TECHNET

A Technical Network for Logistics and Health

REPORT OF 1990 TECHNET CONSULTATION

(WHO/EPI/LHIS/90.2)

Consultation of experts in logistics and the cold chain
on problems facing the EPI during the 1990s

Nicosia, Cyprus
12-16 March 1990.

LOGISTICS FOR HEALTH

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TABLE OF CONTENTS

INTRODUCTION

The first Technet Consultation, held in Nicosia, Cyprus, from 12-16 March 1990, was attended by 32 participants made up of staff members from WHO and UNICEF Regional and country offices, CDC/Atlanta and non governmental organizations and consultants. The following officers were selected:

Chairman:	Ms Nancy Cain (Unicef, New York)
Rapporteur:	Mr David Bassett (CDC, Atlanta, USA)

The meeting was opened by Dr Michael Voniatis of the Ministry of Health, Cyprus, who welcomed the participants of Technet to Cyprus and wished them a successful meeting. He emphasized the impact which this group will have on the operations of the EPI and commented that "Cyprus is fortunate in having a long standing childhood immunization programme through which polio, diphtheria and neonatal tetanus have been eliminated and measles has been reduced to a few cases each year. It is interesting to note, however, that the cold chain in Cyprus was only placed in a proper management framework four years ago through WHO assistance. Future plans in the area of childhood immunization envisage the introduction of Hepatitis B vaccine as part of our EPI schedule."

Dr Voniatis concluded with an invitation to participants to visit the Higher Technical Institute in Nicosia which is both a WHO collaborating centre and an international training centre. Several cold chain courses have been held there in recent years and more are planned in the future.

John Lloyd (WHO/EPI) presented an overview of the aims and objectives of the first global meeting of logistics experts in the history of the EPI and expressed the hope that this Technet consultation would mark the beginning of an initiative to achieve better global communications in the development of logistic systems and the resolution of technical problems.

Although the progress of the EPI in the last fifteen years was called a *near miracle* at the recent *Bellagio meeting* in Thailand, the coming decade poses an even bigger challenge and one which will require greatly improved logistic systems adapted to the new UCI/EPI objectives, which include interruption of the transmission of wild polio virus, elimination of neonatal tetanus, reduction of measles cases, introduction of new vaccines, and reduction of recurrent costs to sustainable levels.

The objectives of this meeting were primarily to share individual perceptions of the current major problems in EPI logistics, to review priorities for development in the present decade, and to plan a communications network which will facilitate improvements in the efficiency of EPI logistic systems.

Opportunities now exist, through the UNICEF electronic mail network (E-mail) and facsimile transmission, to create a global communications network which will enable the problems of one Technet member to be reviewed simultaneously by Technet members in other countries and Regions. This will enable ideas and solutions to flow freely and rapidly to where they can be used.

At the outset, participants were invited to write down what they considered to be the three most important issues or ideas affecting the logistics and operations of the EPI in the coming decade. Each idea was written on a large card. The cards were sorted into the seven categories listed below and displayed prominently in the conference room:

Communications & information
Integration and standardization
Equipment and vehicle maintenance
Management
Sustainability and costs
Safety and injections
New tools and new vaccines

Five working groups were set up. Group 1 was composed of participants with a technical and engineering bias, Group 5 of participants with managerial and operations planning experience. The selection of participants of the intermediary groups (2, 3 and 4) reflected a mix of experience and responsibility between these two poles. The composition of the groups remained the same throughout the meeting.

Each presentation on a technical issue was followed either by a plenary discussion or by a session of the five working groups whose conclusions were subsequently presented in plenary. The members were invited periodically to vote on the importance of issues of global or Regional concern. Plans of action for the coming twelve months were also drawn up for these issues.

CONCLUSIONS AND RECOMMENDATIONS

The group concluded that, although much progress has been made in the development of cold chain and logistic systems during the last decade, much remains to be done to improve performance and achieve efficiency in programme operations in order to meet current and anticipated changes in the EPI during the next decade.

Improvements are particularly needed in the management and planning of supply systems, in the maintenance of equipment and transport systems and in the supervision of programme operations. Poor performance in these areas is attributed to an over-emphasis on equipping the EPI and the narrow scope attributed to the so-called cold chain by senior programme management. In this regard, the absence of active participation of logistics experts at some Regional EPI managers' meetings was particularly noted.

Operations research was perceived by the group to be a vital part of the routine operations of the EPI. Participants from the larger countries and also from countries with good immunization coverage stressed the growing importance which is being placed by governments, as well as donors, on the need for evidence to support large scale decisions which affect the costs of the EPI, particularly when such decisions involve changes in equipment, strategy or established immunization and sterilization practices.

Integration of logistics support to the EPI with the logistic systems of other interventions of primary health care was considered to be another key issue for the 1990s. The group saw many opportunities to improve the efficiency and reduce recurrent costs of the EPI. However, they also noted problems which are developing through the isolation of the cold chain in providing only for the EPI.

Finally, the group concluded that better personal communications, which enable wider participation in the development of global and Regional solutions to logistic problems, is a vital objective for the 1990s so that logistic systems can fully support the new targets of the EPI.

The group therefore:

1. Endorsed the proposal to establish an EPI technical network with an agreed programme of work which will achieve rapid, informal and direct personal communications in order to:

   - collaborate in operations research of global or Regional importance;
   - enable informal consultation to help resolve technical, operational and managerial problems;
   - act as a channel for dissemination of information;
   - promote the participation of logistics experts at every Regional EPI managers meeting.

2. Agreed on priorities for global and Regional operations research and technology development during the coming twelve months, as follows:

   - Develop and test training systems for:
     - central level logistics personnel; and
     - vehicle drivers and motorcycle riders.

   - Develop and conduct surveys to:
     - examine injection and sterilization practices;
     - evaluate impact of 10-dose presentation of EPI vaccines;
     - assess current reliability and cost in the use of solar refrigerators and compare this with alternative energy sources and strategies;
     - analyse logistic costs and establish inventories;
     - assess the lifetime of equipment and vehicles;
     - develop a standardized protocol for cold chain quality surveys;
     - evaluate the feasibility of whole-life contracts for vehicles and cold chain equipment; and
     - evaluate the field performance of kerosene refrigerators.

   - Develop and introduce software, including:
     - impact assessment software to enable the impact of logistic changes in EPI strategies to be assessed in advance; and
     - inventory control software.

   - Develop and introduce new equipment, including:
     - a kit to upgrade the performance of existing domestic refrigerators being used for vaccine storage; and
     - vaccine vial heat exposure indicators.

Any reporting, publications or other products of this programme of work will be identified with the title *Technet* and will include a list of the names of those who have actively collaborated in the work. The purpose of this is to acknowledge the organizations and individuals who have contributed and for Technet to be seen as a resource for primary health care in general, not only for the EPI.

3. Recognizing that official communications remain the only channels for substantive issues and for issues requiring action at organizational level, the group resolved to establish means of personal communication, according to the practical and organizational limitations of each member. This will be initiated through the coordination of WHO/EPI Geneva which has agreed to be the executive secretariat for Technet.

   Ranking the means of communication in order of preference:

   - **Electronic mail (E-mail):** Where equipment is needed to establish E-mail communications, the first source of funding should be the parent organization of the Technet member. Where no such funding is forthcoming, applications may be made in writing to WHO or UNICEF for assistance. The decision of these organizations will depend on the availability of funds and the exceptional circumstances of the request.

     The E-mail bulletin board will provide possibilities for direct posting of new personal messages by any Technet member and the deletion of messages by the source person or the Technet secretariat. It will also be possible to sort messages on any keyword of interest.

     Person to person mail boxes within E-mail can also be used.

   - **Facsimile or telex** on a person to person basis, and/or as a link to the E-mail bulletin board through the Technet secretariat.

   - **Person to person mail** through the normal organizational channels. A summary copy of the bulletin board can also be mailed out by the Technet secretariat once a month.

4. Agreed that the membership of Technet should be broadened and that each current member be able to nominate new members. Nominees should have an active, full time involvement in child survival activities with responsibility for one or more aspects of cold chain, logistics and operational management, international experience and evident motivation.

Nominations of new members will be posted on the E-Mail bulletin board for a period of one month and, if the above criteria are met and no existing Technet members oppose the membership, they will be accepted. Obversely, any existing member who ceases to meet these criteria will cease to be a member of Technet.

The maximum number of members of Technet will be limited only by the capacity of each member's parent organization to cover the recurrent and capital costs of connection to the electronic mail network and/or facsimile costs(1).

5. Endorsed the proposal that the current *Cold Chain Newsletter* be transformed into a *Technet Newsletter on EPI Cold Chain and Logistics* for wider circulation of Technet activities and information exchange of Regional and global importance.

6. Resolved to report the deliberations of the Technet consultation in summary to the WHO/EPI Research and Development Group and to bring key considerations and recommendations to the attention of the EPI Global Advisory Group.

7. Planned to meet again at one of the Regional cold chain and logistics training centres in September 1991 on the understanding that, no matter how numerous the members of Technet become, participants at the consultation will be limited to a number which can be accepted by the Technet secretariat when the meeting is planned. Selection of participants will be made by the Technet secretariat in collaboration with UNICEF.

(1) For consultants, the parent organization is considered to be either WHO or UNICEF, as outlined under paragraph 3.

THE ROLE OF TECHNET

It was UNICEF/India, and Mr Munck in particular, who initiated the negotiations between WHO and UNICEF which led to the formation of Technet and the Cyprus meeting. In his presentation on the role and concept of Technet, Mr Munck stressed that the success of Technet will depend largely on collaboration between professionals on technical issues. To illustrate this point, he recalled two UNICEF experiences: the water programme, considered to be a success, and the transport management programme, considered to be a failure. He attributed UNICEF's success in the former partly to the cooperation between professionals in different countries and Regions on product development and new approaches in programme delivery. The failure of the latter he traced to UNICEF's decision to abolish the vehicle management adviser posts. Now, five years later, there is an urgent need for these posts to be re-established.

There is a growing need for operations research on logistic and technical issues. This includes evaluations, which are of growing interest to both donors and governments, of the lifetime and maintenance of equipment.

The UNICEF team of engineers based in New Delhi has collaborated with the Government of India in an extensive training programme on the use and repair of equipment, as well as the indigenisation of equipment for use in the EPI. This team would like to share its experience and knowledge and may be considered an important resource for Technet.

DISCUSSION ON TECHNET

The concept of Technet as a tool for improving technical communications between logistics specialists was broadly and warmly endorsed by the participants. The most important objectives of such a network stress that it should be an instrument to conduct operational research, as well as to supply and exchange information.

It was also envisaged that Technet has the potential to increase the recognition by the medical programme management of the technical staff's professional role and contribution to the EPI. This view was endorsed in the commitment expressed by the group to work together actively on issues of importance for the improvement of logistic systems. It was recommended that Technet members be nominated to attend key Regional EPI meetings which are attended by EPI programme managers.

Organization of Technet

There should be a clearing house for communications, an intermediary, between individual Technet members. EPI/Geneva agreed to undertake this role and, in close collaboration with UNICEF, will act as the Technet secretariat.

