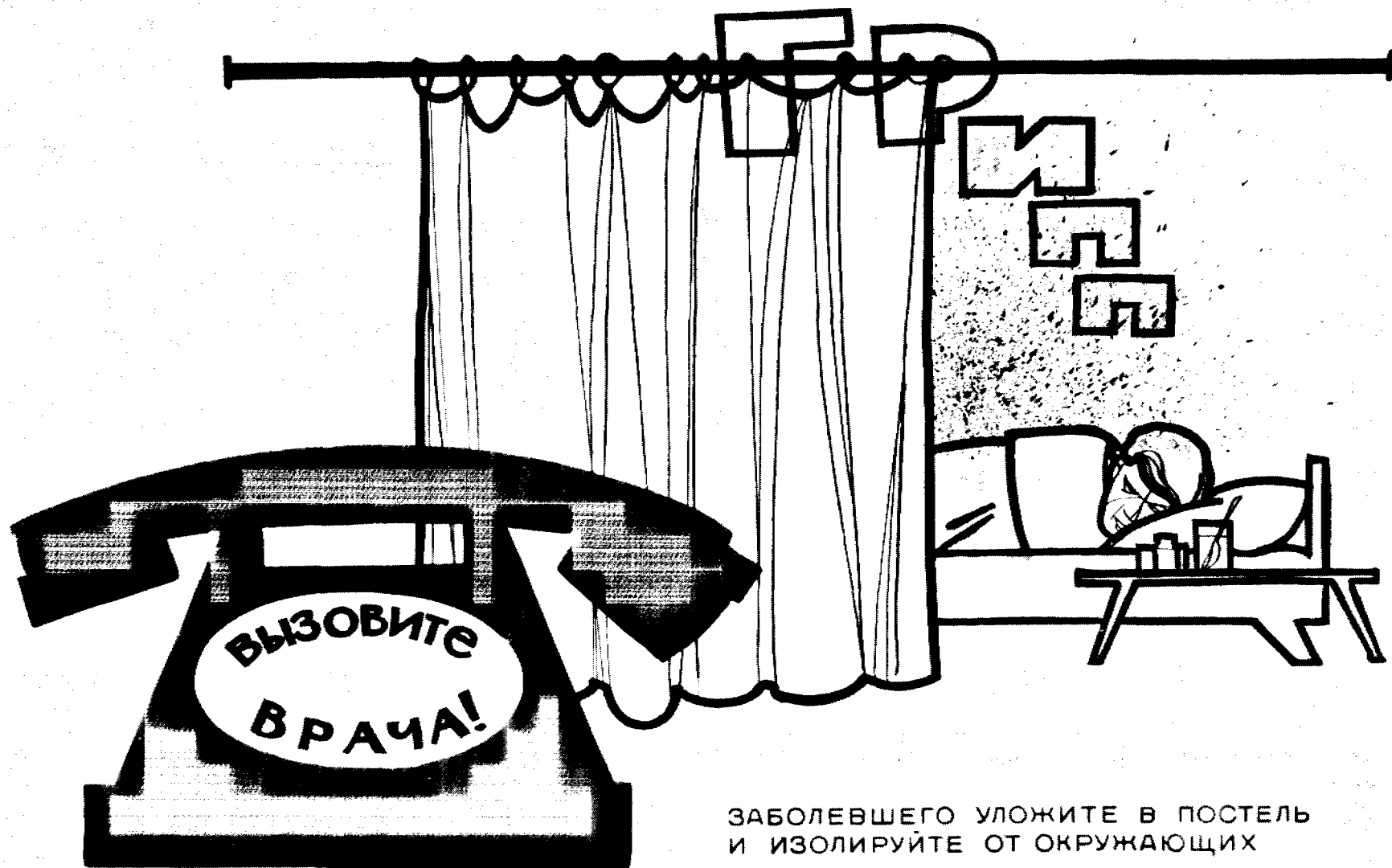
ЦЕНА В СООТВЕТСТВИИ  
С ПРЕЙСКУРАНТОМ  
№35-07-85



**ГРИПП**



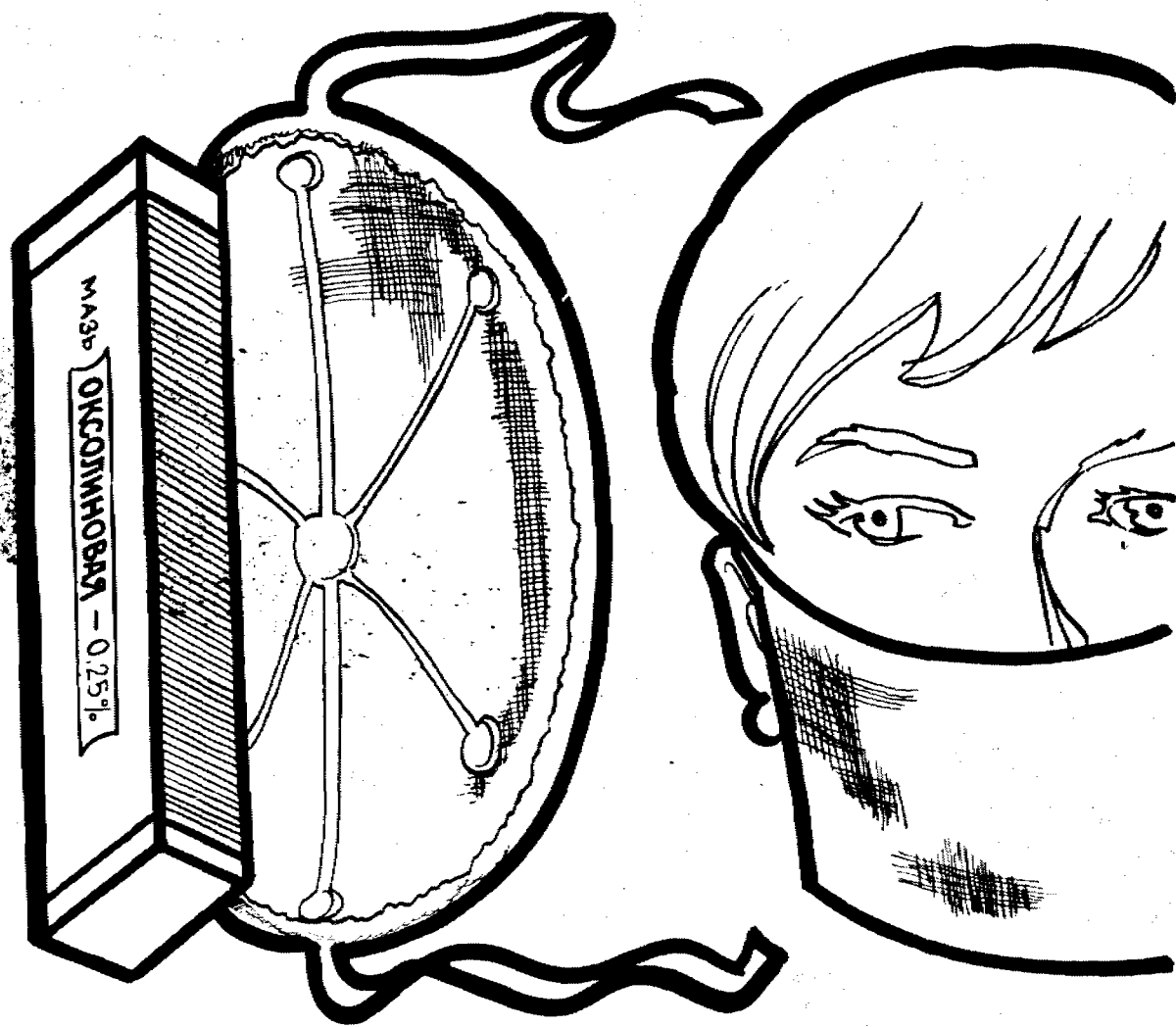
**БОЛЬНОЙ ГРИППОМ ВЫДЕЛЯЕТ ВИРУС  
С КАПЕЛЬКАМИ МОКРОТЫ И СЛИЗИ ПРИ КАШЛЕ,  
ЧИХАНИИ И ДАЖЕ РАЗГОВОРЕ.  
ЕСЛИ ЭТИ КАПЕЛЬКИ ПОПАДУТ В ДЫХАТЕЛЬНЫЕ ПУТИ  
ЗДОРОВОГО ЧЕЛОВЕКА, ОН МОЖЕТ ЗАБОЛЕТЬ ГРИППОМ**



