Basic Design Study
on
the Project for Improvement of Equipment
for
Veterinary Diagnostic Laboratories
in
the Socialist Republic of the Union of Burma

February 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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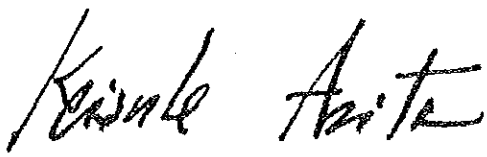
PREFACE

In response to the request of the Government of the Socialist Republic of the Union of Burma, the Government of Japan decided to conduct a Basic Design Study on the Project for Improvement of Equipment for Veterinary Diagnostic Laboratories and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Burma a study team headed by Mr. Tetsuo NISHIMURA, Grant Aid Division, Economic Cooperatin Bureau, Ministry of Foreign Affaires, from October 28, to November 17, 1984. The team had discussions with the officials concerned of the Government of Burma and conducted a field survey in Rangoon, Mandalay, Taunggyi and Bassein. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

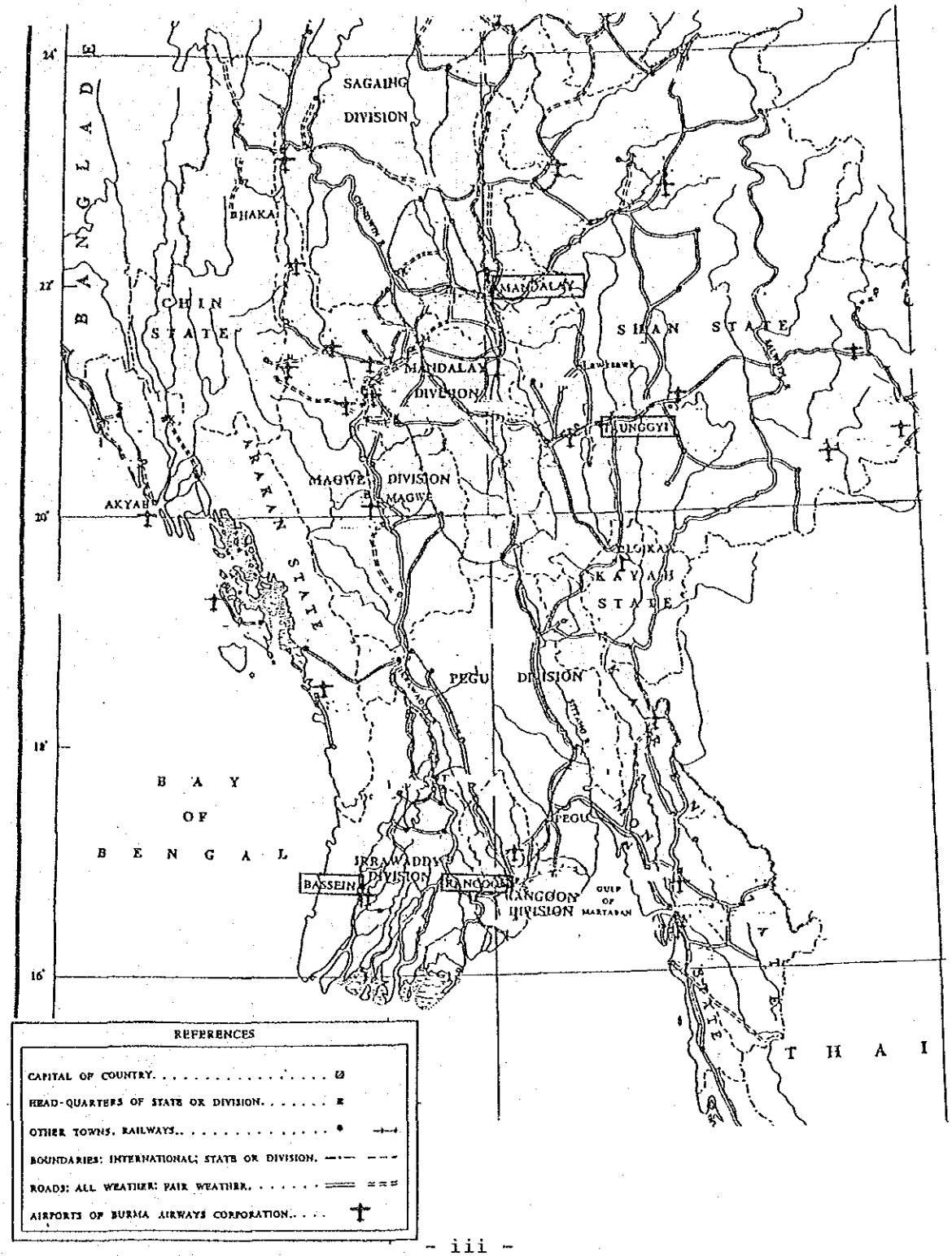
I wish to express my deep appreciation to the officials concerned of the Government of the Socialist Republic of the Union of Burma for their close cooperation extended to the team.

February, 1985



Keisuke ARITA
President
Japan International Cooperation Agency

THE SOCIALIST REPUBLIC OF THE UNION OF BURMA



SUMMARY

Agriculture is the key industry of the Socialist Republic of the Union of Burma, playing an important role in securing stable food supplies for people and earning foreign currency from exports. The livestock industry is also conducive not only to the improvement of people's living standards through provision of livestock products such as meat and dairy products but also to the progress of farming operations by providing animal power.

Development of the livestock industry, therefore, leads to the promotion of agriculture which is closely connected with improving people's living standards. However,some of the biggest obstacles to the promotion of animal husbandry are livestock diseases, especially contagious diseases.

Since 1928, the Burmese Verterinary Research Institute has conducted diagnostic services for major infectious diseases like anthrax, hemorrhagic septicaemia and black quarter. The Central Verterinary Diagnostic Laboratory was established in 1977 in Rangoon. Then regional veterinary diagnostic laboratories were also set up in Mandalay, Taunggyi and Bassein in 1983 under a plan called "Veterinary Diagnostic Laboratories Project" formulated by the Veterinary and Animal Husbandry Department of the Burmese Government, to expand the diagnostic services and study activities. However, because of difficulties in procuring the necessary equipment and materials for these laboratories, the Government of Burma requested grant aid from Japan for improvement of the laboratory equipment and facilities.

In response to the request, the Government of Japan, through the Japan International Cooperation Agency sent a basic design study team to Burma to conduct a survey on the Project for Improvement of Equipment for Veterinary Diagnostic Laboratories. The team visisted Burma for twenty one days from October 28 to November 17, 1984, and had a series of discussions with the officials concerned.

It also gathered necessary data and visited the veterinary diagnostic laboratory's facilities to confirm the Burmese detailed requirements and to clarify the project background and particulars.

The project, representing the key measure of the animal disease control programs, aims to upgrade the equipment and facilities of the Central Veterinary Diagnostic Laboratory in Rangoon and, to simultaneously provide the three regional diagnostic laboratories in Mandalay, Taunggyi and Bassein, which have almost no equipment, with necessary equipment and materials.

Names and organizations of the respective laboratories are as follows:

Name of Laboratory	Organization
Central Veterinary Diagnostic Laboratory	Head of Laboratory Pathology Section Bacteriology Section Virology & Serology Section Parasitology Section Epidemiology Section Toxicology & Biochemistry Section Administrative Section
Regional Veterinary Diagnostic Laboratories: Mandalay Division Taunggyi Division Bassein Division	Head of Laboratory Pathology Section Bacteriology Section Parasitology Section (Toxicology, virology, epidemiology and administration sections will be added in the future)

The Department of Livestock Breeding and Veterinary, Ministry of Livestock Breeding and Fisheries is responsible for the implementation of the project.

When the grant aid takes effect, the project implementation will require about 12 months from conclusion of the exchange of Notes until the completion of equipment delivery and staff training.

Expenses necessary for the maintenance and operation of the Project are estimated at 6 million Kyat a year, which should be appropriated from the budget of the Livestock Breeding and Veterinary Department.

Maintenance and operation plan and personnel plan for the Project have been worked out by the Department and preparations have been made to assign laboratories personnel trained at home and abroad in various new technologies. Therefore, there will be no serious problems of equipment maintenance and operation.

Equipment and materials have been selected on the bases of present and near-future technological levels and environmental conditions. About 400 items have been finally chosen by a process of eliminating inadequate items and adding expendable supplies, chemicals and reagents which are not locally available.

Implementation of this Project is expected to lead to a gradual decrease in the incidence of major animal contagious diseases and will contribute to the promotion of the livestock industry in Burma.

The significance of the Project to be implemented through the Japanese Grand Aid is of great importance and a remarkable outcome from the contribution is expected.

CONTENTS

CHAPTER I. INTRODUCTION

CHAPTER I. INTRODUCTION

The livestock industry is an important component of the Burmese economy which is based on agriculture and it is indispensable in development of the nation. However, animal contagious diseases, which are the greatest obstacle to the growth of the livestock industry, have not yet been controlled despite many years of intensive effort by the government and private sectors.

The Government of Burma, as a result, formulated the Veterinary Diagnostic Laboratories Project in 1983 as part of the counter-measures against animal infectious diseases. It set up the Central Diagnostic Laboratory in Rangoon and regional laboratories in Mandalay, Taunggyi and Bassein. The Government is, however, finding it difficult to procure the necessary equipment and materials for these laboratories because of financial and other reasons and has requested grant aid from Japan.

The Government of Japan, in response to the request, dispatched a basic design study team, through the Japan International Cooperation Agency, to burma for 21 days from October 28 to November 17, 1984, to examine the validity of grant aid program and to study the most suitable items of equipment and materials. (Members and itinerary of the Study Team, are detailed in the Tables 1-1 and 1-2 in the attached appendix.)

The Study Team held discussions with the Government officials concerned, collected data and information and visited the facilities of laboratories under the following items:

(1) Confirmation of the contents of the request for the Project.
(2) Confirmation of the Project background
(3) Positioning of the livestock industry and animal hygiene in the general economy of Burma.
(4) Verification of the validity of the Project.
(5) Verification of Burmese budgetary arrangements.
(6) Confirmation of plans for maintenance and operation of the Project.
(7) Collection of data and information.
(8) Observation of the veterinary diagnostic laboratories

The Study Team held discussions with officials concerned of the Ministry of Planning and Finance, and the Department of Livestock Breeding and Veterinary of the Ministry of Livestock Breeding and Fisheries regarding the above-mentioned items. The team also visited animal husbandry facilities to get information on the actual conditions of livestock industry and animal hygiene in Burma.

This report is based on the analysis conducted in Japan on the result of the foregoing field survey, and contains the background and objectives, validity, contents of optimum scale, Project implementation and maintenance operation system under planning.

CHAPTER Ⅱ. BACKGROUND OF THE PROJECT

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2-1 Overview of Livestock Industry and Animal Hygience in Burma

2-1-1 General Conditions of Livestock Industry

Agriculture is the largest industry in Burma, with fiscal 1983 production accounting for 39.4% of gross domestic product. It employs 63.5% of working population, in fiscal 1983, and exports of agricultural products (mainly rice) represented 51.6% of total foreign exchange earnings.

Cattle are used mainly as work animals for cultivation and transport, but dairy cattle have also been raised in recent years for production of condensed milk and butter which were previously dependent on imports from abroad.

Pigs and poultry are mostly raised by farmers using farm waste as feed. Typically, an ordinary farmer keeps 2 head of cattle, a few pigs and 10 or more fowl.

The Government of Burma puts particular emphasis on the promotion of animal husbandry to increase the production of work cattle, which are essentical to improved agricultural production, and to boost the supply of livestock products. Since 1967, the government has established ten priority project areas where livestock production is being promoted.

Production has been increased in recent years and during the ten years from fiscal 1973/74 to fiscal 1983/84, cattle increased by 28%, buffaloes by 24%, sheep and goats by 80%, pigs by 87%, chickens by 98% and ducks by 79%.

Sheep, goats, pigs and poultry showed remarkable gains. (See Table 2-1)

Production of livestock products also increased but at a level considerably low than the growth in numbers of livestock raised. (See Table 2-2)

1) Cattle

Sagaing, Mandalay and Magwe, (dry plain areas) and Pegu and Irrawaddy in Lower Burma are the five major cattle-raising areas

Table 2-1 Progress in Livestock Breeding

(thousands)

Year	Cattle	Buffalo	Sheep/ Goat	Pig	Fowl	Duck	Quail
2	3	4	5	6	7	8	9
1961/62	5,307	1,020	514	643	7,756	2,416	
1968/69	6,694	1,496	822	1,259	13,616	2,353	
1969/70	6,833	1,541	802	1,478	14,446	3,248	
1970/71	6,993	1,597	759	1,605	15,652	3,464	
1971/72	7,158	1,643	747	1,604	15,840	3,596	
1972/73	7,235	1,601	766	1,489	16,068	3,536	
1973/74	7,267	1,646	732	1,461	15,682	3,186	
1974/75	7,299	1,690	699	1,432	15,296	2,836	
1975/76	7,405	7,718	725	1,578	16,407	2,916	
1976/77	7,526	1,723	750	1,780	16,975	3,176	
1977/78	7,694	1,729	777	1,955	16,968	3,422	
1978/79	7,932	1,769	800	1,985	17,656	3,383	
1979/80	8,307	1,817	805	1,961	20,195	3,720	
1980/81	8,531	1,901	846	2,196	22,407	4,170	6
1981/82	8,857	1,969	1,019	2,631	27,234	4,559	10
1982/83 (Provisional actual)	9,147	2,018	1,173	2,883	29,037	5,368	11
1983/84 (Provisional)	9,338	2,049	1,321	2,734	31,002	5,700	7

Note: All the data are opening stocks.

Table 2-2 Changes in Output of Livestock Products

(in thousands of tons for milk/meat; in millions of pieces for eggs)

Products / Year	Cows' milk	Beef	Pork	Sheet & goat meat	Chicken	Duck meat	Chicken eggs	Duck eggs
1961/62	111.6	17.2	7.9	3.13	12.5	6.94	302	
1971/72	149.5	26.1	24.3	6.40	38.5	9.68	405	94
1972/73	150.3	26.1	22.5	3.42	38.5	9.48	406	93
1973/74	233.8	27.7	25.4	3.75	37.9	10.38	473	107
1974/75	250.2	27.2	23.4	3.43	36.8	7.71	459	79
1975/76	254.0	27.6	25.9	3.55	39.6	7.98	492	82
1976/77	257.5	27.8	29.2	3.68	41.7	8.69	509	89
1977/78	271.1	28.0	32.5	3.79	40.7	9.33	544	96
1978/79	279.3	28.5	33.7	3.92	42.7	9.23	564	102
1979/80	310.3	29.5	32.5	4.00	48.5	10.15	605	104
1980/81	319.8	31.1	36.4	4.20	53.7	11.36	671	117
1981/82	337.6	31.3	36.6	4.01	56.9	15.50	661	149

producing more than 70% of all cattle raised in Burma. The cattle are used as draft animals.

The dry plain areas have been producing cattle for many years, supplying cattle not only to the local market but also to Thailand. Breeds raised include: Pyasein, Shwen, Napyaphu, Thari, etc.; most of them are small-sized, mixed breeds. Breeding is mostly by natural mating although artificial insemination is used in some places. Breeding starts at the age of three to four years with parturition at 18- to 24-month intervals. The breeding period is eight to 10 years long, and the Government bans slaughtering of cattle at less than 17 years of age to promote the reproduction of cattle.

2) Buffalo

Buffaloes are mostly kept in Lower Burma and in the highlands of Sagaing and Shan. Production in Shan has been showing a remarkable increase in recent years.

There are several breeds of work buffalo and Murrah-line dairy buffalo, but no distinct differences in breed are noticeable. The number of dairy buffaloes raised is estimated to be three to five percent of the total. Amount of milk produced per head by dairy buffalo is 1 to 1.5 viss, or 1.6 to 2.4 kg (1 viss = 1.6 kg) per day. Buffaloes' milk, which contains a lot of fat, is more highly priced than other cows milk. Specific conditions for breeding of buffaloes are similar to those of cattle.

3) Sheep and Goats

Many sheep and goats are raised in the dry plain areas of Sagaing, Mandalay and Magwe. They are indigenous breeds and have been crossbred with foreign counterparts, imported in the past. They are raised for production of meat and hide.

Farmers keep an average of five to 10 head per family, raising them mainly by pasturing. They start breeding 12 months after birth and the breeding period is 2 to 3 years.

4) Pigs

Many pigs are kept in Lower Burma, especially in the delta of the Irrawaddy River and in the basin of the Sittang River in Pegu. They are mostly black colored indigenous breeds crossbred with foreign counterpart imported some twenty years ago. Stud boars have been imported recently from Australia and Japan for the Livestock Development Corporation farms and such imported breeds are gradually spreading.

The indigenous pigs start breeding 7 to 10 months after birth and 7 to 8 months for foreign breeds. Breeding is generally done by natural mating although artificial insemination is used for superior breeds. The weight and age of fattening hogs, shipped to market, are 35 to 60 viss (56 to 96 kg), at 10 to 14 months old, for indigenous breed and 60 to 100 viss (80-160kg), at 8 to 12 months old, for foreign breeds. Growth is slow because of poor feeding and high temperature.

