

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)**



**FIRST REPORT
OF THE
WATER TREATMENT COMMITTEE**

Also includes the reports of the Water Treatment Sub-committee



MARCH 1956

PART I



HISTORICAL

In the past 30 years certain measures were taken locally to combat boiler troubles arising from the use of bad feed waters in locomotives on Indian Railways. Just before the second world war, there were approximately 40 lime-soda and base-exchange softeners installed by a few company-managed railways, the majority of which were on the ex-B. N. section of the Eastern Railway, the ex-Jodhpur and ex-Bikaner sections of the Northern Railway and the ex. B. B. & C. I. section of the Western Railway. No progress could be made during the period of last war in the treatment of feed waters on the Indian Railways. In the post-war period, when a number of schemes formulated by the individual railways came up for consideration, the Railway Board appointed a committee in 1945 under Mr. J. S. Hancock of the ex-L. M. S. Railway, to advise on the best methods of carrying out water-treatment. This committee recommended that no new schemes should be undertaken until an assessment of the then existing water-treatment methods was available to the Railway Board. In 1950, a review was made of the water-treatment systems in use on the various railways by the Chief Mechanical Engineers, who recommended that there should be no further extension of external water softening plants as they were not a success to the extent expected, due mainly to (a) lack of sustained mechanical maintenance and accurate chemical control, and (b) the adverse effect of mixing treated and untreated waters. The entire subject was subsequently handed over to the metallurgical and chemical section which started functioning in 1952 under the newly organised Railway Testing and Research Centre.

In accordance with the recommendation made in January 1950 by the Indian Railway Chemists and Metallurgists Committee, a sub-committee on water-treatment was formed with a view to study the performance of water softening plants and their effects on locomotive behaviour and make suitable recommendation in respect of efficient water-treatment. It consisted of the following members:

1. Dr. D. R. Malhotra, Chemist and Metallurgist,
B. B. & C. I. Railway ... (Chairman)
2. Shri K. P. S. Nair, Chemist & Metallurgist,
G. I. P. Railway ... (Member)
3. Shri H. B. Deshpande, Chemist & Metallurgist,
B. N. Railway ... (Member)
4. Shri R. G. Bhatawadekar, Research Officer
(Metallurgical & Chemical), Central Standards
Office ... (Secretary)

Subsequently, in 1952, however, the chairman of the sub-committee, Dr. D. R. Malhotra, having gone on long leave and the member from ex-B. N. Railway having retired, the sub-committee was reconstituted as follows:

1. Shri G. R. Iyengar, Chemist & Metallurgist,
Southern Railway, Madras (Convenor)
2. Shri K. P. S. Nair, Chemist & Metallurgist,
Central Railway, Bombay (Member)
3. Shri N. V. Pandit, Chemist & Metallurgist,
Eastern Railway, Khargpur (Member)
4. Shri R. G. Bhatawadekar, Research Officer
(Metallurgical & Chemical), Central Standards
Office (Member-Secretary)

This sub-committee convened in all eight meetings, the minutes of which are given in Part II.

The Water-treatment Sub-committee of the Indian Railway Chemists and Metallurgists Committee carried out, in the beginning, trials of internal treatment with a boiler compound consisting of 60 parts of tannin and 40 parts of soda ash, on nominated sections of the Indian Railways. As the trials proved to be very successful, the treatment was extended to other bad water sections also and by the end of 1955, there were nearly 879 engines receiving treatment on the whole of the Indian Railways. The main function of the sub-committee having thus been fulfilled, it was necessary to constitute a full fledged experts committee to deal with the application and technical control of the new technique of water-treatment on Indian Railways. The committee was also to have powers to co-opt a deputy chief mechanical engineer for one or more sessions of the meetings. Accordingly the Railway Board formed the Water-Treatment Committee with the following members :

Shri R. G. Bhatawadekar, Joint Director (R), Railway Testing & Research Sub-centre, Chittaranjan	Chairman
Shri G. R. Iyengar, Chemist & Metallurgist, Southern Railway	Member
Shri N. V. Pandit, Chemist & Metallurgist, South-Eastern Railway	Member
Shri K. P. S. Nair, Chemist & Metallurgist, Central Railway	Member
Shri S. Ramanujam, Deputy Director (R), Railway Testing & Research Centre, Chittaranjan	Secretary
A Senior Mechanical Engineer	Co-opted member 1956

The first meeting of this committee was held on 14th March 1956 and its minutes follow.