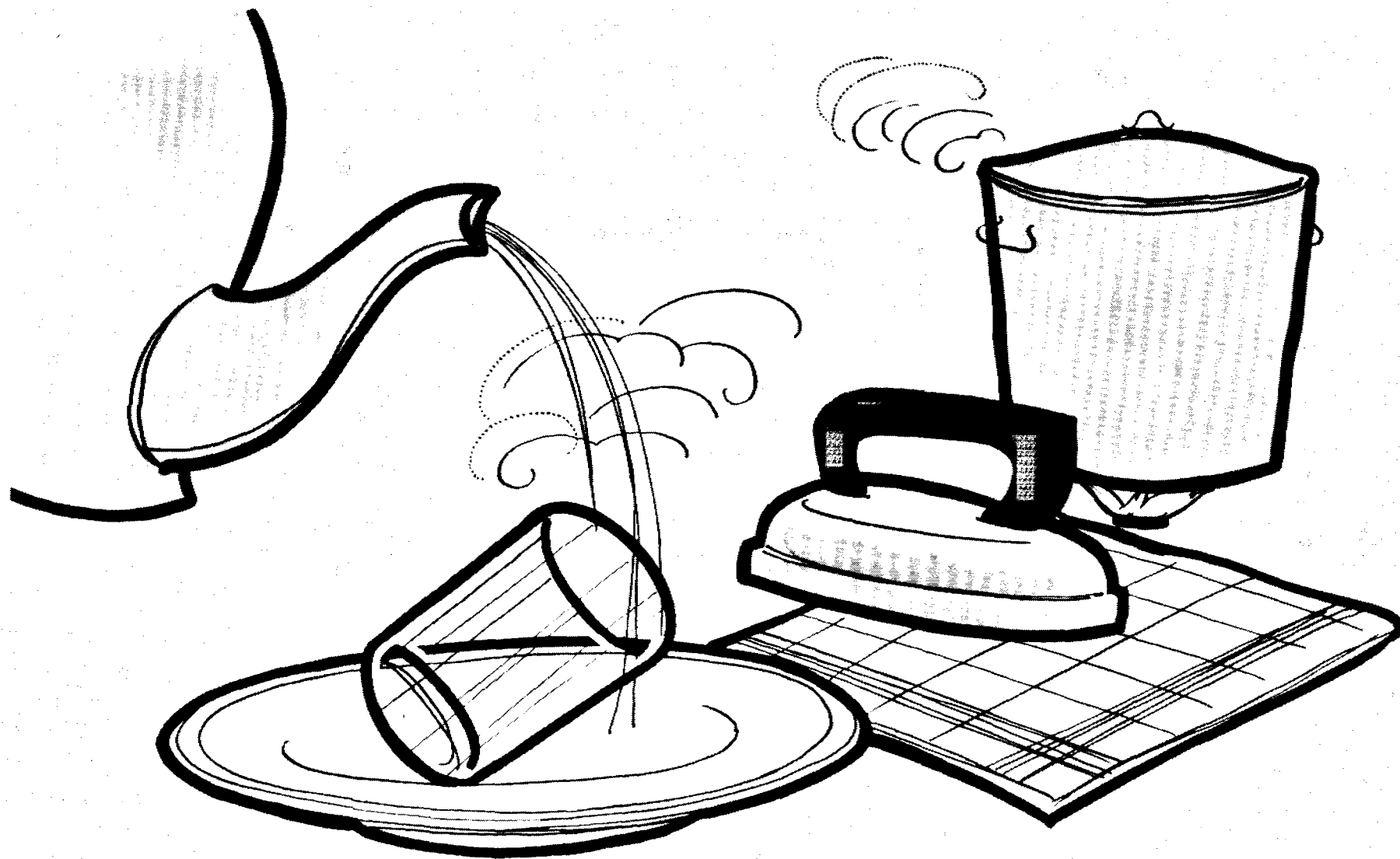
ЗАБОЛЕВШЕГО УЛОЖИТЕ В ПОСТЕЛЬ  
И ИЗОЛИРУЙТЕ ОТ ОКРУЖАЮЩИХ

ГРИПП ОСОБЕННО ОПАСЕН ДЛЯ МАЛЕНЬКИХ ДЕТЕЙ И ПОЖИЛЫХ ЛЮДЕЙ

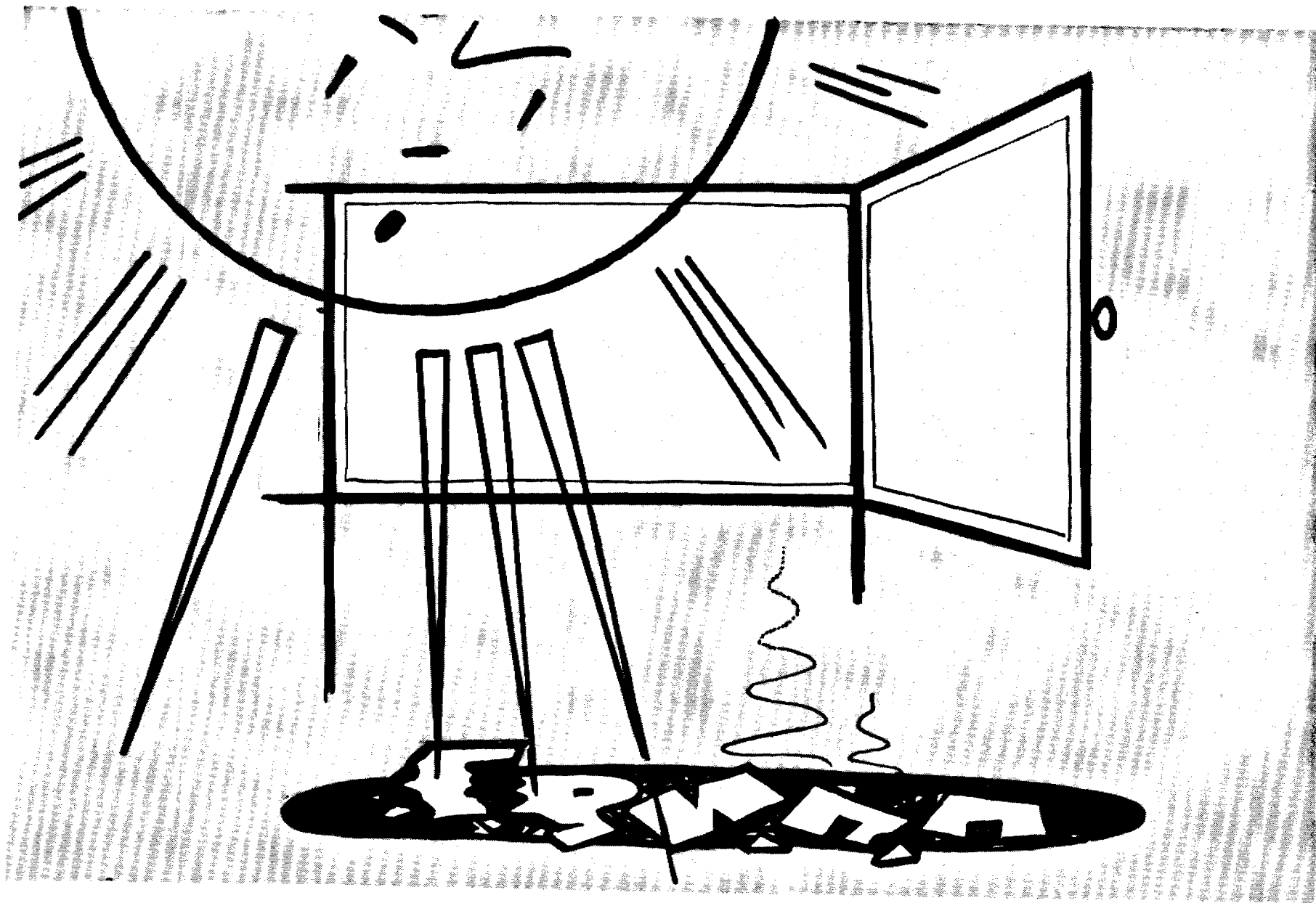
**ЛЕПЕСТОК**



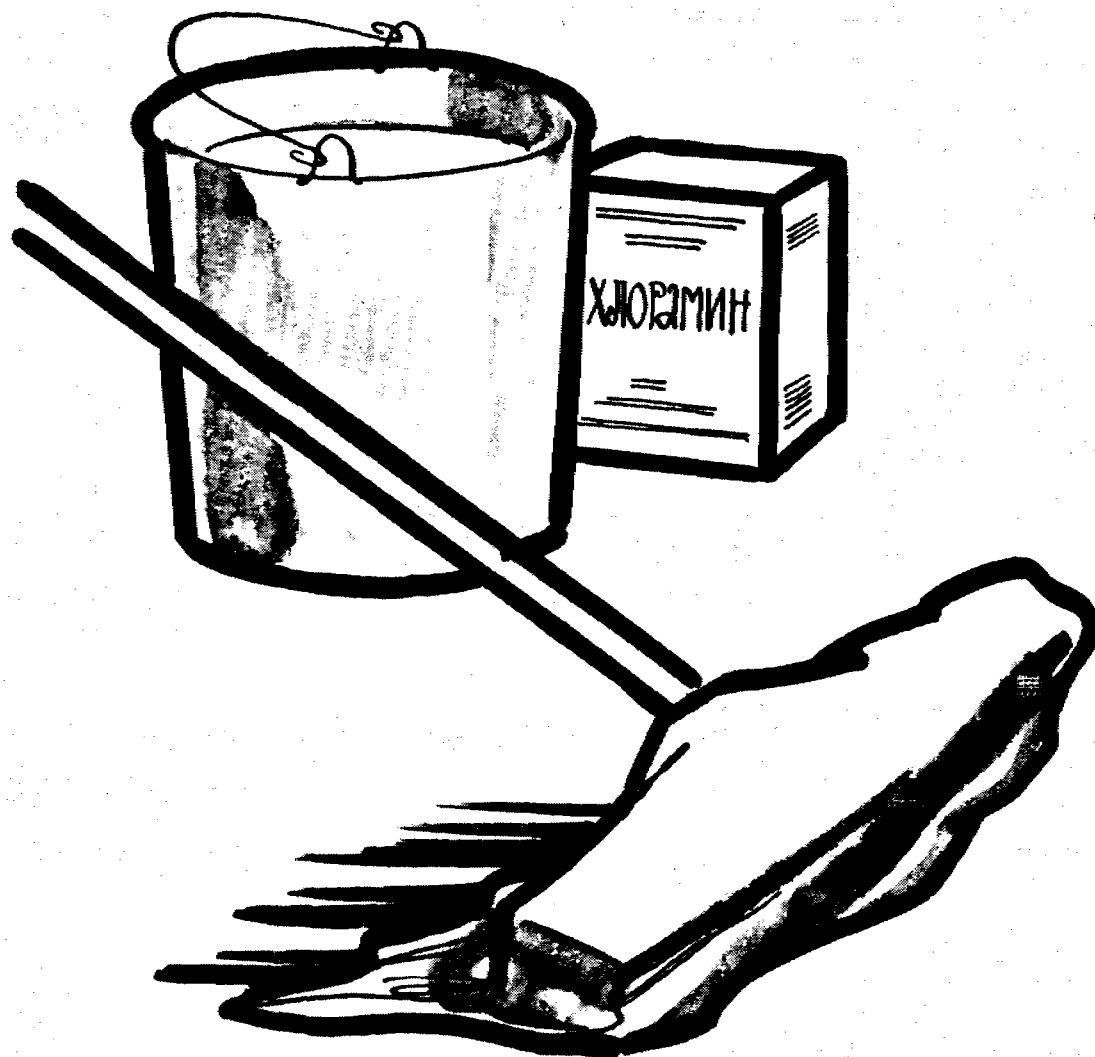
ПРИ УХОДЕ ЗА БОЛЬНЫМ ОДЕВАЙТЕ ПОВЯЗКУ  
ИЗ 4 СЛОВ МАРЛИ ИЛИ МАСКУ «ЛЕПЕСТОК».  
ОНИ ЗАДЕРЖИВАЮТ ДО 94% МИКРООРГАНИЗМОВ.  
МАСКУ ЕЖЕДНЕВНО СТИРАЙТЕ И ПРОГЛАЖИВАЙТЕ.  
СМАЗЫВАНИЕ ВНУТРЕННЕЙ ПОВЕРХНОСТИ НОСА  
ОКСОЛИНОВОЙ МАЗЬЮ  
ТАКЖЕ ПРЕДОХРАНЯЕТ ОТ ЗАРАЖЕНИЯ ГРИППОМ



ГРИППОМ МОЖНО ЗАРАЗИТЬСЯ  
ЧЕРЕЗ ПРЕДМЕТЫ, КОТОРЫМИ ПОЛЬЗОВАЛСЯ БОЛЬНОЙ.  
У НЕГО ДОЛЖНА БЫТЬ ОТДЕЛЬНАЯ ПОСУДА, ПОЛОТЕНЦЕ,  
НОСОВЫЕ ПЛАТКИ.  
ПОСЛЕ УПОТРЕБЛЕНИЯ ИХ НУЖНО КИПЯТИТЬ