Operational research conducted through Technet

Information based on sound operational research is increasingly required by governments wishing to know the cost and management implications of large scale decisions, either in the selection of equipment or in changes in supply specifications. Donors also require hard data for their increasingly rigorous external evaluations of the EPI, particularly in the larger countries.

The group discussed and agreed that a programme of objectives in operations research is needed for the coming year. Fourteen objectives *(topics)* were proposed as the meeting progressed and participants were requested to assign a priority (high, medium or low) to each objective for each Region of the world(2). The results of this survey appear as the *Topic Sheets* in Annex 3.

Many of the topics submitted on cards and classified at the start of the meeting were included in the major objectives.

It was agreed that the Topic Sheets would provide a useful orientation for the work of Technet during the coming year. Not all the important areas for the attention of Technet are reflected yet and other objectives, which were inspired by the discussions, have already been proposed since the meeting. A system for submitting new topics and voting on them is being set up and new Topic Sheets will be added as they are drawn up.

(2) The system of assigning a priority grading has subsequently been revised. Each member can now rate the importance of a topic only as it applies to the Region where he or she currently resides.

Information exchange and consultation through Technet

The group considered that exchange of information through Technet would be useful in the following areas:

- **Training:** Information concerning planned training courses, such as those held at Pune in India, could be shared with members.

- **Development of equipment:** Members could be informed from the very early stages of the development and modification of equipment and could subsequently participate in this process. They could also review ideas (which are not commercially confidential) submitted by inventors and from other sources.

- **Information feedback:** Technet could be used as a feedback mechanism to provide early field evaluation data relating to changes in equipment and supplies, such as the recent change of kerosene wicks from cotton to fiberglass.

Means of communication for Technet

There was agreement that Technet should meet once a year, but it was pointed out that an annual consultation would not be enough to keep Technet functioning during the interim. The challenge was how to exchange information outside these consultations.

This led to a discussion of desired modalities that Technet members could use for communicating with each other. It was widely agreed that Technet should aim to establish E-Mail on a person to person basis, as well as an electronic bulletin board. A survey during the meeting revealed that just under 70% of the participants present had access to E-Mail. The extent to which personal communications can be realized, with or without E-Mail, is of course subject to the organizational limitations of each member.

- **Bulletin boards:** The bulletin board based on UNICEF/UNET electronic mail enables messages to be posted on it from anywhere on the network. Messages can be read and responded to directly, or downloaded to the personal computer of anyone on the network to be read later.

It was recommended that a classification system be established on the bulletin board to enable members to easily identify only those items of interest to them. The categories for this classification should not be set until the network has been formed and information begins to accumulate.

Material on the bulletin board should also be graded by the person submitting it on a scale from *Confidential to Technet members* through to *Public, for open dissemination.*

- **Person to person communications** among members, using E-Mail, fax or telex. Person to person communications should always be treated as confidential to Technet members to allow for personal exchange of views. If action is called for by these communications, the official channels will then be used to initiate and facilitate it.

- **The Cold Chain Newsletter**, which has proved to be a useful medium for information exchange, is seen at present as a channel for EPI/Geneva to provide news to the field and not as an interactive communications device. It could be adapted to be a Technet newsletter.

Field staff noted different problems with electronic communications whether person to person or through a bulletin board. Persons without easy access to such means of direct communication would fall back on the option of using conventional means to communicate with EPI/ Geneva which would arrange for their messages to be transferred to the bulletin board. EPI/Geneva was, however, hesitant to undertake the removal of responses from the bulletin board for redirecting by conventional mail systems to intended receivers.

It was noted that the slower forms of communication might suffer delays as more rapid attention would be given to electronic mail.

When material is sent out for review by Technet members, deadlines for the return of comments should always be declared. These deadlines will be strictly adhered to and it will not always be possible to use comments received late.

GLOBAL OVERVIEW

INTRODUCING NEW TECHNOLOGIES IN THE 1990s

This presentation described the way UNICEF plans to work on the development and introduction of new technologies for primary health care in the 1990s.

The development of new or improved supplies and equipment is nothing new for UNICEF. The Mark II hand pump and ORS are extremely successful examples of what has been accomplished. Unfortunately, there is no effective means of communicating what is being done, so that global introduction of a technology developed at field level, even if warranted, is not likely to occur.

UNICEF has long cooperated with WHO/Geneva on the development of equipment for the EPI, with USAID and PATH on various technologies for primary health care, and with other organizations. The need to combine resources to produce, promote and distribute the technologies more effectively led to a proposal last year that a Technology Introduction Panel be established. This proposal was accepted by WHO, USAID, PATH and UNICEF. The first meeting of this Panel was held in the UNICEF headquarters in New York in September 1989, and the following terms of reference were established:

"1. Identify technological needs, priorities and opportunities to support the health goals of WHO, UNICEF and USAID in developing countries, and determine the feasibility (technical, cultural and economic) and optimal means of promoting the development of such technologies.

"2. Promote the development process by reviewing progress and strategies of each stage:
   a. Definition of technology;
   b. Performance specifications;
   c. Prototype production and testing;
   d. Training development;
   e. Limited production for field trial;
   f. Mass production, promotion and distribution;
   g. Long term monitoring and adaptation;
   to ensure continuing technical and economic viability."

COLD CHAIN PRIORITIES IN THE 1990s

During the past decade, cold chain systems have been installed in every country where the EPI is being implemented. The next decade will witness greater efforts to better coordinate and consolidate the planning, implementation and management of child survival, including the necessary logistic systems to ensure success.

Our principal task for the 1990s, therefore, is to improve the management, quality and efficiency of logistic systems for public health in general and the EPI in particular, from national to peripheral level.

However, the selection and maintenance of appropriate technologies will also continue to be of great importance. The following key activities are drawn from the EPI document *Improving the Cold Chain* (reference WHO/EPI/CCIS/89.2) which describes current and planned work of the cold chain group in Geneva.

Injection technologies

The debate between convenience, cost and safety will remain lively during the next decade, with many countries choosing sterilizable and disposable syringe policies according to their mix of immunization strategies. Efforts will be made to broaden the present options to include auto-destruct disposable syringes and jet injectors within affordable cost limits.

Solar energy

The introduction of solar energy to the cold chain is expected to reduce the recurrent cost burden of the EPI. Field research to examine the potential for cost recovery by the sale of surplus energy for private and communal uses will expand and efforts to improve the lifetime of battery systems will continue.

Transport

Initiatives by WHO in this area are mainly focussed on the training of motorcycle riders and vehicle drivers. The potential to give the driver, as part of the EPI team, additional responsibilities to support maintenance of cold chain equipment will be examined.

Monitoring the cold chain

Suitable indicators to be attached to oral polio and other EPI vaccines are in an advanced stage of development. They are seen as an important management tool for the future and are expected to be implemented in the early part of the decade.

General management training for the EPI

The Mid-Level Management training module, *Manage the Cold Chain,* has been revised and each Technet participant received a copy of the semi-final draft version for comments before it is finalized. Consideration is being given to restructuring the current Logistics and Cold Chain for Primary Health Care series around the revised Mid-Level Management module.

The development and testing of new materials for Senior Level Management of EPI is proceeding and includes only a small section on cold chain and logistics. There is effectively no training at present for the central cold chain and logistics officer who has both operational and technical responsibilities of importance in the national programme.

Participants were invited to give their views on the strength and usefulness of the Repair Technicians Course.

Other projects:

- **Polio specimen cold chain:** A network of international reference laboratories is being established to provide polio specimen testing services for the polio eradication initiative. A set of cold chain procedures and materials is being developed to protect polio specimens. This includes a carrier and shipper for faeces specimens collected in the field and shipped to the selected laboratories.

- **Safe blood cold chain:** The collaboration between EPI and the Global Blood Safety Initiative seeks to establish safe blood collection, storage and redistribution from district and regional hospitals. This mechanism could strengthen the maintenance of the vaccine cold chain by integrating the maintenance of equipment in small hospitals with the maintenance of cold chain equipment.

- **Reduction of Chloro-fluor-carbons (CFCs):** The progress of the refrigeration industry in finding alternatives to polyurethane and C12 refrigerant will continue to be closely monitored. Equipment and techniques are being sought which will enable refrigerant gases to be recuperated following repair work, thus protecting the EPI from shortages of R12 refrigerant and price increases.

- **Improving the cold chain in the private health sector:** Pharmaceutical wholesalers, retailers, private clinics and general practitioners all store vaccine in conditions which are often far from satisfactory. A low cost, small refrigerator designed for general practices in urban areas is being developed by Electrolux. Other objectives need to be developed in this field in order to bring the private sector cold chain up to standard.

EPI EQUIPMENT

THE PRODUCT INFORMATION SHEETS AND EQUIPMENT PERFORMANCE STANDARDS

Both the *Product Information Sheets* and the *Specifications and Standard Test Procedures* are serving an important role in the selection of equipment. However the following points were noted:

- The position of UNICEF in dealing with national manufacturers in India has been weakened by the policy expressed by WHO a year ago that local procurement of equipment need only refer to local standards institutions and need not be constrained by international standards.

- Several participants noted that 50% of the equipment used in the cold chain in areas with electricity is domestic and does not appear in the *Product Information Sheets* or meet EPI standards.

- The process of equipment selection from the *Product Information Sheets* is, today, fairly complex and would be greatly assisted if a format, or template, could be designed to enable different equipment to be evaluated at a glance against certain criteria. Such a template would need to allow for local equipment data to be entered.

- Performance standards have been set too high and therefore too many useful equipment alternatives have been removed. In 1986 the range of options, particularly of locally made equipment, was much greater than it is today.

The group advocated that there should be various levels of standards and that equipment which doesn't meet any of the levels should fail and the reasons for its failure be made public. WHO/EPI noted that multiple levels of standards had already been introduced for 1989/90 but the complexity of this system is unworkable in the longer term.

Relationship with manufacturers

Several design and quality problems with cold chain equipment, notably Electrolux equipment, were quoted to illustrate the fact that much remains to be done to reduce problems in the field. The following factors were cited as being among the reasons preventing greater cooperation

between WHO and the manufacturers, particularly with manufacturers which have a virtual monopoly of the EPI market:

- Manufacturers are unwilling to enter the domestic market. Quantities manufactured therefore do not increase and costs to the EPI do not decrease.

- A low priority is given for development work on EPI equipment when the market for EPI equipment is weak.

- Collaborative arrangements between buyers and manufacturers have failed to control prices and to strengthen the negotiating position of organizations.

- There has been limited success in encouraging local manufacturers to compete effectively with manufacturers in industrialized countries in relation to EPI equipment supplies.

In spite of these problems, it was agreed that there is scope to increase opportunities for encounters between manufacturers and users of equipment in the field. An example of this was the recent workshop in Uganda where manufacturers participated.

Manufacturers should be encouraged to extend their local agency services so that they can install equipment and provide guarantees for a year from the date of installation. Such services are already provided as a routine to UNICEF/India.

The process of developing quality improvements to equipment

Perhaps the best example of the day in illustrating the potential benefits of a technical network surfaced as the issue of the use of domestic refrigerators in the cold chain. Such refrigerators, almost none of which meet EPI standards, are now estimated to constitute more than 50% of the refrigerators in cold chain systems in SEAR, WPR, EMR and AMR. The need for conversion kits to improve the performance of domestic refrigerators to make them suitable for vaccine storage was taken up as a development project in Univalle, Colombia over a year ago. The final test reports will be complete in a month or so.