**Minutes of the First Meeting of the Water Treatment Committee
of the Indian Railways
(March 1956)**

INTRODUCTION

In accordance with the Railway Board's orders contained in Director, Research, letter No. KCI/16 dated 12-2-56, the first meeting of the new Water Treatment Committee of the Indian Railways was held at Baroda on 14th March, 1956. The meeting was inaugurated by Shri R. G. Bhatawadekar, Joint Director, Research (M & C), Railway Testing & Research Sub-Centre, Chittaranjan.

P R E S E N T :

- (1) Shri R. G. Bhatawadekar, Joint Director, Research
(M & C), Railway Testing & Research Sub Centre,
Chittaranjan *Chairman*
- (2) Shri G. R. Iyengar, Chemist & Metallurgist, Southern
Railway, Perambur *Member*
- (3) Shri N. V. Pandit, Chemist & Metallurgist, South-
Eastern Railway, Khargpur *Member*
- (4) Shri K. P. S. Nair, Chemist & Metallurgist, Central
Railway, Parel *Member*
- (5) Shri M. S. Murty, Deputy Chief Operating Superin-
tendent (M & P), Southern Railway, Madras ... *Co-opted
Member*
- (6) Shri S. Ramanujam, Deputy Director, Research
(M & C), Railway Testing & Research Sub-Centre,
Chittaranjan *Secretary*

Shri C. G. Bashyam, Chemist & Metallurgist, Eastern Railway, Jamalpur, and Shri L. R. Fialho, Assistant Mechanical Engineer (W/S), Western Railway, Bombay, also attended the meeting.

The Water - treatment Sub-committee of the Indian Railway Chemists & Metallurgists Committee had decided in 1952 to conduct trials of internal treatment of loco boilers with chemical complex consisting of tannin and soda ash. A chemical formula for dosing was devised which consisted of 60 parts of selected tannins and 40 parts of soda ash. By 1955, the sub-committee had completed extensive trials which proved that treatment by the chemical complex dosed internally was capable of eliminating most of the boiler troubles arising out of bad feed water supplies (for details see part II).

ITEM I: PROGRESS OF WATER-TREATMENT

AGENDA:—To review the progress of water-treatment trials on the Central, Eastern, Southern, South-Eastern and Western Railways for the period August 1955 to February, 1956.

NOTES BY THE SECRETARY

1. (a) The up-to-date position of water-treatment trials on the Central, Eastern, South-Eastern & Western Railways is given in appendix 'A'.

(b) The main observations from reports collected from the various railways are as follows:—

(1) *Central Railway*

*Dhond-Manmad:—*The washout mileages on all the 15 goods engines have been increased from 972 to 1296 miles from 15-10-55. The passenger engines are, however, given a washout at 876 miles. The water ways of the boilers of a number of engines in this section are reported to get heavily congested with scale after working about 20,000 miles. On the other hand, the surfaces of the firebox and casing plates are clean.

The original dosage of 1/2 lb. of 60:40 tannin-soda ash complex per 1000 gallons was reduced, during the last rainy season, to 1/4 lb. in order to keep the tube leakages at a minimum and this reduced dosage was being continued till recently. As this new dosage which was effective during the rainy season was not sufficient to cope up with the deterioration in the quality of feed water, resulting in heavy congestion noticed in the water ways of boilers, the dosage has recently been increased to 1/2 lb per thousand gallons of water.

It is reported that no inspection holes near the smoke box end have been provided in these engines which are reported to be heavily scaled. This would be desirable for enabling effective cleaning of the tubes and flues during washouts. This may also be minimised by instructing the drivers to give more blowdowns by opening the front blow-off cocks than the back ones.

*Dhond-Baramati:—*Two engines have been brought under treatment since 1-9-55.

*Gwalior (narrow gauge):—*Engines working on the Gwalior narrow gauge sections are being operated on a washout mileage of about 600. The boiler condition is satisfactory. If, however, the washout mileage is extended beyond 600, priming has been reported.

*Jhansi-Kanpur-Manikpur:—*On this section orders have been issued by the Chief Mechanical Engineer to increase the washout mileage from 1,000 to 1,272 miles as a trial measure.

*Kurduwadi-Miraj-Latur:—*Two engines have so far been brought under internal treatment with the boiler complex while the remaining are still treated with 'Alfloc'.

It is understood that trials using a mixture of soda ash, tri-sodium phosphate and tannin are being conducted with a view to replace the

proprietary brand of Alfloc in use at present. If this be the case, the Chemist & Metallurgist may please offer his comments regarding these trials.

Wardha-Balharshah-Kazipet:—Only nine engines out of a fleet of 43 are being treated on this section. It is recommended that all the engines be brought under treatment in order to enable them to have clean boilers before the onset of the coming summer.

