

Chapter 1 Background of the Project

The mortality of the infants of less than five years old in the Republic of Peru (to be referenced as "Peru" hereafter) is 58 out of 1,000 and that of less than one year old is 45 out of 1,000, both of which largely exceed the average mortality of the same in Central and South America of 39 out of 1,000 for the infants of less than five years old and 32 out of 1,000 for the infants of less than one year old (by UNICEF, 1998). The mortality of pregnant women is 280 out of 100,000, which also exceeds the average of Central and South America of 190 out of 100,000. Thus, improvement of the health indices of infants and pregnant women constitutes an urgent subject (by WHO, 1990).

Lack of vitamin A is considered as the first cause of infants' blindness in the developing countries. A recent study clarified that even a slight lack of vitamin A could cause the increase of mortality and morbidity of infants. Furthermore, lack of iron constitutes the main cause of anemia. Especially the iron deficiency anemia is often complicated with folic acid deficiency^{*1} of pregnant women and infants suffering from malnutrition. According to the data of the Ministry of Health, 70% of pregnant women, 50% of nursing women, and 30% of children are suffering from anemia.

Lack of iodine causes struma, hypothyroidism in adults, and congenital nervous syndrome. In addition, it is an important cause of the death of fetuses during the perinatal period.

For the above mentioned reasons, the Ministry of Health of Peru positions the improvement of the vaccination rate of above mentioned three nutrients as one of the important subjects to improve the national health. However, with the budgetary restriction, these nutrients cannot be supplied sufficiently in some areas. Especially in the poor areas of Lima department, many residents cannot use the insurance system or have no access to the health services, and they need some measures.

On the other hand, Peru has been recently emphasizing the measures for diseases that can be prevented with the use of vaccination. Thus the vaccination rate has been drastically improved.

Table 1-1 Vaccination rate to infants of less than one year old

Vaccine	1991	1995
Tuberculosis	78.5%	96.2%
Poliomyelitis	74.4%	92.9%
Measles	59.7%	98.9%
MMR	71.0%	94.8%

*1 Lack of folic acid reduces erythrocyte, which causes anemia or weakens mucous membrane.

However, in Lima department, approximately 20% of the health facilities do not have any refrigerator and approximately 20% of the same do not have any freezer also. In Tumbes department, 16% of the health facilities do not have any refrigerator and in Piura department, all health facilities except for the Central Warehouse do not have any refrigerator or freezer. Therefore, these facilities have insufficient storage capacity for vaccines. Furthermore, because the existing equipment is deteriorated, vaccination activity is in trouble. In addition, the Ministry of Health of Peru does not have any refrigerator car to transport vaccines, and vaccine transportation is entrusted to a private transportation company. However, the private transportation company does not transport vaccines in the vehicle exclusive for vaccine transportation, and transports vaccines by changing the ice packs for cooling purpose during the transportation at present. Thus, the safe transportation of vaccines is not secured.

The general economic cooperation study mission sent from Japan to Peru in February 1998 determined that the measures for poverty should be the main part of the economic cooperation to Peru and agreed with the government of Peru on the implementation of a model project mainly consisting of the measures for poverty in Lima, the metropolis of Peru. Based on this agreement, a Project Formation Study Team was sent to Peru in March 1999 and determined to cooperate for the reduction of poverty problems especially in medical field by using the scheme such as the grant aid for child health.

Under the above mentioned circumstances, the government of Peru formulated this Project consisting of the improvement of cold chain facilities and the procurement of micronutrients and so on, and requested the grant aid cooperation from Japan on the funds necessary for implementing the above mentioned measures.

Chapter 2 Contents of the Project

2-1 Objectives of the Project

This Project has the objectives to implement the measures for poverty alleviation in Lima department and support the regional development of the area near the boarder of Ecuador by considering the relationship with the Project Formulation Study conducted by the government of Japan and supports the improvement of the malnutrition and vaccination rate, which are positioned as the important items in the "National Action Plan for Children, 1996 to 2000" and the "Five Year Plan of the Ministry of Health, 1995 to 2000" of Peru.

2-2 Basic Concept of the Project

2-2-1 Basic Concept

The basic concept of this Project is as follows.

(1) Cold chain improvement

By increasing the capacities of the refrigerators and freezers in the project area, vaccination will be effectively implemented and the vaccination rate will be improved in Peru.

(2) Procurement of micronutrients and salt iodization equipment

By supplying vitamin A to the infants of less than two years old and ferrous sulfate to the infant of less than one year old and pregnant women in the project area, malnutrition will be improved and the mortality of pregnant women will be reduced.

With the procurement of the insufficient iodine and salt iodization equipment, the production of iodized salt in the project area will be increased. Furthermore, by procuring the iodized salt quality control equipment, supply of iodized salt of proper quality will be supported.

2-2-2 Selection of Project Sites and Equipment

The initial request from Peru was for cold chain equipment, yellow fever vaccine, syringes, and salt iodization equipment to seven departments including Lima, as well as micronutrients, transportation vehicles, and information system equipment to Lima department. However, based on the results of the study, the following sites and equipment were selected.

(1) Selection of project sites

By considering the relationship with the Project Formulation Study conducted by Japan in March 1999, Lima department was determined as the project site to support the measures for poverty alleviation.

