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ENGLISH

PROGRAMME FOR PRODUCTION OF VACCINES IN AFRICA

UC/RAF/83/088

Technical Report: Programme for Production of Vaccines in Ethiopia

Prepared for the Government of the Democratic and People's Republic of  
Ethiopia by the United Nations Industrial Development Organization

Based on the work of L. Hegedüs and N. Lendvai,  
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and S. Szabó, economist

232

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TABLE OF CONTENTS

<u>Chapters</u>	<u>Page</u>
LIST OF ABBREVIATIONS	2
PERSONS CONTACTED	3
ACKNOWLEDGEMENT	4
GENERAL INFORMATION	5
FINDINGS	7
RECOMMENDATIONS	12
<u>Annexes</u>	
I. Morbidity Data of Preventable Communicable Diseases	15
II. Specialized Health Projects	16
III. Amount of Vaccines Imported during the years 1980-1984	20
IV. Vaccination coverage by Region	21
V. Number of Vaccination performed	22
VI. Some data on the Activity of CLRI	23
VII. Description of the different divisions of CLRI	26
VIII. Production of Cholera and TAB vaccines	29
IX. The Lay out of the new Quality Control Laboratories	31
X. Central Laboratory and Research Institute	32
XI. Production of Rabies vaccine and serum	35
XII. Veterinary Vaccines Production in Debre Zeit	36

1. LIST OF ABBREVIATIONS

UNIDO	United Nations Industrial Development Organization
UNICEF	United Nations Children Fund
WHO	World Health Organization
EPI	Expanded Programme on Immunization
DPT	Diphtheria Pertussis Tetanus Vaccine
TT	Tetanus Toxoid Vaccine
BCG	Bacillus Calmette Guerin/vaccine against Tuberculosis/
PPD	Purified Protein Derivative/Tuberculin/
TAB	Typhoid and Paratyphoid A,B vaccine
CSM	Cerebrospinal Meningitis Vaccine
ATS	Antitetanus Serum
ELISA	Enzyme Linked Immunosorbent Assay
RIA	Radioimmuno Assay
CVS	Central Vaccine Store
DANIDA	Danish Industrial Development Aid
CLRI	Central Laboratory and Research Institute



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### 3. GENERAL INFORMATION

Ethiopia is situated in the north-eastern horn of Africa and has a total surface area of 1,2 million sq. km. It is estimated that the population of the country is in excess of 35 million, of whom close to 90 percent live in rural areas. A country-wide census will be held in 1984. The population is increasing very quickly, it is estimated to reach 50-55 million by the end of this century.

Crude birth rate: 44,7 births/1000 population

Rate of natural increase: 24,9/1000 population

Data concerning public health care are unfavourable:

Infant mortality rate: 155 under 1 year/1000 live birth

Child mortality rate: 247 death of children 0-4 years of age/1000 children of 0-4 years

Life expectancy at birth: 43,7 year.

It has to be mentioned that 45 % of the total population are under 15 years of age and 18-20 % under 4 years. Among the main causes of early death are malnutrition and communicable diseases. Morbidity data of preventable communicable diseases are given in Annex I.

The government is making great efforts to raise the standard of public health care. Concerning communicable diseases specialized health service projects were initiated with the aim of eradicating or controlling a number of diseases.

Some of these projects are as follows:

Malaria Control Program

National Tuberculosis Control Project

National Leprosy Control Project

Venereal Diseases Control Project.

More details of these projects are given in Annex II.

The nationwide Expanded Program on Immunization was launched in January 1980 with the aim of making vaccination services available to all children below 24 months of age and to pregnant women in the country by the year 1990.

As there is no EPI vaccine production in the country at all, vaccines are imported, or donated by UNICEF. The amount of vaccines imported during the years 1980-84 is given in Annex III.

The coverage rate of EPI vaccination is about 12%, in some zones higher as may be seen in Annex IV.

Data concerning the vaccinations performed are shown in Annex V.

It should be noted that some statistical data are not reliable because of the lack of a central statistical registration system and underreporting.



4. FINDINGS

Central Laboratory and Research Institute /Addis Ababa/

Vaccine production for human use in Ethiopia is carried out in the Central Laboratory and Research Institute /CLRI/, Addis Ababa.

