

1. No. 20
2. Date 8-5-37
3. Initials of Authoriser. J
M.R.O. 1-82,400-22-11-80.

MADRAS RECORD OFFICE.

Government of Madras.

Public DEPARTMENT.

G.O. No.	1263	Press Mis.
Dated	17-8-	1871

Not to be folded or roughly handled

No. 1263.

FROM

THE HON. R. S. ELLIS, C.B.,
Chief Secretary to the Government of Fort St. George,

TO

THE SECRETARY TO THE GOVERNMENT OF INDIA,
HOME DEPARTMENT.

SIR,

I am desired to submit copies of correspondence relating to the forms at present in use for recording the analyses of water, and to request that these letters may be sent to Dr. Macnamara for his opinion on the questions raised by the Madras Analysts.

I have the honour to be,

Sir,

Your most obedient servant,

Captain, R. E.,

*Under Secretary, P. W. D.,
for Chief Secretary.*

OOTACAMUND,
17th August 1871.

From the Acting Inspector-General, Indian Medical Department, to the Chief Secretary to Government, Fort St. George, dated Fort St. George, 5th August 1871, No. 260.

Letter, dated 5th July 1871, from Honorary Assistant-Surgeon Harvey, Analyst, Presidency, &c.
Letter, No. 157, dated 20th July, from the Chemical Examiner, Madras.
Letter, No. 21, dated 28th July, from Assistant-Surgeon Nicholson, Analyst, Mysore, &c.

I have the honour to submit, for the consideration and orders of Government, the communications noted in the margin, suggesting some alterations in the prescribed scheme for recording the results of water analysis in this Presidency.

2. The form now in use is a modification of that adopted in Bengal, prepared by the Chemical Examiner, and in submitting it for the sanction of Government, in this office letter, No. 155, of the 5th July,* it was stated that, "without sacrificing uniformity," it "exhibits the essential particulars in a more concise and convenient form," than the Bengal scheme.

* G. O., No. 1366, of 25th Oct. 1870.

3. In paragraph 10 of the same letter, the necessity for securing uniformity in the system of analysis established in this Presidency with that employed in the other Presidencies was pointed out, and the Army Sanitary Commission, in communications recorded in the Proceedings of Government

G. O., No. 690, of 23rd May 1871.
G. O., No. 1122, of 21st July 1871.

marginally noted, have also insisted on the great importance of securing uniformity of analytic methods and tabulation throughout India.

4. Although, therefore, quite agreeing with the Chemical Examiner and the two analysts that some changes in the present form are highly essential, I do not think it desirable that any alteration should be made, unless corresponding changes are made in the Bengal scheme.

5. In paragraph 3 of the letter noted in the margin, the Army Sanitary Commission observe that a scheme of water analysis is being prepared by Dr. Angus Smith and Dr. Macnamara, and recommend that, when completed, it should be adopted throughout India. I have, therefore, the honour to suggest that this correspondence may be communicated to Dr. Macnamara, Chemical Examiner, Calcutta, through the Government of India, with the view of ascertaining whether the scheme above mentioned is ready, and if not, whether he would be prepared to recommend, as a temporary measure, such changes in the existing form as would meet the wishes of the Madras Analysts, and maintain uniformity. A printed copy of the modified form now in use in this Presidency is attached.

From Honorary Assistant-Surgeon R. HARVEY, Analyst Potable Waters, Presidency and Southern Districts, &c., to the Secretary to the Inspector-General, Indian Medical Department, dated Madras, 5th July 1871.

I have the honour to report, for the information of the Inspector-General, that the following analyses were made during the month of June:—

- Quantitative estimations of the inorganic constituents of the residue of three samples of Palaveram water.
- An examination according to the present scheme, as well as a quantitative estimation of the inorganic residue of the water from two wells on the Poonamallee road, known respectively as the "Brahmins' Well," Egmore, and "New Egmore Well."
- Do. Konore water.

The quantitative examinations of two samples have not been completed. Water from Trivatore and from the villages of Erranavoor and Poythawauk, believed to be of great purity, remains to be examined.

I beg to enclose a tabular statement of the results of analysis of four waters with a few remarks thereon.

In the columns marked (a) are recorded the results obtained and arranged under the several heads in the authorized form to be adopted by the water analysts.

In those marked (b) the results obtained and arranged according to recognised principles of combination.

A comparison of the figures in the two columns shows remarkable differences.