In addition, because Peru reached a final peace agreement with Ecuador in October 1998 in relation to the boarder dispute, which had been the concern of Peru since the nineteenth century, many countries are putting efforts in supporting the development of boarder area of two countries. Since Japan dispatched a Project Formulation Study Team in September 1999 and has a policy to

support the development of boarder area, Piura and Tumbes departments shall be included in this Project.

On the other hand, some areas are unstable from the standpoint of peace and order with the threatening of terrorism and so on, study of and procurement in such areas are difficult to implement.

Based on the above mentioned, Lima, Piura, and Tumbes departments are determined as the project sites.

(2) Selection of equipment

1) Yellow fever vaccine and syringes

According to the study of the yellow fever, there is no data confirming the presence of vector (mosquito that carries the yellow fever) and there was no report of the case manifesting this disease in the past forty years, and in Piura and Tumbes departments, it was clarified that the presence of vector was confirmed recently, but there was no case manifesting yellow fever in the past forty years also. Thus, from the standpoint of disease prevention, importance of this vaccine and syringes can be recognized, but these are determined not to have high priority. Therefore, yellow fever vaccine and related equipment including syringes shall not be included in the present Project.

2) Salt iodization equipment

The request was made for the procurement of the equipment to six departments: Piura, Loreto, La Libertad, Moquegua, Ica, and Tacna. However as a result of screening the project sites as mentioned in (1), only Piura department is determined as the project site.

3) Micronutrients

In the initial request, only the poverty area of Lima department was included as the project area. However by considering the state of Piura and Tumbes departments having insufficient amount of necessary micronutrients, the project sites shall be expanded to Piura and Tubes departments.

4) Transportation vehicle

The request was made for the general purpose vehicles to use as the vaccine transportation vehicles from the Central Warehouse to the health office (Dirección de salud) of each department, but the vehicles to be procured shall be freezer cars by considering the purpose to use.

5) Information system equipment

The equipment included in the request but having less relationship with this Project such as computers and air-conditioners shall not be covered by this Project.

From the results of the above examination, the areas to be covered by this Project shall be Lima, Piura, and Tumbes departments and the equipment to be procured shall be cold chain equipment, micronutrients, and salt iodization equipment, the aptness of which was confirmed.

2-3 Basic Design

2-3-1 Design Concept

(1) Cold chain equipment

The government of Peru procured a cold freezing room in the Central Warehouse of Lima health district and the vaccine carriers approximately ten years ago with the supports of the U.S.A. and the UNICEF. Since then, cold chain equipment has been maintained and improved under their own budget without getting the support from other countries. However because of the budgetary restriction, they are difficult to procure new equipment. Since there is no refrigerator sufficient for the storage of vaccines in the project areas, the vaccination project is in trouble. Therefore, in this Project, refrigerators and freezers shall be procured to the areas in Lima, Piura, and Tumbes departments having none of these and the deteriorated existing equipment having been used for more than ten years shall be replaced. The design concept for each item is as follows.

1) Prefabricated cold freezing room

The Central Warehouse of the Ministry of Health controls all the vaccines in Peru. However at the time of vaccination campaign, the amount of vaccines to be stored at this warehouse increases. With the present storage capacity of 50 m³ freezer and 50 m³ refrigerator room, the vaccine storage capacity required at present cannot be accommodated. For this reason, one prefabricated freezer room required at present shall be planned.

2) Electric refrigerator

Because the Central Warehouse and the health center have the obligation to deliver vaccines to their sub-organizations, they shall have medium-size (approximately 15 ft³) refrigerators and to the health posts, small-size (approximately 10 ft³) freezers shall be procured.

3) Gas refrigerator

Gas refrigerators to be procured are for health posts only and shall be of small-size (approximately 220 ℓ).

4) Solar refrigerator

Solar refrigerators to be procured are for health posts only and shall be of small-size (approximately 35 ℓ), to which the necessary solar power supply systems shall be attached. These items must satisfy the WHO / UNICEF specifications.

5) Electric freezer

The electric freezers are used to freeze the ice packs for the cold boxes to transport vaccines by the Central Warehouse of the Ministry of Health and the health center of each department. Thus, they shall be of medium-size (approximately 300 ℓ).

The necessary amounts mentioned in 2) to 5) shall be procured, improved, or replaced

depending on the state of the existing equipment and estimated as shown in the Table below (Table 2-1). The necessary amount is calculated after confirming the present state of each existing equipment (refer to Attachment 6) by the hearing from the staffs in the Ministry of Health and each health district in charge of administration and determining the aptness.

Table 2-1 Calculation table of the necessary amounts of refrigerators and freezers

	Electric (small-size)				Electric (medium-size)				Gas				Solar				Freezer			
	X	Y	Z	Total	X	Y	Z	Total	X	Y	Z	Total	X	Y	Z	Total	X	Y	Z	Total
PIURA	0	0	4	4	5	1	0	6	0	0	30	30	0	0	10	10	3	0	0	3
TUMBES	2	2	2	6	6	3	1	10	0	0	0	0	2	3	4	9	4	0	1	5
LIMA	3	39	50	92	38	44	16	98	0	6	24	30	1	8	51	60	24	5	13	42
Sub-total	5	41	56	102	49	48	17	114	0	6	54	60	3	11	65	79	31	5	14	50
Grand total	102				114				60				79				50			

X: Improvement Y: Replacement Z: New Procurement

6) Vaccine transportation vehicle

Because all vaccines are sent from the Central Warehouse of the Ministry of Health, one 4-ton truck for the transportation to remote areas (Piura and Tumbes) and two 2-ton trucks for near area (Lima) shall be procured.