(2) *Eastern Railway*

Beliaghata Shed:—It is observed from the annexures that some engines in this shed are building scale even after P. O. H. According to the Chemist & Metallurgist, Eastern Railway, scaling is generally on the back casing plates and other locations where cleaning facilities are inadequate. The pressure of water used for washout has also been stated to be low. It is noted that arrangements have been made to supervise treatment at the different sheds.

Chitpur Shed:—Treatment continues satisfactorily.

Bamangachi-Narkeldanga-Naihati:—From reports received in this Sub-Centre it is noticed that internal treatment has been initiated in Bamangachi, Narkeldanga, and Naihati loco sheds on 21-7-55, 10-11-55 and 21-11-55, respectively.

However, annexures on boiler washout mileage and boiler inspection data have not so far been received from Naihati loco shed.

(3) *Southern Railway*

In the Madura shed the washout mileages of M Class engines have been increased from 870 and 834 to 1704 and those of YP & YG from 1,554 to 1,700. The B Class engines are, however, washed out at 1,228 miles, as before.

(4) *South-Eastern Railway*

Besides Khargpur and Santragachi sheds where treatment is continuing satisfactorily, treatment trials have also commenced since 24. 12. 55 on 12 out of a fleet of 25 in Bhojudih shed. After studying the performance of these engines, the rest of the engines will also be brought under treatment.

(5) *Western Railway*

Except Jamnagar-Okha and Jamnagar-Rajkot sections, all the sections are reported to be working satisfactorily.

Heavy scaling was observed in the Nadiad shed on B & WT class boilers which are very old and probably receiving little attention (App. B & B1).

In the Sabarmati shed, priming has been reported in the YF class engines after working more than 600 miles. The representative from the Western Railway may please offer comments.

Though treatment has started in Jamnagar shed from 11-6-55, boilers are observed to be still heavily scaled. Pitting, corrosion and tube bursting have been reported every month. It has, however, been stated that this is under investigation.

Recommendations by the Committee

Progress of Internal Treatment with Tannin Soda

Ash Complex

It is noted that the number of locomotives under treatment is as follows:

Railway	Division/Dist.	Section	No. of engines
Central	Sholapur	Dhond—Manmad	.... 20
		Dhond—Baramati	.... 2
		Kurduwadi—Miraj—Latur	.... 2
	Jhansi	Jhansi—Kanpur	.... 46
		Jhansi—Manikpur	
		Gwalior—Sheopurkalan	.... 24
	Gwalior—Shivpuri		
	Gwalior—Bind		
	Nagpur	Wardha—Balharshah	.... 6
		Balharshah—Kazipet	.... 3
			103
Eastern	Sealdah	Beliaghata	.... 46
		Narkeldanga	.... 82
		Chitpur	.... 45
		Naihati	.... 46
	Howrah	Bamangachi	.... 65
South-Eastern	Khargpur	Howrah—Machada	.... 42(SRC)
		Khargpur—Chitpur	
		East Dock—Shalimar +
		Khargpur—Howrah	.... 32(KGP)
Adra	Bhojudih Colliery area	.... 12	
			86
Southern	Madura	All sections	.... 141
	Hubli	Gadag—Sholapur	.... 38
	Bangalore	Bangalore—Bangarapet	.... 8
	Mysore	Chickjajur—Chitaldroog	.... 2
			189
Western	Abu Road	Ahmedabad—Botad	.... 27
		Ahmedabad—Khedbrahma	
		Abu Road—Mehsana and branches	.... 31
	Pratapnagar	Nadiad—Kapadvanj—Bardan	.... 10
		Champaner Road—Panimines	.... 4
	Bhavanagar	Jetalsar—Rajkot	.... 45
		Jetalsar—Veraval	
		Jetalsar—Probander	
		Jetalsar—Dhola	
	Jamnagar	Junagad—Saradiya	.... 18
		Junagad—Khijadiya	
		Junagad—Visvadar	
		Junagad—Talala	
		Delvada—Kodinar	.... 26
		Jamnagar—Okha	
		Jamnagar—Rajkot	
		Wankanar—Rajkot	
	Wankanar—Viramgam	.... 49	
		Surendranagar—Halvad	.... 7
			217
Grand Total			879

Railway Board's Orders

Noted

ITEM II. WASHOUT MILEAGES

AGENDA: To consider data submitted with regard to washout mileage.

NOTES BY THE SECRETARY

(a) Joint Director (Mech.), Planning, has circulated to General Managers of all railways a letter from this Sub-Centre dealing with water-treatment on bad water sections on Indian Railways (see appendices C & C1).

