Staple	Acceptable Alternative Accompaniment	Remarks
Wheat-flour	Vegetable oil	Different ethnic groups exist with own food habits; pork is avoided by Moslems and beef by the Hindus.
Milk		Pre-harvest food shortage common. Pastoralists don't eat fish. Introduction of yellow maize and red sorghum may give some difficulties. Vegetable oils and animal fats are known in most regions of the country.
Wheat-flour Maize flour	Vegetable oil	
Wheat-flour	Vegetable oil	
Rice Wheat-Bulgur	Vegetable oil	
Rice Wheat-flour	Milk powder	Fish not consumed by pastoralists.
Rice Wheat-flour	Milk powder	
Wheat-flour	Milk powder	

Country	Region	Major Food Staple	Accompaniment
65 Mexico		Maize flour Rice	Phaseolus vulgaris Pork Chicken Milk Cheese-milk products Vegetable oil
66 Mongolia		Meat Wheat-flour	Milk Cheese-milk products Yoghurt Vegetables Butter
67 Morocco	*North*	Wheat-flour Barley Sorghum	Vegetables Chick pea Broad beans Milk Whey Olive oil
	Central	Wheat-flour Barley Maize flour	Vegetables Meat Whey Olive oil
	South (Sahara)	Barley Wheat-flour Maize flour Dates Sweet potato	Vegetable oil
68 Mozambique		Cassava Maize flour Sorghum Millet Rice	Peanuts Fish Meat Peanut oil Cottonseed oil
69 Nepal		Rice Maize flour	Pulses Vegetables Milk Cheese-milk products Yoghurt Mustard oil Butter Ghee
70. Papua—New Guinea		Sweet potato Yam Sago	Leafy vegetables Pulses Pork
71. Nicaragua		Maize flour Rice	Phaseolus vulgaris Cottonseed oil Meat Pork fat

Acceptable Alternative Staple	Accompaniment	Remarks
Wheat-flour	Milk powder	Fish not universally known as a food Food habits differ among regions
Rice	Milk powder	Fish not often consumed Meat is the staple.
Rice	Milk powder	Fish generally not used in South and Central parts.
Rice	Milk powder	
Rice	Milk powder	Argan oil from seeds of Argan tree (like olive oil)
Wheat-flour Dehydrated potato	—	Cereals and tubers consumed in different proportions in different areas.
Wheat-flour Sorghum	Milk powder	Beef not acceptable
Maize flour Rice	—	Fish mainly consumed in the coastal and riverine areas.
Wheat-flour Sorghum	Milk powder	

Country	Region	Major Food Staple	Major Food Accompaniment
72. Niger	*Saharian Zone* (pastoralists)	Millet Dates	Milk Cheese-milk products Butter Meat
	Sahelian Zone	Millet Sorghum	Peanuts Cow peas/black-eyed beans Meat Vegetable oil
	Sudanian Zone (Southwest)	Millet Sorghum Maize flour Rice Cassava	Fish Peanuts Meat
73. Nigeria	*Sahel Zone* (North)	Millet Sorghum	Vegetables Peanuts Meat Fish Milk Butter Peanut oil
	Sudan Zone	Sorghum Millet Digitaria-a variety of grass	Vegetables Peanuts Meat Fish Peanut oil
	Guinea Zone	Sorghum Millet Yam Sweet potato	Cow peas/black-eyed beans Vegetables Meat Fish Vegetable oil
	Equatorial Guinea Zone	Yam Cocoyam Cassava Maize flour	Vegetables Cow peas/black-eyed beans Peanuts Meat Fish Palm oil
74. Oman	*Settled Population*	Millet Wheat-flour Dates	Sesame oil Butter
	Nomads	Sweet potato Cocoyam Millet Dates	

Staple	Acceptable Alternative Accompaniment	Remarks
Wheat-flour Cassava-farina	Milk powder	Pastoralists do not eat fish; pre-harvest food shortage common. Introduction of yellow maize and red sorghum may give some difficulties.
Wheat-flour Maize flour	Dry fish Pulses	
Wheat-flour Maize flour	Dry fish Pulses	
Maize flour Rice Wheat-flour Cassava	Milk powder	Introduction of yellow maize may give some difficulties. Consumption varies according to seasonal supply. In the Sahel and Sudan Zone, pre-harvest food shortages common.
Rice Maize flour Wheat-flour Cassava		
Maize Flour Rice Wheat-flour Dehydrated potato Cassava	—	
Wheat-flour Dehydrated potato Cassava	Dry fish	
Rice Wheat, Bulgur	—	Pork avoidances. Fish is consumed in coastal communities.
Yam	—	