It was observed that the Univalle work was specific for one model of compression refrigerator and a more general kit applicable for different models and manufacturers would also be required.

SELECTION OF ENERGY SOURCES

A presentation was made on the issues which are often overlooked but which should be taken into consideration when alternative energy sources for the cold chain are being reviewed. These include:

- **The quality of the storage of vaccines:** Examples from a recent kerosene monitoring programme conducted in Mali have shown that there appears to be a great discrepancy between temperatures recorded manually and temperatures recorded with automatic devices. The reliability of the kerosene alternative cannot therefore be judged according to manual temperature records. In confirming that this is an area of great concern, several members recounted similar experiences during the discussions.

- **Fuels:** The availability, reliability and quality of the fuel supply available should be carefully assessed.

  Examples from Uganda show that the cost of gas and its distribution is falling, while in Sierra Leone the collapse of gas supplies to the country has crippled parts of the cold chain. The cost and availability of gas are crucial criteria for the decision to choose solar energy.

- **Recurrent costs:** Another important issue is how often recurrent costs need to be paid and who pays for them. The cost of kerosene is usually borne by the ministry of health. However, external donors could be mobilized to bear similar expenses at five year intervals by covering the costs of replacing solar refrigerator batteries.

- **Solar energy:** The breakdown of costs of the different components of a refrigeration system demonstrate that drastic reductions (below US$4,500) are not likely to occur unless a real breakthrough in solar technology is achieved, such as battery-free systems. However, the use of solar refrigeration does open the way to other applications of solar generated electricity which could help spread the burden of the initial investment. The possibility of selling surplus solar electricity to the community through recharging car batteries for domestic use and using it for community television/video for entertainment and health education is currently being investigated in Zaire(3).

(3) This project is described in detail in the document "Sale of surplus energy", reference WHO/EPI/LHIS/90.1, available in English and French from WHO/EPI, Geneva.

An overview of the use of solar energy in the South East Asian Region included a description of small scale photovoltaic solar refrigeration programmes, field trials of solar sterilizers and solar thermal refrigerators. A large scale implementation of solar refrigerators in the Region is also underway in Indonesia, with the assistance of the World Bank.

Another presentation outlined the efforts of the EPI in Mozambique to introduce solar refrigeration systems, in spite of the effects of the guerilla war. The site selection procedure, as well as the results of the trials of the first five units installed, were described. This programme aims to equip 47 health centres, not only with solar refrigerators, but also with solar lighting systems, and to use the surplus energy for income generating activities.

Discussion on selection of energy sources

The following points emerged during the discussion on the above presentations:

- The non-monetary costs of kerosene refrigeration, such as failure to immunize children, need to be considered when weighing the benefits and costs of solar refrigeration.

- Uganda/EPI is just starting to realize the problems with solar, such as overlooked costs for the continuing need to repair compression refrigerators, for advanced training on electrical and electronic concepts, and for retaining skilled technicians.

- The percentage of populations living in areas so remote that solar energy is the only choice available is very insignificant in relation to the total population in any country.

- Alternative strategies, including the use of cold boxes and icepacks as substitutes for refrigerators, also need to be considered when selecting energy sources.

MANAGEMENT AND TECHNICAL TRAINING FOR THE COLD CHAIN

Concerns about the quality, characteristics and nature of the training for the cold chain were outlined in a presentation which touched on the following issues:

- selection of the locations for training courses and the level of training to be offered;
- selection of the category of workers who should be trained and who should attend;
- selection of the training methodologies to be employed; and
- identification and inclusion of issues specific to the area, level or type of training being offered.

It was also recommended that advantage be taken of local training institutions.

The Working Groups discussed the following aspects of training: logistics and management, equipment repair and maintenance, vehicle driver training, computer software in management and gaps in global training materials.

In the presentation of their conclusions and recommendations, summarized below, the needs for new training materials and/or the modification of existing materials were stressed:

Logistics and management training -- training of a central operations officer

Training materials and guidelines on the central planning and management of logistic and cold chain systems do not appear to exist at present. There is a need, first, to create these materials in order to strengthen the position of the central cold chain and logistics officer and, second, to sensitize the programme managers to the importance of this training. One possibility mentioned was to combine the training of programme managers with parallel training sessions for senior cold chain and logistics officers.

The groups recommended that the following subjects be included in this training:

Equipment selection and energy choice
Equipment repair and maintenance systems
Transport planning and management
Distribution systems for vaccines and other supplies
Budgeting and recurrent cost control
Assessment of logistic impact of policy changes
Use of computers and major EPI software

Equipment repair and maintenance

There was general agreement that equipment training should cover all EPI equipment, not just cold chain equipment.

Examples of different equipment maintenance systems exist in many countries and include schemes which involve maintenance contracts with the private sector. There is a need to incorporate information on each of these alternative choices in the training materials.

Training on the planning of maintenance systems also needs to recognize and address problems which have been observed by experience, such as:

- the considerable loss of trained technicians which takes place after training in the public sector; and
- the bureaucratic obstructions which prevent newly trained staff from being fully utilized, unless careful planning for this period has taken place before or during the training process.

User training in the installation and routine use of equipment was also believed to be a problem, attributed in part to:

- the lack of practical training on cold chain equipment in public health schools, and
- the turnover of new nursing staff in health centres.

Here also, innovative examples exist in country programmes, such as the use of drivers and local 'handymen' to assist in practical training and the inclusion of practical training within the rota of supervision visits to health centres.

Vehicle driver instructors training

Training drivers of 4-wheel vehicles is perceived to be an important, though neglected, area of logistics training. Instructor training materials are needed which:

- recognize drivers previous experience;
- seek to reinforce good driving habits;
- demonstrate the consequences of bad habits in terms of safety and the state of repair of the vehicle;
- improve the knowledge, motivation and utilization of the driver by training him/her to:
  - pack vaccines correctly,
  - maintain an absorption refrigerator, and
  - maintain a refrigerated vehicle.

Computer software in logistics management

In view of the increasing use of personal computers in the management of the EPI, training is needed for EPI operational and technical staff in this area. Software exists (or is in the planning stage) for the following functions:

- National immunization and disease statistics (CEIS)
- Immunization coverage (COSAS) and cost surveys (EPICOST)
- Vehicles and equipment inventory (Planned)
- Consumable supplies stock control software (Planned)

EVALUATION AND SUPERVISION OF THE COLD CHAIN

COSTING OF THE COLD CHAIN

Because of the insistence of a donor that national EPIs document and justify their requests for cold chain equipment, AMRO, in collaboration with several member countries, developed a comprehensive survey to obtain estimates of national cold chain costs. The survey has been conducted in 4 countries (Bolivia, Ecuador, Guatemala and Peru).

This exercise -- which crystallized for AMRO the management dimension of the cold chain, especially from the cost perspective -- looked at traditional cold chain costs, as well as outreach activity costs. It did not take account of transport and sterilization costs.

Each survey provided a wealth of information which enabled AMRO to provide donors and ministries with the data needed to assist them in making important management decisions and in allocating funding.

Some of the useful information obtained includes:

- the breakdown of capital costs against recurrent costs;
- the annual costs for running an EPI;
- the demonstration that it is not the cold chain itself, but items such as lack of transport and lack of per diem for staff travel, that most seriously compromise immunization programmes. This supports the argument that it it not feasible to have first class equipment if there is not enough money for outreach activities and supervision.

On the negative side, however, the surveys are time consuming (2-6 months depending on the size of the country), relatively expensive (US$ 20,000 to 90,000), and require the use of trained interviewers. Data management capability has proved to be a problem for the countries as they have not been able to find people with the necessary computer skills for the data analysis. It is also difficult to assure the continued use and updating of the data bank.

The data is only of value in providing significant management information if it is correctly used and analyzed. National programmes are therefore cautioned not to embark upon such comprehensive surveys unless they have the capacity to manage the data.

Discussion on costing survey

The conclusion drawn from the survey that the cold chain had not been a constraint in preventing delivery of vaccines to populations was considered to be a matter of interpretation. The same data could also be interpreted to indicate that health workers did not perceive the cold chain to be a problem because they themselves were not sensitive to vaccine handling issues.

It was also observed that the survey results could provide peripheral managers with some useful data but its utility at that level was limited. The data would be of more interest at central level where budget decisions on equipment purchases are generally made.

It was noted that temperatures were rarely monitored during the survey and quality issues were not addressed. However, there was general agreement that the survey is a very important step forward and can have important applications.

MONITORING THE COLD CHAIN

Cold chain monitor surveys

A methodology for cold chain monitor surveys was described. The first step, preparation of a protocol, is normally done during an initial visit by an outside cold chain consultant assigned to conduct the survey. Health workers at all system levels are then trained in order to ensure that the information is entered on the monitor cards correctly and legibly. The monitor cards are distributed with vaccine shipments and collected after several months from a random sample of health centres which have been selected for inclusion in the survey. The data from the cards is processed by a computer programme, EPIC, especially developed by EPI/Geneva for this purpose.

The monitors provide useful information on the amount of time it takes to move vaccine through the system and the amount of vaccine exposed to unacceptable levels of heat. In one country, results from a cold chain monitor study were used as a basis to redesign the entire national cold chain system. The findings in several other countries were presented.

Discussion on cold chain monitor surveys

It was conceded that cold chain monitor surveys could be a useful evaluation tool but only in countries with a well developed system of management which makes it possible not only to ensure adequate training but also to organize the collection, analysis and interpretation of the data. Surveys serve to create a core of staff trained on cold chain monitors who can then use them routinely.

Several people observed that, in their experience, the routine distribution of cold chain monitors had not proved very useful. They considered the monitors complex to use and interpret. They had also found that monitors are not generally used except as a check on arrival of vaccine consignments from the supplier. It was considered that routine use of the monitors should be looked at separately from special monitor surveys. A sub-working group of five participants was, therefore, established to discuss the advisability of continuing the routine supply of cold chain monitors to countries.

Routine use of cold chain monitors

The sub-working group looked at the current use being made of cold chain monitors which are provided in a ratio of one for each 3,000 doses of vaccine shipped by manufacturers. It had been expected that the monitors would provide a regular surveillance of international shipping conditions, from the manufacturer to country level, and then be used down to health centre level. However it has been found that this is not happening. Monitors are not being correctly used and, in many countries, are rarely sent down the cold chain.

The sub-working group therefore recommended that:

- For international vaccine shipments from manufacturers, a policy of placing only one activated cold chain monitor per insulated shipping carton, regardless of the number of doses of vaccine, should eventually be instituted. It is expected that in most cases this will provide enough cold chain monitors to send on to the next level down. When it is practical to implement this new policy, all countries will need to be advised through WHO and UNICEF that, if desired, they can purchase additional monitors to use throughout the cold chain. All staff who will handle the monitors should be trained.

- One cold chain monitor should continue to be provided with each insulated shipping carton to pin-point breaks in the cold chain, even if a vaccine heat exposure indicator attached to each vial comes into use in the future.

