

1. Number of copies 1-36
2. Date of receipt 22-3-37
Reference

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M.R.O. 1-82 400-22-11-80

MADRAS RECORD OFFICE.

Government of Madras.

Public DEPARTMENT.

G.O. No. 1366	Press Mis.
Dated 25-10-1870	

Not to be folded or roughly handled

No. 163.

To The
Inspector General
Indian Med. Dept.
Fort St George.

Sir,

With reference to your wishes expressed in the course of our conversation on the proposed systematic analysis of water in this Presidency, I have the honor to enclose a copy of the Form which has been in use in Bengal and the Upper Provinces and to suggest that the first six pages of it, (the "development of organized forms") be adopted by the Madras Analysts. The sections relating to Wells, Tanks and Rivers, as sources of water supply, might, as a matter of economy and convenience, be printed separately. For the strictly chemical portion of the scheme, I venture to suggest, the enclosed Form may be substituted; which, while being more concise and convenient than the other, does not omit any information likely to be useful in a sanitary point of view.

2. I understand that the Sanitary Commissioner is anxious that analyses of soils should be made in each Station as well as examinations of waters.

fully quantitative, or even qualitative, analyses of soils would occupy so much time, and augment so considerably the amount of apparatus and material which the analyst must transfer from place to place, that I do not suppose such an examination was contemplated by Mr. Cornish or would seem desirable or possible. Determinations of the volatile matter, the chlorine, and the nitric acid in a given weight of alluvium would perhaps meet the Sanitary Commissioners' wishes.

3. Matter Form of Report may be adopted, uniformity in procedure, in strength of standard solutions and in methods of estimation will be indispensable. This can be ensured by previous agreement between the analysts themselves; or a brief Scheme can be prepared in this Office, if circumstances render a meeting of the four officers inconvenient. I may add that uniformity need not be construed so strictly as to preclude an analyst from giving any information additional to that re-

quired by the Form, which may appear to him ~~interesting~~ ^{interesting} or valuable.

4. I have examined one of the cases of instruments, &c. intended for the Statistical Analysis of Water proposed by the late Sanitary Commissioner and sanctioned by Government. It contains everything, (with the exception of pure carbonate of lime, procurable here), necessary to the carrying out of the scheme drawn up by Mr. Ranking. In order, however, to adapt these cases to the more extended and accurate examination now suggested, certain additions will be required, both of chemicals and of apparatus. They are detailed in the following List, with suggestions as to the manner in which they may be supplied with the least possible delay.

4 Tubulated Retorts, containing 1500 c.c.
can be temporarily supplied from Medical College Laboratory

4 Do. containing 500 c.c.

4 Liebig's Condensers. can be made up in Madras.

4 Water-jars for Condensers. can be obtained in Madras

4 Receivers for 20. can be teen.
for aily supplied from Cal.

4 Quilled Receivers, do.

8 Beakers, containing 1500 c.c.

8 Cylinders glass, ^{do.} containing
200 c.c. graduated to 100,
or feet, $\frac{5}{8}$ inch diameter
may be, perhaps, obtain-
able in Calcutta.

16 Rattan ring-stands - can
be made in Madras.

10 oz. Caustic Soda in Medical
Stores? if not, in Cal-
cutta. If not obtain-
able, next article may
be substituted.

14 oz Caustic Potash, Medical Stores.

4 oz Ammonium sulphate, Med. Coll.

8 oz Pure Borax, Calcutta?

2 oz Ammonium molybdate,
Med. Coll.

Canara Marble, School
of Arts.

Tins, for evaporating & dry-
ness after the manner suggested
by Messrs. Harkly & and Chap-
man, can be easily made
up in Madras.

5. I think it is desirable that
the weights and measures of
the metral system should be
used in the proposed analy-
ses. If this opinion be concurred

in by you, four sets of French
weights from 50 to 0.001 gm. }
should be added to the List.
and results obtained in Eng-
lish denominations might
be reduced to the correspond-
ing numbers in the French
system until the correct
weights have been supplied.

I have the honor to be

Sir

Your most O^b servant

Henry Dering M.B., D.S.
Surgeon

Actg. Chem. Exam^r.