Country	Region	Major Food Staple	Accompaniment
75. Pakistan		Wheat-flour Rice Millet	Pigeon pea Mung beans Split peas, lentils Meat Fish Milk Cheese-milk products Vegetable oil Ghee
76. Panama		Rice Maize flour Plantain	Phaseolus vulgaris Meat Milk Cheese-milk products Fish Pork fat
77. Paraguay		Cassava Maize flour Wheat-flour Sweet potato	Pulses Meat Milk Peanut oil Soya oil Cottonseed oil
78. Peru	*Coastal Zone*	Wheat-flour Rice	Pulses Meat Fish
	Andean Zone	Potato Wheat-flour Maize flour Wheat-noodles	Pulses Meat Milk
	Humid Tropical Zone	Cassava Plantain	Leafy vegetables Meat Fish
79. Philippines		Rice Maize flour	Vegetables Leafy vegetables Fish Pork Coconut oil
80. Qatar		Wheat-flour Rice Dates	Meat Milk Sesame oil Butter

Staple	Acceptable Alternative Accompaniment	Remarks
Sorghum Maize flour	Milk powder Pulses	Pork avoidances
Wheat-flour Oats	Milk powder Cow peas/black-eyed beans Butter beans	
Rice Dehydrated potato	Milk powder	Fish is not known as food
Barley	Vegetable oil	Fish is not known as a food in the Andean Zone. Vegetable oils and animal fats are used in most of the regions
Dehydrated potato Rice Barley Oats	Vegetable oil	
Rice Sweet potato	Vegetable oil	
Wheat-flour	Mung beans Pulses Split peas, lentils	Pork not consumed in some areas in South.
Wheat, Bulgur Sorghum	Milk powder	Pork avoidances.

Country	Region	Major Food Staple	Accompaniment
81 Rhodesia		Maize flour Millet Sorghum Wheat-flour	Vegetables Peanuts Meat Fish Peanut oil Cottonseed oil
82 Rwanda		Sweet potato Maize flour Cassava	Cow peas/black-eyed beans Phaseolus vulgaris Pigeon pea Leafy vegetables Meat Milk Butter
83 Saudi Arabia	*Sedentary Population*	Sorghum Wheat-flour Rice Millet Dates	Meat Milk Butter
	Nomads	Sweet potato Cocoyam Wheat-flour Sorghum Rice Millet	
84 Senegal		Rice Sorghum Millet Maize flour	Leafy vegetables Peanuts Meat Fish Milk Peanut oil
	Casamance	Cassava Rice Millet Sorghum	Leafy vegetables Meat Fish
	Pastoralists	Sorghum Millet Milk	
85 Sierra Leone		Rice Cassava Millet Sweet potato	Leafy vegetables Peanuts Phaseolus vulgaris Fish Meat Palm oil
86 Singapore		Rice	Leafy vegetables Vegetables Pulses Soya bean Fish Pork Chicken

Staple	Acceptable Alternative Accompaniment	Remarks
—	—	Introduction of yellow maize may give some difficulties
Rice Wheat-flour Potato	Milk powder	Record of famines. Cow's milk popular but not regularly consumed. Fish consumed near lakes and rivers. Dry legumes actually replace cereals in diet.
Wheat, Bulgur	Milk powder	Pork avoidances. Fish avoidances. Fish consumed in coastal communities
Wheat, Bulgur	Milk powder	
Wheat flour	Milk powder	Pre-harvest food shortages common. Peanuts are main cash crops. Introduction of yellow maize and red sorghum may give difficulties
Wheat-flour Maize flour Dehydrated potato	Milk powder	
Wheat-flour Milk powder	—	Pastoralists do not eat fish
Wheat-flour Maize flour Cassava-farina	Dry fish	Introduction of yellow maize may give some difficulties
Wheat-flour	—	

Country	Region	Major Food Staple	Accompaniment
87. Somalia	*Settled Population and Semi-nomads*	Sorghum Maize flour	Pulses Milk Butter
	Pastoralists	Milk Butter Meat Sorghum	
88. Sri Lanka		Rice Wheat-flour Cassava	Vegetables Milk Fish Coconut oil Pigeon pea
89. St. Kitts, Nevis and Anguilla		Wheat-flour Rice Sweet potato	Pulses Fish Meat Milk Cheese-milk products
90. St. Vincent		Rice Sweet potato Yam Cassava	Pulses Fish Milk Cheese-milk products Meat Vegetable oil
91. Sudan	*North*	Sorghum Millet Maize flour	Peanuts Pulses Milk Meat Sesame oil Cottonseed oil
	South	Millet Sorghum Cassava Sweet potato	Fish Meat Milk Vegetable oil Butter
92. Surinam		Rice Wheat-flour Sweet potato Cassava	Pulses Meat Fish Milk Cheese-milk products Coconut oil
93. Swaziland		Maize flour Sorghum	Leafy vegetables Peanuts Meat Milk Vegetable oil Butter