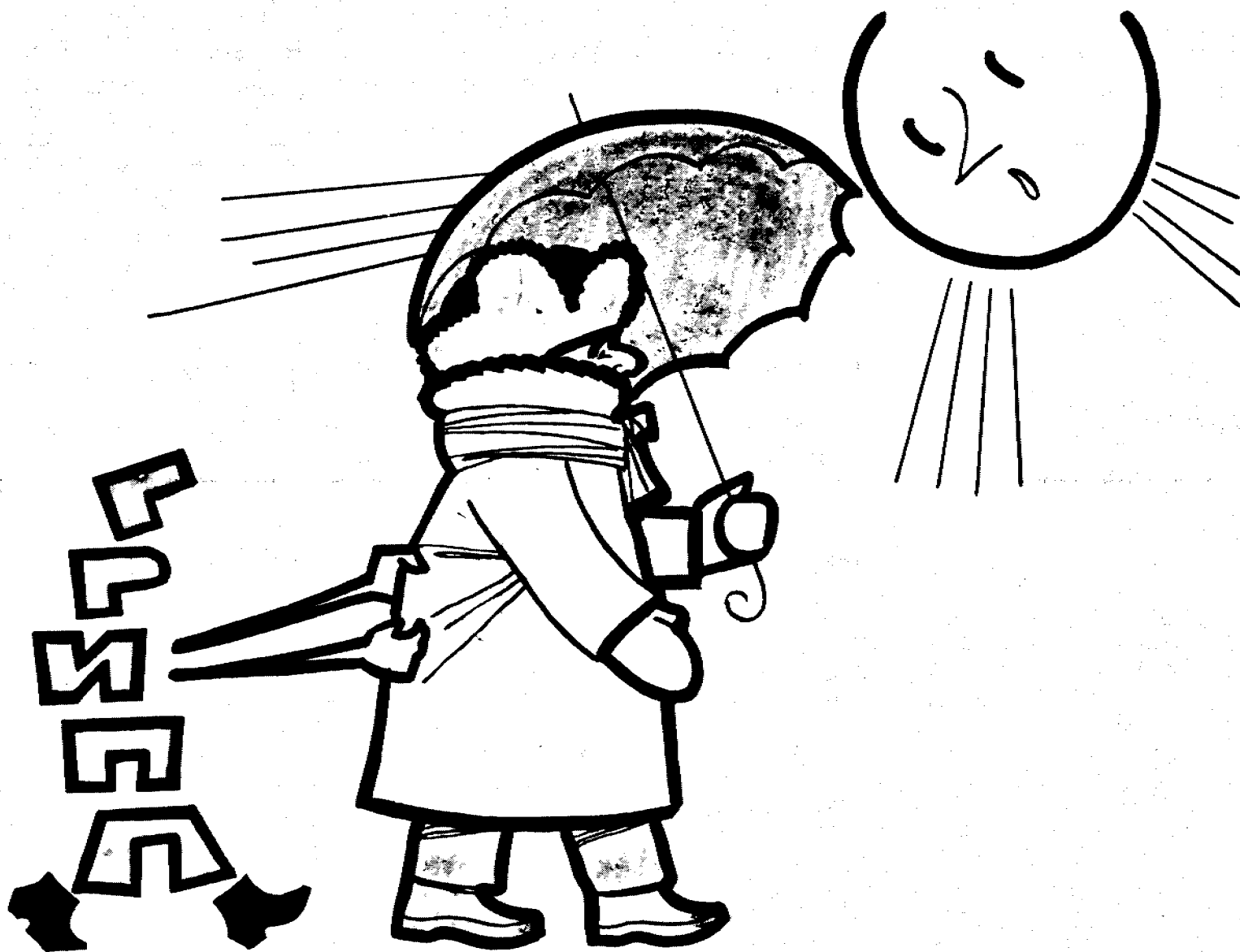


**СВЕЖИЙ ВОЗДУХ И СОЛНЕЧНЫЙ СВЕТ УНИЧТОЖАЮТ ВИРУС ГРИППА.  
КОМНАТУ БОЛЬНОГО ПРОВЕТРИВАЙТЕ НЕСКОЛЬКО РАЗ В ДЕНЬ**

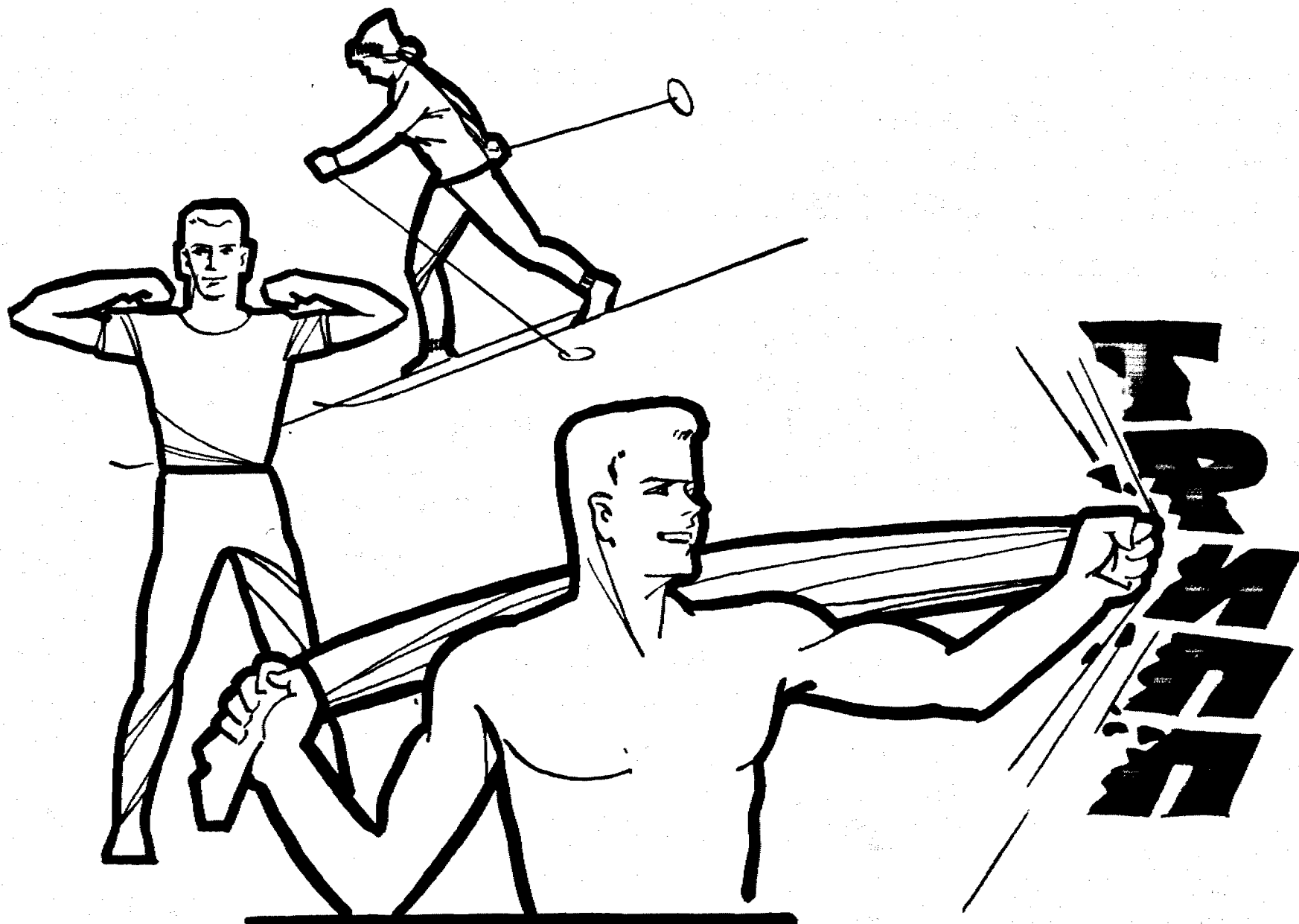


**Г  
Л  
И  
П  
Л**

**УБИРАТЬ КОМНАТУ НУЖНО ВЛАЖНЫМ СПОСОБОМ  
С ПРИМЕНЕНИЕМ ХЛОРАМИНА**



ПЕРЕГРЕВАНИЕ И ПЕРЕОХЛАЖДЕНИЕ ОДИНАКОВО  
СНИЖАЮТ СОПРОТИВЛЯЕМОСТЬ ОРГАНИЗМА  
К ГРИППОЗНОЙ ИНФЕКЦИИ



ЛЮДИ ЗАКАЛЕННЫЕ, ЗАНИМАЮЩИЕСЯ ФИЗКУЛЬТУРОЙ  
И СПОРТОМ РЕЖЕ БОЛЕЮТ ИНФЕКЦИОННЫМИ БОЛЕЗНЯМИ, 10  
В ТОМ ЧИСЛЕ И ГРИППОМ



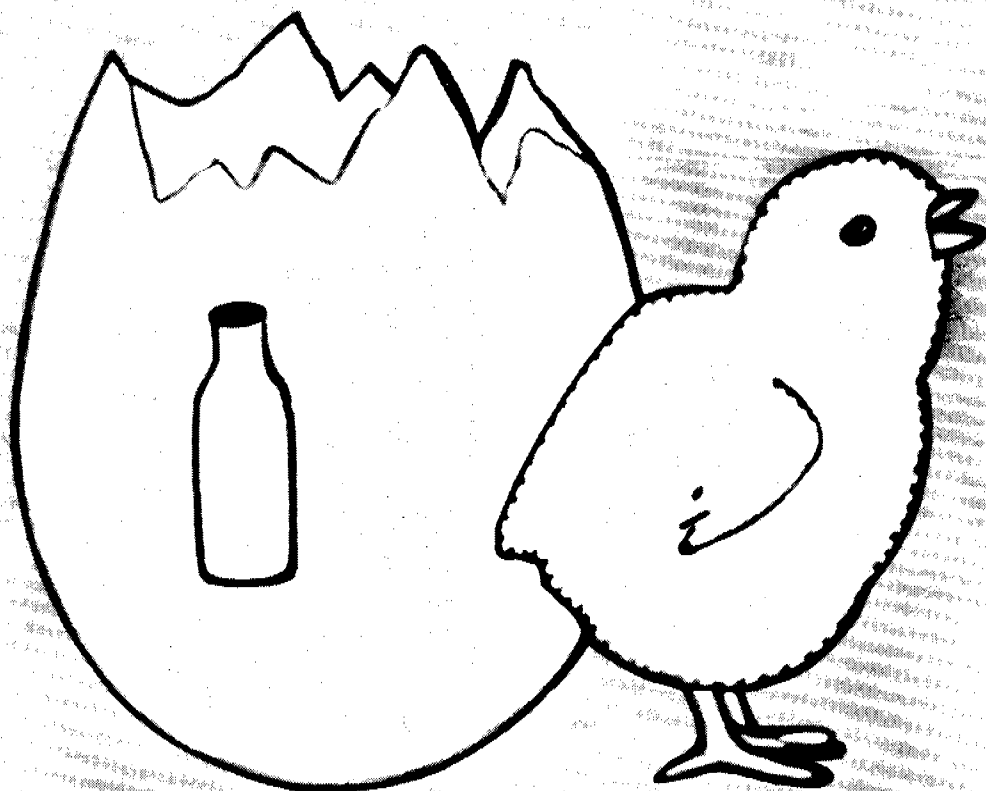
# Сначала игра...



ПРИВЫКАНИЕ  
К АЛКОГОЛЬНЫМ  
НАПИТКАМ  
ЧЕРЕДКО  
НАЧИНАЕТСЯ  
В СЕМЬЕ

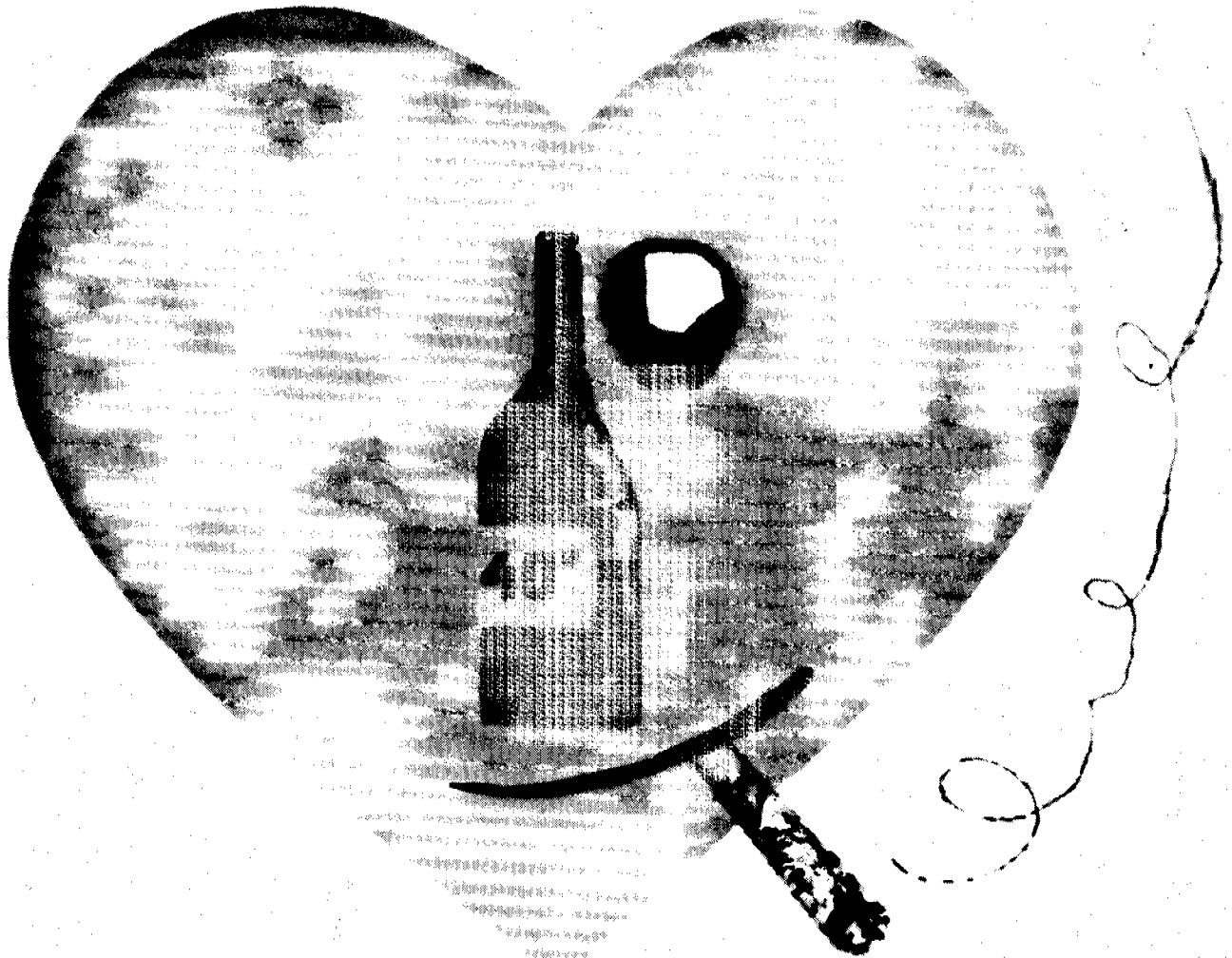
Умно-  
вразумя!



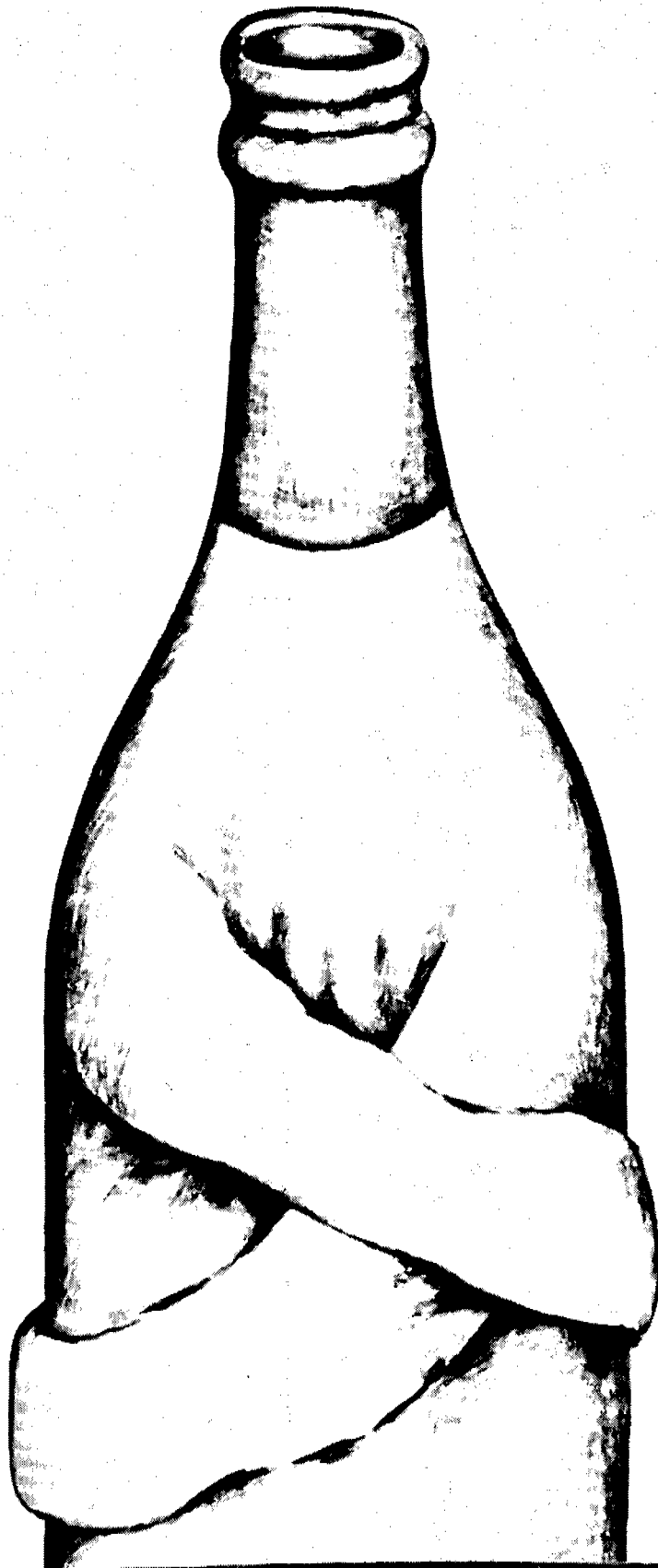


**Будущей матери —  
ни капли алкоголя!**





**а как вы себя чувствуете?**



**ПЬЯНСТВО ВЕДЕТ К ПСИХИЧЕСКИМ БОЛЕЗНЯМ**

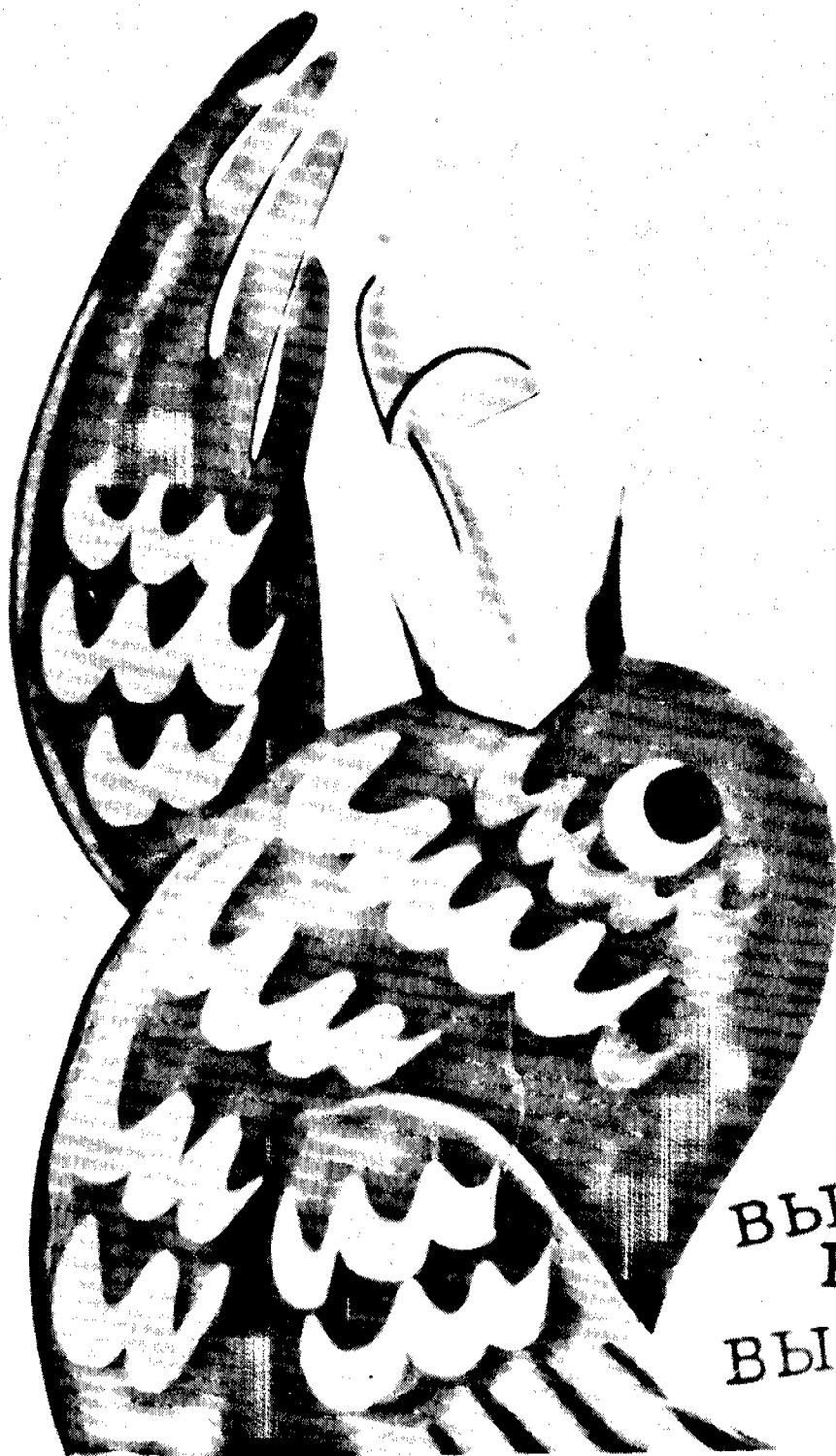




**пристрастился  
выпивать —**

**Костылей  
не миновать**

Рюмка за рюмкой приводят  
К ПЬЯНСТВУ, К АЛКОГОЛИЗМУ



ВЫПИЛ  
РЮМКУ,  
ВЫПИЛ  
ДВЕ...