7) Cold box and vaccine carrier

These items must satisfy the WHO / UNICEF standards.

In accordance with the function of each medical institute, cold boxes and vaccine carriers shall be improved, replaced, or procured (Table 2-2). The improvement plan shall be made for the vaccination activity of health posts as well as for the delivery of vaccines to sub-organizations of the health centers, hospitals, and the Central Warehouse. The numbers of necessary cold boxes and vaccine carrier are shown in Table 2-2. The necessary amounts are calculated after confirming the present state of the existing equipment by the hearing from the staff of the Ministry of Health in charge of administration.

Table 2-2 Calculation table of the necessary amounts of vaccine carriers and so on

	No. of facilities	Vaccine carrier	Cold box (small)	Cold box (medium)	Thermometer
PIURA	48	65	3	6	166
TMBES	41	105	0	13	153
LIMA	573	1,458	172	82	1,646
Total	662	1,628	175	101	1,965

8) Thermometer

For the purpose of controlling the temperatures of refrigerators, freezers, and vaccine carriers, 1,965 thermometers shall be planned (Table 2-2). An average of three thermometers shall be

procured for each of 662 facilities included in this project, which will be used to control the temperatures of refrigerators, freezers, vaccine carriers, and cold boxes. The amounts to be procured shall be planned in accordance with the size of each medical facility.

The instruction manuals of the items mentioned in 1) to 8) shall be written in Spanish.

(2) Micronutrients and salt iodization equipment

1) Micronutrients (vitamin A and ferrous sulphate)

① Vitamin A

In Peru, the Ministry of Health specifies the administration of micronutrients in the form of the "Standard for Prevention and Management of Insufficient Micronutrients (Normas técnicas para la prevención y control de deficiencias de micronutrientes)". As for the vitamin A, the doses are specified as follows in the said Standard. These doses are determined based on the report of the WHO (WHO / EPII/ TRAM / 93.6).

Dose for treatment purpose:

Infants of 6 to 11 months old: Administer the tablets of 100,000 IU ^{*2}for three times (one each tablet on days 1, 2, and 14 after starting the treatment.)

Infants of 1 to 2 years old: Administer the tablets of 200,000 IU for four times (one each tablet on days 1, 2, and 14 after starting the treatment and one tablet before the birthday of 2 years old as the preventative purpose.)

Dose for preventative purpose:

Infants of 6 to 11 months old: Administer the tablet of 100,000 IU once.

Infants of 1 to 2 years old: Administer the tablets of 200,000 IU for three times (one tablet each on months 12, 18, and 24.)

In Comas, Carabayllo, Independencia, El Agustino, Ventanilla, and Chorillos districts, which are the poorest areas in Lima department, necessary amount of vitamin A shall be procured for the treatment of infants of less than two years old. This Project shall be implemented in year 2000 and provided to the number of people calculated by multiplying the population of 1999 by the population increase rate of 0.7% (Table 2-3).

^{*2} IU: International Unit. A unit to express the contents or the efficacy of vitamins or hormones in accordance with the internationally unified Standard.

Table 2-3 Calculation table of the necessary amounts of vitamin A (1)

District	Infants of 6 to 11 months old		Infants of 1 to 2 years old	
	Population in 2000 ①	No. of necessary vitamin A capsules of 100,000 IU ① × 3	Population in 2000 ②	No. of necessary Vitamin A capsules of 20,000 IU ② × 4
COMAS	859	2,577	2,543	10,172
CARABAYLLO	272	816	864	3,456
INDEPENDENCIA	369	1,107	1,119	4,476
EL AGUSTINO	307	921	915	3,660
VENTANILLA	246	738	915	3,660
CHORILLOS	549	1,647	1,368	5,472
Total	2,602	7,806	7,724	30,896

In Piura and Tumbes departments and Villa Maria del Triunfo district of Lima department, the amount necessary for the prevention of the infants of less than two years old shall be procured. This Project shall be implemented in year 2000 and provided to the number of people calculated by multiplying the population of 1999 by the population increase rate of 0.7% (Table 2-4).

Table 2-4 Calculation table of the necessary amount of vitamin A (2)

District	Infants of 6 to 11 months old		Infants of 1 to 2 years old	
	Population in 2000 ①	No. of necessary vitamin A capsules of 100,000 IU ① × 3	Population in 2000 ②	No. of necessary Vitamin A capsules of 20,000 IU ② × 4
PIURA	11,427	11,427	20,141	60,423
TUMBES	1,727	1,727	3,392	10,176
VILLA MARIA DEL TRIUNFO	2,463	2,463	4,831	14,493
Total	15,617	15,617	28,364	85,092

Total of the numbers shown in Tables 2-3 and 2-4 (vitamin A of 100,000 IU: 23,423 tablets and vitamin A of 200,000 IU: 115,988 tablets) is the necessary number of vitamin A in this Project. The number to be procured shall be the number of package units (for example 500 tablets/bottle) by rounding off fractions.