Some laboratories were set up by the Italian army on a field of about 5 hectares, during the 2nd World War for military health purposes. After the war, these laboratories were developed by English and French specialists /Institute Pasteur d'Ethiopia/. When the foreigners left in the early sixties, the existing laboratories received the name CLRI and new facilities have been added.

Main activities of the Institute are:

- Clinical Laboratory Service
- Physicochemical-analytical service
- Production of biologicals
  - diagnostic reagents
  - laboratory animals

Some details of these activities are given in Annex VI.

The Institute is divided into divisions, which are briefly described in Annex VII.

The people employed by the Institute in 1984 could be classified according to qualification as follows:

<u>Qualification</u>	<u>Number</u>
Ph. D.	3
M. Sc.	10
B. Sc.	28
Diploma	20
Senior techn.	32
Junior techn.	36
	<hr/>
	129
Administration	146
	<hr/>
<u>Total:</u>	275

Bacterial vaccine production is carried out by the Bacteriology Division.

Cholera and TAB vaccines are manufactured here, but the production is limited: one batch every two years, or whenever there is a special demand.

Both vaccines are produced from strains received from HUMAN Institute for Serobacteriological Production and Research, Budapest, Hungary.

The production is carried out in two rooms using suitable equipment. Details of the production are given in Annex VIII.

It is suggested that instead of the TAB vaccine, a single typhoid vaccine be produced. According to WHO field trials, the conventional TAB vaccine provides no protection against *S. paratyphi A* and *B* infection.

Because of limited space, equipment and staff, the production of any other human bacterial vaccines in the present situation would be not feasible.

Taking into account the always growing population, production of DPT and Tetanus toxoid vaccines would be desirable, but for this would require a new building, additional equipment and staff. Funds are not available at present for this purpose.

There is no separate quality control department in the Institute. Furthermore, there is no potency testing of cholera and TAB vaccines at all, which is a basic requirement of all vaccine production.

There is some hope that this unsatisfactory situation may change in the near future, because six new rooms have been constructed for this purpose, which seem to be suitable for the potency testing of not only cholera and typhoid, but tetanus toxoid

single, and diphtheria-tetanus-pertussis combined vaccines as well. The lay-out of these six existing laboratories is shown in Annex IX. The six laboratories are not operating as yet because of lack of equipment. The list of equipment required is given in Annex X, the total cost is approx. USD 50.000 according to prices in March 1983. The total is estimated in 1985 US\$ 70,000 approximately.

When introducing quality control potency tests, reference preparations, bacteria challenge strains and toxins are required from abroad /Copenhagen, or Human Institute, Budapest/

The training of two persons for quality control of bacterial and viral vaccines is necessary.

Innocuity and toxicity tests for bacterial vaccines are performed on mice and guinea pigs.

Rooms for breeding and housing of animals are separated from other buildings in the Institute. There are separate rooms for Swiss mice, black mice, rats, rabbits, hamsters and guinea pigs. The animal breeding houses are clean, and the animals look healthy.

There is an adequate supply of food and pellets. The quantity of mice meets the demands and can easily be increased.

Guinea pigs are bred in six rooms in separate spaces /3-4 m<sup>2</sup>/ on a concret floor with hay.

Sterility tests are performed by the Public Health Laboratory which is a part of the Bacteriology Division. The circumstances and conditions in the laboratory are not suitable for such activity: the room, where the sterility tests are being carried out, is also used for administration and other activities. The installation of a laminar airflow cabinet is highly recommended.

Rabies vaccine for human use is produced in the Veterinary Public Health Division of CLRI. The production is carried out in a

separate building consisting of 8 rooms. These rooms and the equipment are suitable for the production, see Annex XI for details.

Nevertheless, the production of vaccine /Fermi type/ must be modernized by using suckling mice or human diploid cells for this purpose.

The quality control of antirabies vaccine is satisfactory: sterility, innocuity, phenol, pH and potency /HABER test/ are tested.

The Virology Section occupies two well equipped rooms. Main diagnostic activities of the section:

- Hepatitis F antigen prevalence
- diagnostic services of rubella, cytomegalo, rota and arbo viruses.

The well trained staff is experienced in using advanced methods like ELISA, RIA, immunofluorescent, tissue culture techniques.

The section seems to be suitable for testing measles and polio vaccines at a later stage. Tissue cultures for this purpose could be obtained from National Veterinary Institute, Debre Zeit.