- The 3M monitor strip used on the current vaccine cold chain monitor card is adequate. However, if a new monitor strip becomes available at a lower cost and is as good -- or better -- than the current 3M monitor strip, it will be considered as a suitable replacement once it has passed laboratory and field tests.

Vaccine vial indicators

There was a brief overview of the history of vaccine vial indicator development. The preliminary field trial results have shown that the early measles vaccine vial indicator was relatively easy to use and supervisors found that it gave them more confidence in vaccine quality and helped improve stock management. However, there were compliance problems and weaknesses because the slow, initial colour change did not allow for an early warning of cold chain breaks and did not serve vaccine monitoring needs for oral polio vaccine.

Improvements have been made since then and the latest generation of vaccine vial indicator now available can be programmed to be suitable for any vaccine and can be used to record any breaks in the cold chain.

The present WHO specifications for vaccine vial indicators can be met by PATH with this new generation of indicator. Also, since the vaccine vial indicators can be programmed, other specifications can be met as well. However, the specifications need to be finalized if utilization is to go forward, as the manufacturers cannot keep making modifications each time the specifications change.

Cost guidelines for vaccine vial indicators stipulate that the cost should not exceed 10% of the cost of a 10-dose vial of polio vaccine. It is not clear at this stage whether the current technology will meet this target.

Discussion on vaccine vial indicators

There is potential for confusion on the part of health workers if there is going to be a combined use of vaccine cold chain monitors and vaccine vial indicators in routine vaccine distribution. There needs to be a clear distinction made between the two.

The vaccine cold chain monitors or temperature threshold indicators, which have a short life above the storage range of temperatures, are used for the purpose of monitoring a system. It was suggested that development efforts be concentrated on the vaccine vial indicators which are used for showing if a particular vaccine vial is usable. Once such indicators are established and workers understand their use, alternative ways of monitoring the cold chain routinely can be reconsidered.

The choice of colour of the vaccine vial indicators is open. Although green/yellow has been chosen for oral polio vaccine on the basis of readability in low light, it may be necessary to choose other colours for other vaccines in order to avoid confusion.

Since the vaccine vial indicator can be programmed within wide limits, it was suggested that the indicator be designed to also change colour on the expiry date of the vaccine thereby providing a backup to the date written on the vial label.

IMPACT ON THE COLD CHAIN OF CHANGING EPI PRIORITIES

Introduction of new vaccines

Since 1986 official WHO documents have referred to the inclusion of additional vaccines in the EPI, such as hepatitis B, yellow fever and meningitis. New vaccines are already being added to the programme in some countries and it is likely that, as new vaccines are developed, there will be decisions to add more during the coming decade.

In the past, consideration of the impact of introducing new vaccines has focussed mainly on the epidemiological aspects. Decisions on this subject have been made by senior EPI management staff with little or no consultation with technical field staff. However, the introduction of new vaccines has serious implications for the cold chain and these issues need to be taken into account.

In future, cold chain and logistics experts should be involved in initial discussions concerning policy decisions which will have an impact on cold chain utilization and operational aspects of the programme.

A hypothetical situation, using standard assumptions, was used to show how the inclusion of Hepatitis B (in its current presentation) could increase vaccine storage requirements by more than four times.

Additional refrigeration capacity will be needed to assure the cold chain for the new vaccines. In the past there has been excess capacity in the cold chain because cold chains were developed on the basis of 100% utilization for the 6 EPI antigens, whereas utilization has been less than 100%. However, as coverage levels have increased, this excess capacity has diminished and there is now little tolerance for the inclusion of additional vaccines.

Before new vaccines are introduced into the EPI, different vaccine manufacturers should be contacted with the aim of standardizing dose size, storage volumes and storage temperatures. Logistics, operational and equipment implications also need to be seriously considered.

Discussion on introduction of new vaccines

Discussion on this topic focussed on the following issues:

- There is a need to start looking at comparative costs for maintaining the cold chain with and without Hepatitis B or other new antigens. Data should be prepared on ways to calculate costs so that people can be made aware of the cost implications of their proposals. Decisions can then be made on the basis of more complete information.

- It was proposed that Technet present a policy or position paper on the effect of introducing new vaccines so that this information could be made available to policy makers.

- In future there may be a small menu of essential drugs that will require refrigeration. However, storing pharmaceuticals and vaccines together in the refrigerator can be dangerous. In one country this was the cause of a serious accident where a vaccinator injected the wrong product and caused the death of several children.

- The attention being given to the missed opportunities issue will probably result in greater vaccine requirements and storage, as well as higher vaccine wastage, at more sites. This will require more equipment and larger capacity in each store. Similarly, the change of policy from vaccinating only pregnant women to vaccinating all women of childbearing age will have an impact on the required capacity of the cold chain.

- Reasons for changing refrigeration limits from +2°C to +8°C to 0°C to +8°C were discussed. There appeared to be general agreement that the **0°C to +8°C** range recommended by WHO/Geneva should remain. However, other temperatures within that range could be promoted if WHO training materials could be worded to allow for this.

Sustainability

The costs of equipping and running the logistic systems of the EPI are second only to the amount allotted for salaries within the scale of EPI costs. It will be vital during the 1990s to reduce these costs to a level which can be covered in the long term by external assistance and local budgets.

Much will depend on a rational choice of cost-effective strategies for equipping and managing the cold chain. For example, Nigeria has adopted a system of transporting cold boxes and leaving them off at health posts on a regular basis in order to avoid the necessity of maintaining unreliable kerosene refrigerators. Other countries have chosen solar refrigeration to reduce fuel and maintenance costs while improving the reliability of vaccine refrigeration at the periphery. Experiences such as these must be closely monitored and the data shared so that sustainable strategies can be developed in each different situation.

The cost of equipment rises steadily each year, increasing the external capital costs of the EPI and resulting in similar price rises in spare parts and consumables for the cold chain. The gradual reduction in the number of suppliers in industrialized countries, as multi-nationals overwhelm their competition, both weakens the bargaining position of donors and further erodes the potential for local suppliers to compete in the international market.

Procedures to control both capital and recurrent costs were discussed and included the following proposals:

- Install routine procedures to monitor recurrent costs, both real and 'shadow', and ensure that health workers and storekeepers are sensitized to cost control through these procedures.

- Ensure that costs are a strong part of the planning of logistic systems and that the cost impact of a proposed change is properly assessed before decisions are taken. Logistics officers should be

trained in cost control and tools should be provided to enable the cost impact of changes to be quickly and easily assessed.

- Conduct cost studies or surveys in areas and countries which do not have routine cost tracking.

- Ensure that, wherever possible, equipment and transport is shared with other child survival interventions.

Reaching difficult areas

In mountainous areas the problem facing the cold chain is not heat, but time. It takes longer to deliver vaccines and time limits are exceeded unless extreme care is taken to organize the distribution and use of vaccine. Creative management is needed with a strong emphasis on the *people chain* so that timing of collections and deliveries is prompt and dependable. Innovation is also needed to find the best ways to store vaccine in remote areas. For example, in Mongolia, vaccine is stored in holes in the ground which are cooled by sub-soil which remains frozen throughout the year.

Conventional options for vaccine storage are so problematic that SEAR countries which have mountainous areas are pursuing completely new solutions with WHO. One new technology, known as Thermopac, employs a super-insulated vacuum container in which 100 vials of vaccine are sealed by the manufacturer and can be stored at temperatures below +10°C for up to six months when the outside temperatures are high. Several other new technologies were presented and are described in the working paper, "Cold chain in mountainous areas".

COLD CHAIN QUALITY REVIEWS

A presentation on a survey methodology for cold chain assessment described a system based on questionnaires, which has been developed and refined over an extensive number of field visits. The data, which is processed by computer, gives a wide range of analyses of the performance of logistic systems.

Examples of results from a random selection of vaccine stores from a number of country assessments showed that the methodology gives a clear picture of the problems encountered.

Discussion on cold chain quality reviews

Standardization of a cold chain assessment methodology was generally felt to be an important global objective for the cold chain and it was considered that this task could be embarked on immediately within Technet. It was also suggested that it might be useful to combine this survey tool with the cold chain monitor survey methodology.

The examples of results shown in the presentation indicated some serious problems. The point was made that if, after 10 years of training and equipment provision, the cold chain is still having the kinds of problems indicated, something is seriously wrong. Technet needs to find out what is being done right, what is being done wrong, and make the necessary adjustments. Two points were stressed:

- The lack of standardization of vaccine expiry dates causes confusion in the field. Urgent action should be taken to standardize expiry dates for each vaccine and, where relevant, recommended storage temperatures.

- It appears that many health centres still do not monitor or record refrigerator temperatures. This is a fundamental problem of low motivation and poor supervision and requires action.

TRANSPORT MANAGEMENT AND MAINTENANCE

Transport is possibly the most formidable challenge facing efforts to improve the logistic systems of primary health care. A brief introduction on the subject emphasized the need to formulate concrete proposals on the improvement of transport management. A transport questionnaire, drafted for inclusion in the EPI review process, was distributed to the groups for comments and suggestions. The group session concentrated on the problems of managing the allocation, utilization and maintenance of transport.

Two presentations were made -- one on an existing transport system and the second on a current transport project:

Transport system in Tanzania

The management of the EPI transport system in Tanzania, which is supported by a Danida transport adviser, is based on a computer data base which keeps track of receipts and issues of spares parts, purchase and suppliers' data, stock records of spare parts, vehicle inventories, and reports. The overall system can be used at all vehicle workshops and at national headquarters.

The data is recorded for every vehicle in the fleet through the use of specially designed forms and log sheets. These include planning forms which outline in advance the routes and uses for each vehicle; log sheets which record fuel consumption; distances covered and maintenance records; and accounts sheets which list drivers' expenses on fuel and minor repairs. All the sheets are collected at the end of each month and summarized. The monthly analysis highlights problems and problem areas.

A vehicle workshop has been established for EPI vehicles at central level and all vehicles are brought in once a year for a major check-up. An inventory and stock control system is used to manage the flow of spare parts and supplies.

Riders for health

A year ago WHO/EPI adopted the hypothesis that the use of light motorcycles could contribute to the reduction of transport costs and enable programmes to extend their activities to difficult-to-reach areas, particularly in countries with a poor transport infrastructure. Unfortunately not much useful information on the subject could be found -- neither from countries where motorcycles had been extensively used nor from donors (of which UNICEF is the largest).

However, field visits to five countries in 1989 revealed that the lifetime of a light motorcycle is directly related to whether or not the rider has received training. In areas in Zaire where rider training was provided, most motorcycles were still in operation two years after they had been supplied; some had even covered over 50,000 kms. Whereas, in areas without training or maintenance support, most motorcycles were out of use within six months. It was also observed that donors rarely involved local agents in the selection or provision of spare parts when motorcycles were supplied. The resulting inappropriate choice of spares also had an adverse affect on the lifetime of motorcycles.

Training materials which aim to train rider instructors in preventive maintenance and off-road riding techniques are being developed and will be tested before the end of the second quarter of 1990.

In an effort to establish collaboration with motorcycle manufacturers, EPI approached several manufacturers in Japan but with unsuccessful results. However, a second approach has been made through the associations of motorcycle manufacturers and the motorcycling racing industry and the results have been more promising.