Staple	Acceptable Alternative Accompaniment	Remarks
Wheat-flour	Milk powder	Fish not a common food.
Wheat-flour	—	
—	Milk powder Split peas lentils Dry fish	
Dehydrated potato	Milk powder	
Wheat-flour Dehydrated potato	Milk powder	
Wheat-flour Maize flour	Milk powder	Pork avoidances. Consumption varies according to seasonal supply Introduction of yellow maize may give some difficulties.
Wheat-flour Rice Dehydrated potato	Milk powder	
Wheat-Bulgur Dehydrated potato	Milk powder	Food habits differ among various population groups
Wheat-flour Rice	Milk powder	Fish not popular food. Canned fish is accepted (sardines and pilchards) Introduction of yellow maize may give some difficulties.

Country	Region	Major Food Staple	Accompaniment
94 Syria	*Settled Population*	Wheat-flour Barley	Broad beans Cheese-milk products Meat Mutton Sesame oil Cottonseed oil
	Nomads	Milk Cheese-milk products Millet	—
95. Tahiti		Yam Taro Sweet potato	Coconut Fish Pork
96 Tanzania	*Settled Population*	Maize flour Millet Sorghum Plantain Cassava	Vegetables Peanuts Cow peas/black-eyed beans Phaseolus vulgaris Meat Fish
	Pastoralists	Millet Blood Milk Meat	—
97. Thailand		Rice	Vegetables Fish Egg Peanut oil Coconut oil
98 Togo	*North*	Millet Sorghum	Vegetables Peanuts Meat Fish Vegetable oil
	South (Guinea Zone)	Yam Cassava Maize flour Cocoyam Sweet potato	Vegetables Peanuts Meat Fish Palm oil Coconut oil
99 Trinidad and Tobago		Wheat-flour Rice	Pulses Fish Milk Cheese-milk products Meat Coconut oil

Staple	Acceptable Alternative Accompaniment	Remarks
Wheat, Bulgur Rice Sorghum	Milk powder	Fish is mainly consumed along rivers. Pork avoidances.
Wheat-flour Rice Sorghum Milk powder	—	
Rice Wheat-flour Dehydrated potato	—	
Dry fish	—	
Wheat-flour Rice	—	
Maize flour Wheat-flour	—	
Maize flour Rice Wheat-flour	—	Introduction of yellow maize may give some difficulties. Consumption varies according to seasonal supply. Pre-harvest food shortages com in the North.
Maize flour Rice Wheat-flour Dehydrated potato	—	
	Milk powder	The food habits of Creole, Hindu, and Moslem population not same.

Country	Region	Major Food Staple	Major Food Accompaniment
100. Tunisia		Wheat-flour Barley Oats	Broad beans Chick pea Meat Milk Cheese-milk products Olive oil
101 Turkey		Wheat-flour Wheat, Bulgur	Broad beans Chick pea Meat Cheese-milk products Olive oil
102 Uganda		Cassava Plantain Sorghum Millet Maize flour	Cow peas/black-eyed beans Chick pea Peanuts Fish Meat Milk Vegetable oil
103 Upper Volta	*Sudan Zone*	Sorghum Millet	Leafy vegetables Peanuts Vegetable oil Peanut oil
	Guinea Zone	Sorghum Yam Cassava	Leafy vegetables Peanuts Vegetable oil Peanut oil
104. Uruguay		Wheat-flour	Meat Milk Vegetables Sunflower seed oil
105. Venezuela		Wheat-flour Maize flour Banana Rice	Pulses Meat Milk Cheese-milk products Coconut oil Sesame oil
106 Viet-Nam, Socialist Republic of		Rice	Vegetables Mung beans Golden mung beans Soya bean Meat Pork Fish Vegetable oil

Staple	Acceptable Alternative Accompaniment	Remarks
Barley Wheat-pasta	Milk powder Split peas, lentils	Pork avoidances.
Rice Barley Maize flour	Milk powder	Pork avoidances. Fish consumed in coastal areas. Rye is used as staple in many places.
Wheat-flour Rice	Milk powder	
Maize flour Rice	—	Pre-harvest food shortages common
Maize flour Rice Dehydrated potato	—	
Rice	Milk powder	
Dehydrated potato	Milk powder	Food habits differ in various regions. Fish not used as food in inland areas.
Wheat-flour Wheat-noodles	Dry fish Pulses	