National Veterinary Institute, Debre Zeit

The Institute started working in 1963 at Debre Zeit and was built in French-Ethiopian collaboration. Since 1979 it has been sponsoring 4 regional laboratories in Asmara, Addis Ababa, Bahr-Dar, Bedella.

The main divisions of the Institute are:

- Biological production laboratory
- Research and diagnostic laboratory
- Foot and Mouth disease laboratory
- Biochemistry and nutrition laboratory.

Bacterial and viral vaccines are produced in the well-equipped laboratories, using modern technologies /tissue cultures, fermentors etc./ against major animal diseases, meeting the international criteria for quality control.

The quantity produced is  $50 \times 10^6$  doses/year. Full capacity is  $80 \times 10^6$  doses/year. Until now 409,405,000 doses of bacterial and viral vaccines have been produced in the Institute. They are producing veterinary vaccines for export, to  $12 \times 10^6$  doses/. Vaccine production target for 1983-84 is shown in Annex XII.

The Institute has conducted training for field veterinarians and laboratory technicians. In order to enhance the qualification of its own professionals, 5 veterinarians and 14 laboratory technicians have been sent abroad for specialization and for higher training. Total manpower: 110 persons, including 6 veterinarian, 50 technicians, 25 animal technicians.

5. RECOMMENDATIONS

First stage

1. Modernization of antirabies vaccine production by using suckling mice or human diploid cell technique.
2. The production of single typhoid vaccine instead of TAB.
3. Strengthening the quality control activity, introduction of potency test for bacterial vaccines /cholera, typhoid, DPT, TT/, and viral ones /measles, polio/ with the aim of becoming a regional center for quality control of EPI vaccines.
4. Establishment of a separate quality control unit is of great importance for reaching the goal set out in point 3 above.
5. Purchase and installation of equipment in six new rooms of the CLPI as soon as possible. This is of fundamental importance for further development in vaccine production and quality control. The equipment required is listed in Annex X.
6. Sufficiently well trained staff should be ensured in the vaccine control unit.  
Training of 2 persons is recommended. (One for bacterial, another for viral vaccines)  
When , quality control potency tests will be introduced, one expert should be on duty.
7. Co-operation between the Central Laboratory and the National Veterinary Institute in the field of vaccine production and quality control is highly recommended.

Second stage

8. At a later stage, production of DPT and TT vaccines in a new building or prefabricated module unit is advisable. /In the first phase from bulk, later from raw materials/.

Proposed time schedule:

First stage

a/ Training course	up to 3th month
b/ Purchasing equipment	up to 6th month
c/ Installation of equipment	6-8th month
d/ Trial runs	8-12 month
e/ Starting routine work	from 12th month

Cost estimate:

a/ Equipment for quality control	70,000 USD
b/ Training 2 persons/ 3 months	12,000 USD
c/ Exp rt 1 person/3 months	24,000 USD

Total: 106,000 USD

Second stage

a/ prefabricated module unit	100.000 USD
b/ equipment for bulk production	300.000 USD
c/ training 2 persons/3 months	12.000 USD
d/ expert 1 person/3 months	24.000 USD

Total: 436.000 USD

6. ANNEXES



ANNEX I

MORBIDITY DATA OF PREVENTABLE COMMUNICABLE DISEASES NOTIFIED  
TO THE MINISTRY OF HEALTH IN 1981-1982 <sup>x</sup>

N.B.: This table does not include reported cases from non-government and military Hospitals, clinics etc.

No.	DISEASE	No. of Cases	
		1981	1982
1	Poliomyelitis	322	115
2	Measles	9,784	10,527
3	Tetanus		
	Neonatal Tetanus	n.d.	220
	Tetanus	668	1,128
4	Pertussis	9,885	9,737
5	Diphtheria	97	93
6	Tuberculosis		
	Pulmonary	39,203	90,667
	Non-Pulmonary	23,526	17,329
7	Severe Diarrhoea	n.a.	354,234
8	Rabies	n.a.	1,103

x - REPORT ON MAJOR COMMUNICABLE DISEASES IN ETHIOPIA, PART 1, MINISTRY OF HEALTH CDC DIVISION, 1983.

n.a. = not available

ANNEX II

Specialized Health Projects

Specialized health service projects were started mostly during the fifties with the aim of eradicating or controlling special health problems or specific diseases.