**ВЫЛЕЧИЛСЯ - ЗАБУДЬ!**





**ПЬЮТ  
РОДИТЕЛИ—  
СТРАДАЮТ  
ДЕТИ**



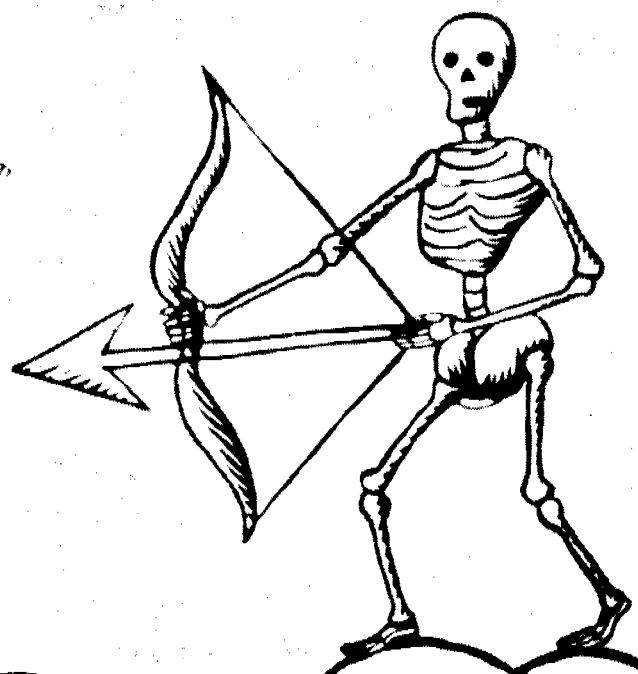
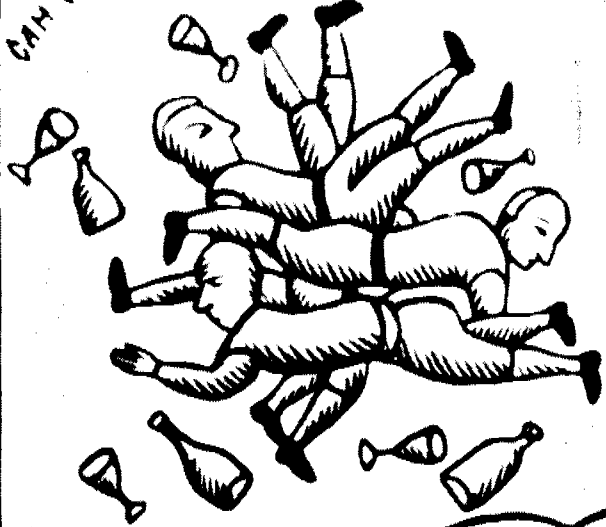
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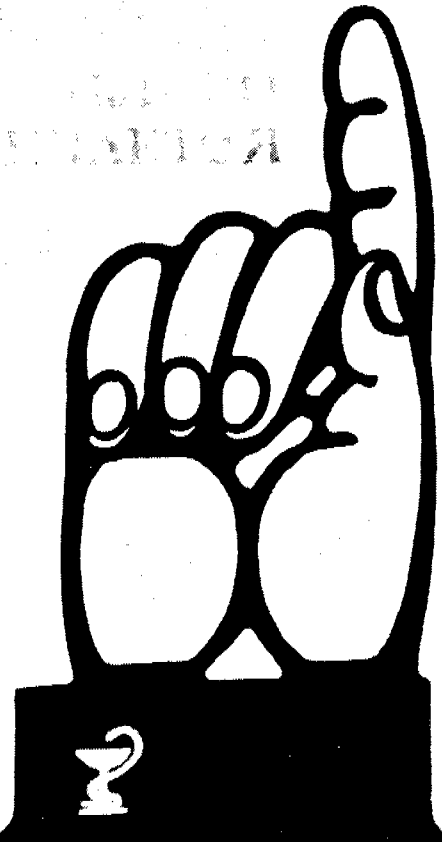
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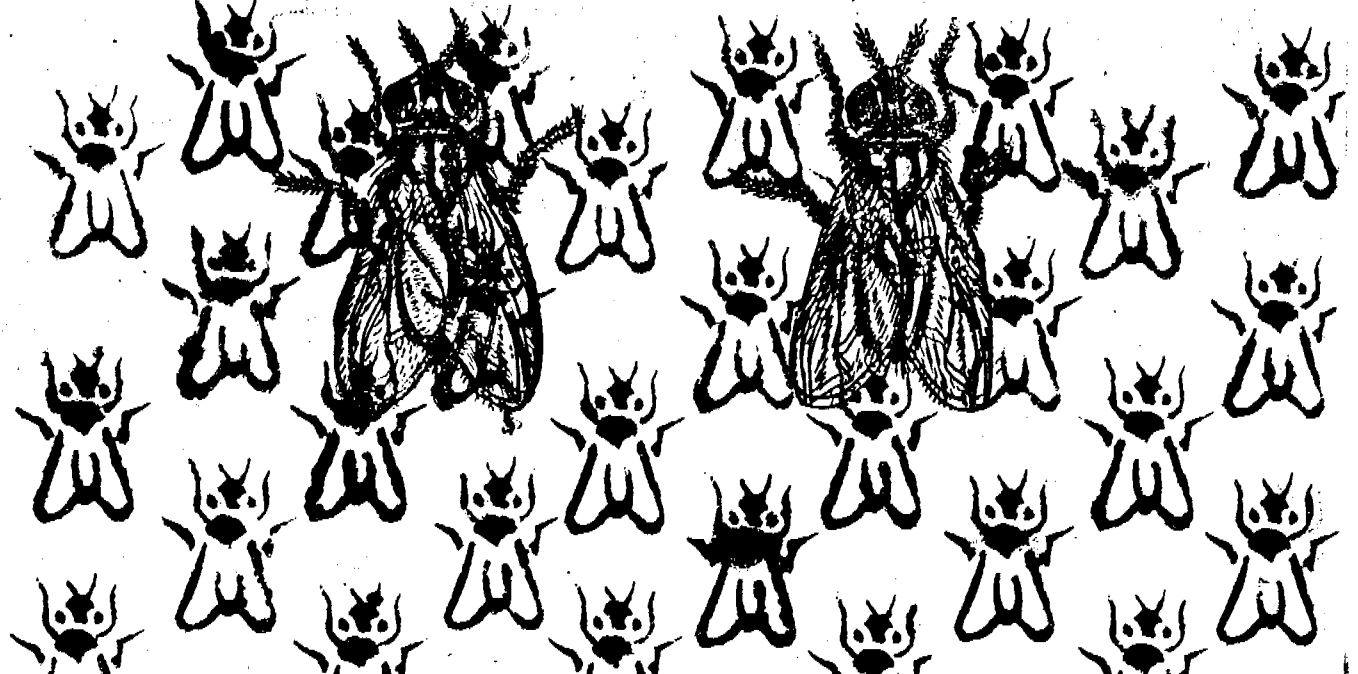


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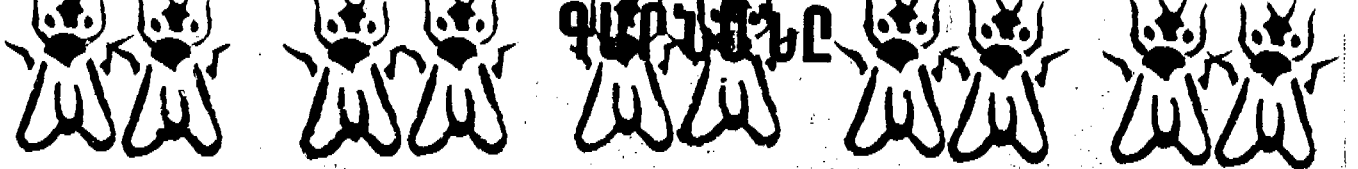


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**Appendix I**

**UNICEF RECOMMENDED PROGRAMME OF COOPERATION, 1993-1994**

**NATIONS UNIES**  
**HAUT COMMISSARIAT**  
**POUR LES RÉFUGIÉS**



**UNITED NATIONS**  
**HIGH COMMISSIONER**  
**FOR REFUGEES**

*Mr Terrence Rabe*  
*c/o USAID*

*Avec les compliments*  
*du*  
*Haut Commissariat des Nations Unies*  
*pour les réfugiés*

—  
*With the compliments*  
*of the*  
*United Nations High Commissioner*  
*for Refugees*

*J A Evans*  
—



COUNTRY PROGRAMME RECOMMENDATION

Armenia

The Executive Director recommends that the Executive Board approve programme activities in Armenia for the period 1993-1994 in the amount of \$ 2,000,000 from general resources and \$ 2,000,000 in supplementary funds, subject to the availability of specific purpose contributions.

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ARMENIA  
Basic data (1991 unless otherwise indicated)

Child population (millions, 0-15 years, 1989-90):	1.0*	Literacy (X, male, female)	..
USMR (per 1,000 live births):	..	Primary school enrolment (X, net male/female)	..
IMR (per 1,000 live births, 1990):	35*	Per cent of Grade 1 reaching Grade 4	..
Underweight (X, mod. & severe):	..	Access to safe water:	..
Maternal mortality rate (per 100,000 live births, 1989):	35*	Access to sanitation:	..
		GDP per capita	\$2,150**

One-year olds fully immunized against:

tuberculosis	..
diphtheria/pertussis/tetanus:	..
measles:	92%*
poliomyelitis:	96%*

Pregnant Women immunized against tetanus ..

- \* Data from 1993 State of the World's Children Report  
\*\* World Bank data

### I. SITUATION OF CHILDREN AND WOMEN

1. The political and economic turmoil associated with the disintegration of the Soviet Union and the birth of the independent Republic of Armenia on 21 September 1991 added further hardships to a population already hard pressed to cope with the aftermath of the disastrous earthquake of December 1988 and armed conflict with Azerbaijan over the disputed enclave of Nagorno Karabakh. These events have made hundreds of thousands of refugees and homeless persons dependent on the support of an increasingly impoverished government. A blockade of Armenia by neighbouring countries, together with ethnic clashes in Georgia, have cut off oil and gas supplies and interrupted normal lines of communications to and from Russia and others of Armenia's trading partners among former republics of the USSR. There are few regularly scheduled flights from abroad to the Armenian capital Yerevan.

2. Thus this landlocked country of 3.3 million people finds itself isolated, its industry strangled and three quarters of its non-farm workforce idled or jobless. During last winter, the country faced a full-fledged emergency. It is running dangerously short of essential supplies of food and energy for a swelling number of vulnerable children, women, the aged and infirm. It is estimated that nearly three quarters of the population is living below the poverty line.

#### The Trials of Transition

3. Armenia is committed to pursuing democratic government and a free market economy, but the transition, difficult enough in other parts of the former Soviet Union, is beset by added burdens. Parallel markets are controlled by special interests which deal in high-priced food and consumer goods. Industry is still mainly state-owned and agriculture is mainly privatized. Safety net provisions are undermined by the economic stagnation that erodes the government's taxation base, leaving social security funds in deficit and vulnerable groups, including refugees, seriously underserved. Health care and education remain free, but medicines, vaccines and equipment--all of which must be imported--are scarce or unavailable at affordable prices. Pensions, unemployment relief and benefits for children and the handicapped are on the books but payments are often late or below official levels.

4. In October 1992 the government doubled payments for the 1.3 million dependent children under 18 (500,000 of these aged 0-6 years), including refugees. The minimum pension/family relief is 1,200 roubles (\$ 3 at 1992 exchange rate) per month. Added to this are the child benefits of 410 roubles a month for each of the first two children and a small addition thereafter. For comparison, 410 roubles

would currently buy a child an egg a day for a month and the bread ration for less than two weeks. With production levels down by 80 per cent and the taxes collected greatly reduced, the fund for family benefits and other government budgets are in serious deficit. Credits from Russia have so far made up this and other government deficits. Armenia at present owes Russia some 80 billion roubles.

5. With scarcity of raw materials and energy supplies, the freeing of prices in 1992 simply meant a sharp increase in prices of available consumer goods. In the first quarter of 1992 prices of these goods were nearly seven times higher than at the same period in 1991 and inflation continues at 20 per cent or more monthly. Bread and a "basket" of basic consumer items are rationed at controlled prices. Eighty per cent of the population live in government housing with controlled rents. Even so, the current minimum individual income of 1,200 roubles (well below the State Statistics Office "survival level" for October 1992 of 2,624 roubles) is not enough to make ends meet. Families now spend three-fourths of their income on essential food items.

6. According to the mayor of Spitak, a town devastated by the earthquake, many impoverished people simply do not pay their taxes, rent and utility bills, which in turn reduces the aid capacity of the municipality--the government's problem in miniature. Only one of the town's factories is still in operation. Only 15 per cent of the post-earthquake reconstruction promised by aid from Russia and other republics has been completed. The sight of half-finished buildings and idle machinery is common in Armenia. The main element of a \$30-million World Bank programme being negotiated is said to be completing construction that is well advanced, but halted for lack of materials and fuel.

#### The Food Shortage

7. In the best of times Armenia used to import from other Soviet republics up to 60 per cent of its meat and dairy products and a significant percentage of wheat for bread, the dietary staple, and for cattle feed. State farms and collectives have been 80 per cent privatised, the highest rate in the former USSR. But farmers don't have fuel for machinery and transport to markets, fertilizers, cattle feed and other essential inputs. Nevertheless, the rural population in heavily urban Armenia is generally better off for food, heating (by wood fuel) and income than their city cousins.

8. According to the Ministry of Agriculture, the country needed to import three quarters of its total 1992 wheat needs, or some 930,000 metric tonnes. Mainly because of the blocked supply lines, at the end of 1992, the shortfall of wheat supplies was in the order of 400,000 metric tonnes. Cattle were slaughtered wholesale by farmers who had no feed to get them through the winter, a circumstance that would have serious effects on herd size and milk/meat supplies in the future. Donors have in the past year provided modest amounts of powdered milk for schools, hospitals, institutions for the handicapped and the elderly. With the food situation deteriorating, the Ministry of Labour and Social Affairs proposed to open public kitchens to serve free meals to the neediest during the winter, mainly pensioners.

#### Effects on Mothers and Children

9. Obviously, the lowering of Armenians' nutrition level particularly affects children and mothers. The trend of a decline in breast-feeding also has affected infant nutrition. Today, only 40% of mothers breast-feed until the fourth month. In the earthquake zone the percentage of breastfeeding mothers is reported to be even lower. Children from these areas, as well as refugee children, also suffer from depression, emotional disturbances and traumatic neurosis due to the nightmarish experiences they have endured. Diarrhoea and upper respiratory ailments are the most prevalent health problems among children.

10. Progressive social legislation provides generous entitlements to employed women. As of 1991, women are entitled to 72 days paid leave before and 56 days after giving birth. They also can take a two-year leave at half pay and a further year without pay and still claim their jobs back. "Idle" workers whose factories have closed down for lack of energy or raw materials are entitled to two-thirds of

their pay, though they do not always receive it. Refugees, whose pensions and benefits were the responsibility of Azerbaijan, are given the same entitlements as Armenian citizens.

#### The Refugees and Earthquake Victims

11. Armenia now shelters nearly 300,000 refugees who fled from violence in the Nagorno Karabakh region. This number represents some 10 per cent of the country's population. The majority of the refugees came in 1988, joined by another influx of 40,000 in 1991. The State Committee for Refugees considers that 71,000 refugees are living in very bad conditions in community buildings and temporary shelters without heat, adequate winter clothing, blankets and bedding. During the winter months when temperatures fell to -20 C. many children and old people died of malnutrition and the cold. Relief to the refugees is being provided by The Federation of Red Cross Societies and the Armenian Red Cross in cooperation with the Government. The Federation has built for the Armenian Red Cross a warehouse facility of more than 1,000 square metres (potentially available for UNICEF too) and the Ministry of Transport is providing trucks for the distribution.