② Ferrous sulphate

Pregnant women and the infants of less than one year old in Lima, Piura, and Tumbes departments shall be covered by this Project. Based on the "Standard for Prevention and Management of Insufficient Micronutrients" by the Ministry of Health, total of 180 tablets containing 60 mg ferrous sulphate and 250 mcg^{*3} folic acid shall be administered to each of the pregnant women during the half year from the fifth month of pregnancy until two months after

*³ mcg : Abbreviation of microgram. 1 mcg = 1 µg = 10⁻⁶ g

delivery for one tablet a day. To the infants of less than one year old, 10 mg of iron a day shall be administered from 6 months to 1 year old based on the same standard. The amount necessary for one person shall be three bottles containing 180 ml in a bottle by assuming that 3 ml of ferrous sulphate containing 3 mg iron/ml is administered a day (the Ministry of Health considers this administration amount as equivalent of 10 mg iron) for six months.

The necessary amounts of iron sulfate and folic acid in this Project are shown in Tables 2-5 and 2-6.

Table 2-5 Calculation table of the necessary amounts of ferrous sulfate and folic acid (for pregnant women)

District	Estimated No. of pregnant women in 2000 ①	Necessary No. of iron sulfate tablets ① × 180
COMAS	5,366	965,880
CARABAYLLO	1,656	298,080
INDEPENDENCIA	2,302	414,360
EL AGUSTINO	1,802	324,360
VENTANILLA	1,621	291,780
CHORILLOS	2,911	523,980
PIURA	33,012	5,942,160
TUMBES	4,209	757,620
VILLA MARIA DEL TRIUNFO	5,711	1,027,980
Total	58,590	10,546,200

Table 2-6 Calculation table of the number of ferrous sulfate tablets to be procured (for the infants of less than 1 year old)

District	Estimated No. of infants between 6 and 11 months old in 2000 ①	No. of necessary iron sulfate bottles ① × 3
COMAS	8,594	25,782
CARABAYLLO	2,718	8,154
INDEPENDENCIA	3,696	11,088
EL AGUSTINO	3,079	9,237
VENTANILLA	2,468	7,404
CHORILLOS	4,719	14,157
PIURA	3,688	11,064
TUMBES	1,295	3,885
VILLA MARIA DEL TRIUNFO	1,851	5,553
Total	32,108	96,324

The number to be procured shall be the number of package units (for example 10

tablets/blister⁴, 10 bottles/box) by rounding off fractions.

For ① and ②, the composition, dosage form, and administration amount shall be in accordance with those specified by the "Standard for Prevention and Management of Insufficient Micronutrients" by the Ministry of Health. The package inserts and labels shall be written in Spanish.

2) Salt iodization equipment

As mentioned in "2-2 Basic Concept of the Project", this equipment shall be procured only to Piura department among the many departments that requested this equipment at first.

① Potassium iodate

An amount necessary for the salt making plant in Piura department for year 2000 shall be procured.

At the said plant, 450 kg of potassium iodate was used both in 1995 and 1996. In 1997 and 1998, the amounts they used were reduced to 300 kg and 200 kg respectively. This was caused by the fact that because of the phenomenon of El Niño, water invaded into salt fields, causing the salt making impossible. At present, the production amount has been resumed and the amount of potassium iodate used during September 1999 was 46 kg, which is more than the average monthly amount of 37.5 kg they used in 1995 and 1996. In 2000, the present production amount is expected to be kept, and the monthly amount of potassium iodate use is estimated at 41.5 kg. Thus the amount to procure for 2000 shall be 500 kg.

② Iodized salt quality control equipment

The amount of test kits for checking iodized salt shall be the amount to be used by Piura and Tumbes departments in 2000.

As the test method of iodized salt, there are three methods: a) the staff of health center tests the salt by visiting each family, b) schools establish a "salt day", and ask the students to bring the salt they use at their homes to school and test, and c) the authority of each district tests the salt. Methods a) and b) are being used because they are meaningful in evaluating the intake consciousness of iodized salt by the residents.

a) For the test by visiting each family

The staffs of health center visit all the households once a year to test, and visit half of the households once more to test the salt again. The necessary amount of test kits shall be as follows by assuming that one bottle of test kit contains 50 drops and eight bottles are contained in one box (Table 2-7).

⁴ Blister: Means a sheet package.

Table 2-7 Calculation table of the necessary number of test kits for the test by visiting each household

Department	No. of households ①	Test 1	Test 2	Necessary amount (boxes)
		① ÷ 50 drops ÷ 8 boxes = ②	② ÷ 2 = ③	② + ③
PIURA	305,277	764	382	1,146
TUMBES	37,744	95	48	143

b) For the test at school

Tests shall be conducted twice a year. The necessary amount is as follows by assuming that the amount used by one student is 1 drop, one test kit contains 50 drops, and 1 box contains 8 test kits (Table 2-8).

Table 2-8 Calculation table of the necessary number of test kits for schools

Department	No. of students ①	Necessary amount (boxes)
		① ÷ 50 drops ÷ 8 test kits × 2 times
PIURA	230,629	1,154
TUMBES	26,775	134

c) For the test by the authority

Three authorities of each district shall conduct one hundred and eighty tests a year. The necessary amount shall be as follows by assuming that the amount used in one test is 1 drop, one test kit contains 50 drops, and one box contains 8 test kits (Table 2-9).

Table 2-9 Calculation table of the necessary number of test kits for test organizations

Department	No. of districts ①	No. of test conducted in a year	Necessary amount (boxes)
		① × 180 = ②	② ÷ 50 drops ÷ 8 test kit × 3 test organizations
PIURA	69	12,420	94
TUMBES	12	2,160	17

The total of a), b), and c), that is 2,688 boxes, is the necessary amount in this Project.

Furthermore, as the test equipment of iodine contents in the iodized salt to be used by the salt laboratory in Piura, three balances, one drying oven, and one deionizer shall be procured.