1. Malaria Control Program

This project was known as Malaria Eradication Service until 1972. The establishment of the project had its background in the systematic studies of malaria in Ethiopia that was begun by Italian and British malariologists between 1936-1971 and 1945-1955 respectively. These surveys demonstrated that malaria was distributed throughout the area below 2000 meters, but the prevalence showed marked variations with place and season.

From 1955 to 1966 five malaria pilot projects were undertaken with USAID, WHO and UNICEF assistance. Besides, the National Malaria Eradication Service was established and the Malaria Training Centre was opened in 1959.

Although malaria has not been eradicated until now, major malaria epidemics ceased to occur and in some previously malarious areas a parasite rate of 5 % was achieved.

Manpower operating in the Program /1982/ 1534 persons.

Budget in Birr /1982/ 13,515.000 /capital budget/

Activities /1981/

Houses sprayed with D D T.	1,752.817
Amount of DDT used	2,545.395 kg
Population protected	4,742.690
Persons given antimalaria tablets	205.038
Number of tablets distributed	11,168.164

## 2. National Tuberculosis Control Project

The Tuberculosis Control Project was established in 1959. as Tuberculosis Demonstration and Training Centre in Addis Ababa. Later on two more tuberculosis centres were established in Asmara and Harar.

Objectives of the project:

- coordinating tuberculosis control activities in the country
- training of health workers
- undertaking a nationwide BCG vaccination campaign
- diagnosis and treatment of patients

Now efforts are being made to strengthen and integrate tuberculosis work into the general health services both in preventive and curative fields.

Activities in the Addis Ababa Tuberculosis Centre:

Manpower: 104 persons /1982/

Budget in Birr: 543.611

Activities /1981/

Number of persons examined	61,135
Number of persons treated	5,747
Laboratory examinations performed	23,540
X-Ray examinations	50,181

## 3. National Leprosy Control Project

The Programme was set up in 1956. In accordance with this Programme leprosy treatment centers were established in areas of high prevalence. Leprosy control work at present is being supplemented by the work of other organizations such as ALERT and AHRI which are engaged in research, training of health workers, treatment and rehabilitation of leprosy patients.

The project has the following goals:

- to interrupt the chain of transmission
- to integrate the activities of the project into the general health services
- to coordinate the work of all agencies engaged in leprosy control work
- to participate in the training of medical and paramedical health workers.

The distribution of leprosy varies greatly, the prevalence is estimated at 5/1000.

Out of the estimated 150.000 cases, only 83.000 have been registered and brought under treatment.

Manpower /1982/: 38 persons

Budget in Birr /1982/ 236,640

Activities /1981/

Number of patients registered during the year:	8,479
Total number of patients under treatment:	83,863
Number of health workers given training:	154

#### 4. Trachoma Control Project

The prevalence of Trachoma has been estimated to be as high as 80 % in some areas. Studies also indicate that trachoma is the major cause of blindness in Ethiopia. It was only in 1973 that a pilot programme was started with the assistance of the Italian government. The results of the activities so far carried out indicate that there is a need for a comprehensive eye care program, to deal with other causes of blindness as well. Therefore, efforts are being made to set up a programme for the prevention of blindness.

Basic statistics concerning the Project:

Manpower /1982/: 27 persons

Budget /1982/ Birr: 239.052 /half of which provided by Italian government/

Activities /1981/:

Persons examined: 49,160

Persons treated: 90,805

5. Venereal Diseases Control Project

The project was started in 1955. Since 1964, diagnosis and treatment of patients have been carried out in Addis Ababa clinic. Very little is done concerning epidemiological studies or operational research.

Available resources and activities of the clinic are as follows:

Manpower /1982/: 78 persons

Budget in Birr /1982/: 370, 116

Activities

Persons examined: 218,857

Persons treated: 108,952

Number of lab. examinations: 55,281

ANNEX III

AMOUNT OF VACCINES IMPORTED DURING THE YEARS 1980-1984\*

NUMBER OF VACCINE DOSES						
YEAR	DPT	TT	BCC	POLIO	MEASLES	TOTAL
1980	1,822,000	72,000	1,311,000	1,645,200	104,920	4,955,120
1981	432,600	401,600	250,000	n.d.	250,000	1,334,200
1982	800,000	556,000	1,000,000	1,050,000	1,000,330	4,406,330
1983	500,000	400,000	250,000	423,200	250,000	1,823,200
1984	500,000	n.d.	250,000	500,000	200,000	1,450,000