Medical College
May 20. 1870

Form A
(in continuation of p. 7 of Calcutta Form - after
"development of organized forms.")

Reaction to test-paper

Carbonic acid

Solid matter in one litre

Volatile

Mineral

Total

Oxygen required for organic matter

Putrid

(Decaying rapidly

(Decaying in 24 hours

Ammonia and organic matter

Free ammonia

Albuminoid do.

Hardness

Removable

Permanent

Total

Chlorine in one litre (volatiles

.....

Nitric acid

Mineral matter

Soluble in water

Insoluble in do.

Insoluble

Silica

Calcium carbonate

Magnesium do.

Oxide of Iron

Soluble

Calcium sulphate

Magnesium do.

Sodium (as sulphate)

Nitrous acid

Sulphuretted hydrogen

Phosphoric acid

* Qualitatively unless present in excess.

+ Qualitatively.

Public (Sanitary) Officer
to the "S" "S" "S"
1870. No. 133.

No. 1904
1870

1870

from

The Medical Officer
Madras

The Deputy General
Commissioner of the
District of Madras

Frank H. George

Dated 20th May 1870.

Enclosure. 200.

No. 163.

Enclosure. 1870. No. 1366.
water analysis used in
Bengal and submitted a
form for use in the Agency.
Reports upon the character
of minerals for water analysis
and gives such articles
required to complete them.

1870. No. 1117. No. 130
1870. No. 1117. No. 130

Okenooks.

B.

ANALYST'S REPORT.

GENERAL.

1. Period during which the waters were examined. ...
2. Average yearly rainfall ...
3. Rainfall of the week preceding the commencement of the analyses ...
4. State of weather at the time of commencing the examination of the water ...
5. State the general features of the adjacent country, noticing—
 - a.—Rivers and water-courses ...
 - b.—Undulation or flatness of the ground ...
 - c.—Contiguity of any hills ...
 - d.—Direction of the water-shed with reference to the source from which the water is taken ...
 - e.—Geological formation of the hills and adjacent country ...
 - f.—Fertility or barrenness of the soil ...
 - g.—The existence of forest land ...
 - h.—Is the country well wooded with large trees?

NOTE.—Answers to the questions in the "General Report" will be inserted in only one of the Reports sent from each station.

S. C. N^o 1366, 25th Oct. 1870

See also 1871

h. b.

For Oct. 1871 of 1870
from 25 Oct. 1870 to 1871

6. Remarks of the people regarding the water of the station as to its purity, wholesomeness, sufficiency, &c. ...

7. Special prevalence of any endemic or epidemic diseases among the people who use the water, *e. g.*, diarrhoea, dysentery, cholera, malarious fever, spleen diseases, typhoid fever, diseases of the skin, calculi, goitre, tenia, lumbricoid, or guinea-worms.

DETAIL.

Date on which analysis of the water of this Well was begun.

*I.—SOURCE OF WATER.—A WELL.

A.—Construction.

1. A shaft without any masonry, commonly called a "kutchra well" ...
2. Pucka brick without lime mortar ...
3. Pucka brick with lime mortar ...
4. The existence of any ridge to prevent spilled water from falling back into the well ... ✓
5. Is there a masonry platform around the well to throw off the water which is spilled during drawing, ablutions, &c., and thus prevent it from immediately trickling down the outside of the masonry and returning to the well?
6. Give the diameter of the platform, and state if there is any drain in or around it to carry off the water ...
7. Date when the well last dried up, or when the supply was so much diminished that it became dry in the middle of the day, while drawing water for usual consumption.

* Each water source should be so described as to be readily identified on a subsequent visit by the same or another Analyst; and a record should be kept in the station of the source from which water has been taken for analysis.

8. Does the depth of water in the well diminish very much during the hot dry months? ...
9. Method of drawing water ...
10. Date when the well was last cleaned ...
11. Is the well covered in so as to exclude dust, leaves, &c.; if so, by what? ...
12. Distance from the surface of the ground to the water ...
13. Depth of the water in the well ...
14. Diameter (interior) of the well ...
15. By whom is the water used, and for what purposes? ...
16. Remarks of those using the water of this well as to its purity, wholesomeness, &c. ...