Replies thereto from Central, Eastern and South-Eastern Railways are at appendices D, D1 & D2, respectively.

According to the Chief Mechanical Engineer, Eastern Railway, "intervals between routine schedule repairs cannot be indefinitely increased without adverse effect on the maintenance and the mechanical condition of the locomotive". It is, therefore, necessary to consider whether all the Chief Mechanical Engineers should be requested to increase the washout mileages on all locomotives (irrespective of sections on which they run) so as to synchronise with the routine schedule repairs. Instances where this is not possible should be reported to this Sub-Centre.

(b) It is still noticed from Annexures II received from treatment sheds that the monthly boiler examination in many cases does not synchronise with the schedule washout mileage. It is, therefore, recommended that an engine should be stopped for its monthly boiler examination only when her next washout falls due.

(c) Many of the annexures do not give information as required in item V of the minutes of the 8th Water-Treatment Sub-committee meeting. Members may please see that this information is submitted hereafter.

Recommendations by the Committee

(1) The following progress with regard to washout mileage is noted:—

Central Railway

Dhond-Manmad:—The washout mileage on all the 15 goods engines has been increased from 972 to 1,196 miles from 15-10-55.

Jhansi-Kanpur-Manikpur:—On this section, orders have been issued by the Chief Mechanical Engineer to increase the washout mileage from 1,000 to 1,171 miles as a trial measure.

Southern Railway

Madura Shed:—The washout mileages of 'M' class engines have been increased from about 850 to 1,704 and those of YP and YG from 1,554 to 1,700.

(2) It is recommended that the washout mileages of all locomotives on sections where both cold and hot water washout facilities are available be increased to synchronise with the repair schedule.

While preparing the engine links, railways should also explore the possibilities of taking advantage of the extended washout mileages arising from internal treatment, where cold water washout facilities only are available.

Railway Board's Orders

(1) Noted.

(2) Approved. If priming or any other difficulties are experienced, Railway Testing & Research Sub-Centre, Chittaranjan, should be consulted.

ITEM III: AUTOMATIC DOSING GEAR

AGENDA: To consider progress made in respect of automatic dosing gear.

NOTES BY THE SECRETARY

Since dosing gears based on Central Standards Office sketches Nos. L-235 and L-249 have, in practice, proved ineffective, the Central Standards Office, Chittaranjan, has designed a hydrostatic dosing gear arrangement which has been circulated to the Chief Mechanical Engineers of all the railways for their comments.

The Chief Mechanical Engineer, Central Railway, has asked for a line diagram of the design. This has been received from the Central Standards Office, Chittaranjan, and sent to the Central Railway.

The Chief Mechanical Engineer, Eastern Railway, would like to continue with the existing procedure of manual addition of the complex in the tender. In his view the proposed hydrostatic dosing arrangement will not be suitable for practical use. The Western Railway has reported that trials are in progress with a similar dosing gear designed by it to suit metre gauge engines of YP and YG class.

It will be seen from the report (six-monthly) on water-treatment forwarded by the Chief Mechanical Engineer, Western Railway (Appendix J,) that though the dosing gear is working satisfactorily, the discharge rate is not accurate. It is reported that certain changes in the concentration of the solution are being tried out to overcome the difficulty.

Recommendations by the Committee

The following progress in respect of automatic dosing gear is noted:—

The Central Standards Office (Loco), Chittaranjan has designed a hydrostatic dosing gear. The blue print of the same along with a line diagram was circulated to the Chief Mechanical Engineers of all railways for their consideration.

The Western Railway is conducting trials with a similar dosing arrangement modified to suit metre gauge engines.

Railway Board's Orders

Noted.

ITEM IV : EXTENSION OF INTERNAL TREATMENT

AGENDA: To consider extension of trials to sections of the Northern Railway.

NOTES BY THE SECRETARY

(a) The following sections of the Northern Railway have been recommended for treatment:

<i>Division/District</i>	<i>Section</i>	
1. Moradabad	Lhaksar	... Dehra-Dun
2. Bikaner	Churu	... Rewari
	Churu	... Sardarshahr
	Churu	... Sadulpur
	Hanumangarh	... Sadulpur
3. Jodhpur	Samdari	... Raniwara
	Jodhpur	... Pokran

(b) It is noticed from the replies to the questionnaire that the engine performance is poor on the Jodhpur Division of the Northern Railway, where external softeners are used. In view of this, it may be necessary to review the engine performance on sections of other railways having external softeners.