Country	Region	Major Food Staple	Major Food Accompaniment
107. Western Samoa		Taro Banana Bread Fruit	Leafy vegetables Fish Meat Coconut
108. Yemen Arab Republic		Millet Sorghum Wheat-flour	Chick pea Vegetables Cheese-milk products Butter Vegetable oil
109. Yemen, People's Dem. Republic	*Settled Population*	Wheat-flour Millet Sorghum Rice Dates	Meat Milk Ghee Vegetable oil
	Nomads	Sweet potato Cocoyam Wheat-flour Millet Sorghum	—
110 Zaire	*Tropical wet-dry areas* (low lands of Kasai and lower Congo Basin)	Cassava Maize flour Plantain	Leafy vegetables
	Equatorial wet areas (North districts)	Cassava Plantain Maize flour	—
	Tropical Highlands (Kasai)	Cassava Maize flour Millet	—
	Temperate Highlands (Katanga)	Maize flour	—
111 Zambia		Maize flour Cassava Millet	Vegetables Peanuts Fish Meat Peanut oil

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Staple	Acceptable Alternative Accompaniment	Remarks
Wheat-flour	—	
Rice Maize flour	Milk powder	Pork avoidances. Fish on coast. Fenugreek is important accompanying item.
Wheat-Bulgur	Milk powder	Pork avoidances. Fish consumed on coast.
Wheat-Bulgur Yam	—	
Rice	—	Introduction of yellow maize may give some difficulties. Vegetable oil (groundnut oil, palm oil) are consumed in nearly all regions.
Rice Wheat-flour	Vegetable oil	
Rice Wheat-flour	—	
Rice Wheat-flour	—	
Wheat-flour		Introduction of yellow maize may give some difficulties.

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APPENDIX 8
Energy* and Protein* Content of Common Articles of Food Included in the Staple Diet

(in 100 g. edible portions)

Food and Description	Energy Kcals	Protein g.
I. Cereals and Millets		
Barley (*Hordeum* vulgare)		
a) whole seeds	330	11
b) pearled or flakes	350	9
Bajra (*Pennisetum* typhoideum)	360	12
Bamboo seeds (*Bambusa* arundinacea)	370	13
Corn (*Zea* mays)		
a) whole kernel, dry, yellow, white or red	360	10
b) corn meal—whole grain, bolted	360	9
c) degermed	360	8
d) tender, raw	100	4
Oats (*Avena* sativa)		
a) oatmeal or rolled oats	390	14
Rice (*Oryza* sativa)		
a) brown raw rice	360	8
b) white raw rice	360	7
c) parboiled rice	370	8
d) glutinous milled rice	360	6
Sorghum (*Sorghum* vulgare)		
Semolina (*Triticum* aestivum)		
Wheat (*Triticum* aestivum)		
a) bulgur wheat	360	8
b) whole wheat	340	10
c) whole wheat flour	330	13

*The energy value has been rounded-off to nearest 10-Kcal and the protein value to the nearest gram.

Food and Description	Energy Kcals	Protein g.
II. Grain Legumes, Pulses, Dry Beans, Dahls		
Bengal gram, chick peas (*Cicer* arietinum)		
a) whole	360	17
b) split (dhal)	370	21
c) roasted	370	23
Mung beans (*Phaseolus* mungo, *P.* aureus)	350	24
Lima beans, sugar beans, white beans (*P.* lunatus)	340	22
Kidney beans, red peas (*P.* vulgaris)	340	22
Cow peas, black eye peas (*Vigna* unguiculata)	340	24
Lentils (*Lens* esculenta)	340	25
Peas (*Pisum* sativum)		
a) dry	320	20
b) roasted	340	23
Pigeon peas (*Cajanus* cajan)	340	22
Khesari dahl (*Lathyrus* sativus)	350	28
III. Roots and Tubers		
Cassava (*Manihot* esculenta)		
a) fresh root	150	1
b) meal and flour	340	2
Taro (*Colocasia* spp.); fresh tuber	110	2
Potato, Irish; fresh tuber	80	2
Potato, sweet; fresh, pale, and orange varieties	120	1
Yam (*Dioscorea* spp.); fresh	110	2
IV. Nuts and Oil Seeds		
Peanuts (*Arachis* hypogea)		
a) raw without skin	570	27
b) roasted	590	26
c) peanut flour - partially defatted	370	48
Soyabean (*Glycine* max)		
a) dry whole seeds	340	38
b) soya flour - partially defatted	260	46
V. Fruits, Vegetables, and Others		
Banana (*Musa* sapienhum; *M.* paradisica)		
a) green	70	1
b) ripe	120	1

Food and Description	Energy Kcals	Protein g.
Bread fruit (*Artocarpus* altilis)	80	1
Dates (*Phoenix* dactylifera), semi-dried	220	1
Sago	350	0
VI. Miscellaneous Foods		
Rice, flaked	360	6
Rice, puffed	350	6
Biscuits (sweet)	440	7
Biscuits (salt)	525	7
Bread (white unenriched)	270	8
Spaghetti/macaroni (unenriched)	370	12
Sugar (brown)	370	0
Sugar (white)	390	0
Coconut (mature, fresh)	290	4
Whole egg powder	590	45
Fish flour (whole fish)	330	75
FPC (solvent extracted for human use)	370	94
Whole milk powder	500	26
Skim milk powder	360	36