12. Armenia also must provide assistance to scores of thousands who are still in need of housing after the 1988 earthquake in which approximately 25,000 people died, 32,000 were injured and 500,000 became homeless. Twenty per cent of the republic's housing was destroyed, along with hundreds of schools and health facilities, 130 manufacturing plants and numerous agricultural processing units. The total loss has been estimated at -- billions of dollars. The disastrous earthquake set Armenia's economic development back by many years.

#### A Health System Stretched to the Limit

13. Armenia's health system has long been rated as good, though not up to date with medical advances in the West. Enrollment in medical schools of 1,600 a year is swelling the doctor-patient ratio. Because two-thirds of the population is urban, there are few village or rural health units. In 1990, a total of 168 outpatient units and polyclinics were available for children.

14. Infant mortality is caused mainly by asphyxia at birth and other perinatal problems that may be minimized by improving the screening of pregnant mothers to identify high risk individuals and by better care during pregnancy and childbirth. Neo-natal tetanus disappeared 20 years ago, thanks to institutional deliveries and immunization.

15. Immunization levels in 1989 were reported as 96 per cent for polio, 92 per cent for measles and 88 per cent for DPT. The power cuts affect both cold chain and sterilization equipment, especially at the 2,820 immunization delivery points. Freezers, cold boxes and vaccine carriers are not available anywhere. Twelve cases of poliomyelitis were reported in 1990 where previously there had been virtually none. Stocks of vaccines are low and must be replenished to maintain standards. There have been no significant outbreaks of other immunizable diseases, but the immunization programme is still fragile because of natural and man-made disasters and the system requires vigilance. No AIDS cases have been recorded.

16. Acute respiratory ailments (ARI) and diarrhoeal diseases are the most frequently reported health problems for young children. ORS is used, but in short supply. Salmonella and dysentery infections among the young constitute an important public health problem. Endemic goiter and anaemia caused by iron deficiency has been recorded in a number of mountain districts. A team from the Communicable Disease Centres in Atlanta, USA, is currently monitoring child nutrition.

17. Foreign aid agencies regard the Ministry of Health as the most efficient arm of the government, an estimation borne out in the practical cooperation the MOH has offered to UNICEF. But the health network suffers from the lack of fuel and energy, the economic blockade that cuts off essential supplies, the added burden of refugee requirements, the isolation from technical progress and the inadequacy of managerial systems that plague the rest of Armenian public life.

### The Situation of Women

18. There are very few Armenian non-governmental organizations. The Women's Council of Armenia began in 1987 as an NGO and has since acquired parastatal status with 48 branches. It monitors the status of women in difficult circumstances, such as widows and single parents with large families and maintains a list of the neediest cases, including refugees. The Council lobbies for women's rights, notably adoption by the government of the UN Convention on the Elimination of All Forms of Discrimination Against Women and the Convention on the Rights of the Child. It will play a lead role in the 1994 UN Year of the Family.

19. A new Constitution is to be presented to Parliament in January 1993 and the President of the Republic had confirmed his desire to have the Convention ratified as soon as possible.

20. Women bear a heavy load in Armenia. Although half the people completing higher education are women, nearly three quarters of the unemployed non-farm workers are women. The problems of caring for their families in the face of reduced incomes, shortages of affordable food and the cold of unheated homes takes its toll in stress and illness. Closing the schools in winter means leaving children of working women unattended without the activities organized in summer.

21. Armenian women have limited access to contraceptives and little information on family planning. No UNFPA-assisted programme has been initiated. There is a high rate of abortions, but the general abundance of medical staff has succeeded in keeping maternal mortality rates fairly stable. The fertility rate is 2.6 children per woman. As noted above, already generous maternity leave provisions have been further improved since independence.

22. Women have less political voice now than before independence. There are only seven women deputies in the 260-member parliament, compared to 30 per cent in the legislature when Armenia was a Soviet republic.

### The Education Sector

23. Armenia had the highest percentage of university graduates among the republics of the former Soviet Union. The education sector continues to function quite well despite the ongoing crises. Attendance in primary and secondary school is compulsory and enrollment is 100 per cent of the age group. Enrollment in kindergartens is 40 percent. Lack of fuel for heating has forced authorities to close public schools as of 15 December 1992 for three months. Instead, pupils will spend the summer months in school. The shortage of food already affects student performance, the Ministry of Education reports, and half the pupils between 3 and 17 years are suffering from varying degrees of psychological stress. Education is free, but supplies are not. Textbooks and note-pads traditionally imported from Russia can make a significant dent in family budget. There are no school lunches or snacks. Where refugees are concentrated, schools have been on a double shift. Teacher's salaries of between 1,000-2,000 roubles are below the poverty line.

### Other Constraints

24. Electricity is provided between 8-12 hours a day, depending on the district. This affects social institutions, hospitals, health care centres and clinics as well as homes, offices and enterprises. The institutions that have generators often can't find or afford the necessary fuel. Lines of customers queuing for bread were a common sight until rationing (250 grams per day per person) was introduced in November 1992. Crowds waiting for the buses operating at half of normal frequency due to the scarcity of fuel are seen everywhere in the capital. Along highways in the country, people try to flag down the few passing cars.

25. Such frustrations have disillusioned the populace with the political process. Opinion polls show that 70 per cent do not support any party. Some 21,000 persons emigrated in 1991 and the exodus continues. Armenia has the advantage of being a homogeneous society with no significant dissident or minority elements. The internal political and social scene is relatively stable.

## Emergency relief needs for Children and Mothers

26. As conditions for vulnerable groups in Armenia continued to deteriorate, DHA requested UNICEF and other UN agencies (UNHCR, WHO, WFP, FAO) in November 1992, to provide humanitarian aid and relief items on an emergency basis. UNICEF in response to the emergency, is aiming to assist at least part of the 500,000 children between 0-6 years, as well as pregnant mothers. Refugee children from the Nagorno Karabakh conflict total 17,500 who are being given priority together with 3,000 orphans and several thousands of single parent families still suffering from the aftermath of the 1988 earthquake. There are immediate needs for blankets, clothing, weaning food, vaccines, syringes and needles, essential drugs for hospitals and maternities as well as emergency kits for rural polyclinics and outpatient clinics. These needs were identified in consultation with Officials from the Ministries of Health, Labour and Social Security, Education and the Women's Council and staff of aid agencies at work in Armenia.

## II. RECOMMENDED PROGRAMME OF COOPERATION, 1993-1994

### RECOMMENDED PROGRAMME COOPERATION FOR ARMENIA, 1993-1994

Recommended general resources: \$2,000,000  
Supplementary funding: \$2,000,000

	(in thousands of US dollars)		
	<u>General resources</u>	<u>Supplementary funds</u>	<u>Total</u>
Emergency (Mother & Child Health)	1,100	800	1,900
Health and Nutrition	400	500	900
Education	150	600	750
Research, monitoring & evaluation	100	100	200
Programme Support	<u>250</u>	<u>---</u>	<u>250</u>
Total	<u>2 000</u>	<u>2 000</u>	<u>4 000</u>

27. The main thrust of the first programme of cooperation between UNICEF and Armenia will be to prevent any deterioration in the survival and development prospects of children in the period of rapid political, economic and social transition through which the country is presently going. A priority will be the protection of the considerable advances made in the fields of child health and education and to bolster the social infrastructure where it appears weakest. Assistance will be carefully targeted to reach the most vulnerable children: those who are victims of war; of poverty; or of the devastating earthquake which left 15% of the population homeless in 1988. Underlying the programme thrust is a belief that the principle of "first call" for children is inherent in Armenian society and that modest amounts of well-focussed assistance, delivered in close cooperation with national and international partners will lead to the realization of the programme targets.

28. To begin with, the programme will employ an emergency strategy. Every year, Armenia is gripped by a severe winter which is at its coldest between December and March. With an almost total absence of heating fuel, a serious shortage of food, and insufficient money in most families for warm clothing, the very survival of vulnerable children is threatened. The initial phase of the programme will therefore aim at preventing death and disease, primarily among the under-fives in the populations most at risk. Working with partners and appropriate distribution networks, the emphasis will be on ensuring that supplies of baby food, essential drugs, vaccines and winter clothing reach the children who are in greatest need.

29. The early urgent assistance phase will be followed by work in laying the groundwork for longer term cooperation in child development. Of particular importance in this regard will be the undertaking of action-oriented research to determine the exact nature of the causal factors underlying the main health and social problems affecting children in the country. This will not only establish the

basis for a more development oriented programme of cooperation in the future, but will also have the effect of orienting the public health system and social services in general towards the kind of low cost but highly effective interventions advocated worldwide by UNICEF. Closely related to this will be the promotion of systems to monitor the changing conditions of children and how they are affected by the economic, political and security situations. A central focus of the programme in the bridging phase will be support for the development of a National Programme of Action (NPA) with clearly defined goals and priorities as well as the identification and mobilization of the necessary human, financial and institutional resources which will be required for implementation.

30. Effective implementation of the new programme will require close collaboration with other agencies and development organizations, particularly the office of the new UN Coordinator in Yerevan where UNICEF staff will be based and also with WHO. The government itself will, of course, be the principal partner in implementation of programme activities, but with national and international NGOs also playing important supporting roles.

### III. HEALTH AND NUTRITION

#### Quality and Coverage of MCH Services

31. Assistance in material and child health will begin with an immediate provision of essential supplies to alleviate serious shortages with the aim of reaching 50,000 children under five. Pre-packed emergency drug and medical supplies will be airfreighted to Armenia to help combat the immediate threats to their survival and sustain basic MCH services. Distribution will be coordinated by the Ministry of Health with priority going to areas where refugees, displaced persons, earthquake victims and other high-risk groups are concentrated. Meanwhile, a longer term distribution plan for essential drugs and basic medical supplies will also be put in place to answer future needs. Support will be provided to the Ministry of Health and to the Department of Living Standards and Social Problems of the State Statistical Administration to carry out ongoing monitoring of the nutritional status of displaced and refugee children. Monitoring the availability and use of basic health services by these "at risk" groups will also be undertaken and assistance for regular testing the quality of the water supply in emergency areas will also be provided.

In order to reduce child mortality and morbidity, operational studies will be carried out on the quality and coverage of selected services in Armenia with a view to improving outreach and effectiveness. Among these will be case management of respiratory infections and diarrhoeas as well as prevention of anaemia and iodine deficiency disorders. The studies will lead to the development of practical action plans to control these health problems and to improve the quality and accessibility of services. UNICEF will provide technical assistance in close co-operation with WHO. Other areas of collaboration with WHO will include support for training seminars, exchange visits with other countries facing similar problems, policy reviews on EPI, CDD, ARI, Safe Motherhood and Family Planning. Improvement of the management information system will also be supported particularly in terms of monitoring progress towards programme and goals of the Summit for Children.

#### Immunization

32. Vaccination coverage has traditionally been high in Armenia. However, stocks of measles and polio vaccine are expected to run out in 1993 and assistance will be provided to replenish these antigens in order to sustain coverage above 90% of under ones. This is particularly important in view of the reappearance of polio and diphtheria in 1990. While the upgrading of sterilization practices is a major concern, disposable syringes and needles will also be provided to ensure the continuous operation of sterilization equipment despite power losses. The problems faced by the cold chain primarily relate to the frequent outages of electricity and the lack of cold boxes and vaccine carriers. A full assessment will be carried out during the programme period in order to clearly identify the precise areas which require improvement.

### Breastfeeding

33. Breastfeeding rates at four months have progressively decreased from 64% in 1988 to 48% in 1991. The main contributing factors cited by health professionals and women's leaders to explain this negative trend include the aftermath of the earthquake, the economic depression, the constant stress induced by the day to day difficulties of life, and inadequate maternal nutrition. The 1993/94 programme will concentrate on developing a positive attitude to breastfeeding among health workers and public opinion leaders so that they may in turn pass on knowledge on the benefits of breastfeeding to mothers through BFHI and other methods.

### Safe Motherhood

34. Abortion is practiced widely as a family planning method in Armenia; contraceptives are not readily available and none were purchased in 1992. This situation frequently leads to infertility and other gynaecological and obstetrical complications. A collaborative project will be worked out with UNFPA during the course of the programme to study the situation more closely and develop appropriate courses of action to address the situation.

### Health Education

35. To ensure that all families are equipped with the basics of primary health care, Facts for Life messages will be translated into Armenian and disseminated through health and educational institutions, the media and other channels. In this regard, UNICEF will support training seminars for health professionals, teachers and media personnel for the development of appropriate communications strategies.

### Research

36. To enable the formulation of medium and long term development strategies for children, particularly in terms of reaching the goals of the World Summit for Children and implementing the Convention on the Rights of the Child, selected studies need to be undertaken in a number of areas to determine underlying causes of various phenomena, patterns and trends of occurrence and identification of high risk groups and geographical zones. Among the areas which need investigation are: incidence and causes of maternal mortality; the effects of abortion on the reproductive health of women; epidemiology of main childhood infectious diseases such as ARI, dysentery, poliomyelitis, diphtheria, measles, brucellosis as well as iodine deficiency disorder in endemic districts; nutritional status of children affected by the emergency situation; KAP studies on breastfeeding and family planning. UNICEF will work with both national and international agencies and research institutions, as appropriate, in the collection, analysis and use of information in these and other areas of concern.

### Alleviation of post-traumatic stress syndrome

37. An estimated 50% of school children in Armenia suffer from stress and depression brought on by the following factors:

- The earthquake
- The conflict in Nagorno-Karabakh
- The conflict in the border areas
- The prevailing social, political and economic instability of the country
- Insufficient availability of food

38. This situation is not only affecting children's rights as enshrined in the Convention on the Rights of the Child, but also has an adverse impact on school performance and educational standards. In order to address this situation, the Ministry of Education, in co-operation with the Department of Psychology at the State University, is proposing a national programme to alleviate the worst aspects of post-traumatic stress and depression among the more than 300,000 children who are believed to be affected.



39. It is planned to scientifically test school children using an internationally developed protocol. This will reveal where counselling centres need to be established and what other kind of interventions need to be made. It is envisaged that widescale training of teachers and parents will take place and that the media, health professionals and psychologists will be mobilized to actively participate in the programme. The experience already gained in psychotherapeutic centres attached to schools in the earthquake zone will be valuable in developing the expanded programme.

40. UNICEF will provide a consultant to advise the Government on the development of the programme as well as equipment and appropriate software for processing data.

#### Education

41. Apart from the lack of heating fuel and the shortage of food and basic commodities, the blockade has also led to a shortage of textbooks, note-pads and other classrooms materials in the school system. Paper for these requirements normally comes from Russia, but because of the blockade, there is expected to be a substantial shortfall in essential learning and teaching materials in the next school year. Added to the other conditions of adversity which exist, overall educational standards and student performance will be affected even further unless the problem is quickly addressed.

42. UNICEF will provide assistance for the provision of learning and teaching aids and other classroom materials to benefit approximately 300,000 pre-school and primary school children.