x - EXPANDED PROGRAMME ON IMMUNIZATION, MINISTRY OF HEALTH

## ANNEX IV

## VACCINATION COVERAGE BY REGION, EPI /BY CLUSTER SAMPLING/

REGION	DPT % 1	DPT % 2	DPT % 3	BO % 1	BO % 2	BO % 3	MEASLES %	BCG %	TT % 1	TT % 2	FULLY	PARTIAL	DATE
Addis Ababa	65	59	50	65	59	50	46	48	10	6	33 %	-	Oct. 1982
Arsi	86	78	65	86	78	65	64	86	20	17	47	39	Febr. 1983
Jimma	71	64	60	71	64	60	65	75	28	25	47	28	Apr. 1983
Gojjam	91	88	79,4	91	87	78,5	71,8	91,9	21,1	14,2	57,4	34,9	June 1983
Harar	48	41	31	48	41	31	28	35	8	3	14,8	33,8	Aug. 1983
Eala	95	92	85	95	91	85	85	96	21	15	68,6	27,1	Nov. 1983
Wellega	93	90	76	93	90	75	80	93,4	41	26	56,4	37	Jan. 1984
Sidamo	76,8	69,7	57,3	76,8	69,2	56,9	59,7	72,5	14,7	11,9	42,2	35,5	Sept. 1983

No of Children in a cluster = 7

No. of clusters = 30

No. of children included in the survey = 210

ANNEX V

NUMBER OF VACCINATIONS PERFORMED

	1980	1981	1982	1983	Total
BCG	161,719	130,951	177,482	213,397	683,549
MEASLES	116,686	90,185	194,861	214,726	616,458
DPT 1	128,488	95,377	138,991	163,969	526,823
2	99,336	79,466	111,465	135,754	426,001
3	80,250	69,618	93,570	114,359	357,777
POLIO 1	130,123	95,889	132,959	162,308	521,277
2	98,051	79,136	107,772	136,322	421,281
3	80,257	69,561	90,548	115,067	355,433
TT 1	33,981	46,602	67,269	87,284	235,136
2	19,966	30,401	41,574	55,483	147,424



SOME DATA ON THE ACTIVITY OF CLRI

Division/Section	No. of laboratory tests performed	
	1981-82	1982-83
Bacteriology	21,143	28,356
Clinical Chemistry	53,166	72,992
Haematology	20,275	42,219
Serology/Immunology	11,572	11,375
Parasitology	6,972	10,597
Vet. Public Health	4,183	4,117
Histology	1,092	1,643
Virology	169	639
TOTAL	118,572	171,938

Physicochemical analytical services for 1982-83, compared to that of  
1981-82

Section	No. of determinations	
	1981-82	1982-83
Industrial Chemistry	1,050	965
Toxicology	159	214
Pharmaceutical Quality Control	740	932
TOTAL	1,949	2,111

Production

The nature of materials and type of laboratory animals produced by the Institute as well as the amount and quantities of the various types of products are shown in the table below.

Biological products, lab. animals and diagnostic reagents produced in 1982-83 as compared to production in 1981-82

Type of product	Quantity	
	1981-82	1982-83
Diagnostic antigens /lit./	19.58	22.5
Rabies vaccine, human /lit./	438	380.0
Rabies vaccine, animal /lit./	54	43.0
Anti-rabies serum, /lit./	5.5	2.0
Miscel. culture media /lit./	1,908.7	2,751.9
Cholera vaccine /doses/	0	29,400
TAB vaccine /doses/	0	10,000
FPD /doses/	0	174,000
Lab. animals	15,000	19,742

Description of the different divisions of CLPI

I. Bacteriology Division

Sections: Clinical bacteriology  
Public Health Bacteriology  
Mycobacteriology

Units: Media preparation  
Mycology  
Vaccine Quality Control

The Division performs routine diagnostic services, production of culture media and vaccines, quality control and research activity.

Building:

One storied building with different laboratories for routine diagnostic services. In some laboratories administrative work is also being performed, which should not generally be allowed!

Equipment:

Meets the requirements of routine laboratories /autoclaves, sterilizers, refrigerators of various sizes, water baths, microscopes, thermostats etc./.

Staff members of this Division prepare the bacterial vaccines.

II. Veterinary Public Health Division /VPHD/

The VPHD, besides serving as the only center for rabies diagnosis in the country, is the only place where rabies vaccine and serum are produced. In addition, the division maintains a small animal clinic, where various pets are treated and vaccination against rabies and other diseases is given.