③ Salt iodization equipment

In order for the Piura health center to rent the equipment to the salt manufacturers in the community to support the improvement of iodized salt productivity, one each of iodine dropping device, salt mixer, motor for salt mixer, and sealer shall be planned.

2-3-2 Basic Plan

(1) Total plan

1) Cold chain equipment

① Prefabricated cold freezing room

This equipment is planned to be installed in the Central Warehouse of the Ministry of Health and has the purpose to store the vaccines to be delivered to all over Peru. The planned place of installation is a corner of the Warehouse and this equipment shall be installed parallel to the existing freezer and refrigerator rooms. The space and the floor to install this equipment have been already secured. Freezer unit is planned to be installed outside the room, and this space is already secured also. The power supply has been already installed and its circuit has been already contained in the emergency circuit.

② Refrigerator

The electric refrigerators planned for storing the vaccines at the medical institutions in the project area shall be installed at the facilities having power supply equipment. For the facilities having no power supply equipment, gas or solar refrigerator is planned. There is no special problem of infrastructure improvement.

2) Micronutrients and iodized salt related equipment

① Micronutrients

At present, micronutrients are delivered through the medical service network of the Ministry of Health. If the amount to be procured by this Project is delivered to the Central Warehouse of the Ministry of Health, they will be delivered by the Ministry of Health through the present delivery system.

② Iodized salt quality control equipment

These equipment are planned for the quality control of the iodized salt related to the intake of iodine, which is one of the micronutrients, and shall be installed in the Iodized Salt Quality Control Department of the Central Laboratory of department. The requested equipment shall replace the existing one. Therefore there is no need to improve the infrastructure.

③ Salt iodization equipment

For the purpose of improving the quality of manufactured salt at the salt iodization plant and increasing the amount of salt to be manufactured, this equipment are planned to be rented from the Department Health Center to communities. This equipment shall replace the existing one. Thus there is no need to improve the infrastructure.

(2) Equipment plan

As the basic plan condition, replacement of equipment shall be the basic principle. The level of the equipment having the purpose of procurement or increase of function shall be the same as the

existing equipment level. Furthermore, by adding a function to increase the implementation efficiency within the range to satisfy the basic priority principle of the equipment procurement, more beneficial effects is pursued.

The basic priority principle and the basic deletion principle of equipment procurement are as follows.

“Basic priority principle”

- 1) Equipment that will replace the deteriorated equipment
- 2) Equipment that will supplement the equipment clearly insufficient in number
- 3) Equipment that is basically indispensable for the examination at hospitals
- 4) Equipment the operation and maintenance of which is easy and possible
- 5) Equipment the beneficial effects of which is much expected
- 6) Equipment the cost effective of which is large
- 7) Equipment the medical efficacy of which has been established

“Basic deletion principle”

- 1) Equipment that needs large amount of maintenance cost
- 2) Equipment the beneficial effect of which is limited
- 3) Equipment the cost effective of which is small
- 4) Equipment that has the academic purpose but not the examination purpose
- 5) Equipment the more simple substitute equipment of which already exists
- 6) Equipment that is afraid to cause environmental pollution by disposal and so on
- 7) Equipment the medical efficacy of which has not been established
- 8) Equipment having the purpose of personal use by the parties related to hospitals (for the purpose other than the medical activity)
- 9) Equipment having more than the minimum necessary number of items (inefficient or overlapping equipment)

Because almost all or a part of the equipment of this Project can be purchased locally or available from the UNICEF, spare parts and consumables can be easily obtained. In addition, since the equipment is already popular in Peru, the maintenance system can be considered to have been established.

The item, the purpose, and the amount of the planned equipment selected in accordance with the design concept mentioned in the previous section are shown in Table 2-10.