B.—Situation of the well and its number.

1. Note the proximity of—

a.—Any dwelling-houses, barracks, cook-houses, latrines, or urinals, and state their probable distance from the well ...

b.—Also of any trees, or accumulation of refuse matter, filth, mud, water, or manure

2. The existence of any saucer-shaped depressions (in which water is liable to lodge), ponds, tanks, drains, water-courses or rivers in the vicinity, and give their respective distances from the well ...

C.—Nature of the soils through which the Well has been sunk.

- a.*—Surface soil ...
1. Alluvium ...
 2. Mur ...

- | | | |
|---|-----|-----|
| 3. Clay | ... | ... |
| 4. Calcareous | ... | ... |
| 5. Sandy | ... | ... |
| 6. Humus | ... | ... |
| 7. Oosur, or soils which have a saline efflorescence on the surface | ... | ... |

b.—Sub-soil—

- | | | |
|-----------------------------------|-----|-----|
| 1. Granitic, metamorphic, or trap | ... | ... |
| 2. Clay | ... | ... |
| 3. Limestone or Kunkur | ... | ... |
| 4. Sandstone | ... | ... |
| 5. Sand | ... | ... |
| 6. Gravel | ... | ... |

II.—SOURCES OF WATER.—A TANK.

Date on which analysis of this Water was begun.

A.—Construction.

1. Give the measurement of the long and short side, or, if square, of one side, and also the depth in centre ...
2. Are the sides of the tank of earth, or of pukka masonry? ...
3. The presence of water plants ...
4. Their nature ...
5. The existence of fish ...
6. Supply of water how maintained, by a spring, or by water derived from rain draining from the adjacent land? ...
7. Is the supply perennial, and does it continue good throughout the year? ...
8. State the depth of water in the centre of the tank at the time of your visit, and also so far as you can learn it, the depth when the water is at its highest and lowest level in the tank ...

9. Purposes for which the water is used, viz., ablution and washing clothes, for drinking or culinary purposes, or all ...
10. Are cattle bathed or watered in the tank, and is jute, sunn, or any of the fibrous or other products steeped or washed in it? ...
1. Remarks of those using the water of this tank regarding its purity, wholesomeness, &c. ...
12. By whom is the water used? ...

B.—Situation of the tank and its number.

- Note also the proximity of any dwelling-houses, cattle-sheds, latrines, large trees, accumulations of refuse matters, filth, manure, and state the probable distance ...
- Do any drains open into the tank, to how far from it do they extend; do they run in the neighbourhood of any Bazaar or other possible source of pollution? ...

—Nature of the Soil in which the tank has been made.

Surface soil :—

- | | | |
|---|-----|-----|
| 1. Alluvium | ... | ... |
| 2. Marl | ... | ... |
| 3. Clay | ... | ... |
| 4. Calcareous | ... | ... |
| 5. Sandy | ... | ... |
| 6. Humus | ... | ... |
| 7. Oosur, or soils which have a saline efflorescence on the surface | ... | ... |

Sub-soil :—

- | | | |
|-----------------------------------|-----|-----|
| 1. Granitic, metamorphic, or trap | ... | ... |
| 2. Clay | ... | ... |
| 3. Limestone | ... | ... |
| 4. Sandstone | ... | ... |
| 5. Sand | ... | ... |
| 6. Gravel | ... | ... |

III.—SOURCE OF WATER.*—A RIVER OR SPRING.

Date on which the analysis was begun.

1. Name of River ...
2. Tidal or otherwise ...
3. Geological formation at the source ...
4. Nature of bed ...
5. Depth of water at the time of commencing the examination ...
6. Velocity of the stream ...
7. Distance from any native city at which the water was drawn, and whether it was taken from above the city or below it ...
8. By whom and for what purposes is the water used? ...
9. Is the suspended matter in large amount, and is it allowed to subside before using, or is the water usually drunk in the same condition in which it is drawn? ...
10. Remarks of those using this water regarding its purity, wholesomeness, &c. ...
11. Is the water equally good throughout the year?

CHEMICAL ANALYSIS.