### III. Virology Section

This section operates in two rooms neighbouring the Bacteriology Division.

Equipment: suitable for following methods:

Complement fixation test, Electrophoresis,

Vacuum fluorescent technique, ELISA, RIA etc.

/Microscopes, Bio Quest Cabinet Air flow, ELISA reader,

SORVAL superspeed centrifuge, magnetic stirring machine STIR JACK,

pH meters, freeze-drying apparatus (Virtis), etc.

Tissue cultures: VERO cells and giant green monkey kidney cells were used formerly. /At present tissue cultures are not being used/.

Main diagnostic activity of the Section:

Hepatitis B antigen prevalence, diagnostic services on rubella virus, cytomegalo virus, rota virus, arbo virus.

### IV. Parasitology Division

### V. Clinical Chemistry Section

/Equipment: Chemomat analyzer, Coulter blood analyzer, Beckman Spectrophotometer, Coleman Linear Absorbance Spectrophotometer, Osmometer, Bilirubin tester WAKO etc./

### VI. Entomology Division

### VII. Drug Control and Toxicology Division

/Equipment: Perkin-Elmer spectrophotometer, Holten Laminar Air Cabinet, Hitachi spectrophotometer and Recorder, Varian Aerograph, Fisher automatic titrimeter, Pye UNICAM spectrophotometer, ERWEKA DT Dissolving time recorder, OSMETTE Automatic Osmometer, BÜCHI Schmelzpunkt-Messer /melting point apparatus/, Hydrogen Generator Gen. Electric etc./.

VIII. Tuberculosis Research Section

IX. Immunohaematology Division

/Coulter Electronics automated haematology Analyzer, SPMAL  
Centrifuge, Spectrophotometer, microscopes etc./

X. Industrial Chemistry Division

/PYE UNICAM Spectrophotometer, Beckman DU-2 Spectrophotometer,  
Photoelectric Colorimeter, Servogor 310 etc./

XI. Pathology-Histology Division

XII. Training Division

Production of Cholera and TAB vaccines

1. Cholera vaccine

Strains: freeze-dried sample received from Human Institute  
Budapest, Hungary

Vibrio cholerae Inaba 35A 3

Vibrio cholerae Ogawa 41 B

Identity: controlled on TCBS agar plates

Cultivation: nutrient agar in Roux flasks

Incubation: 48 hours at 35 °C

Harvesting: washing with 1 % PBS solution

Inactivation: 1 % phenolum liquefactum at 60°C for 1 hour  
control of inactivation by using agar plates

Final bulk suspension: aa partes mixture of Ogawa and Inaba  
strain suspensions, containing 0,5 % phenol

Opacity:  $8 \times 10^9$  germs/ml./Because of lack of international  
opacity standard, final bulk opacity is compared  
with a vaccine produced previously./

Quality control of final bulk: sterility, identity /gram  
staining/ toxicity and chemical analysis /phenol,  
protein content/

No potency test is carried out!

Filling by hand into 100 ml bottles in the same room where  
production is carried out.

Single human dose: 1 ml

2. TAB vaccine

Strains: S. Typhi Ty2 freeze-dried samples received from  
Human Institute, Budapest.

S. Paratyphi A and B: from Pasteur Institute, Paris

Cultivation, harvesting, inactivation: same as in Cholera vaccine production

Final bulk suspension: aa partes mixtures of S. Typhi Ty2 and S. Paratyphi A, B suspensions.