Recommendations by the Committee

Extension of internal treatment

The following sections of the Northern Railway are recommended for treatment:—

<i>Division/District</i>	<i>Section</i>	
1. Moradabad	Lhaksar	... Dehra-Dun
2. Bikaner	Churu	... Rewari
	Churu	... Sardarshahr
	Churu	... Sadulpur
	Hanumangarh	... Sadulpur
3. Jodhpur	Samdari	... Raniwara
	Jodhpur	... Pokran
	Jodhpur	... Kuchaman Road
	Degana	... Ratangarh
4. Ferozepore	Ferozepore	... Fazilka

Railway Board's Orders

Approved. The Northern Railway to take action.

ITEM V: USE OF 60:40 TANNIN-SODA ASH COMPLEX AS A DESCALER PRIOR TO DESCALING SCHEDULE

AGENDA: To consider a suggestion from the Western Railway regarding the use of 60:40 tannin-soda ash complex as a descaler prior to descaling schedule.

NOTES BY THE SECRETARY

Members are requested to give their views on a suggestion from the Western Railway regarding the possibility of descaling a boiler by the chemical complex so as to reduce the number of days an engine is held up for descaling.

In the half-yearly progress report from the Western Railway (see Appendix J), descaling with 60:40 tannin-soda ash complex has been suggested for sections where no full scale treatment for feed waters is considered necessary and where scaling of boilers is attributed only to a few isolated bad water sources in the section.

Recommendations by the Committee

Use of 60:40 Tannin-Soda Ash complex as a descaler

The Western Railway should investigate the cause of heavy scaling of boilers on the Udhna-Jalgaon section before deciding on the use of the complex as a descaler and report to the Railway Testing & Research Sub-Centre, Chittaranjan, in due course.

Railway Board's Orders

Noted. The Western Railway to take necessary action.

ITEM VI: REVIEW OF BUSINESS ARISING OUT OF THE MINUTES OF THE LAST MEETING

AGENDA: To review work arising out of the minutes of the last meeting.

NOTES BY THE SECRETARY

Gondal region:—It is noticed that excepting engines stabled at Jamnagar and Jetalsar, no other engines in this region have been given internal treatment.

Item VI:—Action is being taken by the Chief Engineers of the Central, Eastern and Southern Railways. No information has, however, been received from the South-Eastern Railway. (See appendices E, E1, E2 & E3)

Item VII:—Despite repeated reminders replies to the questionnaire have not yet been received from the North-Eastern and Southern Railways.

Item VIII:—Two varieties of indigenous tannins, viz. myrobalan and acacia catechu, have been obtained for trials on two stationary boilers at Rahuri on the Dhond-Marwad section of the Central Railway.

Results of trials started from 7-2-56, with acacia catechu in the boiler complex in place of chestnut tannin, are reported to be satisfactory. No priming has been observed after working for eight days. The trial is in progress. The object is to assess the comparative suitability of this indigenous variety for descaling as well as preventing formation of scale.

Trials with myrobalan tannin will be taken up soon after the above trials are over.

An extract from a letter received from the Forest Research Institute regarding the nature of these tannins as compared to that used at present is at appendix F.

Item IX:—Designs in connection with this will be tabled at the meeting or sent earlier, if received from the Central Standards Office, Chittaran, Jan.

Item X:—With regard to the problem of analysis of boiler concentrates treated with tannin, a reply received from M/s. Ledoga is at appendix G. The Forest Research Institute has no experience regarding this problem.

Item XI:—Progress reports for the six-month period ending December, 1955 received from the Chief Mechanical Engineer, Eastern Railway, is at appendix H.

Reports from other railways, if received, will be tabled at the meeting.

Recommendations by the Committee

(1) Substitution of corrosive feed water:

Eastern Railway:—Alternative supplies for loco feed water at Belia-ghata be provided as early as possible.

(2) Replies to the questionnaire:

North-Eastern Railway:—The replies to questionnaire issued by the Research Sub-Centre, Chittaranjan, vide their office letter No.KRA/1 dated 12/13-12-54, which have not been received, be submitted early to the Railway Testing and Research Sub-Centre.

(3) Indigenous tannins:

Trials conducted with acacia catechu variety of tannin in a stationary boiler have given promising results and it is proposed to try this tannin in a few locomotive boilers.

It is also proposed to conduct trials with myrobalan tannin in a similar manner.

Railway Board's Orders

(1) Noted. The Eastern Railway to take necessary action.

(2) The North-Eastern Railway to expedite reply to the Railway Testing & Research Sub-Centre, Chittaranjan.