APPENDIX 9: Computations for

Average Daily Ration (g.)	Feeding Days	Total intake (g.) in period per benf.	Total intake (kg.) in period per benf.	10 MT	30 MT
10	90	900	0.9	11,111	33,333
10	120	1,200	1.2	8,333	25,000
10	180	1,800	1 8	5,555	16,666
10	360	3,600	3.6	2,777	8,333
20	90	1,800	1 8	5,555	16,666
20	120	2,400	2.4	4,166	12,500
20	180	3,600	3.6	2,777	8,333
20	360	7,200	7.2	1,388	4,166
30	90	2,700	2 7	3,703	11,111
30	120	3,600	3 6	2,777	8,333
30	180	5,400	5.4	1,851	5,555
30	360	10,800	10.8	925	2,777
40	90	3,600	3 6	2,777	8,333
40	120	4,800	4.8	2,083	6.250
40	180	7,200	7 2	1,388	4,166
40	360	14,400	14 4	694	2.083
50	90	4,500	4 5	2,222	6,666
50	120	6,000	6 0	1,666	5,000
50	180	9,000	9 0	1,111	3,333
50	360	18,000	18 0	555	1,666
60	90	5,400	5 4	1,851	5,555
60	120	7,200	7 2	1,388	4,166
60	180	10,800	10.8	925	2.777
60	360	21,600	21.6	462	1,388
80	90	7,200	7.2	1,388	4.166
80	120	9,600	9.6	1,041	3.125
80	180	14,400	14 4	694	1,083
80	360	28,000	28.0	347	1,041

*For convenience, *final* figures may be rounded upward or downward within the nearest 5%.

Notes: To determine the metric tonnage of food required for a specific number of intended beneficiaries:

- Find the appropriate combination of daily ration and feeding days (in columns 1 and 2);

Requirements of Supplementary Foods*

Average Beneficiaries** per MT				
50 MT	**100 MT**	**200 MT**	**500 MT**	**1,000 MT**
55,555	111,111	222,222	555,555	1,111,111
41,666	83,333	166,666	416,666	833,333
27,777	55,555	111,111	277,777	555,555
13,888	27,777	55,555	138,888	277,777
27,777	55,555	111,111	277,777	555,555
20,833	41,666	83,333	208,333	416,666
13,888	27,777	55,555	138,888	277,777
6,944	13,888	27,777	69,444	138,888
18 518	37,037	74,074	185,185	370,370
13,888	27,777	55,555	138,888	277,777
9,259	18,518	37,037	92,592	185,185
4,629	9,259	18,518	46,296	92,592
13,888	27,777	55,555	138,888	277,777
10 116	20 833	41,666	104,166	208 333
6,944	13,888	27,777	69,444	138,888
3,472	6,944	13,888	34,722	69,444
11,111	22,222	44,444	111,111	222,222
8,333	16,666	33,333	83,333	166,666
5,555	11,111	22,222	55,555	111,111
2 777	5,555	11,111	27,777	55,555
9,259	18,518	37,037	92,592	185,185
7,142	13,888	27,777	69,444	138,888
4,629	9,259	18,518	46,296	92,592
2,314	4,629	9,259	23,148	46,296
6,944	13,888	27,777	69,444	138,888
5,208	10,416	20,833	52,083	104,166
3,472	6,944	13,888	34,722	69,444
1,736	3,472	6,944	17,361	34,722

Multiply beneficiaries by total intake in kg. (column 4 on same line);
Divide by 1,000, then round within nearest 5%.

**From Book F, Chapter I: "Emergency Situations" UNICEF Field Manual, Vol. I, Dec 1975

Average Daily Ration (g.)	Feeding Days	Total intake (g.) in period per benf.	Total intake (kg.) in period per benf.	10 MT	30 MT
100	90	9,000	9 0	1,111	3,333
100	120	12,000	12 0	833	2,500
100	180	18,000	18 0	555	1 666
100	360	36,000	36 0	277	833
125	90	11,250	11.25	888	2,666
125	120	15,000	15 0	666	2,000
125	180	22,500	22 5	444	1,333
125	360	45,000	45 0	222	666
150	90	13,500	13 5	740	2,222
150	120	18,000	18 0	555	1,666
150	180	27,000	27 0	370	1,111
150	360	54,000	54.0	185	555