I.—QUALITATIVE.

A.—Physical Examination.

Filtered water	...	...
Color	...	...
Taste	...	...
Smell	...	...
Transparency	...	...
Development of organized forms	...	...
Unfiltered water	...	...
Color	...	...
Taste	...	...

* Filtering only one
 every when the water
 is turned after rest for
 12 hours.

* The water of any river that may flow within a distance of five miles from the station should be analysed. The water for analysis should be taken from a point above any city or town on its banks, and from a spot where it is not liable to be contaminated by sewage.

Smell	...	...
Transparency	...	...
Development of organized forms	...	...

B.—Chemical Examination of Original Water.

Reaction	...	...
Carbonic acid	...	...
Lime	...	...
Chlorine	...	...
Sulphuric acid	...	...
Nitric acid	...	...
1. Iron test	...	...
2. Brucine test	...	...
Nitrous acid—If present, the amount of dilution required to render the reaction indistinct	...	...
Ammonia—Precipitate or only color with Nessler's solution. If present, the amount of dilution required to render the reaction indistinct	...	...
Sulphuretted hydrogen	...	...
Iron	...	...
Protoxide	...	...
Peroxide	...	...

C.—Examination of Concentrated Water.

Precipitate.

Carbonic acid	...	...
Iron	...	...
Lime	...	...
Magnesia	...	...
Sulphuric acid	...	...
Silica	...	...
Phosphoric acid	...	...

Filtrate.

Reaction	...	...
Carbonic acid	...	...
Sulphuric acid	...	...
Chlorine	...	...
Iron	...	...
Protoxide	...	...
Peroxide	...	...
Lime	...	...
Magnesia	...	...
Silicic acid	...	...
Phosphoric acid	...	...

I.—QUANTITATIVE.

A.—Hardness.

- a. *Total.* Number of decems of soap solution used; total hardness ...
- b. *Permanent.* Number of decems of soap solution used; permanent hardness ...
- c. *Removable hardness* ...

B.—Nitric acid.

Amount of dilution or concentration required to afford the reaction in standard time ...

C.—Organic matter.

Amount of chameleon used to obtain color permanent during fifteen minutes in 10,000 grains of

the water equal grains of
oxygen requisite to purify 1,000 grains ...

D.—General Analysis.

Quantity of water set to evaporate down	...	...
Weight of capsule	...	...
„ „ plus total solids	...	...
Total solids	...	...
Weight of capsule and contents after ignition and recarbonation	...	...
Combustible matters	...	...
Mineral ingredients	...	...
Weight of insoluble mineral matter	...	...
Weight of soluble mineral matter	...	...
If carbonate of soda added, how much?	...	...
Chlorine—How many decems of nitrate of silver solution used in a?	...	...
Chloride of sodium	...	...
Alkaline carbonate—How many decems of nitrate of silver solution used in c?	...	...
Carbonate of soda	...	...
Sulphuric acid—Weight of sulphate of Baryta obtained from b?	...	...
Sulphate of soda	...	...
Silica	...	...
Lime—Number of decems of oxalic acid solution added to ? of the solution of the earthy salts	...	...
Number of decems of chameleon solution used	...	...
Carbonate of lime	...	...

*FINAL RESULT.

Total hardness
Permanent hardness
Removable hardness
Reaction before
And after boiling
Amount of oxygen needed to oxidise organic matter
of ~~1000~~ grains *1 litre*
Nitric acid in ~~70,000~~ grains of the water
Total solids in ~~70,000~~ grains of the water
Volatile matter
Mineral
Earthy salts, silica, cald. of l. sp, insoluble in
water
Carbonate of lime from insoluble matters
Silica
Salts dissolved out by water

Chloride of sodium
Sulphate of soda
Alkaline carbonate

Presence or absence of {
Ammonia
Nitrous acid
Phosphoric acid
Sulphuretted hydrogen

* Should the analysis be conducted according to the more extended method detailed in the "scheme," the results should be embodied in the usual tabular form, and should be attached to this Report.

Report on comparative examination of Water from
source, from upper vessels, and from lower vessels
of filters in Hospitals and Barracks.