#### IV. CONSULTATIONS WITH THE DONOR COMMUNITY

43. A large number of aid agencies are represented in Armenia and UNICEF has had consultations with most of their delegations or visiting groups and previous reports prepared by UNHCR, WHO, WFP and UNDP were taken into consideration in the preparation of this recommendation. Collaboration with other UN agencies in the future is envisaged under the umbrella of the new UN Coordinator leading the UN delegation in Armenia.

44. Large aid programmes have been initiated by the EEC, USAID, The International Federation of Red Cross and Red Crescent Societies and the national French, British, German, Netherlands and Swiss Red Cross Societies, CARE, the US Peace Corps, Médecins sans Frontières, Save the Children's Fund, Project Hope, the governments of Canada, Denmark, Iran, Sweden, the Armenian Church in several countries and others. Consultations continue in order to avoid duplication and to strengthen complementarity of programme components. Areas of joint activities have been identified. Future UNICEF missions, as well as local office operations, will emphasize this cooperation. Regular exchange of views and experience on logistics, supply lines and transport facilities will continue to take place since Armenia's blockade has isolated its territory from neighbouring countries and the rest of the world.

#### V. ORGANIZATIONAL AND ADMINISTRATIVE STRUCTURE

45. UNICEF's activities and staff will be fully integrated into the new UN system headed by the UN Co-ordinator. Modalities of operational assistance within the UN system will be further determined in 1993 when the UN Office will be functioning in Yerevan. One UNICEF international professional, one national officer, two assistants (admin/supply), one secretary and one messenger clerk will implement and monitor the two-year programme bridging operation. They will liaise with other UN agencies and donors to ensure close cooperation in sectors of mutual interest. Initially, UNICEF will also use the network of the Armenian Red Cross/Red Crescent to distribute relief supplies to refugee children and displaced persons. The Ministry of Social Security and the Women's Council will also be selectively involved in aid distribution. It can be expected that UNICEF's programme staff will need temporary strengthening during the programme preparation and implementation of the next cycle of co-operation. The country programme will be of a more regular nature once a basic agreement on co-operation between the Government of Armenia and

UNICEF is signed. For the 1993-1994 programme of co-operation, costs for support staff will be covered by resources available for programme activities which are included in the sectoral breakdown of expenses.

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**Appendix J**

**ESTIMATED BUDGET AND SPECIFICATIONS FOR WATER SYSTEM,  
SEWAGE DISPOSAL SYSTEM, AND LABORATORY EQUIPMENT**

**ARMENIA EMERGENCY WATER AND SANITATION ASSISTANCE  
ESTIMATED EQUIPMENT COSTS**

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<b>EQUIPMENT DESCRIPTION</b>	<b>EQUIPMENT QUANTITY</b>	<b>EQUIPMENT COST PER UNIT</b>	<b>TOTAL EQUIPMENT COST</b>	<b>SHIPPING AND INSURANCE *</b>	<b>TOTALS</b>
Chlorination Units (10-15 kg/h)	9	\$13,800.00	\$124,200.00	\$12,420.00	\$136,620.00
Chlorination Units (25-50 kg/h)	7	\$19,200.00	\$134,400.00	\$13,440.00	\$147,840.00
Chlorine Test Kits	25	\$115.00	\$2,875.00	\$287.50	\$3,162.50
Laboratory Equipment	N/A	\$15,000.00	\$15,000.00	\$1,500.00	\$16,500.00
Leak Detection Units	6	\$2,300.00	\$13,800.00	\$1,380.00	\$15,180.00
Portable Generator	16	\$3,000.00	\$48,000.00	\$4,800.00	\$52,800.00
Underwater Welding Equipment	1	\$23,000.00	\$23,000.00	\$2,300.00	\$25,300.00
Sewer Rodding Machines	3	\$20,000.00	\$60,000.00	\$6,000.00	\$66,000.00
Misc. Equip. Required in Field	N/A	\$5,000.00	\$5,000.00	\$500.00	\$5,500.00

**TOTAL**                      **\$468,902.50**

\* Shipping and Insurance Assumed to be 10% of Total Equipment Cost

SECTION 11234

CHLORINATION SYSTEM

PART 1: GENERAL

1.01 SCOPE OF WORK

- A Manufacturer shall provide vacuum ejector feed chlorination systems for export that will be retro-fitted into existing chlorination systems at potable water distribution stations and pump stations in Armenia. Furnish all materials, equipment and incidentals required for fifteen (15) chlorination systems as specified herein.
1. Thirteen (13) chlorination systems shall be capable of feed rates of 10-15 kg/hr.
  2. Two (2) chlorination systems shall be capable of feed rates of 25-50 kg/hr.
- B The chlorination systems shall be delivered to the Owner's port of departure in Linthizum, Maryland no later than twenty one (21) days after the placement of the order.

1.02 SUBMITTALS

- A Submit to the Engineer three copies of shop drawings, system piping and wiring diagram, and other descriptive material of all equipment to be furnished under this section.
- B Submit to the Engineer certifications that shows compliance with this specification
- C Submit to the Engineer within three (3) business days of the placement of the order three copies of all operation and maintenance instructions.

1.03 QUALITY ASSURANCE

- A The chlorination system equipment manufacturer(s) shall have experience in the design and manufacture of equipment of similar size and capacity and shall present proof of successful operations involving each piece of equipment furnished. All chlorination equipment and accessories shall be designed, manufactured and shipped in accordance with the best practices and methods.
- B Equipment shall be manufactured by Capital Control Company, Inc. of Colmar, PA; Chlorinators Inc. of Jenson Beach ,FL; Wallace & Tiernan Inc. of Belleville, NJ or equal.

#### 1.04 SYSTEM DESCRIPTION

A All of the equipment specified herein shall be furnished by a single manufacturer and shall be in complete conformity with these Specifications. All of the equipment specified herein is intended to be standard equipment for use in a chlorination system and shall include the following for each of the thirteen (13) 10-15 kg/hr feed rate units:

1. Horizontal gas manifold and all accessories capable of connecting to five (5) one hundred pound chlorine cylinders.
2. Manual gas feeder system that consists at a minimum of the following:
  - a. Vacuum regulator
  - b. Inlet filter
  - c. Lead gasket positive yoke cylinder clamp
3. Automatic switchover module
4. Flow rate indicator and manual rate adjusting valve
5. Remote ejector and check valve assembly
6. Water inlet assembly
7. Diaphragm booster pump which shall be a minimum of 3/4 horsepower and compatible with a 220 volt 50 cycle electrical system.
8. Miscellaneous associated equipment required for the proper operation of the system, including but not limited to valves, couplings, pressure switches, fittings, gages, etc.

B All of the equipment specified herein shall be furnished by a single manufacturer and shall be in complete conformity with these Specifications. All of the equipment specified herein is intended to be standard equipment for use in a chlorination system and shall include the following for each of the two (2) 25-50 kg/hr feed rate units:

1. Horizontal gas manifold and all accessories capable of connecting to one two thousand pound chlorine cylinder.
2. Vacuum regulator
3. Wall cabinet manual gas feeder system that consists at a minimum of the following:
  - a. Inlet filter
  - c. Lead gasket positive yoke cylinder clamp
  - d. Manual rate valve
  - e. Flowmeter
  - f. Vacuum gage

4. Remote ejector and check valve assembly
5. Water inlet assembly
6. Diaphragm booster pump which shall be a minimum of 3/4 horsepower and compatible with a 240 volt 50 cycle electrical system.
7. Miscellaneous associated equipment required for the proper operation of the system, including but not limited to valves, couplings, pressure switches, fittings, gages, etc.

#### 1.05 DELIVERY, STORAGE AND HANDLING

- A All equipment shall be crated with packing material suitable for overseas shipment. All equipment shall be shipped to specified port of departure.
- B All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed and the equipment is ready for operation.
- C Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- D The finished surfaces of all exposed flanges shall be protected by wooden blank flanges, strongly built and securely bolted thereto.
- E Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

#### 1.06 MAINTENANCE

##### A Tools and Spare Parts

1. Special tools required for normal operation and maintenance shall be supplied for each piece of equipment furnished.
2. Each piece of equipment shall be furnished with two (2) years of the manufacturer's recommended spare parts to include at the minimum the following:
  - a. Chlorine gas filters.
  - b. Lead chlorine cylinder gaskets.
  - c. Miscellaneous tubing and gaskets.
3. All tools and spare parts shall be furnished in containers clearly identified with indelible markings as to their contents. Each container shall be packed with its contents protected for storage. All tools shall be furnished in steel tool boxes.

## PART 2: PRODUCTS

### 2.01 MATERIALS AND EQUIPMENT

- A These specifications are intended to give a general description of what is required, but do not cover details of construction which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to include the furnishing, shop testing and delivery of all materials, equipment and appurtenances for the chlorination equipment as herein specified, whether specifically mentioned in these Specifications or not.
- B All necessary accessory equipment and auxiliaries required for the proper functioning of the chlorination system incorporating the highest degree of standards for the specified type of service shall be furnished by the chlorination system supplier whether or not specifically mentioned in these Specifications or not shown on the Drawings.

### 2.02 CHLORINATION SYSTEMS

- A Chlorination systems to be furnished shall be a vacuum type solution feeder capable of manual adjustment to regulate dosage of chlorine during the operation.
- B The chlorinators shall be designed to ensure maximum safety for operating personnel. The chlorine gas control system shall operate under vacuum to prevent gas leakage. The chlorinator cabinets on the 25-50 kg/hr feed rate units shall contain a positive acting gas vacuum regulator and shutoff valve, a rotameter, a rate valve for manual dosage adjustment, a pressure-vacuum relief valve and the ability to tie into a 240 volt 50 cycle electrical control and alarm equipment
- C Each chlorinator shall be supplied with a rotameter and parts required to change the rotameter. The rotameter shall be provided on the front of the regulator or cabinet to indicate chlorine gas flow. Accuracy shall be plus or minus 4 percent of indicated flow rate over the full range of the chlorinator.
- D The 25-50 kg/hr chlorinators shall be Capital Control Inc. Series 4100 Wall Cabinet or equal and shall be constructed entirely of materials resistant to the corrosive attack of chlorine gas.
- F All chlorination equipment shall be constructed entirely of materials resistant to the corrosive attack of chlorine gas.



## 2.03 FLEXIBLE CONTAINER CONNECTORS

- A Five flexible container connectors shall be provided for each 10-15 kg/hr feed rate units, one for each chlorine container along the manifold. Each flexible container connector shall be constructed of 3/8-in (9.5 mm) O.D. cadmium plated, dichromate dipped, copper tubing, 6-ft (1.8 m) long. Each connector shall be provided with an isolating valve and a header valve, constructed of brass.
- B One flexible container connectors shall be provided for each 25-50 kg/hr feed rate unit, one for each chlorine container manifold. Each flexible container connector shall be constructed of 3/8-in (9.5 mm) O.D. cadmium plated, dichromate dipped, copper tubing, 6-ft (1.8 m) long. Each connector shall be provided with an isolating valve and a header valve, constructed of brass.

## 2.04 MANIFOLD

- A Thirteen(13) chlorine manifolds shall be constructed of 1-in (25 mm) schedule 80 seamless steel and shall be suitable for use with dry chlorine liquid. Fittings shall be 2000 pounds (1000 kg) forged steel. The manifold shall provide connections a suitable distance apart for use with one hundred pound chlorine containers.
- B Two chlorine manifolds shall be constructed of 1-in (25 mm) schedule 80 seamless steel and shall be suitable for use with dry chlorine liquid. Fittings shall be 2000 pounds (1000 kg) forged steel. The manifold shall provide connections a suitable distance apart for use with one-ton chlorine containers.
- C The manifolds shall contain all required unions and fittings to fit metric chlorine tank fittings.

## 2.05 CHLORINE GAS STRAINERS (FILTERS)

- A There shall be furnished chlorine gas strainers (filters) for each chlorination system. The strainer shall be designed for use with chlorine gas and provided with easy disassembly for servicing. The filters shall be designed to remove ferric chloride and other impurities from the gas.
- B The filter shall consist of two chambers. The lower chamber shall act as a trap for liquid impurities. The upper portion shall have a removable filter cartridge especially designed to "plate out" ferric chloride and to trap other particulate matter.
- C The filter shall be constructed of high tensile strength cast iron tested to a pressure of 300 psi.

## 2.06 VALVES

- A Line valves for liquid or gaseous chlorine shall be forged steel globe valves having bolted bonnet, OS&Y, Hastalloy "C" disk, disk stem ring and body seat ring and stem. Packing shall be of teflon. Valves shall be tested at 300 psi with air under water and shall be as manufactured by Crane Co., Wallace & Tiernan or equal.

## 2.07 CHLORINE LEAK REPAIR KIT

- A Furnish two chlorine emergency repair kits with each chlorination system. The chlorine emergency kit shall be designed to handle leaks which could occur in one ton or one hundred pound chlorine containers. Kit shall be Type "B" and shall be of the type specified by the Chlorine Institute, Inc., and manufactured by Indians Springs Manufacturing Company, Baldwinsville, NY or equal.

## 2.08 SURFACE PREPARATION AND SHOP PRIME PAINTING

- A Prior to prime coating, all metal surfaces of the equipment within the chlorination system shall be thoroughly clean, dry and free from all mill-scale, rust, grease, dirt, paint, and other foreign substances to the satisfaction of the Engineer.
- B All metal surfaces except factory finished equipment surfaces and those obviously not to be painted such as aluminum and stainless steel shall be shop primed with two coats of Tneme Series 23 or equal.

END OF SECTION

## SECTION 11002

### CHLORINE TEST KITS

#### PART 1: GENERAL

##### 1.01 SCOPE OF WORK

- A Furnish twenty five (25) portable chlorine test kits to measure the free residual of chlorine in a water distribution system.
- B The chlorine test kits shall be delivered to the Owner's port of departure in Linthizum, Maryland no later than fourteen (14) days after placement of order.

##### 1.02 SUBMITTALS

- A For chlorine test kits and accessories to be furnished, the manufacturer shall submit three copies of the following to the Engineer within two (2) business days after placement of order:
  - 1. Literature and drawings describing the equipment and showing all important details of operation
  - 2. Certifications that shows compliance with this specifications.

##### 1.03 QUALITY ASSURANCE

- A All chlorine test kits and accessories shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The chlorine test kits and accessories shall be designed, constructed and shipped in accordance with the best practices and methods.

##### 1.04 DELIVERY, STORAGE AND HANDLING

- A All test kits shall be packed in containers which are closely identified with indelible markings on containers. The "packing" materials shall be suitable for overseas shipment.
- B All test kits shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until the test kits are put into operation.

##### 1.05 GUARANTEE

- A The manufacturer shall guarantee his equipment against any defect for one year period free of charge to the owner for any replacement parts and labor.

- B Manufacturers shall list the closest office to Armenia, or the manufacturer's international service department that will have reagents, spare parts, and operation and maintenance servicing.