Calcium and magnesium chlorides are absent in columns a, whilst in three out of four marked b, magnesium carbonate, magnesium and sodium sulphates are absent, and of the salts common to both, the quantity of each present differs considerably. The sulphates of sodium and magnesium as already stated are absent in the Palaveram waters in question, yet these salts have to be recorded as being present and in some quantity in submitting the report to the Chemical Examiner; this will be the case in all waters that contain a small proportion of sulphuric acid; and, in like manner, sodium present only as chloride will have to be recorded as present in the form of sulphate also.

The figures in the columns for "Brahmins' Well, Egmore," show also striking differences.

Under these circumstances, I respectfully submit, for the consideration of the Inspector-General, the advisability of making an alteration in the forms issued to the analysts, so much at least as relates to the arrangement of the inorganic constituents.

The basic and acid radicals might be recorded in one column, in another their presumed state of combination based on recognised principles, and for the sake of uniformity, the directions for arranging results of analyses given in Fresenius' quantitative analysis be adopted.

TABULAR Statement of the results of analysis of four samples of drinking water.

	PALAVERAM.						Brahmins' Well, Egmore, (old.)	
	I.		II.		III.			
	a.	b.	a.	b.	a.	b.	a.	b.
Calcium carbonate	·102	·42160	·114	·1860	·024	·2748	·048	·0864
Magnesium „	·026	.....	Traces.	.....	·0051	.....	·0090	·0314
Iron ... ..	.....	Traces	·002	·004	Traces.	Traces.	·0140	·0140
Silica	·052	.....	·076	·0840	·055	·060	·0400	·0400
Insoluble total...	·180	·47360	·192	·2740	·0841	·3348	·1110	·1718
Calcium sulphate	·1642	·03680	·0187	·0088	·0836	·0144	·0462	·0260
Magnesium „	·0281	.....	·0064	.....	·0140	.....	·0440	.....
Sodium „	·0277	.....	·0247	.....	·0345	.....	·0968	·0882
„ chloride... ..	·4980	·26706	·0702	·0244	·1638	·0132	·0819	·0816
Calcium „ ... ..	.....	·04390	.....	·0088	.....	·0320	.....	.....
Magnesium „ ... ..	.....	·08600	.....	·0296	.....	·0792	.....	.....
Soluble total...	·7180	·43376	·1200	·0716	·2959	·1388	·2689	·1958
Mineral matter total...	·8980	·90736	·3120	·3456	·3800	·4736	·3799	·3676

MADRAS,
5th July 1871.

(Signed) R. HARVEY,
Hony. Asst. Surgeon, Analyst Potable Waters.

No. 3768.

MEMORANDUM.

Referred to the Chemical Examiner for the favour of his views as early as convenient.

(By order.)

FORT ST. GEORGE,
18th July 1871.

(Signed) G. BIDIE, M.D.,
Secy. to the Insp.-Genl., Indian Medl. Dept.

From the Chemical Examiner, to the Acting Inspector-General, Indian Medical Department, dated Madras, 20th July 1871, No. 157.

With reference to your Office Memorandum, No. 3768, of 18th instant, I have the honour to state that the changes proposed by Assistant-Surgeon R. Harvey, in his letter to your Secretary (herewith returned) appear to me judicious and likely to render the results obtained by the water analysts more trustworthy and valuable.

2. I enclose, for your information, a copy of the passage in *Fresenius* to which Mr. Harvey refers.

3. I should suggest that Mr. Nicholson might with advantage be consulted on the subject of your reference, had he not recently published in the *Madras Medical Journal* views differing but slightly from Mr. Harvey's.

Chlorine is calculated in combination with the sodium; if there is an excess, this is calculated in combination with the magnesium; if there is still an excess, this is calculated in combination with the calcium. If, on the other hand, there remains an excess of soda, this is calculated in combination with sulphuric acid. The sulphuric acid or, if part of this has been calculated already in combination with soda, the remainder of it is estimated in combination with lime. The silicic acid is put down in the free state, the remainder of the lime and the magnesia as carbonates, and this, according to the circumstances, as neutral carbonates, or as bi-carbonates.

From Assistant-Surgeon E. NICHOLSON, Analyst of Waters, Mysore, Northern and Ceded Districts, to the Secretary to the Inspector-General, Indian Medical Department, dated Bangalore, 28th July 1871, No. 21.