Average Beneficiaries** per MT				
50 MT	**100 MT**	**200 MT**	**500 MT**	**1,000 MT**
5,555	11,111	22,222	55,555	111,111
4,166	8,333	16,666	41,666	83,333
2,777	5,555	11,111	27,777	55,555
1,388	2,777	5,555	13,888	27,777
4,444	8,888	17,777	44,444	88,888
3,333	6,666	13,333	33,333	66,666
2,222	4,444	8,888	22,222	44,444
1,111	2,222	4,444	11,111	22,222
3,703	7,407	14,814	37,037	74,074
2,777	5,555	11,111	27,777	55,555
1,851	3,703	7,407	18,518	37,037
925	1,851	3,703	9,259	18,518

APPENDIX 10
Weight and Length for Age

Birth to 60 months, 6-month intervals (sexes combined)

Age (months)	Weight (kg.) standard	80% standard	60% standard	Length (cm) standard	80% standard	60% standard
0	3 4	2 7	2.0	50.4	40 3	30 2
6	7 4	5.9	4.5	65 8	52 6	39.5
12	9.9	7 9	6.0	74 7	59 8	44.8
18	11 3	9 0	6 8	81.4	65.1	48.8
24	12.4	9 9	7.5	87 1	69.6	52 2
30	13 5	10.8	8 1	91 8	73 4	55 1
36	14.5	11.6	8 7	96.0	76.8	57 6
42	15 5	12 4	9 3	99.7	79.7	59 8
48	16 5	13.2	9.9	103 3	82 6	62.0
54	17 4	14.0	10 5	106.8	85.4	64.1
60	18.4	14 7	11 0	109.0	87 1	65 3

Values derived from Harvard Standards (1959)

From, D. B Jelliffe, *The Assessment of the Nutritional Status of the Community*, WHO Monograph 53 (1966)

Weight for Length

Young children, 52-108 cm in length (sexes combined)

Length (cm)	Weight (kg.) standard	90% standard	80% standard	70% standard	60% standard
52	3 8	3.4	3.0	2 7	2.3
53	4.0	3.6	3.2	2 8	2.4
54	4.3	3 9	3 4	3.0	2 6
55	4 6	4.1	3 6	3.2	2 7
56	4.8	4 3	3.8	3 4	2 9
57	5.0	4 5	3.9	3 5	3 0
58	5 2	4 7	4 2	3.6	3.1
59	5 5	4.9	4 4	3.8	3 3
60	5.7	5 1	4 6	4.0	3 4
61	6.0	5 4	4.8	4.2	3.6
62	6.3	5 7	5.0	4.4	3 8
63	6.6	5.9	5.3	4 6	3 9
64	6 9	6.2	5.5	4 8	4 1
65	7 2	6.5	5.8	5.0	4.3
66	7.5	6.8	6 0	5 3	4.5
67	7.8	7.0	6.2	5.5	4.7

Length (cm)	Weight (kg.) standard	90% standard	80% standard	70% standard	60% standard
68	8.1	7.3	6.5	5.7	4.9
69	8.4	7.6	6.7	5.9	5.0
70	8.7	7.8	7.0	6.1	5.2
71	9.0	8.1	7.2	6.2	5.3
72	9.2	8.3	7.4	6.4	5.5
73	9.5	8.5	7.6	6.6	5.6
74	9.7	8.7	7.8	6.8	5.8
75	9.9	9.0	8.0	6.9	5.9
76	10.2	9.2	8.3	7.1	6.1
77	10.4	9.4	8.3	7.2	6.2
78	10.6	9.5	8.5	7.4	6.4
79	10.8	9.7	8.6	7.5	6.5
80	11.0	9.9	8.8	7.7	6.6
81	11.2	10.1	9.0	7.8	6.7
82	11.4	10.3	9.1	8.0	6.8
83	11.6	10.4	9.2	8.1	6.9
84	11.8	10.6	9.4	8.3	7.1
85	12.0	10.7	9.6	8.4	7.2
86	12.2	11.0	9.8	8.5	7.3
87	12.4	11.1	9.9	8.6	7.4
88	12.6	11.3	10.1	8.8	7.6
89	12.8	11.5	10.2	9.0	7.7
90	13.1	11.8	10.5	9.2	7.9
91	13.4	11.9	10.7	9.3	8.0
92	13.6	12.2	10.9	9.5	8.2
93	13.8	12.4	11.0	9.6	8.3
94	14.0	12.6	11.2	9.8	8.4
95	14.3	12.8	11.4	10.0	8.5
96	14.5	13.1	11.6	10.2	8.7
97	14.7	13.3	11.8	10.3	8.8
98	15.0	13.5	12.0	10.5	9.0
99	15.3	13.7	12.3	10.7	9.2
100	15.6	14.0	12.5	10.9	9.4
101	15.8	14.2	12.6	11.1	9.5
102	16.1	14.5	12.9	11.3	9.7
103	16.4	14.7	13.2	11.5	9.8
104	16.7	15.0	13.4	11.7	10.0
105	17.0	15.3	13.6	11.9	10.1
106	17.3	15.6	13.8	12.1	10.4
107	17.6	15.9	14.0	12.3	10.5
108	18.0	16.2	14.4	12.6	10.8

Values derived from Harvard Standards — Stuart & Stevenson (1959).