Discussión on transport

The following ideas and proposals emerged from the group and plenary discussions:

- **Surveys:** Transport costing surveys should help to highlight the consequences of mis-use and under-utilization of transport and enable other problems in this area to be identified and analyzed.

  A thorough and complete questionnaire on transport issues should be included in the EPI review process. The superficial questions which are currently included do not give a clear picture of the

problems. However, it was noted that extensive and specific transport questions may be too demanding for inclusion in these reviews.

- **Vehicle specifications and selection:** Global criteria for vehicle selection are needed to ensure that more rational technical choices are made, both on type and specification of vehicles. However, such guidelines will be of little use without closer controls on the vehicle selection process.

  Technet should establish standard categories of vehicles used in the EPI and draw up detailed specifications for inclusion in the *Product Information Sheets*. A decision should be made on whether to also include information on vehicle models which meet the requirements of each category.

  Vehicle standardization is becoming increasingly important because, as the technology of vehicles becomes more sophisticated, the number of different models which can be serviced by the same workshop decreases. Also mechanics need to be more extensively trained.

  Off-road motorcycles are now extremely durable and ideal for rough terrain use.

  Bicycles should be considered as a viable transport alternative for outreach activities.

- **Spare parts:** The provision of spares and maintenance equipment should be preceded by improvements in the workshop, store and distribution infrastructure. Otherwise, new supplies and equipment may continue to be lost or damaged.

  When ordering new vehicles, managers should not accept manufacturers pre-selected spare parts sets. They should rather draw up their own lists of spare parts based on their own experience. Spares should be valued at 10% of the vehicle purchase cost.

- **Sustainability:** In order that well managed transport systems are developed and sustained in the long term, donors of vehicles should provide assistance for the whole working life of the vehicles which they donate.

The possibility of establishing service contracts with manufacturers should be considered. An example was given of a vehicle manufacturer in India who advertised his willingness to make contracts to cover the maintenance of tractors for a reasonable annual fee and to extend the vehicle warranty as part of the package. UNICEF/ India is endeavoring to convince this manufacturer to provide a similar service for the programme vehicles that he supplies.

- **Motivation to improve maintenance:** Ownership schemes could be a means to improve both motorcycle and vehicle maintenance.

  Vehicle leasing is also a possibility. However, it was noted that leasing had not proved to be a viable option in the past and donors are not particularly interested in this arrangement. When accidents occur or when vehicles are heavily damaged, it is the donors who lose as they are considered to be the owners.

- **Management systems:** Inventory control systems which are developed or adopted for the management of vehicle spare parts should also be modified for use in the management systems for cold chain equipment and spare parts.

INJECTIONS AND STERILIZATION

Two major concerns for the 1990s in the area of injections are safety and cost.

If injections are done badly, public and political support for the programme is jeopardized. There is, at the moment, a growing perception that injections are dangerous because of Aids and acceptance of injections is decreasing in some countries.

Possible solutions for improving the safety of injection and sterilization practices were presented, including the use of a sterilization monitor, syringe and needle disposal containers and auto-destruct syringes.

Several technologies currently under development were also described, including the use of sterile drums that can be removed from sterilizers, hard water pads, a substance for re-siliconizing the seal in BCG syringes and prefilled syringes.

Cost is another potential problem. Increased use of disposable syringes may increase programme costs in some countries.

Auto-destruct syringes

The group discussions on auto-destruct syringes focussed on the following areas:

- **Sustainability and cost:** Sustainability is a key issue for countries adopting disposable syringes, particularly if the use is to be nation-wide and substantial quantities are used.

  Logistics systems need to be capable of sustaining procurement and distribution.

  The cost of implementing auto-destruct syringes may be intolerable for countries which now re-use disposable syringes. The choice is between returning to sterilization of reusable syringes or to accept the cost of safety.

  There is a danger that, once donor support for the purchase of disposables is withdrawn, governments will be unable to continue to purchase them.

- **Implementation and training:** The training burden of changes in the choice of injection equipment is usually heavy. Needs for practical training must be addressed in advance of widespread implementation of auto-destruct syringes.

  Implementation should proceed in a phased manner, starting with the countries which have expressed the strongest need.

- **Syringe disposal:** The problem of effective disposal of syringes must be addressed. Accidental needle stick also remains a problem for many countries.

- **Development issues:** There is a need to look into the compatibility of the EPI auto-destruct disposable syringes with other PHC activities.

  A fixed needle would entail different syringes if alternative needle sizes are to be offered.

  The development of an intradermal auto-destruct technology was also suggested.

Current injection and sterilization technologies

The following points were put forward during the group discussions on the problems and solutions facing the EPI in the injection and sterilization technologies currently in use:

- Disposable syringes are the only solution in outreach and hard-to-reach areas which have sterilization problems.

- If a country is using reusable syringes and is following the policies related to reusables well, it would not need to adopt an auto-destruct syringe policy.

- If at any time a country makes the decision to switch entirely to disposable syringes, it will be difficult to change back to reusables.

- It was recommended that siliconizers and hard water pads be used with O-rings in BCG syringes which are not durable.

- The needs for improvement, modification and development include the following:

  - improvement of the quality of the plastic used in reusable plastic syringes;
  - development of sterilizer racks suitable for glass syringes;
  - development of a type of reversible sterilization indicator;
  - need for field and laboratory studies on the development of needles that last longer;
  - development of a BCG needle and syringe with only 0.05 graduations;
  - development of less expensive jet injectors which will allow various dose sizes; and
  - development of a proper kit for carrying vaccination equipment to the field.

ANNEX 1

AGENDA
Technet Meeting
12-16 March 1990

Monday, 12 March

Registration; Introductions and administrative announcements
The aims and objectives of the Technet -- John Lloyd (WHO/Geneva)
Introducing new technologies in the 1990s -- Nancy Cain (UNICEF/NY)
Preparation of topic cards*
Cold chain priorities for the 1990s -- John Lloyd (WHO/Geneva)
Presentation of topic cards
Plenary discussion
Lunch
Performance standards and selection of cold chain equipment -- John Lloyd (WHO/Geneva)
Why we need Technet -- Mogens Munck (UNICEF/India)
Plenary discussion*
Presentations on energy choices for the cold chain :
Introduction -- Michel Zaffran (WHO/Geneva)
Solar energy in Mozambique -- Gordon Larsen (Save the Children)
Solar energy in India -- Naresh Srivastava (WHO/New Delhi)
Plenary discussion

Tuesday, 13 March

Management and technical training for the cold chain :
Introduction -- Anthony Battersby
Plenary discussion*
Costing of the Cold Chain :
Introduction -- Peter Carrasco (WHO/Washington)
Plenary discussion
Lunch
The use of monitors in the cold chain :
Introduction -- Anthony Battersby.
Plenary discussion*
Setting up Technet
Plenary discussion

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* Followed by tea/coffee break.

Wednesday, 14 March

Impact on the cold chain of changing EPI priorities :
- Introduction of new vaccines -- Alan Schnur (WHO/Manila)
- Sustainability -- Bob Davis (UNICEF/New York)

Plenary discussion
Reaching difficult areas -- Dr N. Srivastava, presented on behalf of Garry Presthus (WHO/New Delhi)
Plenary discussion*
Point-of-use indicators for vaccines -- Michael Free (PATH/Seattle)
Plenary discussion
- *Lunch*

Transport management and maintenance :
- Introduction -- Bjorn Poulsen (WHO/Geneva)

Working group discussions and presentations*
Transport system, Tanzania -- Bjorn Poulsen (WHO/Geneva)
Riders for Health -- John Lloyd, (WHO/Geneva)
Plenary discussion

Thursday, 15 March

Quality assessments of the cold chain -- Allan Bass
Plenary discussion
Injections and sterilization :
- Introduction: Peter Evans (WHO Geneva)*

Working group discussions and presentations
- *Lunch*

Plenary discussion
Review of working group conclusions on:
- Performance standards
- Injections and sterilization
- Evaluation and supervision
- Management and technical training
- Transport

Summary of plans of action for each subject area*
Discussion of communication & actions planned by Technet members
Closing

Friday, 16 March

Discussions of work plans *
Individual and group consultations.
- *Lunch*

Visit to Higher Technical Institute, Nicosia, Cyprus

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* Followed by tea/coffee break.

ANNEX 2

LIST OF WORKING PAPERS
Technet Meeting
12-16 March 1990

Improving the Cold Chain (WHO/EPI/CCIS/89.2)

Solar Refrigerators for the EPI - Status Report (M. Zaffran)

Solar Energy in Mozambique (G. Larsen)

Solar Energy in the South East Asia Region (N. C. Srivastava)

Costing of the Cold Chain -- Bolivia Cold Chain Survey Report, PAHO Guidelines for Conducting Cold Chain Surveys

Introduction of New Vaccines (A. Schnur)

Planning Smart and Buying Smart -- Sustaining the Cold Chain in the 1990s (R. Davis)

Cold Chain in Mountainous Areas (G. Presthus)

Vaccine Cold Chain Monitor Exercise (M. Free)

Riders for Health (J. Lloyd)

Electro-Medical and Clinical Laboratory Equipment -- Advanced Technicians Course, Higher Technical Institute, Nicosia

ANNEX 3

PRIORITY TOPICS FOR OPERATIONS RESEARCH

The fourteen pages which follow summarize the Topics which were defined during the consultation as objectives for action during the coming twelve months. This set of Topics is inclusive neither of all the operational research projects which might be planned or in progress in the area of EPI logistics, nor necessarily of the projects of highest priority.

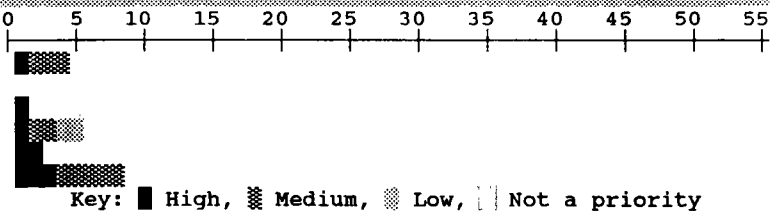
The Topics are a starting selection which can be expanded or modified by a process of voting by members of Technet. The priority rating which now appears on the top left hand box of each page was modified following the consultation and a fresh vote was cast by most participants. These Topic Sheets are therefore updated to May 15 1990.

A format for each objective, similar to these pages, will be posted on the Technet electronic bulletin board and maintained continuously by the secretariat. New objectives can be posted by any Technet member for voting by the entire membership and votes on existing projects can be changed.