5) Chicken

Chickens are raised widely as farmers' backyard poultry. There are indigenous and hybrids with foreign breeds. The egg-laying capacity per chicken is only 50 to 60 pieces a year, weighing 40 to 50 g each. Certain farms, however, are engaged exclusively in raising foreign-breed chickens, producing 180 to 250 pieces annually weighing 50 to 60g each.

6) Ducks

Rangoon, Irrawaddy and Pegu in Lower Burma are the major duck-raising areas, where several breeds are kept in a flock. Farmers keep 20 to 100 ducks per family for eggs and meat.

Chicken represents the largest share of meat production in Burma at 40.3%, followed by pork (25.0%), beef (21.4%), duck meat (10.6%) and sheep/goat meat (2.7%); 76% of total meat production is pork and poultry.

2-1-2 General Conditions of Animal Hygiene

Burma's climate is generally hot and humid except in the highlands and mountainous areas, which have favourable conditions for growing grass necessary for promoting animal husbandry. However, the climate has negative effects on animal hygiene, causing high rates of parasitic diseases. Similarly, insufficient social infrastsucture and traditional farming practices involve high risks of spreading contagious diseases through pasturing and water used for drinking and other miscellaneous purposes.

Additionally, insufficient and poor quality of feed results in poor livestock nutrition which increases the loss of animals for disease and other causes. It also lowers producivity rate of breeding and fattening.

Typical contagious diseases are foot-and-mouth disease, hemorrhagic septicaemia, anthrax and black quarter, of which foot-and-month disease is most common. (See Table 2-3)

The Livestock Contagious Diseases Prevention Law (1936), Glanders and Farcy Control Law (1936), and Livestock Import Control Law (1898) were enacted to take preventive measures against cattle plague, foot-and-mouth disease, anthrax, black quarter, hemorrhagic septicaemia, tuberculosis, surra, glanders, anthrax, epizootic lymphangitis and rabies.

Table 2-3 Major Contagious Disease Outbreak Incidence

State/Division	1981 -82				1982 -83				1983 - 4			
	Foot and Mouth Disease	Hemorrhagic Septicaemia	Anthrax	Black Quarter	Foot and Mouth Disease	Hemorrhagic Septicaemia	Anthrax	Black Quarter	Foot and Mouth Disease	Hemorrhagic Septicaemia	Anthrax	Black Quarter
Kachin	100	7	-	-	80	73	-	-	1,666	-	-	-
Kayah	717	12	-	-	-	5	-	-	896	30	-	-
Karen	248	14	-	18	83	-	-	-	430	-	-	-
Chin	157	5	-	12	213	-	-	86	1,401	-	-	4
Irrawaddy	79	98	-	-	57	-	-	-	5,980	-	-	19
Magwe	239	-	13	210	1,049	6	-	9	-	-	18	119
Rhakhine	1,953	111	-	28	2,309	40	5	3	17,073	80	11	9
Sagaing	5,163	460	99	183	2,238	171	96	80	8,113	288	16	38
Mon	-	-	-	-	117	39	-	-	5,338	-	-	-
Mandalay	2,506	-	-	2	255	-	-	-	-	-	-	20
Shan	1,073	60	20	-	733	124	-	-	783	90	-	2
Tenasserim	-	-	-	-	-	126	-	-	8,109	-	-	-
Pegu	846	2	-	9	3,191	7	1	-	1,949	-	-	-
Rangoon	37	-	-	-	475	-	-	-	7	-	-	-
Total	3,117	769	132	462	0,800	591	102	178	52,745	486	45	211

There has been no incidence of cattle plague since 1957 and prophylactic injections are given to cattle within the national boundary to prevent invasion of the disease from outside the country. (247,000 head of cattle were injected in fiscal 1983/84)

Preventive injections are systematically given to protect against anthrax, black quarter, hemorrhagic septicaemia, hog cholera, swine pasteurellosis, Newcastle disease, fowl pox and pasteurella septicaemia in ducks.

Such programs are undertaken in relation to overall conditions such as incidence of contagious disease, season, age of animals, numbers raised, etc. Injections have been given almost according to plan except for hog cholera, swine pasteurellosis and fowl pox. (See Table 2-4)

However, the vaccine against foot-and-mouth is only given on a trial basis at present because bulk manufacturing of vaccine is still at an early stage. (See Table 2-5)

Although the overall situation of parasitic diseases is not known, diagnoses, conducted at the Central Veterinary Diagnoses Laboratory for one year from April 1983, found parasites in 52% of cattle examined (157/300 head), 45% of pigs (39/86 head) and 17% of chickens (1,492/8,667).

The number of veteriniary staff in the Livestock Breeding and Veterinary Department is 1,430. 169 belong to the head office and auxiliary divisions and 1,261 are stationed in regional offices at township and village level in seven states and seven divisions. (See Table 2-6)

Veterinary institutions belonging to the Department are the Veterinary Research Institute (located at Insein, Rangoon), which is responsible for experiments, research and production of biologics, and the central and regional veterinary diagnostic laboratories. There is a veterinary college giving six-year courses at Pinmana, Mandalay and most of the research staff are the graduates of this college (Institute of Animal Husbandry and Veterinary Science).

The members of research staff trained overseas for learning technology are: six persons for manufacture of foot-and-mouth disease vaccine (in Italy and Thailand); nine for manufacture of virus vaccine (in Japan and Australia); two for bacteria vaccine manufacture (in the U.S.A. and Singapore); and five for disease diagnostics (in Australia, England, Egypt and Malaysia). (See Table 2-7)

Table 2-4 Planning and Execution of Prevention of Infectious Diseases

(thousands)

Year		For Bovine Animals					For Swine		For Fowl	
		Anthrax	H.S.	Black Quarter	Rinder-pest	Hog Cholera	Swine Plague	New-castle	Pox	Duck Septi-caemia and Pasteurellosis
1981 - 82	Plan	5,244	5,850	2,223	389	893	1,038	4,852	994	3,653
	Performance	5,362	5,695	2,202	139	288	224	3,538	334	1,826
	Achievement	102.3%	97.4%	99.1%	35.7%	32.3%	21.6%	72.9%	33.6%	50.0%
1982 - 83	Plan	5,768	6,669	2,379	347	930	1,176	7,500	1,077	4,262
	Performance	6,488	6,664	2,634	164	403	295	4,857	505	2,504
	Achievement	112.5%	100%	110.7%	48.1%	43.3%	25.1%	64.8%	46.9%	58.8%
1983 - 84	Plan	6,299	7,605	2,512	340	986	1,315	8,500	1,160	4,870
	Performance	6,684	7,735	2,721	247	468	381	12,440	618	457
	Achievement	106.2%	101.7%	108.5%	72.6%	47.5%	29.0%	146.3%	53.3%	93.9%

Table 2-5 Production and Distribution of Necessary Vaccines

(Dose in thousands)

Year		For Bovine Animals				For Swine		For Fowl		
		Anthrax	H.S.	Black Quarter	Rinder-pest	Hog Cholera	Swine Plague	New-castle	Pox	Duck Septi-caemia and Pasteurellosis
1981 - 82	Production	6,544	5,621	2,034	125	328	191	0,776	225	2,799
1982 - 83	Production	8,288	8,073	3,189	239	248	199	1,694	416	3,568
1983 - 84	Production	8,104	8,666	3,546	363	383	277	3,949	401	4,560

* All vaccine produced, assumed distributed.

Table 2-6 Livestock Breeding & Veterinary Department
Organization Chart for Veterinary Staff

Sr No.	Particulars	Divisional Level	Township Level	Village Tract Level	Total
1	Head Office with auxiliary divisions	71	53	45	169
2	State & Divisions (Field Service)	62	236	963	1,261
	Total	133	289	1,008	1,430

Table 2-7 Livestock Breeding and Veterinary Department

Trained Technicians (1971 to 1983) Regarding Function of the Veterinary Laboratories

Sr No.	Kinds of Training	No. of Trainees	Man-day or Man-month	Localities of Training Course	Remarks
1	Domestic Training				
1	Animal Health	45	1,246 Man-day	Training Division, Insein	
2	Disease Investigation	35	1,490 Man-day	"	
3	Foot and Mouth Diseases	566	3,435 Man-day	(1) Training Division, Insein (2) Training in all states & divisions	
2	Overseas Training				
1	FMD Vaccine Production	6	36 Man-month	5 trainees in Italy one in Thailand	Present engaged Staff only
2	Virus Vaccine Production	9	49 Man-month	3 trainees in Australia, 6 in Japan	"
3	Bacteria Vaccine Production	2	8 Man-month	One in U.S.A., one in Singapore	
4	Disease Diagnostics Laboratory	5	42 Man-mouth	One in Malaysia, two in Australia, one in England, one in Egypt	

Internal training courses are also given at the Insein Training Division, as well as in each state and division, for personnel mainly engaged in field services, for animal hygiene, disease survey and foot-and-mouth disease.

Actual states of animal infectious disease outbreaks in Burma is not always clearly known because of insufficient diagnostic facilities. The current measures, such as vaccinations, are really only for classic diseases. If the plan for improvement of animal hygiene is to be performed satisfactorily, it is essential that in-depth scientific epidemiological studies are made so that proper adequate preventive measures can be taken.

The proposed project for improvement of diagnostic facilities by an equipment grant from Japan can be considered, in this context, an important undertaking to build up the fundamental conditions for improving animal hygiene in Burma.

2-2 Conditions of Animal Husbandry and Hygiene in the Program Areas

2-2-1 Rangoon Division

Rangoon Division has 4.9% of cattle, 6.1% of buffaloes, 1.6% of horses, 9.0% of pigs, 2.4% of goats, 9.6% of chickens, 29.0% of ducks, 17.6% of geese and 29.5% of swans raised in Burma as a whole. Sheep are not raised in the area. Large number of pigs and poultry are raised because the Rangoon Division is the nation's foremost urban area.

Additionally it has the 10-mile Livestock Breeding Corporation farm, constructed with technical assistance from JICA, which is undertaking improvement and reproduction of pigs and chickens donated from Japan for distribution to farms of the Livestock Corporation. It, therefore, plays an important role as a breed improvement center.

Foot-and-mouth disease breaks out in the division every year and, in 1984, the disease occurred at the 10-mile farm causing a heavy loss of pigs.

2-2-2 Mandalay Division

Mandalay Division keeps 15.4% of cattle, 5.4% of buffaloes, 17.7% of horses, 10.3% of pigs, 43.7% of sheep, 38.3% of goats, 9.3% of

chickens, 2.5% of ducks, 8.0% of geese and 2.7% of swans raised in Burma as a whole.

Numbers of sheep and goats raised in Mandalay are the highest in the country, horses and pigs are second and cattle and geese, third.

Although many herbivorus animals are raised in Mandalay Division, there is insufficient grazing and grass seeds have been introduced from Australia for study of adaptable grass species at Shankangui Pasture Demonstration Farm. Sintkaing Dairy and Meiktila Thapan Sheep Breeding Farms are also undertaking improvement work for dairy cattle and sheep, respectively.

Foot-and-mouth disease occurred in the division from 1981 to 1983 but no incidence has been reported since then. Two cases of black quarter were reported in 1981 to 82 and 20 cases in 1983 to 84.

2-2-3 Taunggyi (Shan State)

Shan State's share of animal numbers is 9.0% of cattle, 19.9% of buffaloes, 34.7% of horses, 9.1% of pigs, 1.0% of goats, 4.4% of chickens, 1.8% of ducks, 4.0% of geese and 1.6% of swans. The state ranks top for numbers of buffaloes and horses and is middle ranked for cattle. It keeps low percentages of goats and fowl and no sheep.

The Taryaw State Livestock Farm is engaged in dairy cattle, pigs and chickens breed improvement.

Since 1981, there have been 700 to 1,000 cases of foot-and-mouth disease every year as well as hemorrhagic septicaemia. Two cases of black quarter were reported in 1983-84.

2-2-4 Bassein (Irrawaddy Division)

Irrawaddy Division's share of animals is: 11.5% of cattle, 12.8% of buffaloes, 2.4% of horses, 20.3% of pigs 2.4% of goats, 17.0% of chickens, 26.7% of ducks, 36.5% of geese, 48.4% of swans and no sheep. The division holds first position for numbers of pigs, geese and swans, second place for chickens and the third for ducks. Holdings of cattle and buffaloes are high in nationwide averages.

Foot-and-mouth disease occurs every year and, in 1983/84, 5,980 cases were recorded along with 19 cases of black quarter. (See Table 2-8)

Preventive injections being applied collectively to cattle in rural districts

Sheep grazing

Table 2-8 Animal Population by State and Division (1983 - 84)

(thousands)

Sr No.	States & Division	Cattle	Buffalo	Horses	Pigs	Sheep	Goats	Chicken	Ducks	Geese	Swans
1	Kachin	182	125	3	137	-1	10	808	29	20	4
2	Kayah	61	26	1	36	-	1	283	5	4	-
3	Karen	248	49	3	85	-	27	822	102	11	4
4	Chin	65	17	10	140	-	33	591	4	-	-
5	Sagaing	1,582	295	14	258	98	112	2,674	49	12	2
6	Tenasserin	83	90	1	33	-	7	623	97	8	3
7	Pegu	1,012	194	6	334	-	17	5,387	1,601	42	17
8	Magwe	1,502	83	12	242	57	280	4,767	56	6	1
9	Mandalay	1,400	110	22	280	123	392	2,787	148	34	7
10	Mon	321	64	4	72	-	24	878	231	23	14
11	Rakhine	501	201	-	52	-	61	1,158	86	19	1
12	Rangoon	456	125	2	245	-	25	2,889	1,646	75	76
13	Shan	844	408	43	246	-	10	1,321	103	17	4
14	Irrawanddy	1,075	262	3	550	-	25	5,100	1,517	156	125
	Total	9,332	2,049	124	2,710	277	1,024	30,088	5,674	427	258

2-3 Present Status of Veterinary Diagnostic Laboratories under the Project

2-3-1 Central Veterinary Diagnostic Laboratory in Rangoon

(1) History

The Central Veterinary Diagnostic Laboratory was established on May 1, 1977 under the Diagnostic Services Division of the Livestock Breeding and Veterinary Department. Prior to the opening of this laboratory, examination of highly infectious diseases such as anthrax, hemorrhagic septicaemia, black quarter and Newcastle disease was conducted at the Veterinary Research Institute establshed in 1928. In 1977, the examination services were transferred to a new laboratory, which had upgraded and expanded functions, within the compound of the Veterinary Research Institute. It moved again to the present new building upon completion on June 6, 1983.

(2) Location and building of the laboratory

The laboratory is located at Station Road, Insein, Rangoon (about ten miles (16 km), from the heart of the city), where there are other Livestock Breeding and Veterinary Department facilities. (See Figure 2-1 Layout Plan of Buildings of the Veterinary and Animal Husbandry Dept. at Insein, Rangoon)

The layout plan of the laboratory building and the room arrangement plans are shown in Figure 2-2.

Major equipment at the laboratory is indicated in Table 2-9.

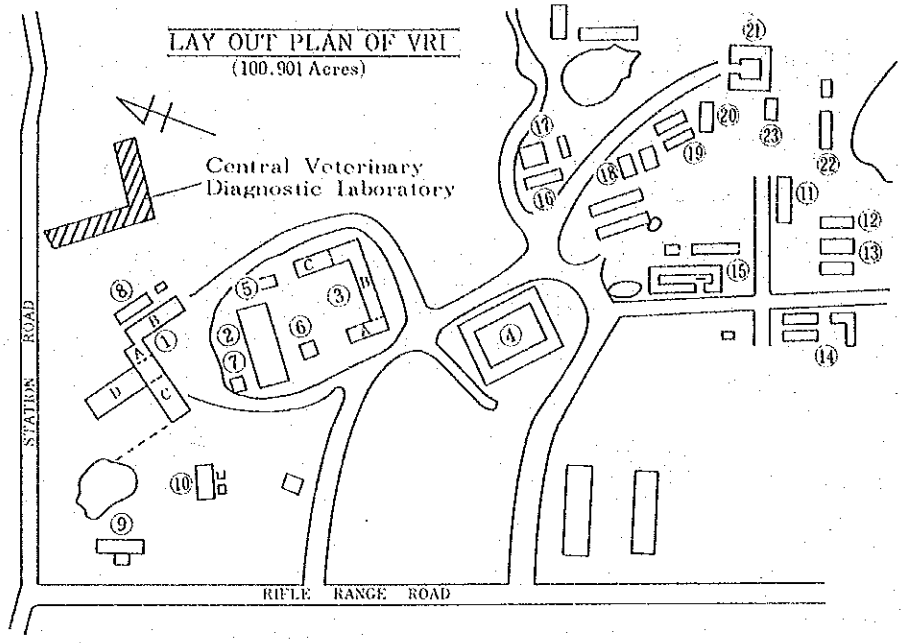
(3) Organization of the laboratory

The laboratory consists of seven sections organized under the head as shown in Figure 2-3.