In reply to your letter, No. 3874, of 25th July, with enclosures herewith returned, I have the honour to state that I fully endorse the views of Honorary Assistant-Surgeon Harvey as to the impossibility of representing the real composition of a water in the form of analysis laid down. Every day's experience confirms me in the opinions I have expressed on the subject, both officially and in the *Madras Medical Journal*. I have had to do double analyses of every water I have examined, one according to the form laid down, following the spirit of it as well as I could, the other according to chemical principles for comparison and future reference.

2. The scheme of analysis is unfortunately an attempt to combine a method of analysis with a form for stating the results of analysis. As a method it indicates a combination of processes which fit badly together, many of them in duplicate do not agree together, whilst most important items, sulphuric acid amongst others, are omitted. As a form it is open to the grave objections which Mr. Harvey has pointed out. For my views at length on this point, I would beg to refer to the *Madras Medical Journal* for June where I have given them perhaps more freely than I would have done in an official document.

3. Mr. Harvey's observations and recommendations differ very slightly, as the Chemical Examiner observes, from those I expressed in the above-mentioned article. The only point of difference is this:—That Fresenius was not acquainted with the siliceous waters of India when he said, "The silicic acid is put down in the free state, the remainder of the lime and magnesia as carbonates." This would admit the possibility of silicic acid being free in a solution of alkaline reaction. In the above-mentioned article I remarked on this point: "Great mistakes will be made if carbonic acid is estimated by difference and silica is given free, as will be shown by the surcharge thus given to the total of the substances found or estimated over the residue of evaporation and ignition." The reason of this is that the decomposition of felspar and mica rocks (the most common class of Indian subsoils) sets free large quantities of soluble silicates, especially magnesium silicate; this is by far the most common form of magnesium in Indian waters, the magnesium carbonate so common in Europe being very scarce here; I do not think I have ever met with it in an Indian water. If this magnesium is calculated as carbonate and the silicic acid given free, there is a surcharge equal to the carbonic acid thus gratuitously introduced. This is a matter of detail which analysts will soon see when they devote their attention to the subject, and nothing will give them theoretical acumen and practical skill so much as working out these questions which are of great chemical and geological importance.

4. I would beg to submit the following recommendations. The form of the analysis should not involve fixed methods. Methods vary infinitely, the form does not vary in principle. I would recommend that some easy and sound methods for the determination of the various constituents of the water be indicated to the analysts until a manual of analysis is available. There is none at present. The chapter of Fresenius which treats of mineral waters is not suited to the present class of examinations, and the few special treatises on the subject are too special to indicate the general principles which should guide the analyst. I am at present engaged on a manual of water analysis for publication, and I should be happy to adapt it as much as possible to the views with which the Inspector-General may favour me.

5. The form of statement of the analysis should give the details of all the metals (basic radicals) and all the acid radicals found. Mr. Harvey here entirely agrees with the views I had expressed. At the end of the detail would be the empirical formula considered by the analyst to represent the combination of the mineral constituents. The possible incorrectness of this formula is of little consequence as the experienced observer can always deduce his own formula from the detail of the analysis given above.

I have the honour to append, 1st, an example of an analysis stated according to the form laid down and according to the form I and Mr. Harvey advocate; 2nd, a form of complete statement of analysis which I submit for consideration, I have drawn it up as it would be printed. On the back of it are some instructions for the guidance of the analysts in uniform procedure. If the items are placed in single column for tabular printing they only occupy 30 lines against 41 in the present form.

I.—PHYSICAL EXAMINATION.

Unfiltered water.	Filtered (or cleared) water. ¹
Colour	Colour
Transparency	Transparency
Taste	Taste
Smell	Smell
Development of organized forms ...	Development of organized forms

Amount of aeration Nature of the deposit

II.—CHEMICAL EXAMINATION.

Grm. per litre.	Grm. per litre
Mineral matters ²	Oxygen required for organic matters ³

MINERAL CONSTITUENTS.

Metals (or basic radicals).	Acid radicals.
Sodium	Chlorine
(Potassium) ⁴	Sulphuric acid SO ₄
(Ammonium) ⁵	Nitric acid NO ₃
Magnesium	Nitrous acid NO ₂
Calcium	Phosphoric acid PO ₄
Aluminium	Carbonic acid CO ₂
or alumina ⁶	Silica SiO ₂
Iron	Oxygen of silicates O ₂
or ferric oxide ⁷	
Total ...	Total ...
Total of basic and acid radicals.	

Empirical formula.

Remarks.

with the printed form in
use in Madras

INSTRUCTIONS.