Number	Topic
T/1	Domestic refrigerator upgrade
T/2	Evaluate the impact of 10 dose vaccine vials
T/3	Solar refrigrator surveys
T/4	Develop and test driver and rider training
T/5	Logistics training for central level officers
T/6	Cost and inventory studies
T/7	Vehicles and equipment lifetime studies
T/8	Develop inventory control software
T/9	Vehicle whole life contracts
T/10	Introduce vaccine vial indicators
T/11	Survey sterilization and injection practices
T/12	Protocol for cold chain quality surveys
T/13	Check performance of kerosene refrigerators
T/14	Develop impact assessment software

TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/ 1
DOMESTIC REFRIGERATOR UPGRADE

VOTES RECEIVED

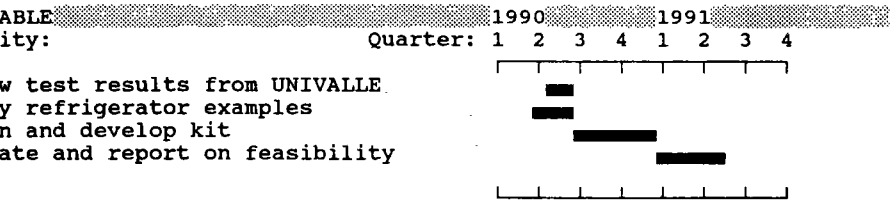


BACKGROUND

Where the electricity supply is continuous, many countries use domestic compression refrigerators for the storage of vaccines. These are cheap appliances and can be bought locally. However, they are a potential danger to vaccines because they heat up quickly when the power fails and when warm icepacks are loaded for freezing.

In an attempt to solve this problem, Univalle, Cali, Colombia has conducted successful research on the possibility of introducing a modification kit that would improve the temperature stability of exisiting refrigerators in the field.

TIMETABLE



PROGRESS

When the final test report is available from UNIVALLE, it will be shared with interested TECHNET members. A survey of the types and internal dimensions of a range of domestic refrigerators used for vaccine storage is being undertaken by participating Technet members. Based on the UNIVALLE tests and the survey data, one or more kits will be designed and prototypes for field evaluation will be constructed. One or more kits should be designed either for use at global or regional level, and will then be approached.

PARTICIPANTS

				STUDIES IN:			
Ahmed.....	Bass.....	Carrasco....	Chaudhary...	AFG	EGY	IND	PHL
Durand.....	Erkilla.....	Free.....	Gomez.....	...	...	...	...
Lainejoki...	Pott.....	Schnur.....	Spanner.....	...	...	...	...
Srivastava..	.....	.....	.....	...	...	...	...
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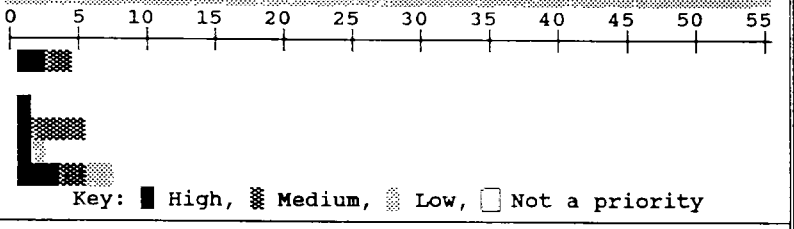
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/ 2
EVALUATE THE IMPACT OF 10 DOSE VACCINE VIALS

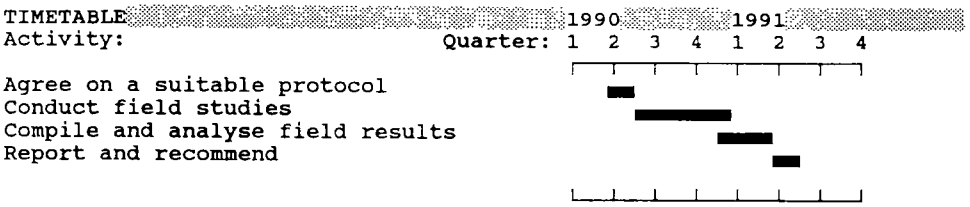
VOTES RECEIVED



BACKGROUND

The per dose cost of large multi-dose vials and small multi-dose vials has become much closer in recent tenders. Immunization session sizes are becoming smaller as high coverage is being achieved. The combination of these two factors makes it economically viable and desirable for other reasons to move towards smaller multi-dose vials in many cases. Surveys are required to establish the session size mix within a programme, to establish which vaccines should be provided in smaller multi-dose vials.

TIMETABLE



PROGRESS

Two protocols are already in circulation and SEARO/WHO are waiting to proceed with proposals to the countries which have expressed an interest in such a study: Bangladesh, Indonesia, Pakistan and Sri Lanka.

PARTICIPANTS

				STUDIES IN:			
Ahmed.....	Bass.....	Battersby...	Chaudhary...	AFG	BAN	INO	PAK
Davis.....	Durand.....	Hatfield....	Kagaruki....	SRL	...	...	...
Larsen.....	Presthus....	Schnur.....	Six.....	...	...	...	...
Srivastava..	.....	.....	.....	...	...	...	...
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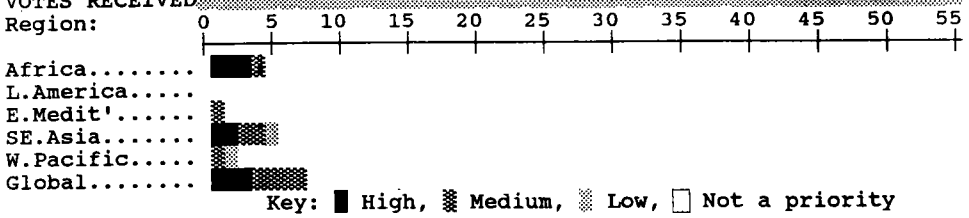
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/ 3
SOLAR REFRIGERATORS SURVEYS

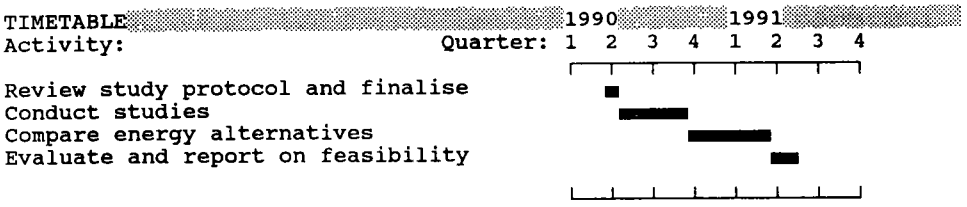
VOTES RECEIVED



BACKGROUND

Solar refrigerators have been in use in several African countries for a number of years. However, no hard data are available on how these appliances perform or on their impact on the cold chain and immunization programmes.
WHO/AFRO wishes to see some of the major solar projects reviewed in order to be able to share the findings with other Regions which are considering the implementation of large scale programmes. The surveys will not only analyse the performance and economy of solar refrigeration projects but will also compare, from a technical and economic viewpoint, the use of solar with other alternative energy sources.

TIMETABLE



PROGRESS

A protocol was drafted and is being reviewed by a panel of experts.
A revised protocol will be issued by the end of March 1990, together with questionnaire forms and shared with the countries concerned.
At least three studies should be conducted and reported on by September 1990. Among the programmes that could be assessed in the coming year are: The Gambia, Ghana, Zaire, Uganda, Kenya, Benin.
The remainder of the studies will be completed by march 1991.
Based on the survey conducted, a policy for the use of solar energy in the cold chain and guidelines for the selection of energy alternatives will be produced and discussed at the next TECHNET meeting.

PARTICIPANTS

				STUDIES IN:			
Ahmed.....	Bass.....	Carrasco....	Davis.....	AFG	BEN	GAM	GHA
Durand.....	Durand.....	Kagaruki....	Larsen.....	KEN	UGA	ZAI	...
Mpayamaguru.	Pott.....	Presthus....	Spanner.....	...	...	...	...
Srivastava..	Weeks.....	.....	.....	...	...	...	...
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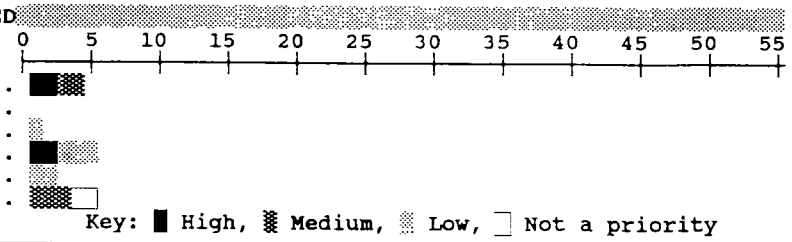
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/ 4
DEVELOP AND TEST DRIVER AND RIDER TRAINING

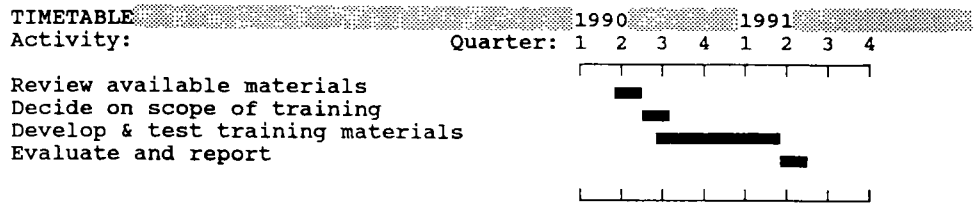
VOTES RECEIVED



BACKGROUND

Participants of Technet have agreed that vehicle and motorcycle drivers are vital members of the EPI team. However, drivers are rarely given adequate training and consequently lack not only safe driving skills and maintenance/repair capabilities, but also the motivation to participate actively and efficiently in the programme.
This project aims to put together and develop new materials for a complete driver/rider training programme, incorporating also training in vaccine handling and the diagnosis and repair of minor faults in absorption refrigerators in order to broaden the scope of the drivers' responsibilities.

TIMETABLE



PROGRESS

An instructors manual for driver training has been drafted. Rider training materials have been prepared by TRANSAID UK and will be tested in Lesotho this July. These materials are being circulated to participating Technet members for comment.
Transport management training will be combined with driver and rider training by inviting managers together with rider/driver instructors to the training courses.

PARTICIPANTS

Ahmed.....	Bhuyan.....	Broms.....	Munck.....
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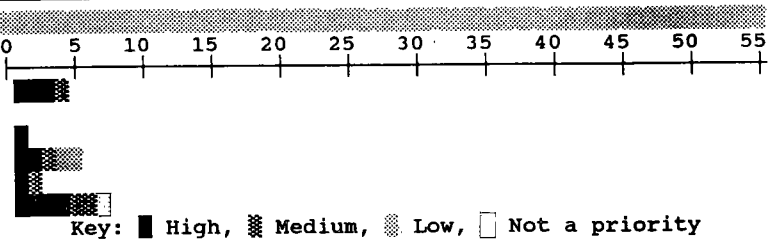
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/ 5
LOGISTICS TRAINING FOR CENTRAL LEVEL OFFICERS

VOTES RECEIVED

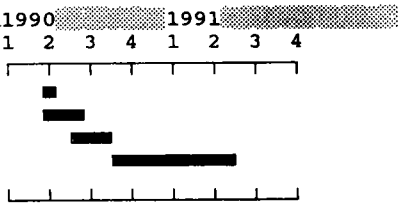


BACKGROUND

Technet members considered the development of training materials for logistical and operational cold chain management at central level as a high priority. These materials should be incorporated in the existing training materials and used as a link in the training of senior management/central level staff and logistics/district level staff. The elements of this training will include:

- energy choice, equipment selection and maintenance systems;
- needs forecasting & assessment of impact of policy changes;
- stock management and inventory control systems;
- selection, maintenance and management of transport.