APPENDIX 11
Treatment of Drinking Water*

A. Disinfection:

Accomplished by boiling or by chemical treatment with chlorine using chlorine-liberating compounds Available in three forms:

1. Chlorinated lime or bleaching powder (25% by weight of available chlorine when fresh), unstable compound; loses chlorine quickly, especially when stored in humid and warm places. Strength to be checked before use.
2. Calcium hypochlorite (contains 70% by weight of available chlorine); to be stored in tight containers and in a dark cool place.
3. Sodium hypochlorite, a solution of approximately 5% strength, has limited use in small quantities under special circumstances.

The use of chlorine and iodine tablets and boiling of water are also limited to small quantities intended exclusively for drinking purposes. Other chemicals suitable for emergency disinfection of water include Lugol's solution (5% available I_2), tincture of iodine (2% available I_2), and various iodophor compounds.

Factors affecting chlorination include:

1. Amount of organic matter and other reducing substances.
2. Contact time and concentration. With ordinary doses of chlorine a minimum contact time of 30 minutes should be maintained.
3. Temperature. The effectiveness is reduced as the temperature of water decreases.
4. Hydrogen-ion concentration. The disinfecting power reduced as the pH value of the water increases.
5. If amount of free chlorine is higher, disinfection more effective.

Methods of chlorination are:

1. Gas chlorinators. These machines draw chlorine gas from a cylinder containing liquid chlorine, mix it in water, and inject it into the supply pipe. Mobile gas chlorinators are made for field use.
2. Hypochlorinators. These are less heavy than gas chlorinators and more adaptable to emergency disinfection. Generally, they use a solution of calcium hypochlorite or chlorinate lime in water and discharge it into a water pipe or reservoir. They can be driven by electric motors or petrol engines and their output can be adjusted. Hypochlorinators are small and easy to install.
3. The Batch Method. It involves applying a predetermined volume of chlorine solution of known strength to a fixed volume of water by

*Extracted from *Guide to Sanitation in Natural Disasters* by M. Assar, WHO, Geneva, 1971.

means of some gravity arrangement. The strength of the batch solution should not be more than 0.65% of chlorine by weight, as this is about the limit of solubility of chlorine at ordinary temperatures. For example, 10g. of ordinary bleaching powder (25% strength) dissolved in 5 litres of water gives a stock solution of 500mg./litre. For disinfection of drinking water, one volume of the stock solution added to 100 volumes of water gives a concentration of 5mg./litre. If after 30 minutes' contact the chlorine residual is more than 0.5mg./litre, this dosage could be reduced. After the necessary contact period has elapsed, excess chlorine can be removed to improve the taste by such chemicals as sulfur dioxide, activated carbon, or sodium thiosulfate. The first two are suitable for permanent installations, whereas sodium thiosulfate is more suitable for use in emergency chlorination. One tablet containing 0.5g. of anhydrous sodium thiosulfate will remove 1mg./litre of chlorine from 500 litres of water.

4. Continuous chlorination. Porous containers of calcium hypochlorite or bleaching powder are immersed in water, mainly for use in wells and springs, but are also applicable to other types of water supply. A free residual chlorine level of 0.7 mg./litre should be maintained in water treated for emergency distribution. A slight taste and odor of chlorine after half an hour gives an indication that chlorination is adequate. In flooded areas a higher residual chlorine in the distribution systems should be maintained. Reaction of chlorine with phenolic or other organic compounds causes an unpleasant taste. It is an indication of safe disinfection and should be accepted.

B. Coagulation-disinfection:

Part of the suspended matter in turbid water will settle if left undisturbed for several hours. The addition of chemicals called coagulants (alum, ferric chloride, and ferrous sulfate) hastens the settling process by forming a "floc" of larger particles. Settling down of the organic matter greatly lessens the amount of chlorine needed for disinfection.

Factors that govern coagulation process:

1. Optimum hydrogen-ion concentration. The pH value changes when coagulants are used and has to be adjusted to optimum value by the addition of alkalis or acids.
2. Thorough mixing can be accomplished by a) pump action, whereby the coagulant solution is added to the suction pipe of the pump and the pump does the mixing; b) the drip-bottle method, i.e. hanging a drip-bottle over the discharge pipe or hose of raw water that feeds the tank and letting the coagulant solution drip on the water jet; or c) dissolution, i.e. allowing the discharge of raw water to splash on to a basket containing solid coagulant.
3. Coagulant dosage.