(4) Staff

The laboratory has a present staff of 34 (fiscal 1983/84), scheduled to increase to 110 persons after the Project is completed. Table 2-10 lists the breakdown of personnel.

Figure 2-1 Layout Plan of Buildings Affiliated to the Livestock Breeding and Veterinary Dept. at Insein, Langoon



GENERAL LAYOUT OF VRI

1. A: Office Room
   B:
   C: Bacteriology Laboratory
   D: Virology (avianized) Laboroy
2. Storage and Sterilization Building
3. A: Quality Control Laboratory
   B: Virology (tissue culture) Laboratory
   C: Foot and Mouth Laboratory (FMD)
4. Virology (tissue culture) New Building
5. Overhead Tank
6. Power Station
7. Duty Officer Station
8. Boiler Room
9. Artisan Well and Pump House
10. Gas plant
11. New Quality Control Laboratory
12. Test Animal House
13. Laboratory Animal Breeding Houses
14. Laboratory Animal Breeding Houses
15. Vaccine Challenge House
16. Store
17. Store
18. Store
19. Store (New)
20. Store
21. Bull-shed
22. Animal House
23. Cattle Pen

Figure 2-2 Livestock Breeding and Veterinary Department
Central Veterinary Diagnostic Laboratory (Plan)

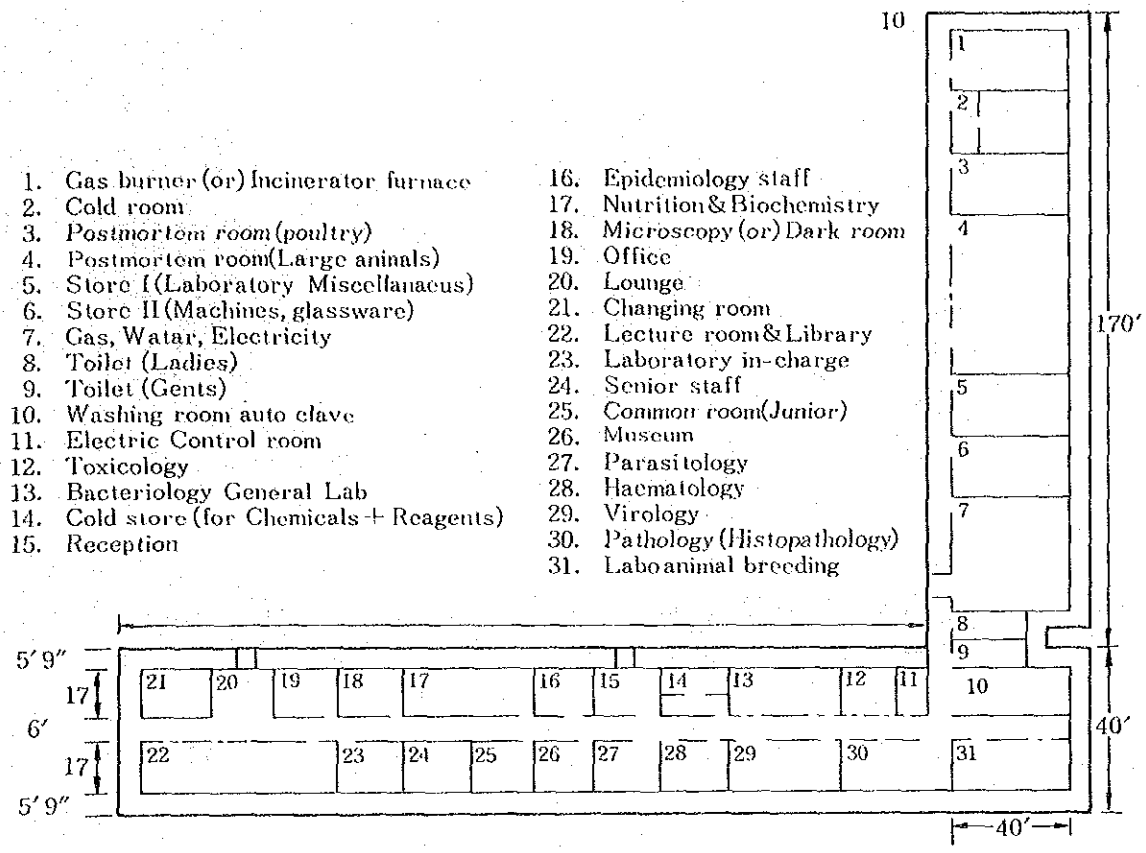


Table 2-9 List of Major Equipment at the Central Veterinary Diagnostic Laboratory (as of Nov., 1984)

Sr No.	Description	No.	Remarks
1	Autoclave	1	
2	Anaerobic Jar	5	
3	Air Conditioner	3	
4	Balance (Electric)	5	
5	Balance (Student)	4	
6	Balance (Spring)	2	
7	Cool CO_2 Incubator	1	
8	Central Cooling Machine	1	
9	Centrifuge	3	
10	Deep Freezer (small & large)	2	
11	Drying Cabinet	1	
12	Dressing drum Sealant	1	
13	Egg Incubator	2	
14	Gas oil tank	1	
15	Hot Air Oven	1	
16	Incubator	3	
17	Microscope (Mono)	4	
18	" (Bino)	2	
19	" (Dissecting)	1	
20	" (Dissecting Stereo)	4	
21	" (American Optical Set)	1	
22	Mixer & Blender	1	
23	Microtome	6	
24	Microhaematocrit	1	
25	Motar	1	
26	Histokinetie	1	
27	P.E. Meter	9	
28	Pressure Cooker	1	
29	Fretridish Container	24	
30	Sterilization Box	3	
31	Sterilizer (Instrument)	1	
32	Refrigerator (large)	5	
33	" (small)	3	
34	Tissue Homogeniser	1	
35	Water Bath	5	

Figure 2-3 Organization of the Central Veterinary Diagnostic Laboratory

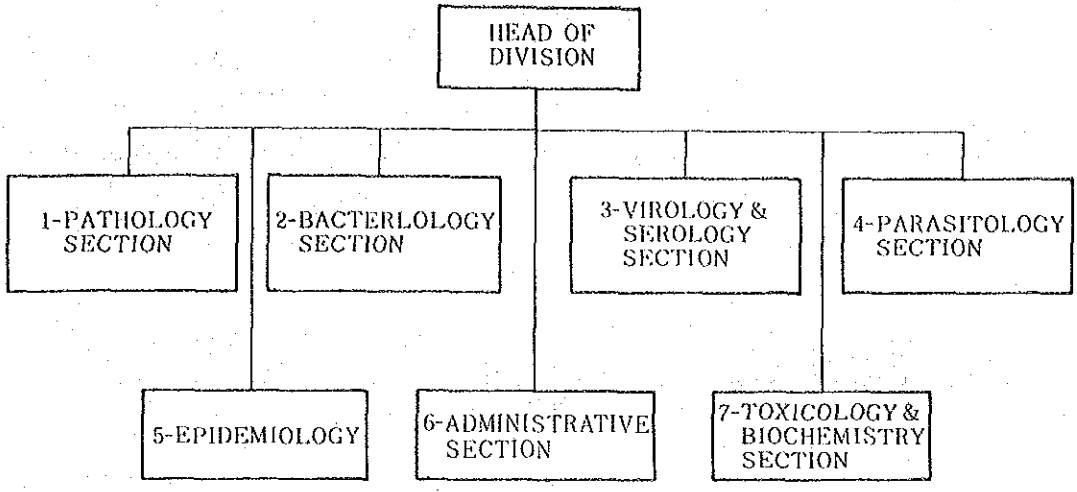


Table 2-10 Breakdown of Personnel at the Centeral Veterinary Diagnostic Laboratory

	Laboratory Staff	Proposed	At present (1983 - 84)
1.	Head of Division	1	1
2.	Senior Veterinary Research Officer	1	-
3.	Veterinary Research Officer	17	4
4.	Researcher	16	3
5.	Branch Clerk	1	-
6.	Assitant Researcher	7	15
7.	Upper Divisional Clerk	4	1
8.	Laboratory Technician	20	-
9.	Lower Divisional Clerk	6	1
10.	Skilled Labourer	25	1
11.	Labourer (LAB)	12	3
12.	Labouror (Office)	-	1
		110	30

(5) Projected laboratory activities

(a) Laboratory diagnostic services for animal diseases

(b) Epidemiological diagnosis of major animal diseases and preventive measures

(c) Participation in the programs for eradication of animal contagious diseases in the country.

(d) Research work on pathogenicity, immunogenicity and clinical medicines

(6) Functions of each section

(a) Pathology section (Reception, post-mortem examination, clinical pathology, histopathology):

(i) Receive all sick or dead animals and various samples for examination, gather information in respect of such cases or investigations.

(ii) Transit observations on pathological anatomy and other examinations as well as samples to other sections concerned.

(iii) Conduct histopathological examinations.

(iv) Collect examination results from other sections, compile and diagnose the case and report to the rspective person, department or corporation concerned.

(v) Conduct investigations on contagious diseases and publicity work.

(b) Bacteriology section

(i) Isolate, culture and identify bacteria.

(ii) Examine the sensitivity of bacteria to antibiotics and other therapeutic agents.

(iii) Report examination results to the Epidemiology Section.

(c) Virology and serology section

(i) Identify virus.

(ii) Diagnose hypersensitivity, anaphylaxis, serum sickness, haemolytic diseases of newborns, etc.

(iii) Conduct serological diagnosis of infectious diseases such as brucellosis, paratuberculosis and mycoplasmosis.

(iv) Report examination results to the Epidemiolog Section.

(d) Parasitology section

(i) Examine external parasites.

(ii) Conduct quantiative analsis of internal parasites.

(iii) Examine blood parasites.

(iv) Culture internal parasites.

(v) Report findings to the Epidemiology Section.

(e) Epidemiology section

(i) Compile diagnostic results of all sections.

(ii) Record and categorize all diagnostic results according to species, locality or geography.

(iii) Conduct animal health surveys using questionnaires, farm inspections and samples to monitor and systematically record seasonal/regional distribution of diseases, disease incidence and mortality of animals.

(iv) Conduct field surveys of disease-affected areas.

(f) Toxicology and biochemistry section

(i) Conduct biochemical examinations.

(ii) Report findings to the Epidemiology section.

(g) Administration section

(i) Management of laboratory staff.

(ii) Laboratory accounting.

(iii) Keep laboratory animals.

(iv) Plan and report laboratory activities.

(7) Laboratory's performance in diagnostic services

As shown in Table 2-11.

(8) Research reports submitted by the laboratory

The laboratory conducts research related to its diagnostic services. Principal research papers submitted by the laboratory in the past are as follows:

(a) Identification of coccidian species from poultry post-mortem cases.

(b) Research on brucellosis of dairy cows using R.B.F.T. and S.A.T. serological techniques.

Table 2-11 Number of Cases of Diagnosed Animal Diseases

	Blood		Ear tips & Miscellaneous	Animal by-product		Bacterio-logical swabs	P.M. Cases		Remarks
	Smear	Sample		Hide	Bone		Poultry	Others	
	Nos	Nos	Nos	Nos	Tons	Nos	Nos	Nos	
1976 - 77 to 1980 - 81	1,907	6,680	5,190	295,122	1,137	1,755	18,777	900	
1981 - 82 to	239	8,736	2,517	71,700	-	8,876	7,636	239	
1982 - 83	381	3,916	1,749	115,900	100	1,848	6,146	189	
1983 - 84	3,386	13,243	88	62,000	510	6,629	11,718	279	
Total	5,913	32,575	9,544	544,722	1,747	19,108	44,277	1,607	

(c) Survey on lung worm infections in pig farms.

(d) Haematological examination on calves born by artifical insemination in the Rangoon Division. Bacteriological examination and isolation of faecal samples from artificial insemination-bred calves, and study of blood parasites in apparently healthy calves within Rangoon Zonal Area.

(e) A study on chicken omphalitis in the Greater Rangoon Area.

(f) A study on the causes of piglet mortality due to the gastrointestinal tract diseases.

(g) Medical treatment and prevention of mastitis of dairy cows.

(h) Causes of reproductive failures of sows.

(i) A study on chronic respiratory disease of chickens in the Greater Rangoon Area.

(j) A study on pasteurella organisms in the upper and lower respiratory tracts of pigs.

2-3-2 Mandalay Regional Veterinary Diagnostic Laboratory

(1) History

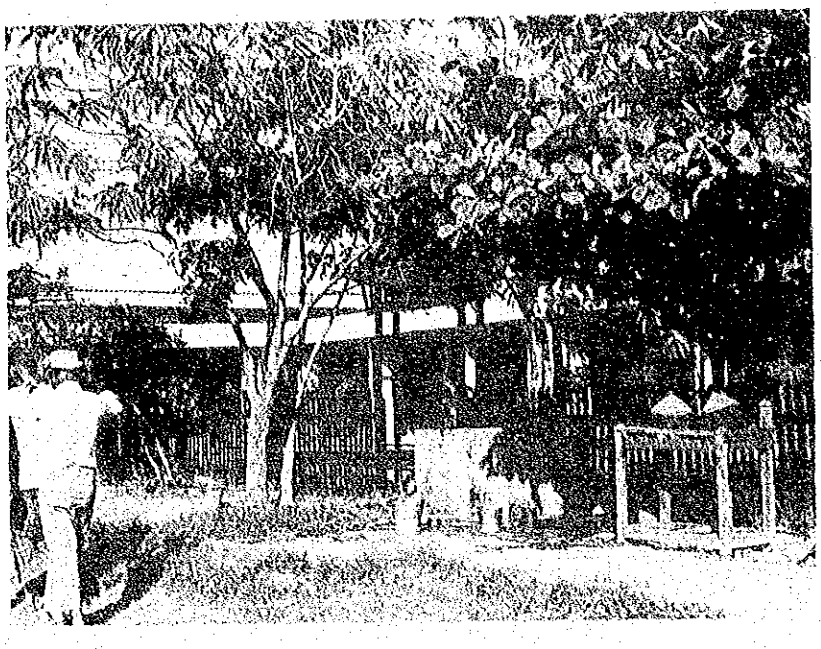
Mandalay Division is almost centrally located in Burma, and raises large numbers of animals. So construction of a regional laboratory building was started in 1981, at about the same time as construction of the Central Diagnostic Laboratory. It was completed and commenced work in December 1983. At present it has only three sections: pathology, bacteriology and parasitology, but virology, serology and hematology sections will be set up upon completion of the equipment improvement project.

(2) Location and building

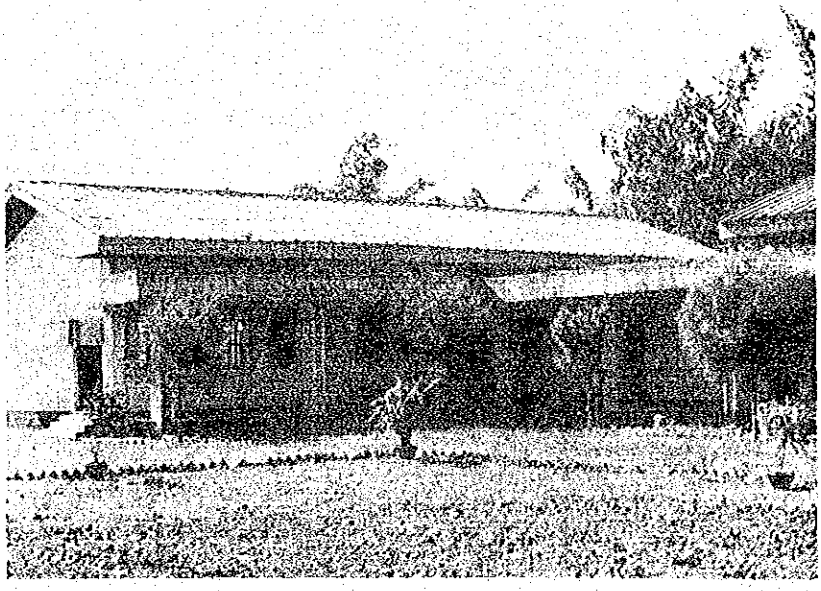
The laboratory is located adjacent to the road running between Mandalay City and the Mandalay Airport, 7 miles (11 km) southeast of Mandalay City centre.

Laboratory buildings and room arrangement plans are as shown in Figure 2-4.

Although a part of the building is in temporary use for artificial insemination services at present, it will be transferred to another place when the equipment improvement project is completed.