Table 2-10 Details of the Project equipment

No.	Item	Specifications	Purpose	Quantity
1	Prefabricated type Cold Freezing Room	50 m ³ , +8°C to -25°C, assembly type, 220V/60Hz/3-phase, accessories: temperature controller, temperature recorder, temperature alarm, emergency refrigerator unit, SUS shelf, lighting fixture, plumbing and wiring materials	Improvement of vaccine storage capacity	1
2	Electric Refrigerator (medium-size)	13 to 16 ft ³ , 0°C to 8°C, semi-automatic defrost, 2-door type, 220 V/60 Hz	Ditto	114
3	Electric Refrigerator (small-size)	9 to 12 ft ³ , temperature range: 0°C to 8°C, semi-automatic defrost, 2-door type, 220 V/60 Hz	Ditto	102
4	Gas/Electricity Refrigerator	Approximately 200l, 0°C to 8°C, tropical specifications, 2-door type, propane gas, regulator, automatic switch, plumbing materials	Ditto	60
5	Solar Photovoltaic refrigerator system	36 to 40l, 0°C to 8°C, solar battery, condenser, control panel, wiring materials, refrigerator stand, solar battery stand	Ditto	79
6	Freezer	300l or above, -15°C to -25°C, tropical specifications, 220 V/60 Hz	Ditto	50
7	Cold Box (medium-size)	20l or above, polyethylene, insulator: 100 to 110 mm polyurethane, accessory: spare ice pack	Improvement of vaccine storage and transportation equipment	101
8	Cold Box (small-size)	8.5l or above, polyethylene, insulator: 100 to 110 mm, polyurethane, accessory: spare ice pack	Ditto	175
9	Vaccine carrier	1.5l or above, polyethylene, insulator: polyurethane, accessory: spare ice pack	Ditto	1,628
10	Thermometer	Glass thermometer, temperature measurement: alcohol, -10°C to 100°C, accessory: wood or plastic stand with scale	Improvement of vaccine storage equipment	1,965
11	Refrigerated Vehicle for Vaccine Transport Medium Type	Loading capacity: 4-ton, container-type, accessory: refrigeration unit, tropical specifications	Improvement of vaccine transportation equipment	1
12	Refrigerated Vehicle for Vaccine Transport Small Type	Loading capacity: 2-ton, container-type, accessory: refrigeration unit, tropical specifications	Ditto	2
13	Retinol, 100,000 IU	Tablets, 100,000 IU	Improvement of vitamin A deficiency of the infants of less than 1 year old	23,500 tablets
14	Retinol, 200,000 IU	Tablets, 200,000 IU	Improvement of vitamin A deficiency of the infants of less than 2 year old	116,000 tablets
15	Ferrous Sulphate + Folic Acid	Tablets, contains 60 mg elemental iron + 250 mcg folic acid in a tablet	Improvement of iron deficiency of pregnant women	10,546,200 tablets
16	Ferrous Sulphate	Oral solution, contains 3 mg/ml, 180 ml/bottle, with 3 ml measuring spoon	Improvement of insufficient iron intake of the infants of less than 1 year old and prevention of anemia	96,330 bottle
17	Potassium iodate	FCC grade, 50 kg, supply in fibre drums	Improvement of iodine deficiency	500 kg
18	Test kit for checking iodized salt	Test solution to test the 0 to 50 PPM iodized salt, 10 ml/bottle, with color chart	Quality control for the improvement of iodine deficiency	21,472 kits
19	Electronic Balance	Measurement range: 200 to 220 g, accuracy: 0.1 mg, 220 V/60 Hz	Improvement of the quality control laboratory for the improvement of iodine deficiency	1
20	Drying Oven	70l or above, No. of shelves: 2, 220 V/60 HZ	Ditto	1
21	Deionizer	Manufacturing capacity: 4 l/min Type: wall hung type, Accessory: spare resin	Ditto	1
22	Table balance	Measurement range: 2 kg or above, accuracy: 0.1 g	Improvement of salt iodization equipment	2
23	Iodine Dropping Device	Capacity: 20l or above, dropping speed: approx. 15 cc/min	Ditto	1
24	Salt Mixer	Processing capacity: approx. 0.5 ton/hour, Power: 3 Hp, 220 V/60 Hz	Ditto	1
25	Motor for Salt Mixer	Power: 20Hp, 220 V/60 HZ/3-phase	Ditto	1
26	Sealer	Seal length: 36 to 40 cm, Accessory: stand, 220 V/60 Hz	Ditto	1

The items to be procured locally and from third countries are shown in Table 2-11.

Table 2-11 Items planned to be procured locally or from the third country

No.	Item	Country to procure	Reason
2	Electric Refrigerator (medium-size)	Local	Because local procurement of the equipment satisfying the conditions is possible and the supply of spare parts is easy.
3	Electric Refrigerator (small-size)	Local	Because local procurement of the equipment satisfying the conditions is possible and the supply of spare parts is easy.
4	Gas/Electricity Refrigerator	Local / third country	Because there is only one agent at site that can procure the equipment satisfying the conditions. The procurement source should be widened by including the procurement from third countries. In Japan, the equipment satisfying the conditions is not manufactured.
5	Solar Photovoltaic refrigerator system	Third country	Because the equipment satisfying the conditions is not manufactured locally or in Japan.
6	Freezer	Third country	Because the equipment satisfying the conditions is not manufactured locally. The one made in Japan is available, but very expensive.
7	Cold box (medium-size)	Third country	Because the equipment satisfying the conditions is not manufactured locally or in Japan.
8	Cold box (small-size)	Third country	Because the equipment satisfying the conditions is not manufactured locally or in Japan.
9	Vaccine carrier	Third country	Because the equipment satisfying the conditions is not manufactured locally or in Japan.
13	Retinol, 100,000 IU	Third country	Because this item is not manufactured locally, and the item satisfying the conditions is not manufactured in Japan also.
14	Retinol, 200,000 IU	Third country	Because this item is not manufactured locally, and the item satisfying the conditions is not manufactured in Japan also.
15	Ferrous sulphate + Folic Acid	Third country	Because the item satisfying the conditions is not manufactured in Japan. Although this item is manufactured locally, the one manufacturer in the third country is much inexpensive and can be procured.
16	Ferrous Sulphate	Third country	Because the item satisfying the conditions is not manufactured in Japan. Although this item is manufactured locally, the one manufacturer in the third country is much inexpensive and can be procured.
17	Potassium iodate	Third country.	Because this item is not manufactured locally.
18	Test kit for checking iodized salt	Local	Because the equipment satisfying the conditions can be procured locally.
24	Salt Mixer	Local	Because the equipment satisfying the conditions can be procured locally and the spare parts can be supplied easily.