1. When filtration or clearing is required the means used should be stated "through paper," "through a carbon filter," "as filtered at the water works," &c.
2. Ignition to be done at the lowest possible temperature, especially when nitric acid is present.
3. At a temperature of about 140° (just sufficient to cause a slight steam) with $\frac{1}{1000}$ of pure sulphuric acid the permanganate solution should contain 0.395 per litre; each c. c. contains nearly .0004 = .0001 of active oxygen.
4. Potassium need not be sought for under ordinary circumstances.
5. Or ammonia.
6. It is more convenient to give alumina Al_2O_3 .
7. If very small the ferric oxide and alumina may be bracketed together. Ferrous oxide is very rare.
8. Any metal combined with silica will require oxygen to form a silicate. If alumina has been given as such it requires no oxygen; magnesium or calcium will require oxygen.

NOTE.—Quantities calculated indirectly by difference (e. g. Sodium) to be marked "calculated."

Quantities which cannot be determined accurately (e. g. Nitric acid) to be marked "estimated."

"Traces" are only admissible for quantities below .0001. Small quantities estimated to be not less than .0001 should be given in figures ("estimated" if necessary).

More than a fourth decimal figure should be avoided.

In making an empirical formula the acid and basic radicals (not being less than .0010) are to be combined in the order given. (Ex. If there is an excess of chlorine after combining all the sodium available, then it will be combined successively with magnesium and calcium; if on the contrary there is an excess of sodium over the quantity required for the chlorine, the sodium will be combined successively with sulphuric acid, nitric acid, &c.). Carbonic acid if not actually determined will be assumed to exist in such quantity as will bring up the total to the amount of mineral residue found by experiment, making allowance for the oxygen required for the silicates. The remaining basic radicals will be combined with silica and the requisite amount of oxygen to form silicic acid.

If the analysts find any difficulty about this they may leave the empirical formula unfilled, stating the difficulty in a brief memorandum attached to the form.

The Remarks should contain the analyst's opinion as to the origin or character of the organic matter, and as to the connexion, if any, between the mineral constituents of the water and organic contamination, past or present. When a water is impure but of importance for the local water supply, some brief suggestions as to means of purification would be desirable.

Analyses stated in the form laid down,
as nearly as possible.

Analyses stated according to chemical
principles (correct).
The detail of the analysis is omitted,
only the formula is given.

1° Filtered water from Ulsoor Tank.

		Grm. per litre.			Grm. per litre.		
Insoluble—							
Silica	...	...	0.231	Sodium chloride	...	...	0.585
Calcium carbonate	...	...	0.780	Sodium sulphate	...	...	0.059
Magnesium do.	...	...	0.098	Sodium, magnesium, and alumi-			
Oxide of iron	...	very small.		nium silicate	...	...	0.498
Soluble—				Calcium carbonate	...	...	0.612
Calcium sulphate	...	...	none.				

No. 1263 ✓ *Public Department.*

To

The Secretary to Government
of India,

Sir,

Home Department.

*I am desirous to submit
copies of correspondence relating
to the form at present in
use for recording the analysis
of water, and to request
that these letters may be
sent
submitted to Dr. Macnamara
for his opinion on the
questions raised by the
Madras Analysts.*

*Cotnamund
17 August/94.*

Magnesium sulphate	...	none.		1754
Sodium (as sulphate)	...	1171	Total mineral solids by expt.	1757
		2280		

2° Well in A. Co. Lines, 27th N. I.

Insoluble—				
Silica	...	0485	Sodium chloride	5640
Calcium carbonate	...	0767	Magnesium do.	1215
Magnesium do.	...	none.	Calcium do.	0734
Oxide of iron	...	very small.	Do. sulphate	0057
Soluble—			Do. nitrate	4814
Calcium sulphate	...	5605	Do. carbonate	0767
Magnesium do.	...	1215	Aluminium silicate	0678
Sodium (as sulphate)	...	6848		13905
		14920	Total mineral solids by expt.	14057

(Signed) EDWARD NICHOLSON, Asst. Surgeon, R. A.,
Analyst of Waters, Mysore and Ceded Districts.

Home 1871 Dept.

[]

From Government of

Fort St. George.

Dated 17th Aug. 1871.

No.

Enclosure

R.

Spare copies

D. No.

D.

Procs.

L. No. 1263.

No.

Forwarding, for the opinion of Dr. Macnamara,
certain questions raised by the Madras Analysts
relating to the forms prescribed for recording the
results of waters analysed.