Regional Veterinary Diagnostic Laboratory in Mandalay



Regional Veterinary Diagnostic Laboratory in Bassein

Figure 2-4 Plan of Regional Veterinary Diagnostic Laboratory

1. Bees Keeping & Bees' Disease Research
2. Parasitology
3. (Washing, Sterilization and General Preparation) Bacterilogy
4. Bacterilogy (Media Preparation Isolation + Identification)
5. (a) Staff Common Room
   (b) Office (Records Keeping + General Epidemiology)
6. (a) Pathology + Reception
7. (a) Lab; Animals
   (b) Toilet
8. }A. I (2) TEMPORARILY OCCUPIED
9. }
10. }
11. Postmortem Room
12. Corridor

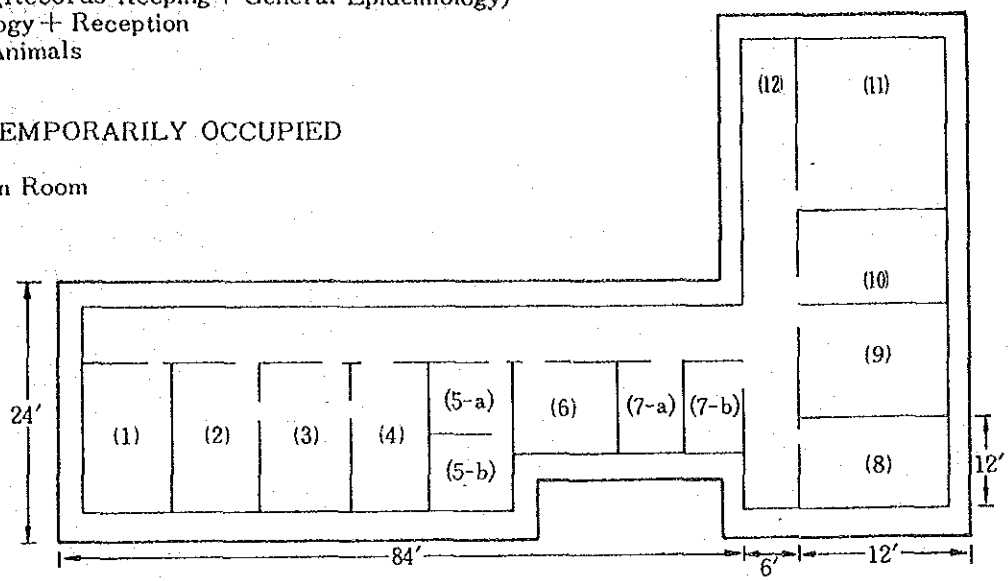
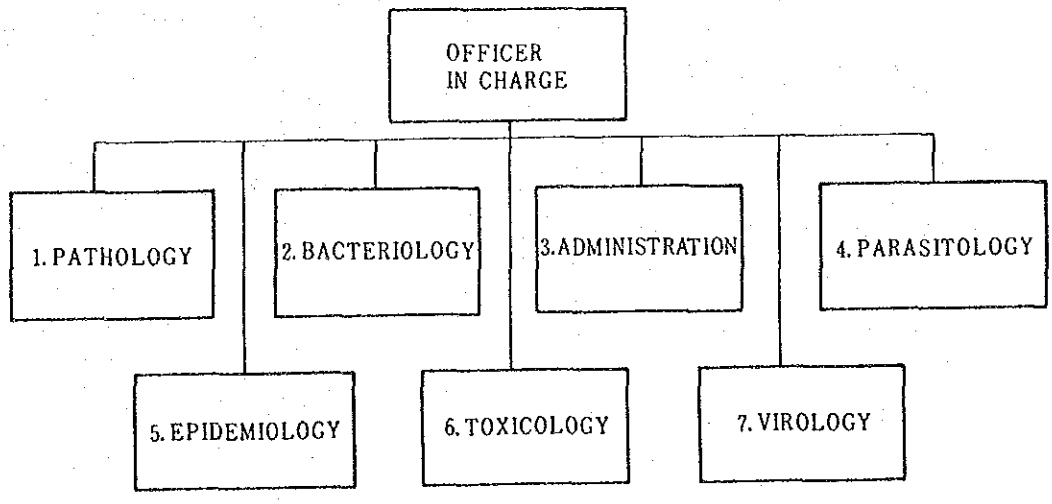


Figure 2-5 Regional Veterinary Diagnostic Laboratory



(NOTE): SECTIONS (5) (6) (7) are not established

Current laboratory equipment only consists of a high-pressure steam sterilizer, dry heat sterilizer, incubator and microscope.

(3) Organization

The laboratory officer-in-charge controls three sections, which will be expanded to seven in the future, as shown in Figure 2-5.

(4) Staff

Existing staff consist of five members but they will be increased to 18 after the equipment is augmented. The breakdown of the personnel is shown in Table 2-12.

Table 2-12 Regional Veterinary Diagnostic Laboratory

	Laboratory Staff	Proposed	At present (1983 - 84)
1.	Officer-in-charge	-	-
2.	Veterinary Research Officer	3	-
3.	Researcher	3	3
4.	Assitant Researcher	1	1
5.	Laboratory Technician	3	-
6.	Lower Divisional Clerk	1	-
7.	Skilled Labourer	4	1
8.	Labourer (LAB)	2	-
9.	Labouror (Office)	1	-
		18	5

(5) Projected laboratory activities

(a) Responsibility for animal health improvement programs in Mandalay Division, Sagaing Division, Chin, Kachin and Northern Shan States.

(b) Presently only carries out diagnostic services for detecting bacteria and parasites.

(c) Diagnostic services for animal diseases in the Livestock Development Corporation, military and other government farms.

(d) Epidemiological surveys on major animal diseases and study of preventive measures against such diseases.

(e) Study of traditional goat-farming practices in Upper Burma, with special reference to the diseases of kids, and the causes of mortality and reproductive failures.

(6) Functions of each section

(a) Pathology section

(i) Receive sick or dead animals and various post-mortem materials for pathological examination. Collect information regarding features of the diseases.

(ii) Send the observations and specimens obtained by the post-mortem examination to other sections. If toxicological testing is required, then specimens are to be sent to the National Health Laboratory in Rangoon.

(iii) Collect and compile the results of examinations from other sections for making final diagnoses.

(b) Bacteriology section

(i) Identification of bacteria.

(ii) Plate tests in cases of suspected chronic respiratory disease and pullorum disease.

(iii) Bacteriological examination of various specimens sent from field veterinary staff-members, Forest Department and Livestock Breeding Corporation's farms.

(iv) Sensitivity tests on antibiotics, etc. Veterinary medical suggestions and advice to animal owners.

(v) Examination of milk samples for tuberculosis.

(vi) Preparation of materials for animal inoculation.

(c) Parasitology section

(i) Examination of internal parasites.

(ii) Examination of external parasites.

(iii) Examination of blood parasites.

(iv) Survey of parasitic diseases and periodic activities for prevention and control of diseases.

(v) Research on effectiveness of anthelmintics.

(vi) Technical assistance to animal-breeding model villages and private dairy farms for parasite control activities.

(7) Research programs at regional level

Research on the incidence of infectious and general diseases, examinations of bacteria and parasites, bacteriological inspection of slaughter houses, study on reproductive failures of dairy cattle and other research work are scheduled to be conducted.

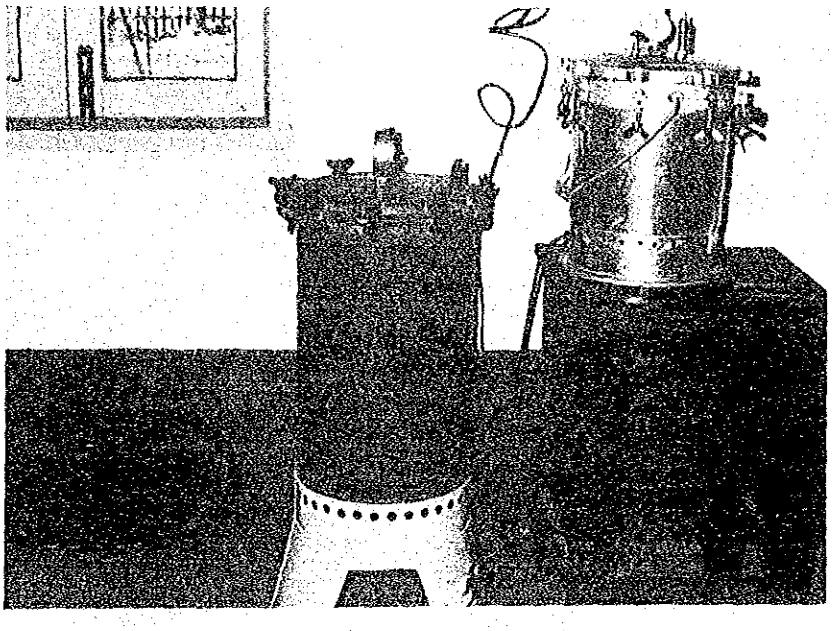
2-3-3 Taunggyi and Bassein Regional Veterinary Diagnostic Laboratories

These two regional laboratories, have completed buildings, some personnel but no equipment.

The buildings are of the same design as the Mandalay Laboratory. The interior power and water supply systems have been completed but the supply power main has not been connected. A transformer is ready for installation, but there are no incidental materials and these are included in the list of grant equipment and materials. The water supply to the Taunggyi Laboratory is in short supply during the dry season because of the location at the end of the city water supple line. Construction of a by-pass line from the water supply source is, therefore, required.

When the two regional laboratories commence operations with sufficient equipment and personnel, their organization, activities and sectional functions will be similar to those of the Mandalay Regional Laboratory.

Postmortem Examination of Chicken at Mandalay Regional Diagnostic Laboratory



Existing Equipment (High-pressure Sterilizer) at Mandalay Regional Veterinary Diagnostic Laboratory

CHAPTER Ⅲ. DESCRIPTION OF THE PROJECT

CHAPTER Ⅲ. DESCRIOPTION OF THE PROJECT

The first required equipment list originally submitted to the Government of Japan by the Government of Burma in connection with the Project for Improvement of Equipment for the Veterinary Diagnostic Laboratories, consisted of 31 items of equipment, including CO_2 incubators, indicated in the Table 1-6 in the appendix. A second list, which was submitted afterwards in Burma is comprised of a wide range of items (shown in the Table 1-7 in the appendix) and covers equipment, furnishings and consumable goods for each pathology, bacteriology, virology, parasitology, biochemistry section and library, etc. It includes all kinds of equipment required for diagnostic services at each section and ranges from electron microscopes and vans for collection of diagnostic materials to glass slides.

3-1 Contents of the Request

Comprehensive diagnostic services are performed by examining the causes of a disease at respective sections of laboratories and by correlating the results. Therefore, each section's functions should be performed at the same technological level and imbalances between sections will cause unfavorable results.

In this respect, there seems to have been no coordination between respective sections and it is presumed that lists of required equipment were prepared according to each section's independent requirements.

Contents of the requested equipment of each section are outlined as follows:

(1) Pathology: Equipment for pathological work ranging from collection of morbid materials to preparation of specimens and microscopic examination.

(2) Bacteriology and Virology: Equipment for work ranging from extraction of pathogens to isolation, culture and identification.

(3) Parasitology: Equipment for work ranging from picking and collection of parasite eggs to egg culture and microscope examination.

(4) Biochemistry: Equipment for analysis of blood and urine, serum reaction and other tests.

(5) Others: Vans and motorcycles for field collection of diagnosis materials. Micro-films and micro-computer for filing, compilation and analysis of records.

Particulars of equipment required by respective sections are presented in Tables 1-6 and 1-7 in the appendix.

3-2 Positioning of the Proposed Project with Respect to the "20-year Longterm Plan of Burma (1974–1994)" and the "Fourth 4-year Plan (1981–1985)".

The "20-year long-term Plan ..." gives top priority to "development of primary industries such as agriculture, forestry and fisheries to expand the exports of primary products" for attainment of long-term development goals.

Furthermore, the current 4-year development plan sets its goal for livestock industry to "expand the financial and technical assistance to livestock farms and to promote the development of large-seale animal husbandry projects in the vicinity of urban districts". The growth of livestock industry and fisheries is projected to be 8.2%, much higher than 5.4% for general agriculture.

The proposed, equipment improvement project, represents part of the livestock industry development plan of the nation. Large animals, like cattle, play an important role as work animals in farming operations. Therefore, diseases of such animals cause both loss of livestock and difficulties in farming. The Burmese Government also aims to enlarge the scale of small and medium livestock-raising operations, in the vicinity of urban districts, to meet increasing urban requirement for animal protein.

Small-scale livestock breeding operations put major emphasis on medical treatment of sick animals but the growing scale of animal husbandry in Burma requires greater emphasis on preventive measures against disease. Systematic, preventive measures are essential for establishing preventive, hygienic, conditions. Also in the event of a sudden outbreak of an infectious disease, appropriate and prompt countermeasures using early discovery and diagnosis must be taken. Such work is to be

the responsibility of the veterinary diagnostic laboratories. Improvements in equipment and facilities of diagnostic laboratories are, therefore, essential for the performance of the development programs for agriculture and livestock industry.

3-3 Priorities for Equipment Required

It is difficult to decide as order of priority for equipment for each laboratory section because the diagnostic services make final judgements on the disease through comprehensive study of the examination results obtained by respective sections. However, in view of the fact that the veterinary diagnostic laboratories have the prime duty of performing diagnostic work on contagious diseases, greater emphasis has been given to equipment for bacteriology, virology and pathology sections.

Furthermore, as described in Section 2-3 (Present Status of Veterinary Diagnostic Laboratories) there are differences in the activities between the central and regional laboratories. The Central Laboratory is part way between the equivalent Japanese animal health service center at prefectural level and the national institute of animal health. It has both advnaced diagnostic services and research functions. Regional Laboratories have the equivalent combined functions of Japan's animal health service center at prefectural level. They are basically engaged in relatively simple diagnostic services and preventive activities. Suitable items of equipment have been chosen, taking such functional differences into consideration, so that they may match the respective functions of the laboratories. Due consideration has been given to the Mandalay Regional Laboratory, in the light of the large number and heavy density of livestock raised in the area, as well as geographical conditions, to enable it to perform almost all the necessary diagnostic services for the central area of Burma.

Particulars of selected equipment are listed in Table 4-2.

3-4 Description of the Project

3-4-1 Central Veterinary Diagnostic Laboratory

The projected activities of the Central Laboratory are mentioned in Subsection 2-3-1.

(1) The prime objective of the laboratory lies in the diagnostic services. In view of existing animal health conditions in Burma, development of the livestock industry cannot be achieved without eradicating animal diseases. Efforts to minimize the damage to livestock by disease, through improvement of diagnostic functions, will lead to growth of the livestock industry and Buruma's request for a grant for improvement of laboratory equipment is considered reasonable. in this respect.

(2) Epidemiological diagnosis of principal diseases and preventive measures, represent the first step for eradication of disease. The Veterinary Research Institute manufactures vaccines but does not produce the diagnostic solutions needed for the epidemiological diagnosis. It is therefore necessary, that either the Veterinary Research Institute or the Central Diagnostic Laboratory produce diagnostic solutions.

(3) It is reasonable for laboratory staff to give technical suggestions with regard to the Laboratory's participation in infectious disease eradication programs, although the execution of the programs will be the work of other government authorities.

(4) It will be difficult to raise the technological standards of the laboratory to international levels, because of the present gap between the Laboratory and world standards without help from abroad. Introduction of foreign experts and overseas training of technicians will be necessary.

(5) Research work on animal diseases will be good because it will not only keep the laboratory work from becoming stereotyped, as a result of engagement solely in diagnostic activities, but also because it will upgrade the technical level. To assist in research work, foreign literature and information should be collected and actively studied.

Although it has not been mentioned in the projected activities, the Central Diagnostic Laboratory plans to train personnel from

regional laboratories. This will improve their technical level and also spur the Central Laboratory's staff enthusiasm for research work.

3-4-2 Regional Veterinary Diagnostic Laboratories

Although only the Mandalay Regional Laboratory is presently operating, the activities of the other two regional laboratories will be similar to it. The projected activities of the Mandalay Laboratory are, therefore, discussed as follows:

(1) The Mandalay laboratory is projected to engage in planning animal health improvement programs for its area of jurisdiction. It will be familiar with local livestock hygieme conditions and it is considered appropriate for formulation of a carefully thought out program which match as actual conditions in the area.

(2) Although the laboratory's diagnostic services are presently confined to bacteriology and parasitology, the scope of activities will be further expanded along with augmentation of equipment and personnel. However, virological diagnosis will only be conducted by the Mandalay Laboratory.

(3) With regard to the diagnostic services for government-related farms, it will be alright if such services are for examination of brucellosis, tuberculosis, etc. and for diagnosis of contagious diseases, but diagnosis and treatment of general diseases would be considered a deviation from the prime functions of the laboratory. It should concentrate upon its primary duties of diagnosis.

(4) There is no problem about the epidemiological surveys and study of preventive measures.

(5) The laboratory plans to begin studying diseases of kids as in-house research. This will present no problem, but an in-depth study should be carried out in collaboration with the Central Laboratory because it has higher level equipment.

The projected goals of the project will be difficult to achieve unless still more regional veterinary diagnostic laboratories are established because of the vast area of Burma, the number of livestock raised and transport conditions when compared with Japan.