Chapter 3 Implementation Plan

3-1 Implementation Schedule

3-1-1 Implementation Schedule

(1) Budgetary year

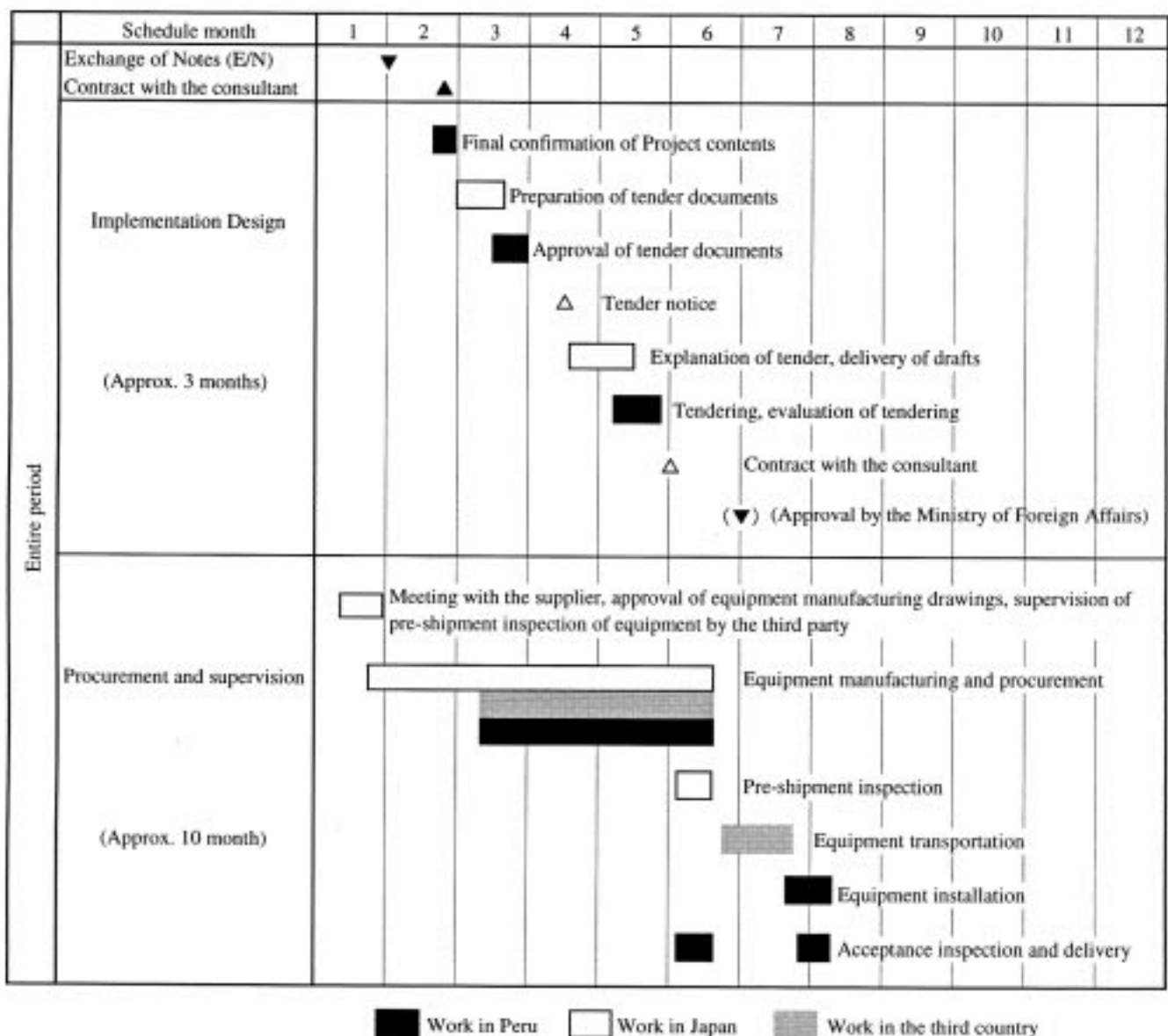
Single year (1999)

(2) Schedule table

Entire period (from E/N to delivery): 12 months

From E/N to contract with the supplier: 4 month

Delivery date (contract with the consultant to delivery): 8 months



3-1-2 Obligations of the Recipient Country

The obligations of Peru for implementing this Project are as follows.

- (1) To pay the notification charge for the authorization to pay (A/P) and the bank handling charge to the Japanese bank based on the banking arrangement
- (2) To promptly unload the procured equipment in Peru and proceed the customs clearance procedure, as well as exempt taxes
- (3) To exempt customs, domestic taxes, and other financial surcharges to be imposed in Peru to the supply of products and services conducted based on the approved agreement to the Japanese nation that must supply the services in relation to the supply of products and services to be conducted based on the approved agreement
- (4) To give necessary conveniences for entering to and staying in Peru to the Japanese nation that must supply the services in relation to the supply of production and services to be conducted based on the approved agreement for implementing the works
- (5) To properly and effectively use and maintain the equipment to be procured by the grant aid cooperation
- (6) To bear all the expenses necessary to transport and install the procured equipment (except for those borne by the grant aid cooperation)

3-2 Project Cost Estimation

Costs to be borne by Peru : None

3-3 Maintenance Plan

In the three departments to be covered by this Project, one maintenance staff of cold chain equipment is allocated to each health district. (Refer to Attachment 6.) In Lima department where there are specially large number of items, engineers of the Ministry of Health are included in the staff. Therefore, the maintenance plan is assumed to be implemented properly if repair parts can be secured. With regard to the technical ability, the PAI (Programa Ampliado de Inmunizaciones) has formulated and is implementing a training and guidance program to the engineers of health districts all over Peru. In addition, because the Ministry's engineers can also take in the technical knowledge from the private companies, it is assumed that there should be no problem. However there is a problem of securing the financial source to purchase the spare parts. Thus it is necessary to strongly suggest the securing of maintenance cost to the Peru side.