## PART 2 : PRODUCTS

### 2.01 MATERIALS AND EQUIPMENT

#### A General

1. The equipment covered in these specifications shall be manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
2. All parts shall be so designed and proportioned as to have liberal strength, stability and stiffness and to be adapted for the work to be done.
3. These specifications call attention to certain features, but do not purport to cover all details of construction of the units.

#### B Chlorine test kits and accessories shall consist of the following items:

1. Chlorine Test Kits: Test kits shall measure the free residual chlorine of potable water at detection limits down to one (1) part per million. Each test kit shall have sufficient reagents to conduct at least 500 tests per kit. All reagents shall have a minimum of shelf life of year from date of delivery.
2. Accessories: Each test kit shall be provided with a suitable, non breakable container to store the test kit, reagents and instructions.

END OF SECTION

## SECTION 11380

### GASOLINE POWERED CUT-OFF SAW AND ACCESSORIES

#### PART 1: GENERAL

##### 1.01 SCOPE OF WORK

- A Furnish six (6) gasoline powered 35 cm (14 inch) diameter cut-off saws and all accessories required to cut through asphalt, steel pipe, cast iron pipe and reinforced concrete pipe.

##### 1.02 SUBMITTALS

- A For cut-off saws and accessories to be furnished, the manufacturer shall submit three copies of the following to the Engineer for approval:
  - 1. Literature and Drawings describing the equipment and showing all important details of construction and dimensions.
- B Certifications that shows compliance with this specifications.
- C Operation and Maintenance Data
  - 1. Operating and maintenance instructions including the manufacturer's recommended spare parts shall be furnished.

##### 1.03 QUALITY ASSURANCE

- A All cut-off saws and accessories shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The cut-off saws and accessories shall be designed, constructed and shipped in accordance with the best practices and methods.
- B Equipment shall be furnished by STIHL of Virginia Beach, Virginia or equal. This specification is based upon their standard product Model No. TS-760AVE Cutquik.

##### 1.04 MAINTENANCE

- A The cut-off saws and accessories shall be equipped with spare parts sufficient to last for a minimum of a two year period.
- B All spare parts shall be packed in containers which are closely identified with indelible markings on containers. The "packing" materials shall be suitable for overseas shipment.

##### 1.05 GUARANTEE

- A The manufacturer shall guarantee his equipment against any defect for two years period free of charge to the owner for any replacement parts and labor.
- B Manufacturers shall list all offices nearby the project that have spare parts and operation and maintenance servicing.

PART 2 : PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A General

1. The equipment covered in these specifications shall be manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
2. All parts shall be so designed and proportioned as to have liberal strength, stability and stiffness and to be adapted for the work to be done.
3. These specifications call attention to certain features, but do not purport to cover all details of construction of the units.

B Cut-off saws and accessories shall consist of the following items:

1. Cut-off Saws: The manufacturer shall provide 14 inch cut-off saws with a two cycle, single cylinder, fan cooled gasoline engine with a minimum cylinder volume of 110 cc. The ignition shall be electronic type and carburetor shall be diaphragm type. The cut-off saw shall have an adjustable wheel guard.
2. Accessories: Provide one hundred fifty (150) 35 cm (14 inch) diameter abrasive type blades for each cut-off saw. Provide a wooden storage box for each cut-off saw and it's accessories.
3. Safety Accessories: Provide three (3) units of protective eyewear that conform to ANSI Z87.1 and three (3) units of hearing protection that conform to ANSI S3.19 for each cut-off saw.

END OF SECTION

## SECTION 11381

### GASOLINE POWERED JACK HAMMER AND ACCESSORIES

#### PART 1: GENERAL

##### 1.01 SCOPE OF WORK

- A Furnish twelve (12) gasoline powered jack hammers and all accessories required for demolition of asphalt, concrete and stone in use associated with water and sewer line repair.

##### 1.02 SUBMITTALS

- A For jack hammers and accessories to be furnished, the manufacturer shall submit three copies of the following to the Engineer for approval:
  - 1. Literature and Drawings describing the equipment and showing all important details of construction and dimensions.
- B Certifications that shows compliance with this specifications.
- C Operation and Maintenance Data
  - 1. Operating and maintenance instructions including the manufacturer's recommended spare parts shall be furnished.

##### 1.03 QUALITY ASSURANCE

- A All jack hammers and accessories shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The jack hammers and accessories shall be designed, constructed and shipped in accordance with the best practices and methods.
- B Equipment shall be furnished by ATLAS COPCO of Holyoke, Massachusetts or equal. This specification is based upon the ATLAS COPCO Model Number FB-60.

##### 1.04 MAINTENANCE

- A The jack hammers and accessories shall be equipped with the manufacturer's recommended spare parts sufficient to last for a minimum of a two year period.
- B All spare parts shall be packed in containers which are closely identified with indelible markings on containers. The "packing" materials shall be suitable for overseas shipment.

##### 1.05 GUARANTEE

- A The manufacturer shall guarantee his equipment against any defect for two years period free of charge to the owner for any replacement parts and labor.
- B Manufacturers shall list all offices nearby the project area that have spare parts and operation and maintenance servicing.

PART 2 : PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A General

1. The equipment covered in these specifications shall be manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
2. All parts shall be so designed and proportioned as to have liberal strength, stability and stiffness and to be adapted for the work to be done.
3. These specifications call attention to certain features, but do not purport to cover all details of construction of the units.

B Jack hammer and accessories shall comprise of the following items:

1. Jack Hammer: The manufacturer shall provide jack hammers with a two stroke, single cylinder, fan cooled gasoline engine with a minimum cylinder volume of 105 cc. The ignition shall be transistor type and carburetor shall be diaphragm type. The impact energy of the hammer shall be a minimum of 60 Joules and capable of 1,200 blows per minute.
2. Jack Hammer Accessories: Provide five (5) heavy duty cutting blades, two (2) narrow concrete chisel points, two (2) wide concrete chisel points, two (2) digging blades, two (2) wedges and one (1) moil point for each jack hammer. All points shall be 1 1/4 inch hex shank made to fit the specified jack hammer. Provide a wooden storage box custom made for each jack hammer and it's accessories.
3. Safety Accessories: Provide three (3) units of protective eyewear conforming to ANSI Z87.1 and three (3) units of hearing protection that conforms to ANSI S3.19 for each jack hammer.

END OF SECTION



SECTION 11600

LABORATORY EQUIPMENT AND SUPPLIES

PART 1: GENERAL

1.01 SCOPE OF WORK

- A Furnish all laboratory equipment, supplies and accessories as specified herein.

1.02 SUBMITTALS

- A For all equipment and materials to be furnished, the supplier shall submit three copies of the complete list of equipment and supplies including catalog cuts, data sheets and other pertinent information including the manufacturer's printed instructions for operation and maintenance of equipment, where applicable.
- B Certifications that show compliance with this specification.

1.03 DELIVERY, STORAGE AND HANDLING

- A All materials, equipment and accessories shall be packed in containers which are closely identified with indelible markings on the containers. The packing material shall be suitable for overseas shipment.
- B All materials, equipment and accessories shall be shipped to the specified port of departure.
- C All materials, equipment and accessories shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation.

PART 2: PRODUCTS

2.01 LABORATORY EQUIPMENT AND SUPPLIES

- A The below scheduled items have been described by the SIGMA Chemical Company 1992 Catalog and are referenced by either I.D. number or page number. References to specific manufacturers is for the purpose of establishing a quality or parameter for specification writing and is not to be considered proprietary. In all cases any comparable and equivalent approved equipment and supplies will be acceptable.

<u>Description</u>	<u>I.D. Number</u>	<u>Quantity</u>
Cystine 1-cistine	Page 85	1.0 kg
Cleansphere 1000 Portalebench	1672.00	2
Electrophoresis	447.20	1
Signaware Lab Markers (10/pkg)	S6394 S6644 S6769 S6269 S6864 S5894 S6519	100 Items of Each Color

<u>Description</u>	<u>I.D. Number</u>	<u>Quantity</u>
Lead Rings for Sealing Laboratory Gas Tanks	Page 1876	10 Each
Air Displacement Pipets	P2425 P2550 P2675	10 Each
Finnpipette Adjustable Volume Multi-Channel Pipets	P3174 P3299	4 Each
ph Measurement	P4536 (ph Range 4.5-10)	60 Sets

B The below scheduled items have been described by the ENVIRONETICS May 1992 catalog. References to specific manufacturers is for the purpose of establishing a quality or parameter for specification writing and is not to be considered proprietary. In all cases any comparable and equivalent approved equipment and supplies will be acceptable.

<u>Description</u>	<u>I.D. Number</u>	<u>Quantity</u>
Colilert Economy P/A	WP200	10 Cases
Colilert Economy Pre-dispenced MPN	W200	10 Cases
Comparator MPN	W102	20 Each
Semi-Quantitative Comparator Set	W105	4 Sets
Pocket U.V. Fluorescent Lamp	WL200	2 Each

C The below scheduled items have been described by the GELMAMN 1992 catalog. References to specific manufacturers is for the purpose of establishing a quality or parameter for specification writing and is not to be considered proprietary. In all cases any comparable and equivalent approved equipment and supplies will be acceptable.

<u>Description</u>	<u>I.D. Number</u>	<u>Quantity</u>
Magnetic Filter Funnel (47 mm Pad Size)	4201	6 Each
Absorbent Pads With Dispenser (1,000 count)	66025	2 Packs
Manifold	4205	2 Each

E Provide two (2) QUANTUM-2 devices for microbiological and parasitological analysis manufactured by ABBOT-I or equal.

F Provide two (2) liquid chromatographs, Star 9010 Pump Polychrome Diode Array Detector including the AASP, as manufactured by the VARIAN Company or equal.

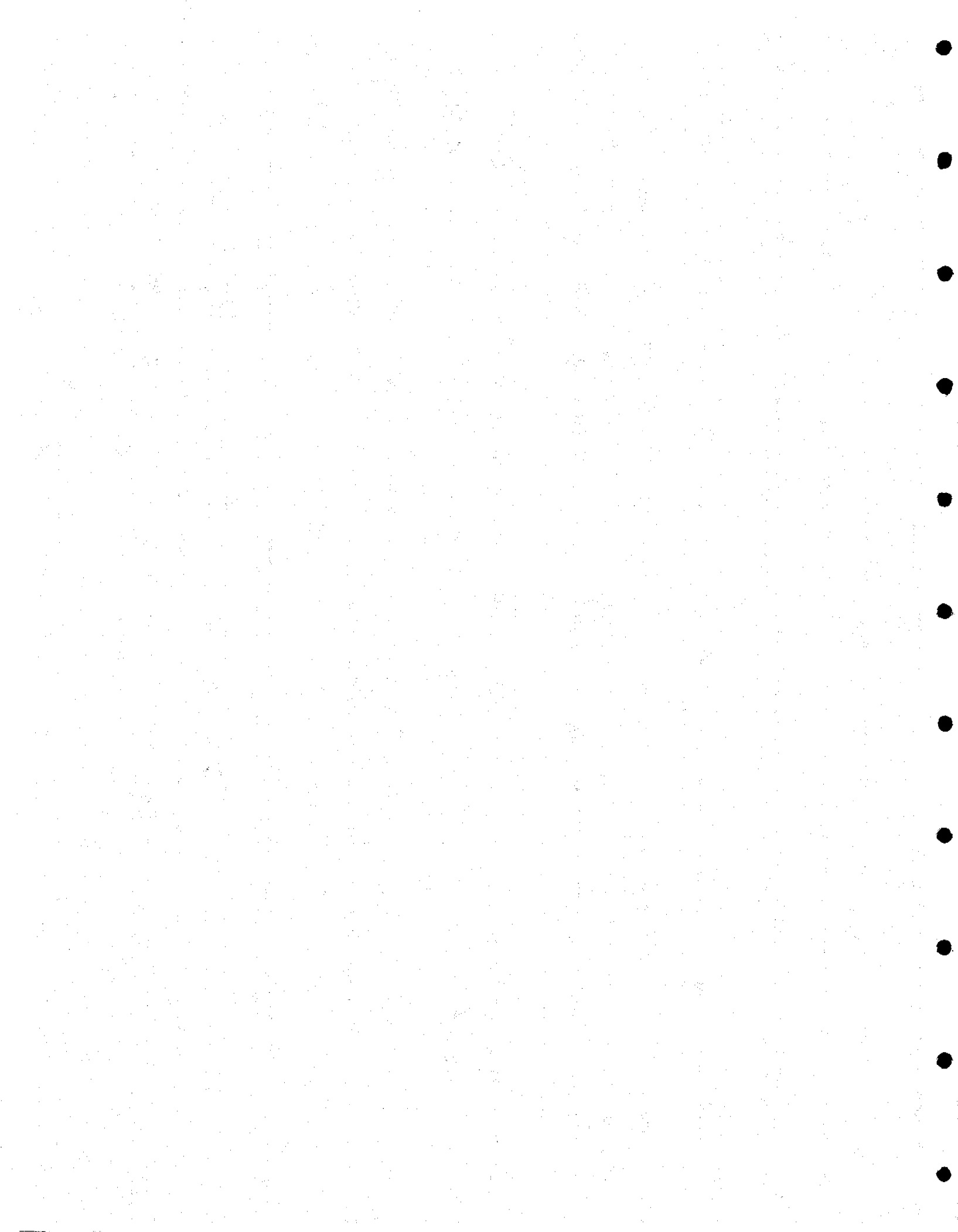
- G Provide one hundred (100) plastic media bottles, 100 ml capacity, manufactured by Pyrex or equal.

PART 3: EXECUTION

3.01 PRODUCT SHELF LIFE, WARRANTY AND SERVICE

- A Product shelf life of perishable supplies and reagents and time-dated equipment shall be a minimum of twelve (12) months or 90% of the specified shelf life at the time of acceptance of material by the Project.
- B Manufacturers of equipment items which include guarantees and/or warranties of their products shall furnish a written statement that the time period of these services will start upon installation of the equipment to the satisfaction of the Engineer.

END OF SECTION



SECTION 11001

LEAK DETECTION EQUIPMENT

PART 1: GENERAL

1.01 SCOPE OF WORK

- A Furnish six (6) electro-sonic water leak detectors, two (2) electronic pipe locators and all accessories required to locate water leaks in buried conduits at depths down to 4 meters.
- B The leak detection equipment shall be delivered to the Owner's port of departure in Linthizum, Maryland no later than fifteen (15) days after placement of order.

1.02 SUBMITTALS

- A For electro-sonic water leak detectors, electronic pipe locator and accessories to be furnished, the manufacturer shall submit three copies of the following to the Engineer within two (2) business days after placement of order:
  - 1. Literature and Drawings describing the equipment and showing all important details of construction and dimensions.
  - 2. Certifications that shows compliance with this specifications.
  - 3. Operating and maintenance instructions including the manufacturer's recommended spare parts shall be furnished.
- B A manufacturer's representative who has complete knowledge of the proper operation and maintenance of the leak detection equipment shall be available to instruct representatives of the Owner and the Engineer on proper operation and maintenance.