CHAPTER Ⅳ. BASIC DESIGN

CHAPTER Ⅳ. BASIC DESIGN

4-1 Basic Policy for Selection of Equipment

Prior to selecting equipment, the study team visited the Central Veterinary Diagnostic Laboratory in Rangoon and the Regional Veterinary Diagnostic Laboratory in Mandalay; both are presently engaged in diagnoses of animal diseases. It also visited facilities manufacturing animal vaccines in Rangoon to obtain information and materials about present operations, past performance and utilization of existing equipment. After discussion of the survey results a basic policy for selection of equipment, using the following six criteria, was agreed:

Principles for Selection of Equipment

(1) Selected equipment should be required for performance of the projected activities of respective diagnostic laboratories; any items considered necessary will be added to the list even if they are not included in the Burmese list.

(2) Equipment should be suitable, in terms of technology ad function to the laboratory staffs current technical standards in diagnostic work. Selection of certain kinds of equipment will take into account expected advances in the technical level of laboratory staff in the near future (about five years hence) because overseas training of laboratory staff-members is scheduled in Japan and other countries.

(3) Equipment should be chosen with respect to maintenance and management capabilities on technical standards in Burma, or through simple technical guidance.

(4) Equipment should not require large-scale remodeling of existing facilities, or construction work, for installation.

(5) Care should be taken not to cause safety and environmental pollution problems etc. after installation of equipment.

4-2 Design Plan

Buildings necessary for diagnostic services are already completed at all the laboratories. Additional construction of new buildings is not currently required, but some rearrangement of rooms is required because of the necessity for collaboration between laboratory sections and new equipment installation space requirements. The plan for rearrangement of rooms is shown in Figure 4-1. Additionally, windows must be made airtight for installation of air-conditioning and light-tight for a darkroom. Concrete foundations for an automatic generator and incinerator are also required.

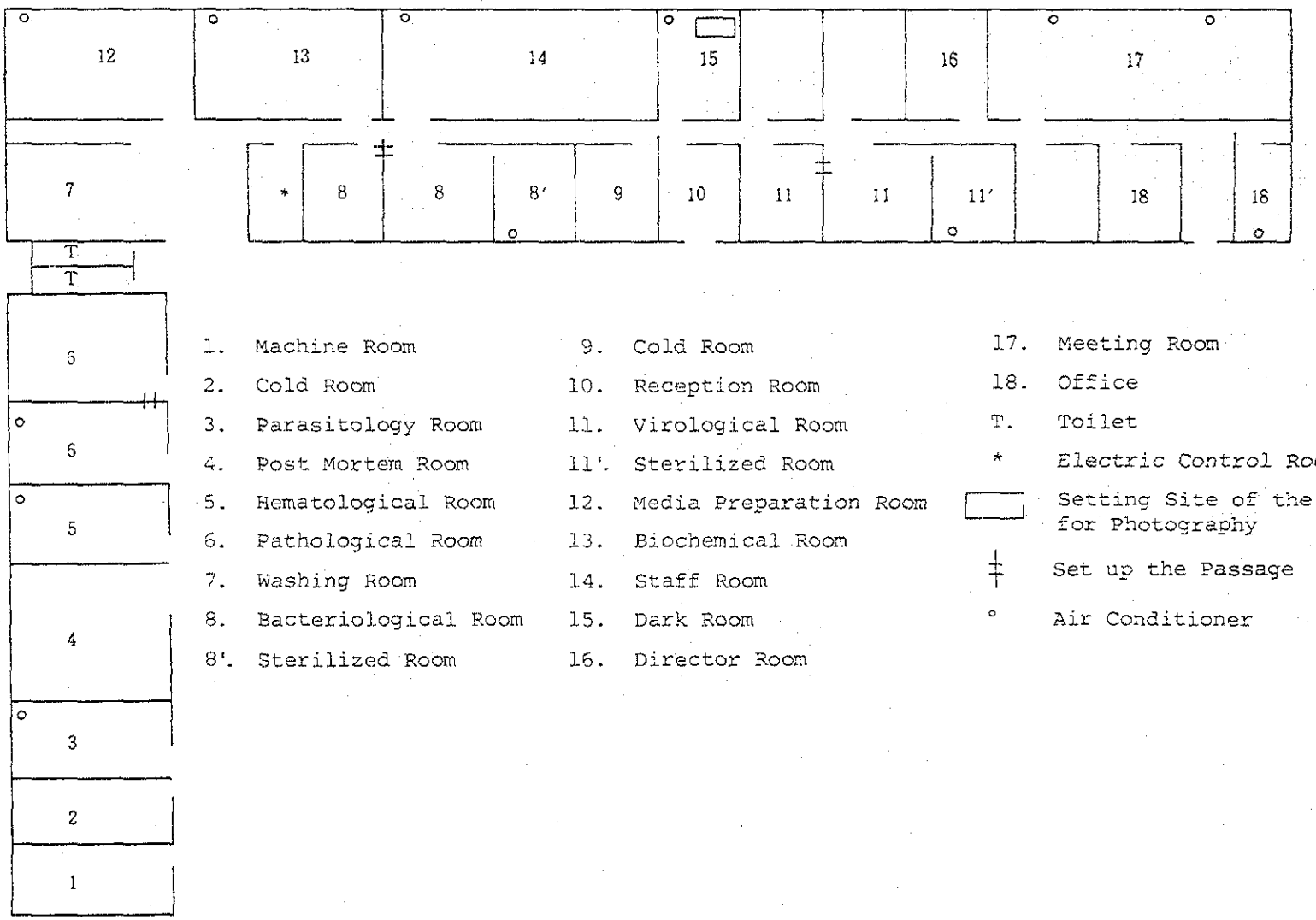
4-2-1 Central Veterinary Diagnostic Laboratory in Rangoon

The Central Laboratory plays a leading role for the three regional laboratories. It requires a higher level of technology and equipment than the regional laboratories for diagnostic work as identification of bacteria and viruses and preparation of fluorescent antigens. Therefore, equipment allotted to the Central Laboratory is naturally greater in number than that for the regional laboratories. The Central Laboratory also has a training program for re-education of personnel from regional laboratories and other general veterinaries. Training programs help improve standards of animal hygiene, and allotment of equipment, necessary for such training programs, is also considered essential. Other roles of the Central Laboratory are preparation of materials for educating livestock farmers about animal health and collection and analyses of records and statistics about animal diseases. Such work helps the fight against disease and the necessary equipment is also required.

Electron microscope and other items of advanced equipment were included in the list submitted by Burma. However, such items would be difficult to maintain and use efficiently in Burma. After discussions with the Burmese side about the principles for equipment selection, such advanced items were excluded from the present list.

Excluded equipment and reasons for exclusion are shown in Table 4-1.

Figure 4-1 Plan for Rearrangement of Rooms of the Central Veterinary Diagnostic Laboratory



1. Machine Room
2. Cold Room
3. Parasitology Room
4. Post Mortem Room
5. Hematological Room
6. Pathological Room
7. Washing Room
8. Bacteriological Room
8'. Sterilized Room
9. Cold Room
10. Reception Room
11. Virological Room
11'. Sterilized Room
12. Media Preparation Room
13. Biochemical Room
14. Staff Room
15. Dark Room
16. Director Room
17. Meeting Room
18. Office
T. Toilet
* Electric Control Room
▭ Setting Site of the Sink for Photography
‡ Set up the Passage
° Air Conditioner

Table 4-1 List of Equipment Exluded

Section	Description of Equipment	Quantity Requested C	M	T	B	Total	Reasons for Exception
Microbiology	Anaerobic incubator	2	1	1	1	5	Unnecessary
	Gas chromatograph	1	1			2	Unnecessary for diagnosis of contagious diseases Premature even for biochemistry
	Thin layer Chromatograph kit	2	1	1	1	5	- ditto -
	Thin layer Chromatograph flame	1	1	1	1	4	- ditto -
	Double beam spectrophotometer	2	1	1	1	5	- ditto -
	Scanning electron microscope	1				1	Difficult to maintain
Parasitology	Disecting microscope	1	1	1	1	4	Altered to a unified type of zoom stereo microscopes
	Stereo microscope	2	2	2	2	8	
Pathology	Vacuum automatic tissue pocescer	1				1	
	Tissue exbedding center	1				1	Combined as one set
	Parappin oven	1				1	
	Trinocular microscope	1	1	1	1	4	Combined to one unit each
	Photomicrographic system	1	1	1	1	4	
	Speciman cuttingbed	1				1	Not necessary
	Automatic centrifuge	1				1	- ditto -
	Deep freezer	2	1	1	1	5	- ditto -
	Water bath	1	1	1	1	4	- ditto -
	Multi dryer	1	1	1	1	4	Substituted by Slide Warmers
	Dark field and phase contract attachment	1	1	1	1	4	Not necessary

Remarks: C=Central Laboratory, M=Mandalay Laboratory, T=Taunggyi Laboratory, B=Bassin Laboratory

Section	Description of Equipment	Quantity Requested C	M	T	B	Total	Reasons for Exception
Biochemistry	Digital ion meter	1				1	Premature, not necessary for diagnosis of contagious diseases
	Flame photometer	1				1	- ditto -
	Water bath	1	1	1	1	4	Joint Use with other sections in view of utilization frequency
	Deep freezer	1				1	- ditto -
	Magnetic stirrer	1	1	1	1	4	- ditto -
	Automatic analyzer	1				1	Difficult to maintain, Premature
	Chloride meter	1				1	Premature
	Digital glucese analyzer	1				1	- ditto -
	Microliter pipette	3				3	Not necessary
	Touch mixer	1	1	1	1	4	Joint Use with other sections in view of utilization frequency
	Automatic blood cell counter	1	1	1	1	4	Difficult to maintain
	Distillation aparatus	1				1	Joint Use with other sections in view of utilization frequency
	Gas chromatograph recorder	1				1	Premature
	Thin layer chromatograph kit	1				1	Combined to one item
	Thin layer chromatograph	1				1	
Library equipment	Copying printer	1				1	Not necessary since there is an electron copying machine
Epizichology section	Color enlarger	1	1	1	1	4	Technically difficult. Altered to ordinary enlargers.

4-2-2 Mandalay Regional Veterinary Diagnostic Laboratory

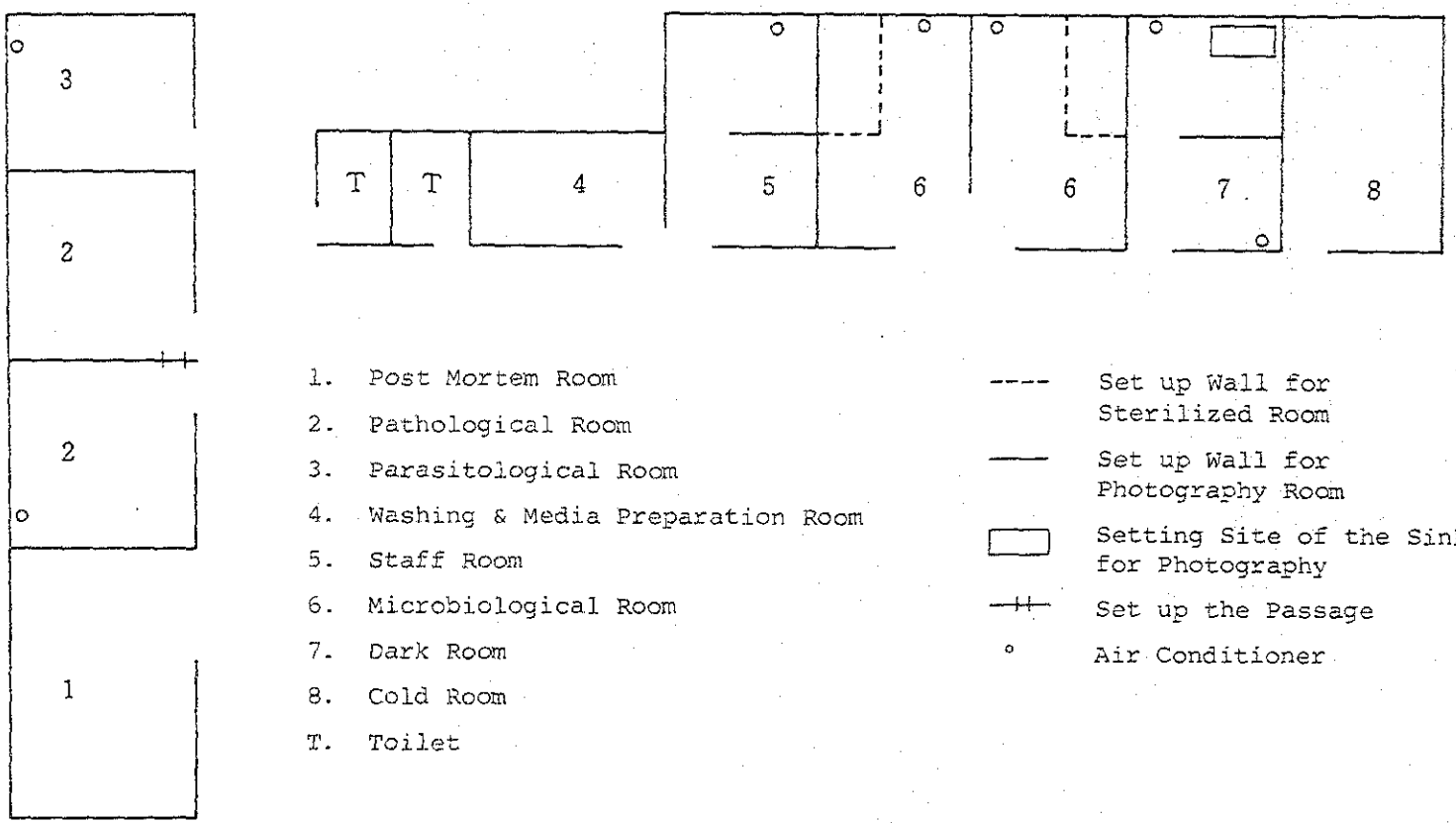
The Mandalay Laboratory ranks second, among the regional veterinary diagnostic laboratories, after the Central Laboratory. This is because of its almost central geographical location in the second largest city, and also because of the large numbers of livestock raised in the vicinity. The laboratory is now conducting some post-mortem and bacteriological examinations although its equipment is far from sufficient. In view of this situation, the equipment improvement project gives second priority to this laboratory, especially for the allocation of virology-related equipment. The plan for rearrangement of rooms in the laboratory building is shown in Figure 4-2.

4-2-3 Taunggyi Regional Veterinary Diagnostic Laboratory

The laboratory building has been constructed but neither personnel nor equipment have been assigned. Unlike the other laboratories, houses are scattered around this laboratory. Equipment plans for both Taungyi and Bassein Regional Laboratories, in contrast to Rangoon and Mandalay, are limited in scope. For example, equipment for bacteriology is limited to isolation and culture, and serum reaction tests, on the premise that identification work will be sent to the Rangoon Central Laboratory. Taungyi Laboratory's water supply, meanwhile, depends on a reticulated, city water supply which is disrupted during the dry season by decreased volume and pressure. This is because the laboratory is sited at the end of the city water pipeline, far from the source. The Burmese, therefore, want to construct a pipeline leading directly to the laboratory. The laboratory cannot function unless sufficient water is provided and construction of a new pipeline has been included in the plan. Labour will be provided by the Burmese with pipes and other materials provided by Japan.

Furthermore, the internal wiring of Mandalay and Taungyi Laboratories has been completed, and transformers are ready for installation, but the external wiring is not connected. Electrical supply materials are difficult to buy domestically and their provision has been requested. Electricity is essential for laboratory operations and such materials are included in the present plan.

Figure 4-2 Plan for Rearrangement of Rooms of
Local Veterinary Diagnostic Laboratories



1. Post Mortem Room
2. Pathological Room
3. Parasitological Room
4. Washing & Media Preparation Room
5. Staff Room
6. Microbiological Room
7. Dark Room
8. Cold Room

T. Toilet

---- Set up Wall for Sterilized Room

—— Set up Wall for Photography Room

▭ Setting Site of the Sink for Photography

—++— Set up the Passage

° Air Conditioner

4-2-4 Bassein Regional Veterinary Diagnostic Laboratory

As previously mentioned, Bassein's laboratory building and quarters for personnel have already been constructed, but neither personnel nor equipment has been assigned. The Bassein area is in the delta of the Irrawaddy River, and rich in ground water. The laboratory has a well on the premises and water is presently pumped from the well by an air-compressor. However, a submersible pump is recommended for future, which is more efficient. Electricity supply presents no problems because the laboratory is close to a substation.

Common problems of all the laboratories are gas supply, water quality, electrical voltage and so on. For example, bacteriology and virology, need a gas burner for sterilization of the platinum loop. Alcohol burners cannot provide sufficient heat for sterilization. However, neither town gas nor LP gas is available in Burma and a gas generator is required. Similar problems exist with water. Although plenty of water is available (except for the Taungyi Laboratory), it contains large quantity of inorganic substances and unsuitable for culture of bacteria and tissue. Glass ware cannot be cleared using it. Therefore, equipment for producing pure water (including distilled water) is needed at each laboratory and has been added to the list. (Analysis of water is included in the appendix.)

The domestic electricity supply is 220 V in Burma but 100 V in Japan and equipment with 100 V specifications sent from Japan, will require transformers.