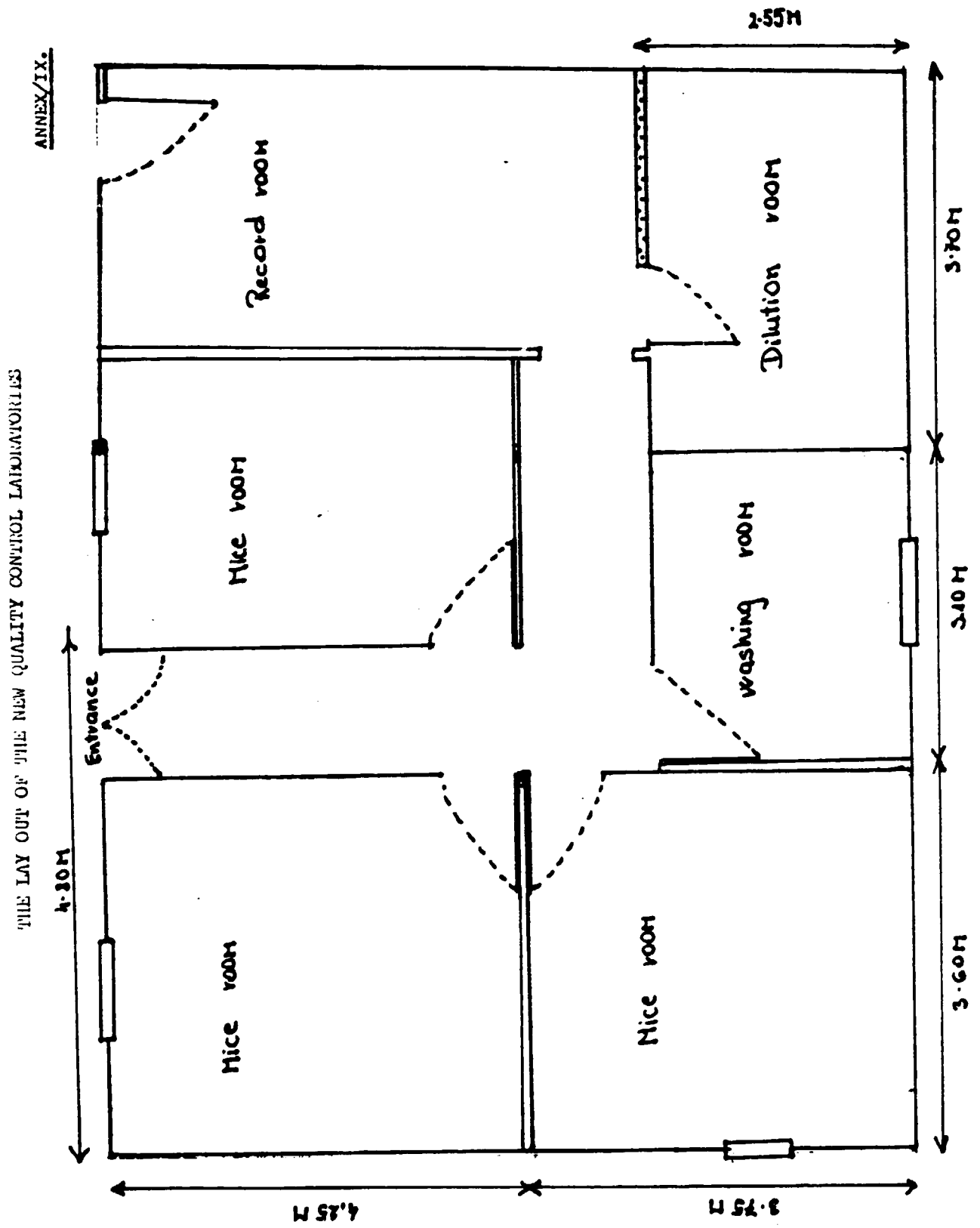
Quality control of final bulk: same as in cholera vaccine production

No potency test is carried out!

Filling: by hand into 100 ml bottles.

Single human dose: 1 ml





## CENTRAL LABORATORY AND RESEARCH INSTITUTE

ANNEX X

## Equipment and Reagents Required for Quality

## Control of Bacterial Vaccines

March, 1983

## 1 Equipment

No.	Item Description	Item catalog/Code No.	Supplied Quantity /by manufacturer/	Unit Cost of Supplied Quantity in US\$	Quantity Desired	Total Price
1	Animal Cage /Mice/	1115 A20 Cage	1	23.75	200	4750.00
2	Animal Cage /guinea pig/	1115-T 10 Cage	1	96.00	200	1920.00
3	Cage rack /Mice/	1116-W10 Cage rack	1	269.00	15	4035.00
4	Shelf	1116-W-25 Shelf		35.50	60	2130.00
5	Feeding dish /Aquaria/	1113-F12 Aquaria	case of 24	45.36	3 cases	136.08
6	Drinking bottle /glass/	1113-R10 Bottle, 1602	1	0.90	50	49.50
7	Drinking tubes, straight	1113-S10 drinking tube 76 mm	1	1.00	50	50.00
8	Stopper, 1 hole	1113-R50 Stopper No. 8	1	0.68	50	34.00
9	Animal balance /guinea pig/	1369-R25 balance	1	149.00	2	298.00
10	Animal balance /mice/	1109-B10 Animal balance model 730	1	93.50	1	93.50
11	Sensitive balance	1339-F37	1	2395.00	1	2395.00
12	ph meter, digital	41155-A42	1	750.00	1	750.00
13 x	Laminar-air flow cabinet	L 5325-1 cabinet	1	3770.00	2	7540.00
14 x1	Freez-dryer	D 6801 freez-dryer	1	1300.00	1	1300.00