(3) Noted.

ITEM VII

AGENDA: To discuss any other relevant subject.

(1) To consider substitutes for polyamide emulsion.

The Chemist & Metallurgist, Eastern Railway, has stated that the use of tannin-soda ash complex while minimising boiler troubles in the Sealdah Division has not removed troubles due to priming at this place during summer. Polyamide emulsion No. 6 of I. C. I. Ltd., has, however, been found successful for this purpose. As this is an imported item, in the interests of self-sufficiency, he would like to have suitable anti-priming compounds from indigenous materials. A reference to the National Chemical Laboratory shows that it is not possible to produce indigenously anti-primers of the polyamide type. It is, therefore, proposed to develop other types of anti-priming compounds. But, this can only be taken up by the Railway Testing & Research Sub-Centre, Chittaranjan, after the priority research programmes have been completed. As this may take time, it is suggested that the Eastern Railway continue using the proprietary material till such time as an indigenous substitute is developed.

(2) To consider revision of annexure pro forma.

The Chemist & Metallurgist, South-Eastern Railway, has recommended adoption of a revised pro forma for Annexure I (see appendix I) as suggested by the Boiler Inspector, Khargpur. It has been stated that the additional information obtainable from the revised pro forma will be valuable in giving a true picture of the boiler condition.

(3) To consider a note on blowdown counter given by the Chief Design Engineer (L), Central Standards Office, Chittaranjan (see appendix K)

Recommendations by the Committee

Monthly reports from sheds on boiler condition

(1) A revised pro forma in lieu of previous annexures (Nos. I & II) be used by sheds for reporting on boiler conditions on sections under internal treatment. The sheds in future will report in the manner indicated in a sample pro forma enclosed with the minutes.

(2) Blowdown counter

The Central Standards Office (Loco), Chittaranjan, is working on a design of a blowdown counter which will record the number of blowdowns of a specified duration.

(3) Blowdown counter

In the first instance, it will be sufficient if the Central Standards Office, Chittaranjan, produces a design of mechanism to record the number of blowdowns of a duration of one minute.

Railway Board's Orders

(1) Noted.

(2) Noted.

(3) Noted. Central Standards Office, Chittaranjan, to pursue.

APPENDIX A

Railway	Division/Dist.	Section	No. of engines
Central	Sholapur	Dhond—Manmad	.... 20
		Dhond—Baramati	.... 2
		Kurduwadi—Miraj—Latur	.... 2
	Jhansi	Jhansi—Kanpur	} 46
		Jhansi—Manikpur	
		Gwalior—Sheopurkalan	} 24
	„ —Shivpuri		
	„ —Bind		
	Nagpur	Wardha—Balharshah	.... 6
		Balharshah—Kazipet	.... 3
Eastern	Sealdah	Beliaghata	.... 46
		Narkeldanga	.... 82
		Chitpur	.... 45
		Naihati	.... 46
	Howrah	Bamangachi	.... 60
	South-Eastern	Khargpur	Howrah—Machada	} .... 42(SRC).
Khargpur—Chitpur			
East Dock—Shalimar			
Khargpur—Howrah			
	Adra	Bhojudih Colliery areas	... 12
Southern	Madura	All sections	.... 141
	Hubli	Gadag—Sholapur	.... 38
	Bangalore	Bangalore—Bangarapet	.... 8
	Mysore	Chikjajur—Chitaldroog	.... 2
Western	Abu Road	Ahmedabad—Botad	} 24
		Ahmedabad—Khed Brahma	
		Abu Road—Mehsana		.... 20
	Pratapnagar	Nadiad—Kapadvanj	} 9
		Badran	
	Bhavnagar	Jetalsar	.... 47
		Jamnagar	.... 26
			783

APPENDIX B

Copy of D. O. letter No. KRA/1 dated 19/20th December, 1955, from, Shri R. G. Bhatawadekar, Jt. Director, Research, RTRC, Chittaranjan, to Shri I. C. Bahree, Dy. C. M. E., Western Railway, Churchgate, Bombay.

Sub:—Water-Treatment on the Nadiad-Kapadvanj Section.

Ref:—My D. O. No. KRA/1 dated 12-12-55.

Since the despatch of my above-mentioned D. O. to you, Agarwal has today sent me annexures in respect of the Nadiad Loco shed for the month of October, 1955 under his letter No. C & M/1770/55 of 5-12-55.