Public transportation is not yet developed in Burma making it necessary for the laboratories to have vehicles. Staff-members have to go to sites of infectious disease out-breaks quickly to collect materials for diagnostic examination and to give preventive injections. Cars can only use main roads during the wet season so motorcycles are also requested in the plan.

The following list of equipment has been prepared, on the basis of the previous results, for the basic design of the equipment improvement project.

4-3 Construction Work Related to Installation of Equipment

The Japanese side is responsible for supply and installation of equipment and the Burmese side for construction of facilities to accommodate equipment. Such construction work only involves partitioning rooms for setting up a darkroom, building foundations for installing an incinerator and independent power generator etc. at each laboratory.

4-4 Estimated Project Cost

4-4-1 Conditions for Cost Calculation

(1) Date of Integration: December 1984

(2) Exchange Rate: The exchange rate between the currency of Burma (Kyat) and U.S. dollar (US$) is based on a floating system. For price conversion purposes, the exchange rate in May 1985 has been estimated as:

1 Kyat = US$ 0.1176 = ¥ 27.80

4-4-2 Estimated Project Cost

the Burmese side bears the expense of equipment installations. This is broken down into:

Water supply work (Taunggy)	4,000 Kyats
Foundation works for installation of incinerators and generators	20,000 Kyats
Total	24,000 Kyats

Table 4-2 Basic Design Equipment List

Minutes No.	Description	Unit	Quantity C*	M*	T*	B*	Total
1.	Microscope, binocular	unit	2	2	2	2	8
	Microscope, binocular, dual viewing	"	1	1	1	1	4
2.	Microscope, inverted	"	1	1			2
3.	Microscope, fluorescence	"	1	1			2
4.	Multiteaching microscope	"	1	1	1	1	4
5.	Photomicrographic system	set	1	1	1	1	4
6.	Zoom stereo microscope	unit	1	1	1	1	4
7.	Freezing microtome, cryostat	"	1	1			2
8.	Freeze dryer	"	1				1
9.	Deep freezer(vertical type, 340 l)	pc.	1				1
	" (horizontal type, 340 l)	"	1	1	1	1	4
	" (" , 514 l)	"	1	1	1	1	4
	" (" , 712 l)	"	1				1
10.	Clean bench	unit	1	1	1	1	4
11.	Safety cabinet	pc.	1				1
12.	Colony counter	"	1	1	1	1	4
13.	Filtration set						
	(filter holder, 142mm dia.)	pc.	3	2	1	1	7
	" (" " " , 50mm dia.)	"	5	2	1	1	9
	" (injector holder)	"	10	5			15
	" (filter paper [HA] 142mm dia.)	"	800	200	100	100	1,200
	" (" " " 50mm dia.)	"	800	200	100	100	1,200
	" (" " " for injector holder)	"	800	200			1,000
14.	Pressure tank for filter (2 ltr)	pc.	2	1	1	1	5
	" " (5 ltr)	"	1				1
15.	Balances (200g)	unit	1	1	1	1	4
	" (2,100g)	"	2				2
	Balance, digital display	"	1	1	1	1	4
	Precision balance	"	1	1	1	1	4
16.	Liquid nitrogen tank (22.7 ltr)	pc.	1	1			2
	" " (33.4 ltr)	"	3	1	1	1	6

C*= Central laboratory; M*=Mandalay; T*=Taunggyi; B*=Bassein

Minutes No.	Description	Unit	Quantity C*	M*	T*	B*	Total
17.	Glassware washing-drying machine, fully-automatic	unit	1				1
18.	Pipette washer	"	1	1	1	1	4
	Pipette washer-dryer	pc.	1	1	1	1	4
19.	Basket units (for rabits)	set	10	5	3	3	21
	" (for rats)	"	10	5	3	3	21
	" (for mice)	"	5	3	2	2	12
20.	Laboratory washer	unit		1	1	1	3
21.	Autoclave (large size)	"	1				1
	" (small size, with drying device)	"	1	1			2
	" (small size)	"	1	1	1	1	4
22.	Hot air ovens	"	1	1	1	1	4
23.	Water still	set	1	1	1	1	4
24.	Water bath	unit	1	1			2
	" " shaker	"	1	1	1	1	4
	Low-temperature thermostatic bath	"	1	1	1	1	4
	Thermostatic bath (70 ltr)	"	1	1	1	1	4
	" " (L)	"	4	3	3	3	13
25.	Incubator (550 x 520 x 780mm)	unit	1	1	1	1	4
	" (800 x 680 x 800mm)	"	1				1
	" (1000 x 600 x 800mm)	"	1	1	1	1	4
	Low-temperature incubator	"	1	1	1	1	4
	CO_2 gas incubator	"	1	1			2
	Rotary culture incubator	"	1	1			2
26.	CO_2 gas cylinder	pc.	3	2	2	2	9
27.	CO_2 gas regulator	"	1	1	1	1	4
28.	Laboratory cart (900 x 600 x 750mm)	unit	2	1			3
	" " (620 x 370 x 850mm)	"	2	1	1	1	5
29.	Ice maker, fully-automatic	"	1	1	1	1	4
30.	Microtome, large size, rotary	"	1				1
	Microtome, large size, sliding	"	1				1
31.	Automatic knife sharper	"	1	1			2

Minutes No.	Description	Unit	Quantity C*	M*	T*	B*	Total
32.	Steam warmer (stretching face ø300 x (D) 75mm)	unit	1				1
33.	Slide warmer (stretching face 450 x 310mm)	"	1				1
34.	Tissue tech-III system	complete set	1				1
	Automatic vacuum embedding device	unit	1				1
	Paraffin melter	"	1				1
	Embedding console	set	1				1
35.	Ultra-histodyer	unit	1				1
36.	Vibrator (slide cleaner)	"	1	1			2
37.	Preparation-keeping box	set	1	1	1	1	4
	Specimen box	pc.	10	5	5	5	25
38.	Motorcycle	unit	6	6	6	6	24
39.	Microbus	"	1	1	1	1	4
40.	Inter-phone	set	1	1	1	1	4
41.	Incinerator (for big animals)	unit	1	1	1	1	4
	" (for small animals)	"	1	1	1	1	4
42.	Vacuum cleaner	"	1	1	1	1	4
43.	Stop watch	pc.	2	1	1	1	5
44.	Gas generator	set	4	2	1	1	8
45.	Scissors (ophthalmologic)	dz.	4	2	2	2	10
	" (surgical)	"	4	2	2	2	10
	" (surgical, sharp tip)	"	4	2	2	2	10
	" (for hair-cutting)	pc.	10	5	5	5	25
46.	Forceps (surgical, w/o hook)	dz.	4	2	2	2	10
	" (surgical, straight)	"	4	2	2	2	10
	" (surgical, curved)	"	3	1	1	1	6
	" (ophthalmologic, w/o hook)	"	4	2	2	2	10
	" (ophthalmologic, w/ hook)	"	4	2	2	2	10

Minutes No.	Description	Unit	Quantity C*	M*	T*	B*	Total
47.	Sterilizer, dry heating						
	" " (600 x 500 x 500mm)	unit			1	1	2
	" " (800 x 600 x 800mm)	"	1	1			2
	" " (300 x 150 x 120mm)	"	3	1	1	1	6
	" " (360 x 180 x 120mm)	"	3	1	1	1	6
	" " (240 x 90 x 55mm)	"	4	3	3	3	13
	" " (270 x 120 x 65mm)	"	1	1	1	1	4
48.	Homogenizer	"	2	1	1	1	5
	Homogenizer mixer	"	1	1	1	1	4
	Homogenizer cube (5ml)	pc.	300	100	100	100	600
	" " (10ml)	"	300	100	100	100	600
49.	Stainless basket (ø270mm, 270mm deep)	"	2	2	1	1	6
	" " (450 x 250 x 200mm)	"	4	2			6
	" " (250 x 220 x 200mm)	"	10	5	5	5	25
	" " (180 x 180 x 150mm)	"	10	5	5	5	25
50.	EPG counter	"	5	5	5	5	20
51.	Liver fluke detetion set	set	1	1	1	1	4
52.	Sink	"	1	1			2
53.	Spatula (L160 x W 30mm)	pc.	10	5	5	5	25
	" (L120 x W 22mm)	"	5	3	3	3	14
	Spoon	set	5	3	2	2	12
54.	Pocket timer	pc.	6	5	4	4	19
55.	Fluorescence spectrophotometer	unit	1				1
	Thin layer chromatography scanner	"	1				1
	Visible spectrophotometer	"	1				1
56.	Refrigerator	"	5	2	2	2	11
57.	Cold store (4°C)	"	1	1	1	1	4
	" " (-20°C)	"	1				1
58.	Centrifuge (high-speed cooling)	"	1				1
	" (loco-speed cooling)	"	2	1	1	1	5
	" (low-speed)	"	1	1	1	1	4
	" (low-speed, swing-type)	"	1	1	1	1	4
59.	Centrifuge for haematocrit	"	1	1	1	1	1
60.	pH meter	unit	3	1	1	1	6

Minutes No.	Description	Unit	Quantity C*	M*	T*	B*	Total
61.	Magnetic stirrer (0.1 - 5 ltr)	unit	1				1
	" " (100 - 3,000ml)	"	1	1	1	1	4
	" " (6-series, 100-1,000mlx6)	"	1	1	1	1	4
	" " (0.1 - 1 ltr)	"	1	1	1	1	4
62.	Automatic mixer	"	3	2	1	1	7
	Mixer	"	4	3	2	2	11
63.	Ectoparasite set	set	1	1	1	1	4
64.	Electronic calculator	unit	3	1	1	1	6
65.	Rotating filing cabinet	"	1	1	1	1	4
66.	Overhead projector	"	1	1	1	1	4
67.	Slide projector	"	1	1	1	1	4
68.	Portable VTR system	"	1				1
69.	VTR television set	set	1	1	1	1	4
70.	Electronic copying machine	unit	1	1	1	1	4
71.	Air conditioner	"	11	5	5	5	26
	" " (dual-duct)	"	1	1	1	1	4
72.	Stand-by generator (35 kVA)	"		1	1	1	3
	" " (50 kVA)	"	1				1
73.	Electric duplicator	"	1	1	1	1	4
74.	Post mortem set (for big animals)	set	1	1	1	1	4
	" (for small animals)	"	1	1	1	1	4
	" (for chicken)	"	1	1	1	1	4
75.	Organ photographic apparatus	unit	1				1
76.	White blood all differential counter	"	1	1	1	1	4
77.	Tally counter	"	5	3	3	3	14
78.	Necropsy table	"	1	1	1	1	4

Minutes No.	Description	Unit	Quantity C*	M*	T*	B*	Total
79.	Center table	unit	2				2
	Side table (kneehole, with 5 drawers on one side and 1 on the other)	"	7	4	4	4	19
	" (kneehole, with one drawer & shelve on each side)	"	4	2	2	2	10
	" (kneehole, with one drawer on each side)	"	4	2	2	2	10
	" (small-sized)	"	3	1	1	1	6
	" (with three pockets)	"	1				1
80.	Work benches	"	4	2	2	2	10
81.	Enlarger	set	1	1			2
82.	Camera, 35mm	unit	1	1	1	1	4
83.	Desiccator, automatic	pc.	4	1	1	1	7
	" , PVC	"	8	6	5	5	24
84.	Pipette shaker	unit	1	1	1	1	4
85.	Pipette for haemocyte						
	(for white blood cell)	dz.	3	2	2	2	9
	" (pipette holder)	"	4	3	3	3	13
	" (for red blood cell)	"	2	2	2	2	8
	" (pipette holder)	"	3	3	3	3	12
86.	Blood cell counter	pc.	5	5	5	5	20
87.	Tripod for burners	unit	6	4	4	4	18
88.	Gas cock, double, table	pc.	10	6	4	4	24
89.	" , " , wall	pc.	6	4	2	2	14
90.	Test tube rack (for 50 tubes, ϕ12mm)	"	25	12	10	10	57
	" (48 , ")	"	6	6	2	2	16
	" (36 , ")	"	6				6
	" (50 , 15mm)	"	30	15	10	10	65
	" (24 , ")	"	6	2	2	2	12
	" (12 , ")	"	6	2	2	2	12
	" (60 , 17mm)	"	10				10
	" (50 , 18mm)	"	25	10	5	5	45
	" (for roller tubes for tissue culture, 48 tubes)	"	30	10			40
	" (" , 48 tubes, 12mm)	"	30	10	10	10	60
	" (" , 48 tubes, 15mm)	"	20	5	5	5	35

Minutes No.	Description	Unit	Quantity C*	M*	T*	B*	Total
91.	Porcelain mortar (outside dia. 90mm)	dz.	4	2	2	2	10
	" (" 120mm)	"	2	1	1	1	5
	" (" 150mm)	"	4	2	2	2	10
92.	Air compressor	unit	1	1	1	1	4
93.	Suction units, electric	pc.	2	1	1	1	5
94.	Micro pipetter, proper	"	2	1	1	1	5
	" (combination tip 0.5ml)	"	10	3	2	2	17
	" (" 2.5ml)	"	10	3	2	2	17
	" (" 12.5ml)	"	2	1	1	1	5
	Fin Pipette, proper	"	2	1	1	1	5
	" (tips for fin pipette)	case	10	3	2	2	17
	Dropper (0.025ml)	pc.	50	30	10	10	100
	" (0.05ml)	"	50	30	10	10	100
95.	Micro diluter (0.025ml)	"	100	50	10	10	170
	" (0.05ml)	"	100	50	10	10	170
	" (measuring paper)	"	50	30	10	10	100
96.	Stainless-steel trays, square						
	(cabinet size)	"	6	4	3	3	16
	" (8 vo)	"	6	4	3	3	16
	" (6 vo)	"	6	4	3	3	16
	" (4 vo)	"	6	4	3	3	16
	" (w/cover, cabinet size)	"	3	2	1	1	7
	" (" , 8 vo)	"	3	2	1	1	7
	" (" , 6 vo)	"	3	2	1	1	7
	" (" , 4 vo)	"	3	2	1	1	7
97.	Dressing drum (70 x 80 x 480mm)	"	20	10	10	10	50
	" (240 x 240 x 200mm)	"	10	5	5	5	25
	" (70 x 80 x 400mm)	"	10	10	10	10	40
	" (ø270m, D 170mm)	"	3	2	1	1	7

Minutes No.	Description	Unit	Quantity C*	M*	T*	B*	Total
Minutes No. 99 "Other Items"							
99-1.	Safety cabinet	pc.	1	1	1	1	4
2.	Washing machine	"	2	1	1	1	5
3.	Consecutive injector (1ml max.)	"	10	5	5	5	25
	" " (2ml ")	"	10	5	3	3	21
	" " (5ml ")	"	5	3	3	3	14
	" " (10ml ")	"	5	3	3	3	14
	" " (cylinder 1ml)	"	20	10	10	10	50
	" " (" 2ml)	"	20	10	10	10	50
	" " (" 5ml)	"	10	5	5	5	25
	" " (" 10ml)	"	10	5	5	5	25
4.	Micro plate (96 holes)	"	700	300			1,000
	" (U-type)	"	100	50	30	30	210
	" (V-type)	"	100	50	30	30	210
5.	Sahlis Haemometer	"	2	1	1	1	5
6.	Serum protein meter		1	1	1	1	4
7.	Fraction Collector distribution system		1				1
	test tube		400				400
8.	UV Monitor		1				1
9.	Electrophoresis apparatus	unit	1	1	1	1	4
10.	Cork borer		2	1	1	1	5
11.	By-torch		4	3	3	3	13
12.	Caliper		2	1	1	1	5
	" (15cm)	pc.	2	1	1	1	5
13.	Wire net	m.	2	1			3
14.	Hand Dryer	pc.	1	1			2
15.	Drying table	set	5	3	3	3	14
16.	Refuse pail	pc.	10	6	5	5	26
17.	Sterilizing lamp set (proper, 40W)	pc.	10	4	2	2	18
	" (sterilizing lamp 40W)	"	50	20	10	10	90

Minutes No.	Description		Unit	Quantity C*	M*	T*	B*	Total
	"	(proper, 20W)	"	10	4	2	2	18
	"	(sterilizing lamp 20W)	"	50	20	10	10	90
	"	(bench-type, proper, 20W)	"	5	1	1	1	8
18.	Dry ice maker, simpel type		unit	1	1			2
19.	Laboratory cooler	(18 ltr)	pc.	2	1	1	1	5
	"	(23 ltr)	"					
	"	(35 ltr)	"	2	1	1	1	5
20.	Ice box		"	5	3	3	3	14
21.	Keeping box		"	4	3	3	3	13
22.	Cabinet for machines		"	2	1	1	1	5
23.	Chairs for experimental use		"	4	2			6
	"	"	"	8	4	3	3	18
24.	Stands	(H 750mm)	set	5	3	2	2	12
	"		"	5	3	2	2	12
	"		"	15	9	6	6	36
	"		"	2	2	2	2	8
25.	Micro-film maker		complete set	1				1
26.	Micro reader		unit	1				1
27.	Micro computor		"	1				1
28.	Water supply by-pass materials for Taungyi					1		1
29.	Equipment and materials for electric work				0.5	0.5		1

CHAPTER V. PROJECT IMPLEMENTATION

CHAPTER V. PROJECT IMPLEMENTATION

5-1 Organization Responsible for Implementation of the Project

The Project for Implovement of Equipment for Veterinary Diagnostic Laboratories is undertaken as a project of the Ministry of Livestock Breeding and Fisheries. The Livestock Breeding and Veterinary Department is responsible for execution of the construction work and for management and maintenance after completion of the facilities.