1.03 QUALITY ASSURANCE

- A All electro-sonic water leak detectors, electronic pipe locator and accessories shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The electro-sonic water leak detectors and accessories shall be designed, constructed and shipped in accordance with the best practices and methods.
- B Equipment shall be furnished by HEALTH Consultants of Houston, Texas Teledyne of Garland, Texas or equal.

#### 1.04 MAINTENANCE

- A The electro-sonic water leak detectors, electronic pipe locator and accessories shall be equipped with the manufacturer's recommended spare parts sufficient to last for a minimum of a one year period.
- B All spare parts shall be packed in containers which are closely identified with indelible markings on containers. The "packing" materials shall be suitable for overseas shipment.

#### 1.05 GUARANTEE

- A The manufacturer shall guarantee his equipment against any defect for one year period free of charge to the owner for any replacement parts and labor.
- B Manufacturers shall list the nearest office to Armenia that have spare parts and operation and maintenance servicing or the manufacturer's international service department.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- A All equipment shall be crated with packing material suitable for overseas shipment. All containers shall be identified with indelible markings on the crates.
- B All equipment shall be properly protected when packed so that no damage or deterioration shall occur during a prolonged period of delay from the time of shipment until the equipment is put into operation.

### PART 2 : PRODUCTS

#### 2.01 MATERIALS AND EQUIPMENT

##### A General

1. The equipment covered in these specifications shall be manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
2. All parts shall be so designed and proportioned as to have liberal strength, stability and stiffness and to be adapted for the work to be done.
3. These specifications call attention to certain features, but do not purport to cover all details of construction of the units.

B Electro-sonic water leak detectors, electronic pipe locator and accessories shall consist of the following items:

1. Electro-sonic Water Leak Detectors: Detecting system shall consist of battery operated amplifier and belt mounted receiver with internal fixed filtering capable of amplifying the complete range of leak noise frequencies ranging from 10 Hz to 6 KHz. The unit shall also have a direct contact microphone with a minimum of eight feet in extensions, a ground microphone withy handle, two (2) microphone cables, and a sound protection headset.
2. Electronic Pipe Locator: Locating system shall consist of electronic transmitter and receiver. Transmitter shall be battery operated with a nominal power output of 300-600 mW operating at an output frequency of 82.230 kHz. The receiver shall have complete automatic sensitivity adjustment and control. The receiver shall be battery operated with digital read-out including directional arrows including a push button depth indicator with a maximum depth reading up to 375 cm.
3. Accessories: Battery chargers (240 V), one extra battery, carrying cases and instruction manuals shall be provided for each piece of equipment.

END OF SECTION

SECTION 11383

PORTABLE GASOLINE GENERATOR

PART 1: GENERAL

1.01 SCOPE OF WORK

- A Furnish five (5) portable gasoline powered 6 KV generators and all required accessories.

1.02 SUBMITTALS

- A For generators and accessories to be furnished, the manufacturer shall submit three copies of the following to the Engineer for approval:
  - 1. Literature and Drawings describing the equipment and showing all important details of construction and dimensions.
- B Certifications that shows compliance with this specifications.
- C Operation and Maintenance Data
  - 1. Operating and maintenance instructions including the manufacturer's recommended spare parts shall be furnished.

1.03 QUALITY ASSURANCE

- A All generators and accessories shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The generators and accessories shall be designed, constructed and shipped in accordance with the best practices and methods.
- B Equipment shall be furnished by Briggs & Stratton, Dayton, Homelite or equal.

1.03 DELIVERY, STORAGE AND HANDLING

- A All spare parts shall be packed in containers which are closely identified with indelible markings on containers. The "packing" materials shall be suitable for overseas shipment.
- B All equipment shall be shipped to the specified port of departure.
- C All equipment, accessories and spare parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation and the equipment is ready for operation.

1.05 MAINTENANCE

- A The generators and accessories shall be equipped with spare parts sufficient to last for a minimum of a two year period.



1.06 GUARANTEE

- A The manufacturer shall guarantee his equipment against any defect for two years period free of charge to the owner for any replacement parts and labor.
- B Manufacturers shall list all offices nearby the project that have spare parts and operation and maintenance servicing.

PART 2 : PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A General

1. The equipment covered in these specifications shall be manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
2. All parts shall be so designed and proportioned as to have liberal strength, stability and stiffness and to be adapted for the work to be done.
3. These specifications call attention to certain features, but do not purport to cover all details of construction of the units.

B Generators and accessories shall consist of the following items:

1. Generators: The manufacturer shall provide 6 KV gasoline powered generators mounted on skids with a wrap around frame. The engine shall be air cooled with a minimum of 10 hp with electric start with a pull or crank start as a back-up. The full tank shall provide enough fuel for a minimum of eight hours running time. The generator shall provide two 240V twist lock full powered receptacles.
2. Accessories: In addition to the manufacturers recommended spare parts provide twenty five (25) spare spark plugs and two spark plug wrenches for each generator. Provide a custom fit canvas or vinyl cover for each generator.

END OF SECTION

## SECTION 11384

### UNDERWATER WELDING EQUIPMENT

#### PART 1: GENERAL

##### 1.01 SCOPE OF WORK

- A Furnish one complete underwater welding system and all required accessories to make repairs to submerged large diameter steel pipelines.
- B The welding equipment shall be delivered to the Owner's port of departure in Linthizum, Maryland no later than fifteen (15) after placement of order.

##### 1.02 SUBMITTALS

- A For welding equipment and accessories to be furnished, the manufacturer shall submit three copies of the following to the Engineer within two (2) business days of the placement of the order:
  - 1. Literature and Drawings describing the equipment and showing all important details of construction and dimensions.
  - 2. Certifications that shows compliance with this specifications
  - 3. Operating and maintenance instructions including the manufacturer's recommended spare parts shall be furnished.
- B A manufacturer's representative who has complete knowledge of proper operation and maintenance of the underwater welding unit shall be available to instruct representatives of the Owner or the Engineer on proper operation and maintenance.

##### 1.03 QUALITY ASSURANCE

- A All welding equipment and accessories shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The welding equipment and accessories shall be designed, constructed and shipped in accordance with the best practices and methods.
- B Equipment shall be furnished by Arcair, Inc. of Wichita, Kansas Model Sea-Pack 400 or equal.

##### 1.04 DELIVERY, STORAGE AND HANDLING

- A All equipment and accessories shall be packed in containers which are closely identified with indelible markings on containers. The "packing" materials shall be suitable for overseas shipment.
- B All equipment shall be shipped to the specified port of departure.
- C All equipment, accessories and spare parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation and the equipment is ready for operation.

#### 1.05 SPARE PARTS

- A The welding equipment and accessories shall be equipped with the manufacturers recommended spare parts and repair tools sufficient to last for a minimum of a two year period.

#### 1.06 GUARANTEE

- A The manufacturer shall guarantee his equipment against any defect for two year period free of charge to the owner for any replacement of parts and labor.
- B Manufacturers shall list all offices near Armenia, or the manufacturer's international service department that have spare parts and operation and maintenance servicing.

### PART 2 : PRODUCTS

#### 2.01 MATERIALS AND EQUIPMENT

##### A General

1. The equipment covered in these specifications shall be manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
2. All parts shall be so designed and proportioned as to have liberal strength, stability and stiffness and to be adapted for the work to be done.
3. These specifications call attention to certain features, but do not purport to cover all details of construction of the units.

- B Welding equipment and accessories shall consist of the following items:

1. Power Supply: The manufacturer shall provide a 400 ampere DC constant current machine with a 100% duty cycle at 40 arc volts. A 3 KVA 240 volt twist lock full powered receptacle shall be provided. The unit shall be diesel driven mounted on skids with a 3 inch square tube wrap around frame.
2. Welding Equipment: The system shall be self contained with all the components required to perform underwater welding and cutting. It shall have a five station oxygen manifold with individual shut off valves and pigtails and a safety bar to hold all the tanks. The manifold and valves shall be adaptable to 7.8 m<sup>3</sup> (277 ft<sup>3</sup>) capacity high pressure oxygen tanks. The system shall have a two pole single throw knife switch to guard against electrical faults. The electrode holder shall accept 1/8 inch, 5/32 inch and 3/16 inch electrodes.
3. Electrodes: Provide three hundred (300) 1/8 inch diameter, three hundred (300) 5/32 inch diameter and three hundred (300) 3/16 inch diameter welding electrodes. Provide two hundred (200) 5/16 inch diameter cutting electrodes.
4. Accessories: Provide 200 ft of 1/4 inch inside diameter oxygen hose and 200 ft of cable with all required lugs. Provide a custom fit canvas or vinyl cover for the welding unit and a wooden or metal storage box for all the accessories.
5. Spare Parts: Provide two years worth of all manufacturer's recommended spare parts and all required repair tools.

END OF SECTION

## SECTION 02744

### SEWER RODDING MACHINE

#### PART 1: GENERAL

##### 1.01 SCOPE OF WORK

- A Furnish three (3) hydraulic powered sewer rodding machines with accessories for cleaning blockages from sewer lines ranging in size from 100 mm (4 inch) up to 1500 mm (60 inch) in diameter.
- 1 The machine shall have the capability of removing blockages consisting of unusually heavy root growths, hardened grease or scale, trash and other debris.
  - 2 The machine shall be capable of pushing, pulling and rotating either a 7.8 mm or 9.4 mm (5/16-in or 3/8-in) diameter sectional rod to clean and remove obstructions from sewer lines.
- B The sewer rodders shall be delivered to the Owner's port of departure in Linthicum, Maryland no later than thirty (16) days after placement of order.

##### 1.02 SUBMITTALS

- A For all sewer rodding machines to be furnished, the manufacturer shall submit three copies of the following to the Engineer within two (2) business days of the placement of the order:
1. Literature and drawings describing the equipment and showing all important details of construction and dimensions.
  2. Certification that shows compliance with this specifications.
  3. Operating and maintenance instructions including the manufacturer's recommended spare parts list.
- B A manufacturer representative who has complete knowledge of proper operation and maintenance of the sewer rodding machine shall be available to instruct representatives of the Owner and the Engineer on proper operation and maintenance.

##### 1.03 QUALITY ASSURANCE

- A Sewer rodding machines shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The rodding units shall be designed, constructed and shipped in accordance with the best practices and methods.

- B Equipment shall be furnished by Aquatech, Cleveland, Ohio; Sreco Flexible, Culver City, California; Vac-Con, Glenview, Illinois or equal. The above specification is based upon Sreco Flexible Sewer Rodding machine Model No. HM-516 TR.

#### 1.04 MAINTENANCE

- A The sewer rodding machine shall be equipped with the manufacturer's recommended spare parts sufficient to last for a minimum of a two year period.
- B The sewer rodder shall be equipped with all special tools required for normal operation and maintenance of the sewer rodders.

#### 1.05 GUARANTEE

- A The manufacturer shall guarantee his equipment against any defect for two years period free of charge to the owner for any replacement parts and labor.
- B Manufacturers shall list the nearest offices to Armenia that have spare parts and operation and maintenance servicing or the manufacturer's international service department.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- A All equipment shall be crated with packing material suitable for overseas shipment.
- B All parts shall be packed in containers which are closely identified with indelible markings on containers. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged period of delay from the time of shipment until the equipment is put into operation.
- C All spare parts shall be packed in containers which are closely identified with indelible markings on containers. The "packing" materials shall be suitable for overseas shipment.

### PART 2: PRODUCTS

#### 2.01 MATERIALS AND EQUIPMENT

##### A General

1. The equipment covered in these specifications shall be manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be

designed, constructed and installed in accordance with the best practice and methods and shall operate satisfactorily.

2. All parts shall be so designed and proportioned as to have liberal strength, stability and stiffness and to be adapted for the work to be done.
3. These specifications call attention to certain features, but do not purport to cover all details of construction of the units.

B The sewer rodding machine shall comprise of the following items:

1. Trailer: The trailer shall be constructed from heavy duty 12.5 cm (5-in) structural steel channel and all welded frame. Torsion type suspension shall allow for on and off road travel. The towing end shall be equipped with a heavy duty, retractable stabilizer with a swivel wheel. High quality pneumatic rubber tires and wheel axle and bearings shall be provided. The trailer shall be equipped with a lockable tool and accessory box.
2. Engine: The engine shall have a minimum of 18 hp, gasoline engine, 2 cylinder, air cooled. Engine shall have electric start, start-stop switch and alternating charging system.
3. Control Panel: Sewer cleaning functions and controls shall be capable of operation from one position at the operator's station. The control panel shall consist of:
  - o push button electric start and on/off switch.
  - o locking throttle control
  - o single lever control for rod push and pull and reel rotation direction. The control lever shall have the ability to control each function separately, or both functions simultaneously.
  - o Rod travel adjustable pressure control.
  - o Rod travel pressure gauge.
  - o Reel rotation adjustable speed control.
  - o Ammeter
  - o Rod speed control adjustment.
  - o Sealed beam, rotating amber beacon.
4. Rod Reel and Drive: The rod reel and drive system shall be of single unit construction designed to rotate the reel and the drive head with the rod rotation, eliminating rod stresses caused by a stationary system.

The rod storage reel shall be capable of holding 305 meter of 7.9 mm (1000 feet of 5/16-in diameter) or 244 meters of 9.5 mm (800 feet of 3/8-in diameter) sectional sewer rod.

5. Hydraulic System: Tank with a minimum of 114 liters (30 gallon) reservoir, the tank shall be bolted to frame and be removable for servicing. A minimum rating of 2000 psi operating pressure. Dual hydraulic gear pumps with 3635 l/s (15 gpm) rating on each pump.
6. Shrouding: Steel shroud with access doors shall be provided to house all the equipment for transportation and safe storage.
7. Accessories: The manufacturer shall furnish the following accessories with this machine:
  - o 18 feet (5.5 meters) Fleximetallic rod guide house (trailer mountable)
  - o Assembly wrench 7.9 mm (5/16-in) Rod
  - o Assembly turning wrench 7.9 mm (5/16-in) Rod.
  - o Lower rigid rod guide and rope.
  - o Pick-up rod recovery tool.
  - o Square bar corkscrew 10 cm (4-in)
  - o Square bar corkscrew 15 cm (6-in)
  - o Square bar corkscrew 20 cm (8-in)
  - o Square bar corkscrew 25 cm (10-in)
  - o Square bar corkscrew 30 cm (12-in)
  - o Round wire corkscrew 3.75 cm (1.5-in)
  - o Round wire corkscrew 7.5 cm (3-in)
  - o Round wire corkscrew 10 cm (4-in)
  - o Auger, 10 cm (4-in)
  - o Auger, 15 cm (6-in)
  - o Auger, 20 cm (8-in)
  - o Auger, 25 cm (10-in)
  - o Pilot bullet tool
  - o Spear point cutter, 4.5 cm (1 7/8-in)
  - o Spear point cutter, 10 cm (4-in)
  - o Porcupine, turn type 15 cm (6-in)
  - o Porcupine, turn type 20 cm (8-in)
  - o STD. Root Saw, 7.5 cm (3-in)
  - o STD. Root Saw, 10 cm (4-in)
  - o STD. Root Saw, 15 cm (6-in)
  - o STD. Root Saw, 20 cm (8-in)

END OF SECTION