No. 157 2.
To The
Actg. Surgeon Genl. J. L. Smith
Fort St. George.

Sir,

With reference to your
file memorandum No. 3768
of 18th inst., I have the honor to
state that the changes proposed
by Asst. Surgeon P. Harvey, in his
letter to your Secretary, (inclosure
returned) appear to me judicious,
and likely to secure the results
attained by the Water Analysts
more trustworthy and valuable.
I enclose for your information
a copy of the passage in the
series to which Mr Harvey refers.
3. I should suggest that Mr Harvey
on might with advantage be
consulted on the subject of your
reference, had he not recently
published in the Madras Medical
Journal news differing but slight
by from Mr Harvey's.

I have the honor to be
Sir

Your most Obedt. Servant,

Henry Davis
Chem. Examr.

Med. Coll.
July 20. 1871

Fort Saint George, 5th August 1871.

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

The Chief Secretary to Government
Public Department

I have the honour to submit for
the consideration and Orders of Government the communications noted
in the margin, suggesting some
alterations in the prescribed
Scheme for recording the results
of Water Analysis in this Presidency.

Letter dated 5th July 1871 from Hon^{ble} Asst. Surg^t
Harvey, Analyst Presidency
Letter No 157 dated 20th July from the Chemist
Examiner Madras.
Letter No 21 dated 20th July from Asst. Surg^t
Nicholson, Analyst Mysore

2. The form now in use is a modifica-
tion of that adopted in Bengal, prepared by
the Chemical Examiner, and in submitting
it for the sanction of Government, in this
Office letter No 155 of the 5th July, it was stated
that, "without sacrificing uniformity," it exhibits
"the essential particulars in a more concise and
convenient form," than the Bengal Scheme.

3. In para. 10 of the same letter, the necessity
for securing uniformity in the system of Analysis

*G.O. No 1366 of 25th
October 1870

The Chemical Examiner
Madras.

To the Asst. Inspector General
Indian Medical Dept
Fort Saint George.

Dated 20th July 1871.
Received 29th July 1871.

Enclosure - 200.

No 157

Return Mr. Harvey's
letter on the analysis of
waters with remarks.

20th July 1871
No 18 of 1871 - 5th July 1871
No 21 of 17 Aug 1871
No 13 of 1871

Established in this Presidency with that Employed in the other Presidencies was pointed out, and the Army Sanitary Commission, in communications recorded in the Proceedings of Government marginally noted, have also insisted on the great importance of securing uniformity of Analytic methods and tabulation throughout India. G.O. No 690 of 23rd May 1871. G.O. No 1122 of 21st July 1871.

4. Although therefore quite agreeing with the Chemical Examiner and the 2 Analysts that some changes in the present form are highly essential, I do not think it desirable that any alteration should be made, unless corresponding changes are made in the Bengal Scheme.

5. In para. 3 of the letter noted in the margin, the Army Sanitary Commission observe that a Scheme of Water Analysis is being prepared by Dr Angus Smith and Dr Macnamara, and recommend that when completed it should be adopted throughout India. I have, therefore, the honour to suggest that this correspondence may be communicated to Dr Macnamara, Chemical Examiner Calcutta through the Letter from the Army Sanitary Commission to the Under Secretary of State for India dated 1st March 1871. and recorded in P.G. No 690 of 23rd May 1871.

Government of India, with the view of ascertaining whether the Scheme above mentioned is ready, and if not, whether he would be prepared to recommend as a temporary measure, such changes in the Existing form as would meet the wishes of the Madras Analysts, and maintain uniformity. A printed copy of the modified form now in use in this Presidency is attached.

I have the honor to be
Sir
Your most Obedient Servant
Edward M. Alford Esq
Acting Inspector General
Indian Medical Department

Public 1871. Agents

From

Inspector General,

India Medical Department,

Fort Saint George,

To

S. L. No. 1263

Dated

5. 11/17/71
No. 9. 12/21/71

No. 260

Indians to 12

No. 1704

Supplies contain charges
with the returns for
renewing supply of
water supplies.

84-85

*Comm. on the
Suez Canal - 1877
1877*

Dated

187

To
The Secretary to the
Government of
Department

No.

187

Department

Home 1877. Dept.

Government of

Port St. George

Aug. 7 187

No.

D. No.

L. No. *1263*

Nos. *84-85*

*Forwarding for the opinion of
Lt. Macnamara, on the
questions raised by the
Analyst relating to the
forms provided for forwarding
the results of water analysis*

C. 10-8.

2 17/8