5-2 Implementation Plan

The Project is scheduled to be implemented with grant aid from the Government of Japan. After the project is finally decided by E/N, contractors are to be designated through a public bidding by the Government of Burma. The project will be carried out using processes such as: public bidding, designation of contractors, equipment order, placement, equipment manufacture, mini-training for operation and maintenance of equipment, and final acknowledgement of equipment receipt.

Administration of the project is to be undertaken by the Burmese side.

5-3 Scope of Work

The scope of work to be undertaken by both the Japanese and Burmese partners is understood to be as follows:

5-3-1 Undertakings of Japanese Side

(1) Supply of equipment for the following veterinary diagnostic laboratories:

- 1 Rangoon Central Veterinary Diagnostic Laboratory
- 2 Mandalay Regional Veterinary Diagnostic Laboratory

- 3 Taunggyi Regional Veterinary Diagnostic Laboratory
- 4 Bassein Regional Veterinary Diagnostic Laboratory

(2) Supply of Materials related to incidental work:
Provision of materials for construction of a water supply system at the Taunggyi Regional laboratory and wiring material for the Mandalay, Taunggyi and Bassein Regional Laboratories.

(3) Others
Installation of equipment, explanation of equipment operation, delivery of equipment, equipment installation services etc.

5-3-2 Undertakings of Burmese Side

(1) Preparation of the sites for installation of equipment
(2) Provision of temporary electricity and water supplies and drainage.
(3) Provision of necessary information for delivery and installation of equipment
(4) Provision of temporary storage space for equipment and protection against rain
(5) Main construction work
- 1 Water supply (plumbing of service pipes)
- 2 Drainage (plumbing of sewer pipes)
- 3 Service wiring (from outside and inside the facilities to fixed spots)
- 4 All remodelling work for the facilities

(6) Speedy unloading, customs clearance and transportation of equipment
(7) Exemption from custom duties, taxes and other levies with respect to the equipment and related services.
(8) Necessary permission, licences and approval for execution of the project
(9) Arrangements by the Government of Burma, for easy entry and departure of Japanese engineers working on the Project to and from Burma.
(10) Bearing of all expenses, other than those covered by the Japanese grant aid, for implementation of the project

5-4 Procurement of Equipment for the Veterinary Diagnostic Laboratories

Equipment required by the project, is impossible to get in Burma and must be imported from Japan.

5-5 Implementation Schedule

The implementation schedule will commence after an Exchange of Notes between the Government of Japan and the Government of Burma. The schedule is roughly divided into three stages; preparation of specifications, open bidding and execution work.

Project work will start when the contracts for work have been verified by the Government of Japan.

The time schedule from conclusion of contracts to delivery of equipment is as shown below.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
E/N
Government of Burma
Government of Japan
Contractor
Approval of Tender Document
Approval of Tender and Construction Contract
Incidental Engineering
Menagement
Operation
Verification of Contract
Contract of Supplying Equipment
Manufacture
Transport
Installation
Training

CHAPTER VI. MAINTENANCE AND OPERATION

CHAPTER VI. MAINTENANCE AND OPERATION

6-1 Maintenance and Operation

Maintenance and management of the equipment will be carried out by each laboratory. Most of the equipment to be provided will be used by individual laboratory sections, so each section will be responsible for management of its equipment. Maintenance and repairs will be commissioned by outside engineering companies.

6-2 Plan for Maintenance and Operation

6-2-1 Maintenance and Operation Policy

If the objectives of the improvement project are to be performed satisfactorily by the laboratories, then proper maintenance and management must be carried out by the organizations and managerial systems of each laboratory.

Arrangements have already been made to provide personnel required for laboratory management and operations, as well as for maintenance and management of facilities.

Equipment to be provided to the Rangoon Central Diagnostic Laboratory, under the proposed grant aid, will be distributed between the pathology, bacteriology, virology, parasitology, toxicology and epidemiology sections. Most of the equipment now in use in these sections, is old-fashioned, but is similar to that scheduled to be provided. A similar situation exists at the vaccine manufacturing facilities adjoining the Central laboratory. Equipment of the same type as that now used will be provided. There is a repaire shop within the compound of the Livestock Breeding and Veterinary Department at Insein which can deal with general purpose refrigeration and other equipment.

In view of the prevailing conditions in Burma, adequate guidance and mini-training on the methods of operation and maintenance of equipment should be given to persons in charge, at the time of delivery and installation. Sufficient supply of spare parts should also be made.

All these provisions will ensure that the equipment improvement project will proceed satisfactorily.

6-2-2 Maintenance and Operation Personnel

Arrangements have already been made, in Burma, for assignment of maintenance engineers to each laboratory.

Most of the equipment to be supplied this time is not very complex or mechanically and electrically sophisticated. Local technicians educated to the general technical standards in Burma will be able to handle it. (Certain items of equipment, from specific manufacturers, have been designated according to the availability of spare parts in Burma.)

6-3 Cost of Maintenance and Operation

Maintenance and management costs which will be borne by the Government of Burma, in relation to the improvement project, are those for operation of equipment (which consist mostly of personnel expenses for laboratory staff engaged in diagnostic services and other work), expenditure for consumable goods, electric power, fuel and spare parts for operation of equipment.

Employment of new staff-members, which will increase personnel expenses, will not be made in the present stage of the improvement project.

Other expenses for consumable goods, electric power, fuel and spare parts, will depend upon the frequency of use which is related to disease incidence. Quantities are difficult to estimate but most needs, for a certain period of operations, are included in the list equipment to be provided this time. However, future consumable goods and spare part expenses will have to be borne by Burma.

Burmese expenditure in connection with the project (principally electricity for operation of equipment and fuel for the gas generators, incinerators and vehicles) will be bearable although it depends on the frequency of use. Implementation of the project, therefore, will not require many large amount of additional appropriation from the Burmese budget for maintenance and management.

Budgetary expenses for the project are slated to be incorporated into the national budget for the new fiscal year 1985/86 and will be executed when the project commences.

Expenditure required for maintenance and management is estimated as follows:

(1) Consumable goods related to the operation of equipment:
316,223 Kyats

(2) Electric power for operation of equipment:
Approx. 31,600 kW/month,
approx. 474,000 Kyats x 12 months = 5,688,000 Kyats

(3) Fuel for operation of equipment:
Approx. 4,100 ltr/month,
approx. 12,300 Kyats x 12 months = 147,600 kyats

Total 6,151,823 Kyats

CHAPTER VII. PROJECT EVALUATION

CHAPTER VII. PROJECT EVALUATION

Agriculture is a vital industry in Burma. Cattle, buffaloes and horses are indispensable to farm operations as work animals for cultivation and transportation. They are also a form of wealth for farmers. Pigs, chickens and ducks, are also raised by most farmers, using farm waste as feed, and are an important market product.

Meanwhile, the Government of Burma is encouraging increased production of animal protein to raise the standard of people's nutrition. Some farmers near urban areas are exclusively engaged in raising livestock (mainly chickens).

As mentioned before, top priority is given to agriculture in Burma to promote the nation's economic development, and the livestock industry is also given a high priority as a part of agricultural development.

However, in Burma, high incidences of serious contagious diseases such as foot-and-mouth disease, haemorrhagic septicaemia, hog cholera and many other diseases, cause high death rates among animals and pose a great threat to livestock production. In such circumstances, the equipment improvement project for veterinary diagnostic laboratories is an appropriate program which will contribute to the upgrading, strengthening and expansion of the nation's animal hygiene services.

Implementation of the present Project will not only solve the problem of equipment shortages but also facilitate prompt execution of in-depth diagnostic services. This will enable necessary preventive measures to be taken without delay in the early stages of infectious disease outbreaks, and minimize damage to the livestock industry.

At the Rangoon Central Veterinary Diagnostic Laboratory, which is the center of livestock hygiene services in Burma, there are a limited number of obsolete equipment which do not always meet the needs of a satisfactory diagnostic service. Elimination of such problems by the present Project will make it possible for the laboratory to upgrade its diagnostic work. Additionally, the scheduled training program for personnel from regional laboratories, and veterinarians, will help advance technological standards of animal hygiene in Burma as well as produce necessary personnel.

Regional diagnostic laboratories, which, to date, have sent materials for diagnosis to the Central Laboratory taking a long time will be able to react speedily to outbreaks of infectious diseases, and therefore greatly benefit the livestock industry.

Cost for maintenance and operation of these laboratories is estimated to total 6,151,823 Kyats annually. This does not include personnel expenses, which will be appropriated from the budget of the Ministry of Livestock Breeding and Fisheries. These expenses are, mostly, for electric power and fuel mentioned previously. The amount will not present a problem because costs will be reduced by more efficient operation and management of the facilities.

Technical maintenance and operation of the Project can be performed without problems, as mentioned in Section 6-2 "Maintenance and Operation Plan".

Implementation of the Project will greatly contribute directly to upgrading the diagnostic services as well as growth of livestock industry. This will lead to stable development of agricultural and improved nutrition of people.

The Project will, therefore, have a great impact on Burma for veterinary diagnostic laboratories by improving their function as key institutions in animal hygiene.

CHAPTER Ⅷ. CONCLUSIONS AND RECOMMENDATION

CHAPTER Ⅷ. CONCLUSIONS AND RECOMMENDATION

8-1 Conclusions

The Project for Improvement of Equipment represents an important national objective for the Government of Burma.

This assessment concludes that the project will be effective and sustainable. It will contribute to animal hygiene in Burma, and is of profound significance to the nation because the livestock industry development program will be promoted. Modernization of animal hygiene services, will result in expanded livestock production, giving a better income to farmers, improve nutrition of the people and enhance the level of public health.

8-2 Recommendation

The growth of Burma depends heavily on the stability and development of the economy of farmers, who represent an overwhelming majority of the population. Protecting livestock from diseases is very important in Burma because livestock produciton is affected by many diseases.

The Government of Burma, including the Ministry of Livestock Breeding and Fisheries, the people engaged in animal hygiene services and livestock farmers place great hope on the outcome of the improvement project. However, success of the project largely depends on the enthusiasm and efforts of the Government and other officials to ensure effective use of the new equipment.

(1) Recommendation to the Government of Burma

It is suggested that the Government should give persons working at veterinary diagnostic laboratories, and other related organizations, a clear idea of the significance of this project. This will help them work with the equipment to provide a well-coordinated operation which covers all phases of animal hygiene.

Appropriate maintenance and management of equipment are essential for the satisfactory performance of laboratory functions and achieve-

ment of project goals. Measures must be taken to ensure the continued success of the project by employing technicians to maintain and manage the equipment. Improving the education of such technicians, paying constant attention to provision of consumable goods and regular checking of principal equipment are all essential.

It is also suggested that a proper administrative system should be set up to perform these tasks.

(2) Recommendation to the Government of Japan

Diagnostic techniques for livestock diseases are advancing rapidly. Equipment included in the list has been selected as appropriate to the current technical level in Burma but does not necessarily meet present world standards. It is advisable, therefore, that another grant for additional equipment be considered in several years as technical levels in Burma progress.

APPENDIX

1-1 Schedule of the Study

Oct. 28 (Sun.)	Dep. Tokyo - Ar. Bangkok (JAL467), stayed overnight
Oct. 29 (Mon.)	Dep. Bangkok - Ar. Rangoon (TG305) Prior arrangements with the officials of the Ministry of Livestock Breeding and Fisheries at Airport. Stayed at Hotel
Oct. 30 (Tues.)	Courtesy call at the Japanese Embassy Courtesy call and discussions at the Ministry of Planning and Finance's Foreign Aid-Related Affairs Department
Oct. 31 (Wed.)	Courtesy call and discussions at the Planning and Statistics Department, Ministry of Livestock Breeding and Fisheries. Courtesy call at the Livestock Breeding Corporation. Courtesy call and discussions at the Livestock Breeding and Veterinary Department, Ministry of Livestock Breeding and Fisheries. Visited the Central veterinary Diagnostic Laboratory in Rangoon.
Nov. 1 (Thurs.)	Dep. Rangoon - Ar. Mandalay (UB) Visited Mondalay Regional Veterinary Diagnostic Laboratory
Nov. 2 (Fri.)	Visited the Grassland Experimental Station and its branch station. Visited dairy cattle farms
Nov. 3 (Sat.)	Visited sheep farms

Nov. 4 (Sun.)	Inspected vaccination against anthrax and artificial insemination of cattle at villages. Visited the Livestock Breeding Corporation's farm Dep. Mandalay - Ar. Taunggyi (trip by land)
Nov. 5 (Mon.)	Visited the Taunggyi Regional Veterinary Laboratory. Inspected the source of water supply Dep. Taunggyi - Ar. Rangoon (UB)
Nov. 6 (Tues.)	Discussion at Insein about the study. Dep. Rangoon for Bassein (by water)
Nov. 7 (Wed.)	Ar. Bassein. Visited the Bassein Regional Veterinary Laboratory. Visited the branch station of the Grassland Experimental Station. Dep. Bassein (by water).
Nov. 8 (Thurs.)	Ar. Rangoon. Discussion at Insein about the equipment to be provided.
Nov. 9 (Fri.)	Signed the minutes of discussions. Discussion at Insein about the equipment to be provided.
Nov. 10 (Sat.)	Discussion at Insein about the equipment. Mr. Nishimura, head of the Study Team, and Mr. Yoshida left Rangoon for Japan.
Nov. 11 (Sun.)	Discussion at Insein about the equipment. Mr. Sasaki left Rangoon for Japan.

Nov. 12 (Mon.) to Nov. 14 (Wed.)	Discussion at Insein about the equipment
Nov. 15 (Thurs.)	Visited the Ten-mile Farm of the Livestock Breeding Corporation.
Nov. 16 (Fri.)	Courtesy call at the Livestock Breeding and Veterinary Dept., Ministry of Livestock Breeding and Fisheries. Courtesy call at the Japanese Embassy. Messrs. Oishi, Kaji and Inui left Rangoon and arrived at Bangkok (UB211)
Nov. 17 (Sat.)	Dep. Bangkok - Ar. Narita Airport (JAL466)

1-2 Members of the Study Team

Leader - Tetsuo Nishimura, Grant Aid Division, Ministry of Foreign Affairs - in charge of managerial affairs

Member - Minoru Yoshida, Livestock Hygiene Division, Ministry of Agriculture, Forestry and Fisheries - in charge of animal hygiene

- Naoyoshi Sasaki, Basic Design Division, Japan International Cooperation Agency - in charge of planning and management

- Yuichi Oishi, Central Association of Livestock Industry in charge of animal hygiene

- Takashi Kaji, Central Association of Livestock Industry - in charge of diagnostic equipment for bacteriology and virology

- Sumio Inui, Central Association of Livestock Industry - in charge of diagnostic equipment for pathology and parasitology

1-3 List of Persons Interviewed

i) Japanese Embassy, Rangoon

Mr. Tsukamoto, Ambassador
Mr. Nitta, Counsellor
Mr. Motosugi, Secretary

ii) JICA Rangoon Office

Mr. Shinoura, General Manager
Mr. Takashima, Staff-member

iii) Livestock Breeding and Veterinary Department

U. THA KHIN, Director General
U. KO KO GYI, Director
MAJ KYAW LWIN, Additional Director
U. MGO MYING, Assistant Director
U. THAN DAING, Planning Officer
U. MAUNG MAUNG, Research Officer
SAW PLEI SAW, Assistant Research Officer

iv) Planning and Statistics Department

U. PYI, SOE, Director General
U. TIN MAUNG MYINF, Director
MAJOR KYAW LWIN, Additional Director
U. SOE WIN, Deputy Director

v) Foreign Aid-Related Affairs Department,
Planning and Finance Ministry (FERD)

U. NYUNT MAUNG, Director General
U. KHIN MAUNG, Advisor
U. ANTT KYAW, Deputy Director
U. THAN MYING, Assistant Director

DAW MYO NWE, Chief of Section

U. MAUNG MAUNG LAY, Chief of Section

vi) Livestock Breeding Corporation

U. KHIN LATT, Managing Director

U. KHUN SAES LWIN, Manager 10th Mile Farm

U. OHU THWIN, Deputy General Director, Milk Plant

v) Mandalay

U. SHWE TUN, Head of Division, Mandalay

U. TIN LATT, Deputy Head of Division

U. KYAW VAW AUNG, Deputy Head of Division

U. SAW MAUNG MAUNG, Township Veterinary Officer

U. TIN MAUNG MYING, Township Veterinary Officer

vi) Taunggyi (Shan State)

U. KHIN MAUNG, Head of State

U. SOE LWIN, Deputy Head of State

U. THAUNG SEIN, Township Veterinary Officer

vii) Bassein (Irrawaddy Division)

U. HLA MYINT, Head of Division

U. SAW R.D. KHAING, Deputy Head of Division

U. THAN MYING, Township Veterinary Officer

viii) Segaing Division

U. SEIN TUN, Head of Division-Segaing

U. HAN NYUNT, Deputy Head of Division

U. BA PHEIN, Township Veterinary Officer

1-4

MINUTES OF DISCUSSIONS
ON
THE IMPROVEMENT PROJECT FOR VETERINARY
DIAGNOSTIC LABORATORIES
IN
THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

In response to the request made by the Government of the Union of Burma for the Improvement Project for Veterinary Diagnostic Laboratories (here inafter referred to as "the Project"), the Government of Japan has sent, through the Japan International Cooperation Agency (here inafter referred to "JICA") which is an official agency implementing the technical and economic cooperation of the Government of Japan, the team headed by Mr. Tetsuo Nishimura, grant aid officer, Ministry of Foreign Affairs, to conduct the Basic Design Study from October 29 to November 11, 1984.