TIMETABLE



PROGRESS

An outline of the major skills to be developed was developed during the meeting. This is being refined and extended and will be returned for comment to participating Technet members in June.

PARTICIPANTS

				STUDIES IN:			
				AFG	PHL	...	...
Ahmed.....	Bass.....	Battersby...	Broms.....				
Chaudhary...	Gomez.....	Guichard....	Lainejoki...	...	...	...	...
Larsen.....	Ledoux.....	Pott.....	Presthus....	...	...	...	...
Schnur.....	Srivastava..	Weeks.....	.....	...	...	...	...
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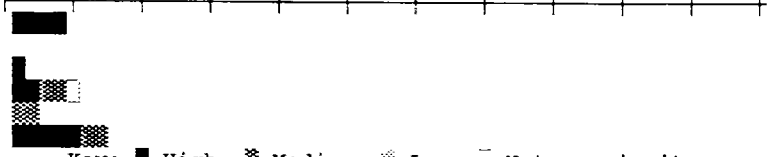
TECHNET TOPIC STATUS SHEET
COST AND INVENTORY STUDIES

Date:18/05/90 TOPIC: T/ 6

VOTES RECEIVED

Region: 0 5 10 15 20 25 30 35 40 45 50 55



Key: High, Medium, Low, Not a priority

BACKGROUND

In order to justify large scale requests for cold chain equipment, extensive national surveys of equipment/costs were conducted in Peru & Bolivia. The results of these surveys clearly showed both the true needs for equipment and the recurrent cost consequences of different cold chain and equipment strategies. Although views varied on the methodology used, Technet members considered this type of survey to be a useful tool, especially in countries which have not yet established an equipment inventory. The methodology will be adjusted where necessary to agree on a standard which will enable international comparisons to be made.

TIMETABLE

Activity:	1990 Quarter: 1	2	3	4	1991 1	2	3	4
Review survey methodology								
Develop a standard survey method								
Conduct surveys								
Analyse and report								

PROGRESS

The AMRO survey methodology has been circulated for comments. The AMRO data entry analysis software will be translated into English.

PARTICIPANTS

				STUDIES IN:
Ahmed.....	Bass.....	Battersby...	Carrasco....	AFG ... ...
Davis.....	Guichard....	Kagaruki....	Lainejoki...	... ...
Munck.....	Six.....	Srivastava..	.....	... ...
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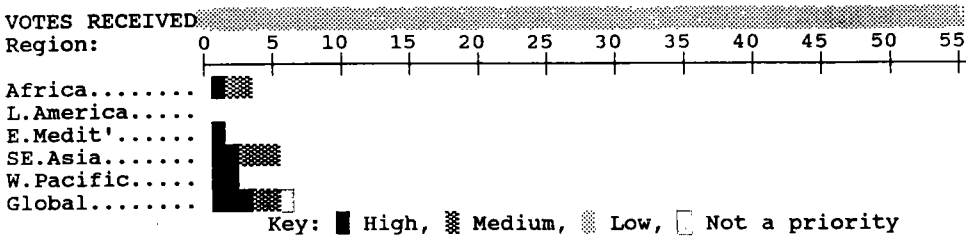
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/ 7
VEHICLES & EQUIPMENT LIFETIME STUDIES

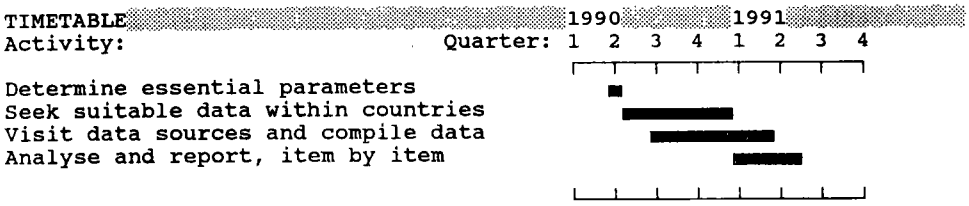
VOTES RECEIVED



BACKGROUND

The lack of information on anticipated lifetimes of EPI equipment and transport prevents many programmes from planning an efficient schedule of routine replacement. Yet the data exists within the recording systems of well managed programmes to analyse and report on the lifetime and spares replacement intervals of commonly used cold chain equipment, supplies and vehicles.
This project will seek such databases and provide the resources and skills to compile, analyse, report and disseminate this information to EPI countries worldwide.

TIMETABLE



PROGRESS

Essential parameters which would enable the lifetime of equipment to be estimated are being discussed. India and Tanzania appear to be sources of data for analysis.

PARTICIPANTS

				STUDIES IN:			
Ahmed.....	Bhuyan.....	Chaudhary...	Erkilla.....	AFG	IND	...	...
Lainejoki...	Munck.....	Pott.....	Srivastava..	...	...	...	...
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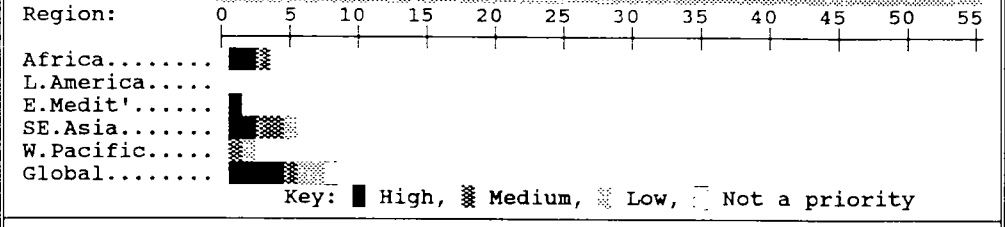
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/ 8
DEVELOP INVENTORY CONTROL SOFTWARE

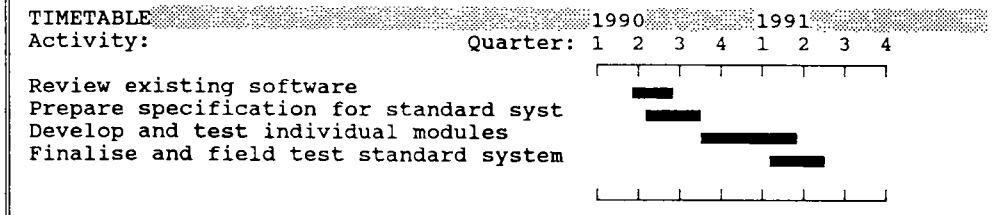
VOTES RECEIVED



BACKGROUND

Many examples of inventory control software are already in use in the EPI. Some are tailored to vaccines , others to vehicle spares. Some appear weak in aspects of stock control and ordering, others are storng in these aspects but only match the needs of one type of supplies. This project will collect and review existing software within the EPI and relevant software on the open market, comparing what is found to a specification for all EPI supplies and equipment. Software will then either be adopted or developed as a standard pert of the CEIS.

TIMETABLE



PROGRESS

Existing software is being collected and is being reviewed by Allan Bass and REACH, USA in order to build a specification for this software before proamming can begin. The specification will be shared with Technet members in July for comment and REACH will then arrange for the software to be written. Evaluation of the software is expected in several countries to be decided.

PARTICIPANTS				STUDIES IN:
Ahmed.....	Bass.....	Battersby...	Broms.....	AFG ... ...
Guichard....	Kagaruki....	Larsen.....	Munck.....	... ...
Six.....	Spanner.....	Srivastava..	Weeks.....	... ...
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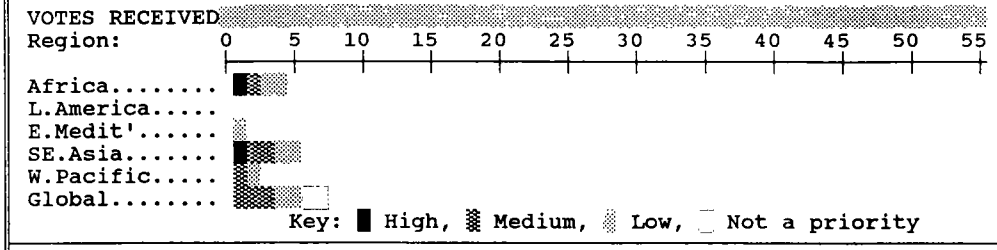
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/ 9
VEHICLE WHOLE LIFE CONTRACTS

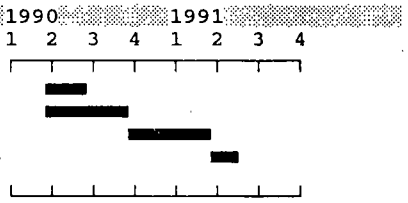
VOTES RECEIVED



BACKGROUND

Although donors now spend around 20% of their budgets on transport and the trend is to increase this spending, the attention has shifted over the last decade away from providing assistance in maintenance/spare parts supply to a preoccupation with reducing purchase costs.
While recognising that experience in the public sector with vehicle maintenance has not been encouraging and that this maintenance is becoming progressively more specialised as vehicles become more sophisticated, this project seeks to explore the potential for long term service contracts between donors, vehicle manufacturers' local agents and the ministries of health.

TIMETABLE



PROGRESS

WHO Geneva hopes to join discussions with UNICEF and IAPSO on these proposals during the 2nd quarter 1990 and will report progress.

PARTICIPANTS

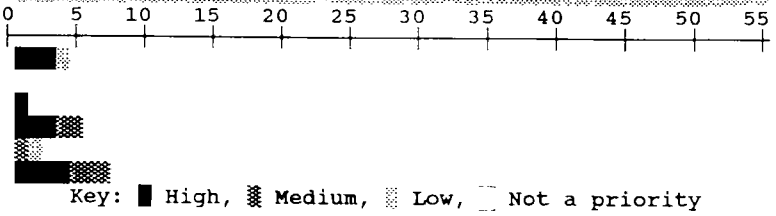
Ahmed..... Munck..... ....

STUDIES IN:

AFG ... ...

TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/10
INTRODUCE VACCINE VIAL INDICATORS

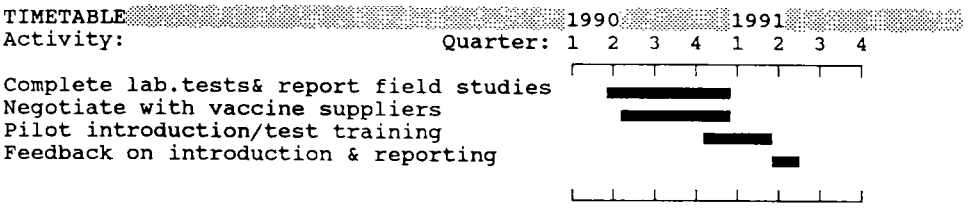
VOTES RECEIVED



BACKGROUND

The technology to indicate on each vial, whether the vial has been protected adequately from excessive heat exposure, is now available. Such a vial indicator is separate from supervision and monitoring of the cold chain. The vial indicator is a useful tool for the health worker and should be developed and introduced quickly.

TIMETABLE



PROGRESS

Current field studies on the Measles, Path vaccine vial indicator will be reported and the results disseminated during 1990. Major vaccine manufacturers are being visited to discuss practicalities of attachement of the indicators and laboratory test will continue to arrive at a final product this year.