2. I give below an extract of the observations made in annexure I for the Nadiad shed :—

Eng. No.	3B	61WT	62WT	6B	10C	11C
Tubes	Heavily	Yes	Yes	Yes	Nil	Nil
Flues	scaled					
	1/8" & over					
Stays	Heavily	Yes	Yes	Yes	"	"
	scaled		3/8" or			
	1/8" & over		above			
Firebox plates	1/16" &	1/8" to	1/8"	Nil	1/16"	1/16"
	above	1/4"			& below.	& below.

3. It is not understood how under identical conditions of treatment since February, 55 (viz. softened water and internal tannin dosing) engines 3B, 61WT, 62WT, should have built up 1/8" scale and over, while engines 6B, 10C and 11C are practically clean.

4. The heavy scale noticed in the B and WT class engines might be connected with the age of their boilers. These engines have boilers as old as 20 to 28 years and it appears that the scale has accumulated through time or ineffective descaling done during their P. O. H.

5. It will be observed that engine No. 6B has been returned from shops on 15-9-55 with a clean boiler.

6. Will you, therefore kindly investigate why the boilers of engine Nos. 3B, 61WT & 62WT are so heavily scaled and instruct Agarwal to send me the boiler concentrate analysis drawn from the Nadiad engines during the months of August, September and October, 1955.

APPENDIX B1

Copy of D. O. letter No. 540/4/14 dated 5-1-56 from Shri I. C. Bahree, Dy. C. M. E. (G), Western Railway, Churchgate to Shri R. G. Bhatawadekar, Jt. Director, Research (M & C), RTRC, Chittaranjan.

Sub:—Water-treatment on the Nadiad-Kapadvanj Section.

Your D. O. No. KRA/1 of 20-12-55.

B and WT class boilers are much older than the C class boilers. The WT class boilers are from 20 to 28 years old, B class 20 years old and C class only 10 to 15 years old. This is probably the reason why the former had been found to be more heavily coated with scale.

2. At the time of POH, it is not possible to remove the scale altogether, particularly at the water legs.

3. Agarwal is being instructed to send the analysis of boiler concentrates drawn from the Nadiad engines during the months of August, September and October 1955 to you.

APPENDIX C

Copy of letter No. 52/645/M dated 16-11-55 from the Joint Director, Mechanical Engg. (P), Railway Board, New Delhi to the General Managers, all Indian Railways and copy to the Joint Director, Research (M & C), RTRC, Chittaranjan and others.

Sub:—Water-treatment of bad water sections on Indian Railways.

A copy of letter No. KRA/1 dated 6-10-1955 (Appendix C1) from Shri R. G. Bhatawadekar, Joint Director, Research, Chittaranjan, is sent herewith for favour of early remarks. You are also requested to furnish your proposals in respect of the following :—

- (1) Extending the use of tannin-soda ash process on each railway.
- (2) Steps to be taken to increase the mileage between washouts.

APPENDIX C1

Copy of letter No. KRA/1 dated 6th October 1955 from the Joint Director Research (M & C), Railway Testing & Research Centre, Chittaranjan, to the Joint Director, Mechanical Engineering (P), Railway Board, New Delhi.

Sub:—Water-treatment of bad water sections on Indian Railways.

Ref:—Your No. 52/645/M of 29-9-55 to Director Research, Railway Testing & Research Centre, Alambagh, Lucknow, copy to this office.

The up-to-date position in regard to water-treatment, by tannin-soda ash process, developed by the Railway Testing & Research Sub-Centre, is as follows : —

Railway	Div./District	Section	No. of Engines
Central	Sholapur Jhansi	Dhond—Manmad	.... 20
		Jhansi—Manikpur—Kanpur	.... 46
		Gwalior—Sheopurkalan	} 24
		“ — Shivpuri	
“ — Bhind	}		
Eastern		Sealdah	South Sealdah	.... 22
	Chitpur		.... 45
	Howrah	Howrah—Burdwan	} 60
		“ — Bandel	
		“ — Tarakeswar	
“ — Sealdah			
South Eastern	Khargpur	Howrah—Khargpur	} 74
		Chitpur—Khargpur	
		Shalimar—Khargpur	
		East Dock—Khargpur	
Southern	Madura Hubli Bangalore	All	.... 141
		Gadag—Sholapur	.... 38
		Bangalore—Bangarapet	.... 8
		Chickjajur—Chitaldroog	.... 2
Western	Abu Road	Ahmedabad—Rotad	} 24
		Ahmedabad—Khedbrahma	
		Abu Road—Mehsana		.... 20
	Pratapnagar Bhavnagar	Nadiad—Kapadwanj—Badran	.... 9
		Jetalsar	.... 36
		Jamnagar	... 20
			589

2. Reports on the above engines under trial, received from the sheds in which they are stabled, indicate that the treatment has been a great success. It has not only prevented formation of hard adherent scale, but priming and corrosion of boilers have been practically eliminated. Boiler maintenance has been made simpler owing to absence of hard scale and cleaner plates and tubes. Injector troubles have practically disappeared.