The team carried out a field survey, held a series of discussions and exchanged views with the authorities concerned of the Socialist Republic of the Union of Burma. Both parties agreed to recommend to their respective Governments and the authorities concerned to examine the result of the survey (attached herewith) with a view towards the realization of the project.

T. Nishimura

TETSUO NISHIMURA
Team Leader
Basic Design Study Team

U THA KHIN
Director General
Livestock Breeding and
Veterinary Department.

ATTACHMENT

1. The objective of the project is to contribute towards the upgrading of the veterinary diagnostic standards and services by improving the present condition of the laboratories, related equipment and facilities in Rangoon, Mandalay, Taungyi and Bassein.

2. The Basic Design Study Team will convey to the Government of Japan the desire of the Government of Burma that the former takes necessary measures to cooperate in implementing the Project.

3. The Government of Burma will undertake the items listed in Annex I.

4. The basic design for the Project has been carried out by giving due consideration to the overall diagnostic situation and the mid-term planned target of the Socialist Republic of the Union of Burma.

5. The Japanese Basic Design Study Team will recommend to the Government of Japan for the items shown in Annex II, which should be considered as an appropriate design for realization of the objective of the Project.

Annex I.

Following arrangements are requested to be undertaken by the Government of Burma

1. To secure space or facilities to accomodate the equipments and to make the alternations of laboratories buildings necessary for the Project.

2. To secure the necessary electricity, water supply and the related civil construction work.

3. To ensure prompt unloading, customs clearance and domestic transportation of the Project equipment.

4. To exempt from custom duties, taxes and other levies with respect to the supply and services concerned with the Japanese grant aid.

5. To ensure that budjet allocation necessary for the alterations related to civil construction works, maintenance and operation of the laboratories will be made.

6. To provide and accord the necessary permission, lincences and other authorization for the execution of the Project.

7. To bear all expenses other than those to be borne by the Japanese grant aid necessary for the implementation of the Project.

ANNEX II

LIST OF EQUIPMENTS

1. Microscope, binocular.
2. Microscope, Inverted
3. Microscope, Fluorescent
4. Multiteaching microscope
5. Photomicrographic system
6. Zoom stereo microscope
7. Freezing microtome, cryostat
8. Freeze dryer
9. Deep freezer
10. Clean bench
11. Safety cabinet
12. Colony counter
13. Filtration set
14. Pressure tank for filter
15. Balances
16. Liquid Nitrogen Tank
17. Glassware Washing Machine
18. Pipette Washer
19. Bracket units
20. Laboratory washer
21. Autoclaves
22. Hot air ovens

23. Water still
24. Water bath
25. Incubators
26. CO_2 gas container
27. CO_2 gas regulator
28. Laboratory cart
29. Ice maker
30. Microtome
31. Automatic knife sharpener
32. Steam warming
33. Slide warmer
34. Tissue tech - III system
35. Ultra-histodyer
36. Vibrator (Slide cleaner)
37. Preparation keeping boxes
38. Motor cycle
39. Mobile diagnostic microbus
40. Inter phone
41. Incinerator
42. Vacuum cleaner
43. Stop watch
44. Bunsen burner

45. Scissors
46. Forceps
47. Sterilizer
48. Homogenizer
49. Stainless baskets
50. EPG Counter
51. Liver fluke detection set
52. Sink
53. Spatula
54. Timer
55. Electrophoresis apparatus
56. Refrigerator
57. Cold store
58. Centrifuge
59. Centrifuge for haematocrit
60. pH Meter
61. Magnetic stirrer
62. Mixer
63. Ectoparasite set
64. Electronic calculator
65. Rotating filing cabinet
66. Over head projector
67. Slide projector

68. Portable VTR System
69. Monitor system
70. Plain paper copier
71. Air conditioner
72. Stand by generator
73. Electric duplicator
74. Post mortem sets
75. Organ photographic apparatus
76. White blood cell differential counter
77. Tally counter
78. Necropsy table
79. Center table
80. Work benches
81. Enlarger
82. Camera
83. Desiccator
84. Pipette shaker
85. Pipette for haemocyte
86. Blood cell counter
87. Tripod, iron, for burners
88. Gas cock, double, table
89. Gas cock, double, wall
90. Test tube racks

91. Mortar and pestles
92. Air compressor
93. Suction units, electric
94. Micro pipetters
95. Micro diluters
96. Trays, instrument
97. Dressing drum
98. Glasswares, chemicals and culture media
99. Other items

Table 1-5 Results of Analysis of Water at Veterinary Diagnostic Laboratories

Elements Analysed	Unit	Sample No. 1 Insein	No. 2 Bassein	No. 3 Mandalay	No. 4 Taungyi	No. 5 Tungyi
Date of Sampling		11/24/'84	11/15/84	11/15/84	11/15/84	11/15/84
pH		6.7	7.9	8.4	7.9	8.2
Electric Conductivity		1.7×10^2	1.5×10^3	5.9×10^2	4.9×10^2	4.1×10^2
TDS	mg/l	1.2×10^2	9.7×10^2	4.0×10^2	3.1×10^2	2.7×10^2
$KMnO_4$ Consumption	mg/l	0.7	3.3	2.0	4.8	1.3
Turbidity	degree	0.1	1.4	0.7	2.0	6.5
Total Solids	$CaCO_3$ mg/l in $CaCO_3$	36	3.1×10^2	60	2.3×10^2	2.0×10^2
Calcium	$CaCO_3$ mg/l in $CaCO_3$	18	1.6×10^2	37	1.6×10^2	1.3×10^2
Magnesium	$CaCO_3$ mg/l in $CaCO_3$	18	1.5×10^2	23	74	74
Sodium	$CaCO_3$ mg/l in $CaCO_3$	33	3.5×10^2	2.2×10^2	1.5	1.4
Potassium	$CaCO_3$ mg/l in $CaCO_3$	3.6	14	1.5	0.92	0.88
Total Cation	$CaCO_3$ mg/l in $CaCO_3$	72	6.7×10^2	2.8×10^2	2.4×10^2	2.0×10^2
Total Iron	mg/l as Fe	<0.05	<0.05	<0.05	<0.05	<0.05
Total Manganese	mg/l as Mn	0.17	0.68	<0.02	<0.02	<0.02
Bicarbonate Ion	mg/l as Mn	38	98	2.9×10^2	2.5×10^2	2.0×10^2
Acid Ion	$CaCO_3$ mg/l in $CaCO_3$	4.5	17	5.5	4.1	3.4
Chloride Ion	$CaCO_3$ mg/l in $CaCO_3$	28	5.5×10^2	7.2	1.4	3.0
Nitrate Acid Ion	$CaCO_3$ mg/l in $CaCO_3$	5.0	6.3	<1.6	<1.6	<1.6
Total Anion	$CaCO_3$ mg/l in $CaCO_3$	75	6.7×10^2	3.0×10^2	2.6×10^2	2.0×10^2
Soluble Silica	mg/l as SiO_2	29	16	20	4.2	3.9
Total Silica	mg/l as SiO_2	30	19	21	7.1	7.1
TOC	mgC/l	-	-	-	-	-
MF Value	minute	-	-	-	-	-

Remarks: For use as a raw water for R/O, a device (such as sand filtering) is required for Samples No. 1 and No. 2 to remove manganese and for Samples No. 2 to No. 5 to remove turbidity. No. 2 is not suited for use as raw water because of the high TDS content. Since the quality of lake water can fluctuate widely a design with sufficient allowances will have to be made.

Table 1-6 Initial List of Equipment Proposed by Burma

Sr. No.		Q'ty
1.	CO_2 incubator	4
2.	Sterilizer	12
3.	Hot air sterilizer	12
4.	Microscope (a) Biocular	16
	(b) Dissecting	16
	(c) Inverted Microscope	8
5.	Centrifuge swing head	12
6.	Freeze drying unit (Potable)	8
7.	Biohazard cabinet (Laminar flow) air filter system	8
8.	Overhead projector and accessories	4
9.	Autoclave	8
10.	Calorimeter	8
11.	Microscope with photomicrographic	6
12.	Glass ware washer	2
13.	Electric balance	16
14.	Drying cabinet	8
15.	Wax embedding oven	8
16.	U.V. spectrophotometer DU-7	1
17.	Automatic microtome knife sharpener	3
18.	Tissue Tek.(Embedding System)	2
19.	Tissue processor	2
20.	Paraffin dispenser	8
21.	Automatic staining machine	1
22.	Dual viewing microscope	2

Table 1-6 (continued)

Sr. No.		Q'ty
23.	Water distiller	8
24.	Mazda E2000	2
25.	Mazda Jeep	5
26.	Mobile laboratory with diagnostic facilities	5
27.	Electron microscope	1
28.	Central cooling unit	1
29.	Incinerator	1
30.	Generator	8
31.	Transformer	6

Table 1-7 Second List of Equipment Proposed by Burma

Microbiology Section

Sr. No.	Description	Central	Regional			Total
			MDY	TGY	BSN	
1	Autoclave	2	1	1	1	5
2	Hot air oven	2	1	1	1	5
3	Distillation apparatus	2	1	1	1	5
4	Water bath	2	1	1	1	5
5	Incubator	2	1	1	1	5
6	Anaerobic incubator	2	1	1	1	5
7	CO_2 incubator	2	1	1	1	5
8	Top loading Balance	2	1	1	1	5
9	Binocular microscope	2	1	1	1	5
10	Fluorescence microscope	1	1	1	1	4
11	Freezer dryer	1	1			2
12	Deep freezer	2	1	1	1	5
13	Clean bench	2	1	1	1	5
14	Coloney counter	1	1	1	1	4
15	Stop watch digital display	4	2	2	2	10
16	Gas chromatograph/Recorders	1	1			2
17	Thin layer chromatography kits	2	1	1	1	5
18	Thin layer chromatography-flame ionizing detector	1	1	1	1	4
19	Immemnoelectrophoresis apparatus	2	1	1	1	5
20	Double beam spectrophotometer	2	1	1	1	5
21	Refrigerated centrifuge	1	1			2
22	Centrifuge	1	1	1	1	4

*MDY - Mandalay *TGY - Taunggyi *BSN - Bassein

Sr. No.	Description	Central	Regional			Total
			MDY	TGY	BSN	
23	Digital pH meter	2	1	1	1	5
24	Water bath, low temperature	2	1	1	1	5
25	Water bath, shaking	2	1	1	1	5
26	Magnetic stirrer	2	1	1	1	5
27	Air compressor	2	1	1	1	5
28	Vacuum pump	2	1	1	1	5
29	Autostill (Double distillation unit)	2	1	1	1	5
30	Filtration sets	2	1	1	1	5
31	Balance electronic precision top-pan & digital	2	1	1	1	5
32	Balance double beam	1	1			2
33	Inverted microscope	2	1			3
34	Liquid nitrogen tank	2	1			3
35	Inverted microscope	1	1	1	1	4
36	Safety cabinet	1	1	1	1	4
37	Ultrasonic cleaner	1	1	1	1	4
38	Micro haematocrit centrifuge	1	1	1	1	4
39	Rabbit bracket unit	15	10	10	10	45
40	Rat bracket unit	10	5	5	5	25
41	Laboratory washers	1	1	1	1	4
42	Scanning electron microscope	1				1
43	Washing machine	1	1	1	1	4
44	Dry ice machine	1	1	1	1	4
45	CO_2 gas cylinder	1	1	1	1	4
46	Ultra centrifuge	1	1	1	1	4
47	Gas regulator	1				4

Pathalogy Section

Sr. No.	Description	Central	Regional			Total
			MDY	TGY	BSN	
1	Vacuum automatic tissue processor	1				1
2	Balance hanging scale	1	1	1	1	4
3	Refrigerator	2	1	1	1	5
4	Freezing microtome	1				1
5	Rotary microtome	1				1
6	Automatic knife sharpener	1				1
7	Paraffin section mounting bath	1				1
8	Slide warmer	1				1
9	Binocular microscope	1	1	1	1	4
10	Trinocular microscope	1	1	1	1	4
11	Photomicrographic system	1	1	1	1	4
12	Specimen cutting bed	1				1
13	Automatic stainer	2				2
14	Tissue embedding canter	1				1
15	Paraffin oven	1				1
16	Paraffin cleaner	1				1
17	Specimen adjusting box	1	1	1	1	4
18	Automatic centrifuge	1	1	1	1	4
19	Inoculator	1	1	1	1	4
20	Deep freeme	2	1	1	1	5
21	Water bath	1	1	1	1	4
22	Multi dryer	1	1	1	1	4
23	Port mortem set for large animal	1	1	1	1	4
24	Port mortem set for small animal	1	1	1	1	4
25	Port mortem set for poultry	1	1	1	1	4
26	Dark field and place contrast					

Biochemistry Section

Sr. No.	Description	Central	Regional			Total
			MDY	TGY	BSN	
1	Direct reading analytical abalance	1	1	1	1	4
2	Automatic pH meter	1				1
3	Digital pH meter	1				1
4	Digital Ion meter	1				1
5	Flame photometer	1				1
6	Digital spectrophotometer	1	1	1	1	4
7	Flucrescence spectrophotometer	1				1
8	Refrigerator	1	1	1	1	4
9	Automatic centrifuge	1	1	1	1	4
10	Refrigerated centrifuge	1				1
11	Water bath	1	1	1	1	4
12	Deep freezer	1				1
13	Magnetic stirner	1	1	1	1	4
14	Automatic Analyzer	1				1
15	Chloride meter	1				1
16	Digital glucose analyzer	1				1
17	Microliter pippette	3				3
18	Touch mixer	1	1	1	1	4
19	Top loading balance	1	1	1	1	4
20	Distillation apparatus	1	1	1	1	4
21	Automatic blood cell counter	1	1	1	1	4

Parasitology Section

Sr. No.	Description	Central	Regional			Total
			MDY	TGY	BSN	
1	Binocular microscope	1	1	1	1	4
2	Disecting microscope	1	1	1	1	4
3	Top loading balance	1	1	1	1	4
4	Refrigerator	1	1	1	1	4
5	Automatic centrifuge	1	1	1	1	4
6	Magnetic stirrer	1	1	1	1	4
7	Water bath	1	1	1	1	4
8	Tally counter	2	2	2	2	8
9	Stop watch digital display	2	2	2	2	8
10	Refrigerated centrifuge	1	1	1	1	4
11	Stereo microscope	2	2	2	2	8

Library Equipment

Sr. No.	Description	Central	Regional			Total
			MDY	TGY	BSN	
1	Overhead projector	1	1	1	1	4
2	Slide projector	1	1	1	1	4
3	Screen	1	1	1	1	4
4	Portable VTR system	1				1
5	Monitor system	1	1	1	1	4
6	Copying printer	1	1	1	1	4
7	Plain paper copier	1	1	1	1	4

Miscellaneous Equipment

Sr. No.	Description	Central	Regional			Total
			MDY	TGY	BSN	
1	Air conditioners	12	6	6	6	30
2	Stand-by generator (Power rating 33 kVA)		1	1	1	3
3	Stand-by generator (Power rating 50 kVA)	1				1
4	Electric duplicator	1	1	1	1	4
5	Moror cycle	6	6	6	6	24
6	Mobil Diagnostic Van	1	1	1	1	4
7	Intercom system	1	1	1	1	4
8	35 mm SLR camera	1	1	1	1	4
9	Color enlarger	1	1	1	1	4
10	Distillation plant	1	1	1	1	4
11	Deionizer	1	1	1	1	4
12	Incinerator, for large animal	1	1	1	1	4
13	Incinerator, for small animalf	1	1	1	1	4
14	Cold store (4°C)	1	1	1	1	4
15	Cold store (-20°C)	1				1

Epizootiology Section

Sr. No.	Description	Central	Regional			Total
			MDY	TGY	BSN	
1	Microfiling unit	1				1
2	Microfiche reader	1				1
3	Micro-computer	1			1	1
4	Electronic calculator	3	1	1	1	6
5	Rotating filing cabinet	1	1	1	1	4

Others

Sr. No.	Description	Central	Regional			Total
			MDY	TGY	BSN	
1	Water supply by-pass materials			1		1
2	Electric work machinery materials		1	1		2