REMARKS.

(Signed)

No. 156

OFFICE OF INSPECTOR GENERAL, INDIAN MEDICAL DEPARTMENT,

Fort Saint George, 5th July 1870.

From

The Inspector General, Indian Medical Department,
Fort Saint George,

To

The Chief Secretary to Government, Public Dept.
Fort Saint George.

SIR,

I have the honor with reference to G. O. No. 357 of the 29th March, to submit the following remarks on the scheme for the systematic analysis of Potable waters in this Presidency, and to state that I have delayed forwarding my reply until I could render it as complete as possible.

I have communicated with the Sanitary Commissioner as to the range which should be allotted to each analyst, and we are of opinion that they should be employed as follows:—
1 for Hyderabad and Vagpore
1 for Ceded Districts, Mysore, and Northern Division.

1 for Presidency and Southern Districts.
1 for British Burmah.

I have also conferred with the Chemical Examiner as to the arrangements best calculated to secure uniformity in the operations of the Analysts, and with this view

8-11-3000/25 Oct 1870

8-11-1970

I requested Dr. King to obtain from the L. Chemical Examiner Calcutta, such information as might aid me in submitting a complete scheme for the organization and working of the new department in Madras.

4 The attached printed form B exhibits the various points, which the Bengal analysts notice in their investigations. The results are classified in their reports under two heads, General, and Chemical. The former embraces topographical and other general matters, having a practical bearing on the special subject of the inquiry, and appears to me very complete. I would therefore recommend that the Bengal form for the General portion of the report be adopted in this Presidency, and printed separately from the Chemical, as the former will only have to be submitted once from each station.

5 Dr. King considers the Bengal form for submitting the results of the Chemical Analysis somewhat lengthy, and therefore proposes to substitute for it, attached form A which, without sacrificing uniformity, exhibits the essential particulars in a more concise and convenient form. I would therefore respectfully recommend the adoption of form A.

6 I have also been favored with an interesting communication from the Sanitary Commissioner, offering various suggestions for the guidance of the analysts. I shall not enter into details regarding these here, but may state, that his chief object is to show, that in certain circumstances and situations, it will be essential to examine chemically the neighbouring soil, as well as the water of reservoirs from which the people get their supply. I have consulted with Dr. King on this subject, and he is of opinion, that anything like a complete analysis of soils would occupy so much time, and so greatly augment the amount of apparatus and material which the analyst would have to carry about, that he does not think such an examination desirable or possible. While concurring generally in this view, I think it very desirable that the Analysts should be made acquainted with Mr. Cornish's opinions, and will therefore furnish each of them with a copy of his letter.

7 In the latter part of his letter, the Sanitary Commissioner points out the desirability of analysing the water of certain wells at different seasons of the year, and the importance of systematic microscopic examination of all potable waters. These are matters to which the attention of the Analysts may be specially directed.

8 The Government of India Pro-
ceedings marginally noted, so far back as ^{*Proceedings of} 1865, sanctioned a scheme for the analysis ^{of Port. Military} of water in Military Encampments, and ^{Department, and order} ordered the procuring for this purpose ^{No 3353 of 31st August} of 10 sets of apparatus and chemicals from ¹⁸⁶⁵ England. These arrived some time ago, and with the view of ascertaining their suitability for the present scheme, I requested the Chemical Examiner to examine and report on them. He states that a few additions will be necessary, to adapt them to the more extended and accurate examination now contemplated.

A list of the desiderata will be found in ³¹ para 4 of his letter No 163 of the 20th May, herewith enclosed, and as they can all be procured locally, or in Calcutta, I would beg to solicit sanction for their being obtained by the Principal Medical Store-keeper, from the sources indicated by the Chemical Examiner.

9 The weights which have been furnished with these sets of apparatus are English, but as Chemists now almost universally adopt the metrical system, I would recommend, that 8 sets of French weights, ranging from 50 to 0.001 grammes be obtained from England. Until the latter arrive, the results obtained with the present English might be reduced to the corresponding French weights, to admit of easy comparison with operations in other parts of India &c.