Most of the maintenance cost necessary for the equipment to be supplied by this Project is for the cold chain equipment. The annual cost for the cold chain equipment is shown below (Table 3-1). This cost is assumed to become necessary after three years have passed since the equipment is purchased. Securing of the budget by the Ministry of Health by that time is assumed sufficiently

possible from the present economic indices.

Table 3-1 Annual maintenance cost

(Unit: Yen)

Item	No. of items to be maintained	Necessary parts	Quantity	No. of replacements in 10 years	Price	Total price
Prefabricated type Cold freezing room	1	Blower coil unit	1	1	428,000	42,800
		Refrigerator Unit	1	1	108,000	10,800
		Automatic control	1	1	300,000	30,000
		Switch	1	2	25,400	5,080
		Electromagnetic switch	1	2	26,000	5,200
		Auxiliary relay	1	2	15,000	3,000
		Timer relay	1	3	9,600	2,880
		Display lamp	3	2	3,000	1,800
Electric refrigerator	216	Compressor	23	1	50,000	115,000
Gas/Electricity Refrigerator	60	Fire detection part	10	2	1,100	2,200
		Burner	10	5	2,000	10,000
		Thermocouple	10	2	150	300
		Ignition unit	10	5	250	1,250
Solar Photovoltaic refrigerator system	79	Solar module set	6	1	26,500	15,900
		Condenser fan	6	1	10,000	6,000
		Compressor set	6	1	63,500	38,100
		Condenser	6	1	30,000	18,000
		Temperature display set	6	2	73,000	87,600
Freezer	50	Compressor	8	1	63,500	50,800
Total annual maintenance cost						446,710

Other than mentioned above, the salt iodization equipment is included in this project. However this equipment is small in number and size, its maintenance cost can be ignored in the maintenance cost of the entire plan.

Chapter 4 Project Evaluation and Recommendation

4-1 Project Effect

(1) Direct effects

① Cold chain equipment

With the increase of the vaccine storage capacity of the Central Warehouse of the Ministry of Health to 1.5 times and the improvement of the cold chain equipment in the project areas at the same time, vaccines shall be able to store securely. If the equipment supplied in this Project is installed to all the planned facilities, the necessary amount of cold chain equipment in three departments will be improved to sufficient level.

Vaccine transportation is being entrusted to a private transportation company at present, but delivery to some places takes more than ten hours. Vaccines are transported by placing ice packs or dry ices in the cooler box now. For the transportation of long distance, melted ice packs or dry ices must be replaced on the way at present. With the procurement of refrigerated vehicles for vaccine transport, vaccines will be able to be transported safely and securely.

② Micronutrients and salt iodization equipment

With the procurement of micronutrients, vitamin A deficiency of approximately 54,000 infants of less than two years in the poor area of Lima department and in Piura and Tumbes departments, and iron deficiency of 59,000 pregnant women and iron deficiency of approximately 32,000 infants of less than one year old in the poor area of Lima department will be resolved as well as anemia prevention will become possible. In addition, with the procurement of salt iodization equipment, the production amount of iodized salt in Piura department can be doubled, which can satisfy the demand. Thus a proper supply of iodized salt in the project area will become possible.

(2) Indirect effects

① Cold chain equipment

With the implementation of this Project, the budget for the cold chain equipment to the project area can be divided and allocated to the improvement of cold chain equipment in other departments, which will lead to strengthen the cold chain equipment in other departments. Furthermore, the said budget can be used to purchase vaccines or vaccination, which will lead to reduce the treatment cost of patients who may manifest diseases because they do not receive vaccination.

② Micronutrients and the salt iodization equipment

By distributing micronutrients to the infants of up to two years old, the mortality and morbidity of infants will be improved and the blindness can be prevented as well as growth can be promoted. Furthermore, mothers' anemia can be prevented and the mortality of pregnant women can be reduced.

Proper iodized salt can be supplied to the residents of the project area, which will lead to the increase of the amount of iodine intake and improve the residents' malnutrition.

4-2 Recommendation

As the recommendation of this Project, the following items can be considered in relation to the cold chain equipment.

The existing compression-type (electric) refrigerators are old-fashioned and use the Freon gas that will cause environmental destruction as a refrigerant. Thus they must be replaced at an early possibility. Because the refrigerators having exceeded the service life will be replaced in the project area with the cooperation of this Project, the present state will be improved. However there still remains some equipment that needs replacement. The plan to process these items must be formulated and implemented. Because this problem must be handled not only in this project area but throughout Peru, it will be necessary to propose a replacement plan to Peru.

In addition, the number and the quality of maintenance staff are determined to have no problem with regard to the maintenance of the existing equipment. This is because the engineers of the Ministry of Health understand the state of the equipment all over Peru and if any situation occurs in which the maintenance staff of local level cannot handle, the said engineer will visit and instruct the local staff. The Ministry of Health said they would strengthen the technical guidance to the premature engineers of local level and actual activities seem to have been conducted. However, the Ministry of Health expresses they have insufficient budget for implementing this kind of technical guidance. If a cooperation such as the technology transfer of maintenance is securely implemented to all the engineers in the project area when procuring new equipment by this Project, more effective maintenance will become possible.