C. Coagulation-filtration-disinfection:

In this method filtration is added to the procedures described above. If temporary reservoirs can be arranged, it is preferable to let the water settle before filtering it.

D. Filtration-disinfection:

In this method water is mixed with diatomaceous earth, then passed through the filter unit under pressure. Mobile purification units using this process have been produced with capacities ranging from 7,000 to 50,000 litres per hour.

E. Tests:

Tests of water samples should be made at laboratories in the vicinity of the disaster area. The most important tests to be carried out are:

1. Determination of residual chlorine (free and combined);
2. Bacteriological examination for coliform bacteria;
3. Determination of hydrogen-ion concentration;
4. Determination of type of alkalinity.

APPENDIX 12
Conversion Factors: Metric, British, and US Units

Length

1,600 m	= 1 6 km	= 1 mile	= 1,760 yd = 5,280 ft
1×10^3 cm	= 1000 m	= 1 kilometre (km)	= 0 625 mile 1,100 yd
91 4 cm	= 0 91 m	= 1 yard (yd)	= 3 ft. = 36 in.
1,000 mm	= 100 cm	= 1 metre (m)	= 1.093 yd. = 3 28 ft. = 39.37 in
0 3048 m	= 30.48 cm	= 1 foot (ft)	= 12 in.
25.4 mm	= 2 54 cm	= 1 inch (in)	= 1/12 ft
10,000 μ	= 10 mm	= 1 centimetre (cm)	= 0.394 in. = 0.033 ft.
1,000 μ		= 1 millimetre (mm)	= 0.0394 in.
0.001 mm	= 0 0001 cm	= 1 micron (μ)	= 0.000039 in (about 1/25 000 in)

Area

	259 ha	= 1 square mile (sq mile)	= 640 acres
	100 ha	= 1 square kilometre (km^2)	= 0 39 sq mile = 247 acres
10,000 m^2	= 0 01 km^2	= 1 hectare (ha)	= 2.47 acres
4,047 m^2	= 0.405 ha	= 1 acre	= 4,840 $yd.^2$ = 43 560 $ft.^2$
	10,000 cm^2	= 1 square metre (m^2)	= 1 2 $yd.^2$ = 10.76 ft^2 = 1,550 $in.^2$
	0,84 m^2	= 1 square yard (yd^2)	= 9 $ft.^3$ = 1,296 in^2
930 cm^2	= 0 093 m^2	= 1 square foot (ft^2)	= 144 in^2
	6.45 cm^3	= 1 square inch (in^2)	= 0 007 ft^2
	100 mm^3	= 1 square centimetre (cm^2)	= 0.155 $in.^3$
	93 m^2	= 1,000 square feet (ft^2)	

Volume

1,000 litres	= 1 cubic metre (m^3)	= 1 307 yd^3 = 35 32 ft^3
2 83 m^3	= 100 cubic feet (ft^3)	= 3 7 $yd.^3$
0 77 m^3	= 1 cubic yard (yd^3)	= 27 $ft.^3$
28 32 litres	= 1 cubic foot (ft^3)	= 0.037 $yd.^3$ = 1728 in^3
16 39 cm^3	= 1 cubic inch (in^3)	= 0.000579 $ft.^3$

Liquid capacity

3.79 litres	= 1 US gallon (US gal)	= 0 83 UK gal = 231 $in.^3$
4 55 litres	= 1 UK gallon (UK gal)	= 1.2 US gal
1,000 ml	= 1 litre	= 0.26 US gal (0.22 UK gal)
32 US fl oz	= 1 US quart (qt)	= 0.9463 litre
Approx. 40 UK fl oz.	= 1 UK qt	= 1 136 litres
3 teaspoonfuls	= 1 tablespoonful	= 0.5 USfl oz.

Weight

1,000 mg.	= 1 gram (g)	= 0.0352 oz
28.35 g	= 1 ounce (oz)	= 1/16 lb = 437.5 grains
64.8 mg	= 1 grain	= 1/7,000 lb
453.6 g	= 1 pound (lb.)	= 16 oz.
1,000 g	= 1 kilogram (kg)	= 2.2 lb = 35.27 oz
1,000 kg	= 1 metric ton	= 2,204 lb.
907 kg	= 1 US short ton	= 2,000 lb. = 0.893 UK ton
1,018 kg.	= 1 UK ton (1 US long ton)	= 2,240 lb = 1.12 US short tons

Weight of water in various volumes at 16.7°C (62°F)

1 ft^3 = 62.3 lb
1 litre = 1,000 g. = 1 kg. = 2.2 lb.
1 US gal = 8.33 lb
1 UK gal = 10 lb

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