10 Before entering on their duties, the analysts should be instructed to communicate with each other, and make arrangements for securing absolute uniformity in procedure, strengths of standard solutions, and methods

methods of estimation. I would further recommend that in these particulars they should strictly conform in the usages ^{now} which obtain in the other Presidencies.

11 Since the receipt of the order now under reply, Messrs. Carter and Macrae, who were recommended by me for employment as Analysts having incurred considerable expense in taking up new appointments, have asked me to withdraw their names from the list of candidates. I therefore beg to nominate in their place. Assistant Surgeons - S. M. Tyrrell, and David Sinclair, M.D., who have been regularly trained to the work at Netley, and seem qualified for the duty. With these changes the proposed Staff of Analysts will now stand as per margin. The first named Officer belongs to H. M. British Army, and a requisition for his services will therefore have to be made to the Inspector General British Medical Service.

12 In conclusion I have the honor to recommend that, as in Bengal,

147
the Analysts be required to communicate the results of their work periodically to the Chemical Examiner, and that the latter Officer be instructed to review these in an annual report submitted to Government. Without this control it will hardly be possible to secure uniformity and regularity of procedure, and I believe that such supervision would greatly promote the successful working of so important a scheme.

I have the honor to be
Sir,

Your Most Obedient Servant
W. Maclellan

Inspector General
Indian Medical Department

E. Nicholson Esq.
S. M. Tyrrell Esq.
D. Sinclair Esq. M.D.
Sub. Asst. Surgeon
R. Harvey.

24/2/02

26/10.

Public (Domitory) at the
to try 2 1/2 " 1/2
1970 No " 33.

Inspector General Surran Medical Department.

Here later 5/26/90 p. 135.

Yds. them 25 Ac. 1/2 No. 136

In the foregoing letter
the Inspector General Sanran
Medical Department submits
his remarks on the Scheme
for the systematic analyses
of potable water in this
Vicinity referred to in the
Order of Government noted
in the margin.

2. ... Dr Mackenzie pro-
poses, after communication
with the Sanitary Commission,
to employ the Medical
Officers

Are letters sent to
in closed? I would
say - Dr. King

1719 Aug 1. 1869 Nov. 157.

10-12

" 29 March 1870 - 106-100.

L. H.

7. 1.

1890. *P. H. H. H.* De
The Inspector General,
Indian Medical Department,
Fort Saint George
To: *Chief*
The Secretary to Government,
P. H. H. H. Department,
Fort Saint George
Dated *5. 8. 90*
Received *5. 8. 90*

No. 17.

✓ 38 acres ✓
John Hill

adjustments the above, which
 showed a view for an
 improvement of a system
 and a view of a system
 = less in time and distance

Officers who are to be detached
for the duty in the following
ranges, viz,

1. Hyderabad and Nagpur.
2. Ceded Districts, Mysore,
and the Northern Division.
3. Presidency and Southern
Districts.
4. British Barmah.

3. Dr. Mackenzie also
proposes, after communication
with the Chemical Examiner,
that the information required
under the head of "General"
in the printed form of Analyst's
Report, marked B, which
is used in Bengal, be adopted
in this Presidency; and
printed separately from the
information under the head
of "Chemical".
The Chemical

Examiner consider the Bengal
report of the results of
Chemical Analyses some-
what lengthy, and proposes
to substitute the form A.
submitted with his letter.

Doctor Mackenzie recom-
mends the adoption of the
form in preference to the
Bengal form.

5. The Government ap-
prove these proposals and
direct that the special
attention of the Analysts
be directed to the importance
of analysing the water of
certain wells at different
seasons of the year, and
to the systematic microscopic
examination of all potable
water.

6. Orders will be
issued.

who will review them in
his annual report to Genl.

11. The appointment of
Mr. J. W. ...
...

Asst Surgeon E. Nicholson
do — S. M. Lyrell
do — D. Sinclair, M.D.
Sub Asst Surgeon R. Harvey.

12. The Surgeon General
has been requested to place the
services of Asst Surgeon
E. Nicholson at the disposal
of —

To the Military Department
Lieut. Genl. Robert Wood
By — Susan M. Dept
Chemical Examiner
Sanitary Committee
Lieut. Genl. General