PARTICIPANTS				STUDIES IN:
Ahmed.....	Bass.....	Basset.....	Battersby...	AFG ... ...
Chaudhary...	Davis.....	Durand.....	Free.....	... ...
Hatfield....	Larsen.....	Ledoux.....	Presthus....	... ...
Srivastava..	.....	.....	.....	... ...
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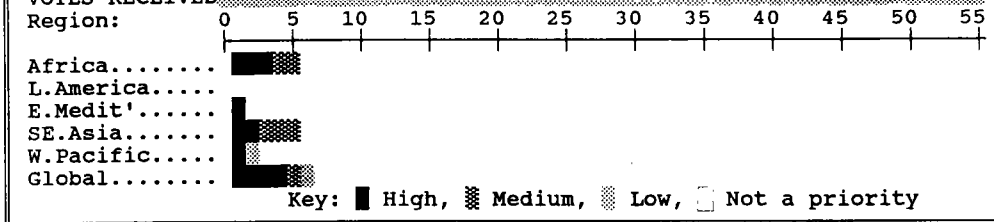
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/11
SURVEY STERILIZATION AND INJECTION PRACTICES

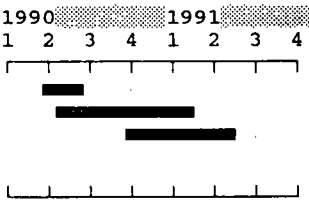
VOTES RECEIVED



BACKGROUND

Sterilizable syringes often fail prematurely and programmes are turning back to disposable syringes. Disposable syringes are often reused without sterilization. To establish the performance of the injection and sterilization equipment and the practices of the health workers, surveys are to carried out within the programmes.

TIMETABLE



PROGRESS

Caroline Six has been asked to prepare protocol.

PARTICIPANTS				STUDIES IN:
Ahmed.....	Bass.....	Chaudhary...	Durand.....	AFG ... ...
Hatfield....	Ledoux.....	Mpayamaguru.	Presthus....	... ...
Schnur.....	Six.....	Srivastava..	Weeks.....	... ...
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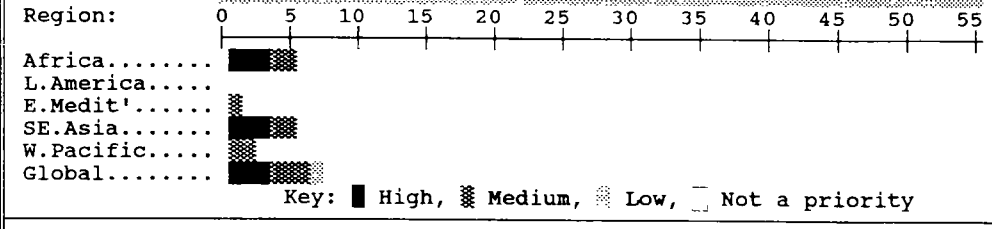
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/12
PROTOCOL FOR CC QUALITY SURVEYS

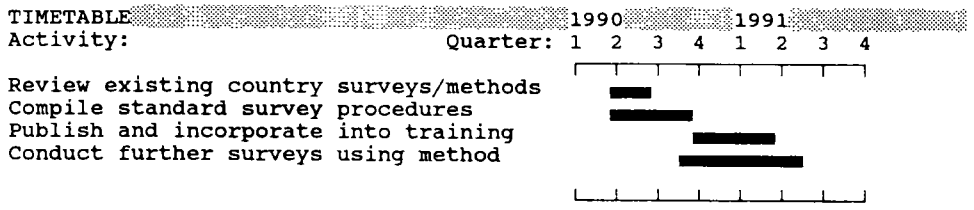
VOTES RECEIVED



BACKGROUND

Surveys of the quality of the cold chain system have been conducted in many EPI countries within the last decade and have gradually become more systematic and more effective at pinpointing problems for priority management attention, even in countries with high immunization coverage and a well developed logisitc system.
Now is the time to gather this experience and write a single standard protocol within which a menu of investigation methods can be offered both for one-time surveys and also to incorporate in the supervision process for logistic management.

TIMETABLE



PROGRESS

Existing surveys and their methods are being reviewed and prototype standard protocols will be shared with Technet participants.

PARTICIPANTS

				STUDIES IN:
Ahmed.....	Bass.....	Basset.....	Battersby...	AFG ... ...
Kagaruki....	Ledoux.....	Munck.....	Pott.....	... ...
Presthus....	Srivastava..	Weeks.....	.....	... ...
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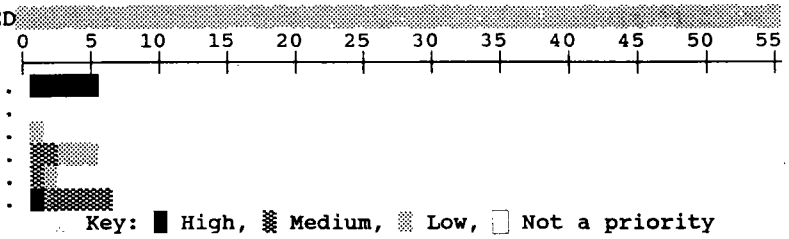
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/13
CHECK PERFORMANCE OF KEROSENE REFRIGERATORS

VOTES RECEIVED

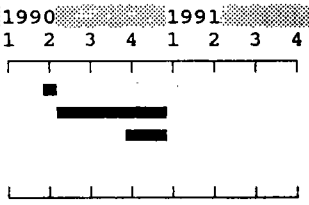


BACKGROUND

Very little hard data are available on how kerosene refrigerators actually perform. Interim data from a monitoring survey conducted in Mali on Sibir kerosene refrigerators have shown a great discrepancy between manually and automatically recorded temperatures.

Tools such as simple data loggers, stopWatches are now available which can provide feedback on the performance of kerosene refrigerators.

TIMETABLE



PROGRESS

The field trial protocol used in Mali together with the results of the programme will be shared among Technet members and revised to meet more global objectives. The interim report will be distributed by the end of May 1990. The final report will be available later in June 1990.

Agreement on the protocol should be reached no later than end of May. Preparations for conducting trials in Chad (StopWatch) and Zaire (Data loggers and StopWatch) are already made. Trials could start in June. Other countries could launch similar trials (Ethiopia) in the same period.

PARTICIPANTS				STUDIES IN:			
Ahmed.....	Bass.....	Battersby...	Broms.....	AFG	CHA	ETH	MAI
Durand.....	Kagaruki....	Lainejoki...	Mpayamaguru.	ZAI	...	...	...
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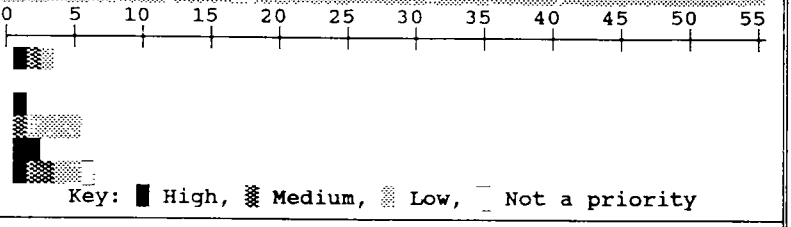
TECHNET TOPIC STATUS SHEET Date:18/05/90 TOPIC: T/14
DEVELOP IMPACT ASSESSMENT SOFTWARE

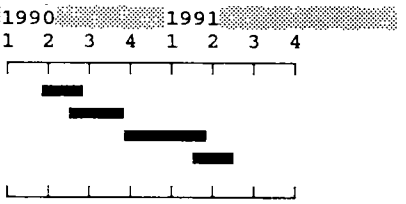
VOTES RECEIVED



BACKGROUND

The impact of changes in the implementation strategy or the policies of the EPI on the requirements of equipment and supplies and on recurrent costs is seldom rigorously calculated before such changes reach implementation stage.
Computer software is needed which would model the impact of such changes based on an inventory of equipment and supplies actually existing in country and based on the actual immunization workload in the country. This tool would be used by the central operations and logistics manager when interrogated by senior programme managers on the logistic impact of such proposed changes.

TIMETABLE



PROGRESS

A specification for this software is being prepared and will be shared with Technet members for comment while a start is made to construct a working model.

PARTICIPANTS

Ahmed.....	Bass.....	Erkilla.....	Schnur.....
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STUDIES IN:

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ANNEX 4

DIRECTORY OF TECHNET MEMBERS

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United States of America

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ANNEX 4

AREAS OF INTEREST OF TECHNET MEMBERS*

Emergency and disaster cold chain equipment
Bass, Durand T., Free, Gomez V., Guichard, Srivastava

Injection equipment
Bach, Bass, Cain, Carrasco, Evans, Free, Mpayamaguru, Schnur, Six

Logistics and distribution
Ahmed, Bach, Bass, Basset, Battersby, Broms, Carrasco, Davis, Durand T., Free, Gomez V., Guichard, Larsen, Lloyd, Munck, Pott, Poulsen, Schnur, Weeks

Monitoring of the cold chain
Ahmed, Basset, Battersby, Bhuyan, Carrasco, Chaudhury, Durand JM., Evans, Free, Guichard, Kagaruki, Lainejoki, Lloyd, Mpayamaguru, Munck, Pott, Schnur, Six, Spanner, Srivastava

Operational research
Bhuyan, Carrasco, Durand JM., Durand T., Free, Gomez V., Larsen, Mpayamaguru, Munck, Pott, Spanner, Srivastava, Zaffran

Programme costing
Carrasco, Durand T., Gomez V., Guichard, Lloyd, Munck, Pott, Six, Weeks, Zaffran

Quality – assessment and maintenance
Ahmed, Bhuyan, Carrasco, Durand JM., Durand T., Free, Gomez V., Guichard, Kagaruki, Lainejoki, Larsen, Mpayamaguru, Munck, Pott, Spanner, Srivastava, Zaffran

Refrigeration equipment - selection and maintenance
Bach, Bhuyan, Cain, Carrasco, Davis, Evans, Free, Mpayamaguru, Munck, Schnur, Srivastava

Renewable energies
Bass, Battersby, Carrasco, Chaudhury , Gomez V., Guichard, Mpayamaguru, Munck, Pott, Schnur, Six, Spanner, Srivastava, Zaffran

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* This list includes only the names of members who participated in the Technet Consultation, Cyprus, 12-16 March 1990.

Sterilization
Bass, Bhuyan, Carrasco, Davis, Durand JM., Gomez V., Guichard, Lainejoki, Munck, Pott, Schnur, Spanner, Srivastava, Zaffran

Supervision
Bass, Basset, Battersby, Broms, Cain, Carrasco, Gomez V., Guichard, Pott, Srivastava, Weeks, Zaffran

Training
Bass, Carrasco

Vaccine distribution
Ahmed, Battersby, Broms, Carrasco, Chaudhury, Free, Gomez V.

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Note: Additional areas of interest were specified by some members, as follows:

All PHC technologies:	Free
Computers:	Bass
Equipment development/improvement:	Cain
Evaluations and studies:	Mpayamaguru, Six
Disease outbreaks:	Bass, Six
Planning:	Bass
Sustainability:	Durand, T.
Transport:	Lloyd, Munck, Poulsen