No.	Item Description	Item catalog/Code No.	Supplied Quantity /by manufacturer/	Unit Cost of Supplied Quantity in US\$	Quantity Desired	Total Price
	2/ Vacuum indicator, electronics	D 6825-1 Vacuum indicator	1	345.00	1	345.00
	x3 Temperature indicator	D 6825-2 Temp. indicator	1	631.00	1	631.00
15	x Pipet washer/Dryer	P 5257	1	127.77	3	383.31
16	x Incubator	J 1645-1 Incubator	1	2535.00	1	2535.00
17	xxxx Programmable calculator TI 59 /for probit analysis/	-	-	-	2	2000.00
18	xxxx Air conditioner	-	-	-	5	5000.00
20	xxxx Electrical incinerator	-	-	-	2	10000.00
21	Lab. - line supermixer, shaker	8294-F10	1	99.00	2	198.00

T O T A L

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2. Reagents and Media

No.	Item Description	Item catalog/Code No.	Supplied Quality /by manufacturer/	Unit Cost of Supplied Quantity in US\$	Quantity Desired	Total Price
1 xx	Bordet-Gengou base	0048-01-3	1 lb	8.85	10 lbs	88.50
2 xx	Casamino acid	0048-01-1	1 lb	9.40	10 lbs	94.00
3 xx	Soybean-Casein digest	0230-01-1	1 lb	5.20	10 lbs	52.00
4 xxx	Ammonium Oxalate Crystal	A 679	5 lbs	22.96	5 lbs	22.96
5 xxx	Safranin	S-670	100 gm	16.30	300 gm	48.90
6 xxx	Gentian Violet	G-13	1/2 lb	13.48	12 1/2 lbs	161.76
T O T A L						468.12
G R A N D T O T A L						52.036.54

Source: - Catalogue

1. Thomas Scientific Apparatus Arthur H. Thomas Company, 1980
2. x Scientific Product /S/P/, 1976
3. xx DIFCO, 1973
4. xxx Fisher Scientific Co., 1973
5. xxxx Roughly estimated price

ANNEX XI

Production of Rabies vaccine and serum

Rabies vaccine and serum are produced in a separate one-story building consisting of 8 rooms. There is no shortage of place, rooms and equipment are suitable for production:

Sorval centrifuge

Aseptic steril box

Deep-freezer REVCO

Filling-capsulating machine

pH meter, water baths etc.

/VIRTIS freez-drying machine does not work/

a/ Rabies vaccine for human use

Strain: PV 2 /Inst. Pasteur, Paris/

Fermi type vaccine is produced on 6 month old sheep brain.

Inactivation: 1 % phenol

Final bulk product: sheep brain suspension containing  
0,5 % phenol.

Filling: 100 ml/vials

Expiry date: 6 months

Producing capacity: 500.000 ml/year

b/ Rabies vaccine for veterinary use

Fermi type vaccine containing 20 % glycerine in final product.

Quantity of production: 10-20.000 ml/year

c/ Antirabies serum from horse, for human use.

Produced from 4 horses immunized against rabies.

Purified by ammonium sulphate.

Filling: 5 ml/amp.

Expiry date: 2 years

Quantity of production: 10-15.000 ml/year

ANNEX XII

VEGETINARY VACCINES PRODUCTION IN DEBRE ZEIT

/1983-84/

Type of vaccine	Production target	
Rinderpest	15,000,000	doses
Pleuropneumonia C.B.P.P.	15,000,000	"
Anthrax	5,000,000	"
Blackleg	5,000,000	"
Pasteurellosis	1,500,000	"
Newcastle disease	1,000,000	"
Sheep pox	500,000	"
African horse sickness	500,000	"
Fowl pox	100,000	"
Foot and Mouth Disease	20,000	"
Fowl Typhoid	10,000	"
For Export	5,000,000	"
Total production	48,630,000	