3. Washout mileages have been considerably improved in many cases by more than hundred per cent. As a result of greater engine availability and owing to the absence of engine failures enroute, more

traffic could be moved on some of the sections under treatment. Greater advantage, however, remains to be taken of increased washout mileage owing to the frequency of attention required to be given to engines for routine fitting repairs. In my opinion, better utilisation of locomotives as a result of water-treatment can only be achieved if co-operation from the traffic and operating departments is readily forthcoming and if the mechanical department can increase the interval between the routine fitting repairs, so as to synchronise with the increased washout mileage.

4. It had been customary for some railways in the past to ask for copper fire boxes on engines running on bad water sections. It has been amply proved that the present water-treatment has rendered this practice unnecessary.



APPENDIX D

Copy of letter No. W. 823. W./M.RM dated 5/12/55 from the General Manager. Central Railway, Bombay VT, to the Jt. Director, Mechanical Engg., Railway Board, New Delhi, copy to the Joint Director, Railway Testing & Research Centre, Chittaranjan.

Sub:—Water-treatment of bad water sections on Indian Railways.

It is agreed that water-treatment by the tannin-soda ash process has given very good results on this railway particularly on the Dhond-Manmad Section of the Sholapur division. The good results achieved have been in two directions, e. g.

- (a) Increased mileage obtained between boiler washouts particularly during the height of the dry season. The mileage before treatment was approximately 600 and, during the premonsoon period, had to be reduced to 300.
- (b) Avoidance of hard scale formation in the boilers which led to over-heating of the firebox plates and tubes, etc.

2. Of the other bad water sections on this railway, the Jhansi-Manikpur-Kanpur Section comes next in order of importance. Although on this section it was possible even without water-treatment to do boiler washouts at intervals of a thousand miles, there was considerable trouble experienced due to the formation of hard scale and repeated bookings of injectors, clack valves, etc. The introduction of water-treatment has reduced the troubles experienced with scale and has also permitted of boiler washout mileages being increased from 1,000 to 1,200 in the first instance and this will be stepped up by another 100 miles at a time in the near future.

3. The ex. Scindia State Railway (narrow gauge section) also has had water and used a proprietary compound till recently. This has since been replaced by tannin and although the results so far have not been reported to have been as before, it is considered that in course of time, there will be no cause for complaint against the tannin treatment.

4. Similarly, on the ex-Barsi Light Railway Section, a proprietary compound was in use which is still being used, but steps have been taken to replace it with tannin and trials are in progress.

5. The only other remaining bad water section is Wardha-Balharshah-Kazipet. Trials have already been started with three engines on the Wardha-Balharshah Section and these will be shortly extended to the Balharshah-Kazipet Section. Initial troubles are invariably experienced when the treatment is started due to the process of descaling which takes place causing leaky tubes, leaky seams, etc. These have to be put up with and the treatment introduced gradually on clean boilers or as engines come out from shops after P. O. H.

6. From the point of view of the Maintenance Engineer, the benefit obtained from boiler water-treatment in the way of a clean boiler and elimination of pitting and corrosion of boiler plates, etc. as well as trouble with injectors, clack valves, etc. due to heavy sedimentation, is much more important than that of increased mileage between boiler washouts. It is with this aspect in view that boiler water-treatment is being pursued. Hot water washout or, alternately, even changing of boiler water is no great handicap or burden on a shed and is done well within the time that an engine is available for running repairs. But all the same, where the water-treatment permits of increased mileages between washouts, advantage is being taken so as to save labour expended on it.

APPENDIX D1

Copy of letter No. MM, 77 dated 29th Nov. 1955, from the General Manager, Eastern Railway, Calcutta, to the Joint Director, Mechanical Engineering (P), Railway Board, New Delhi, and copy to R. T. R. C. Chittaranjan.

Sub:—Water-treatment of bad water sections on Indian railways.

Ref:—Board's letter No. 52/645/M dated 16/11/55

As far as this railway is concerned, the use of tannin-soda ash process for water-treatment is being adopted in all sections where it is considered necessary.

Regarding the question of increasing the mileages between two consecutive boiler washouts, I am not in favour of the same. As you are probably already aware, all our periodical examinations are timed to synchronise with the monthly boiler washout. Intervals between routine schedule repairs cannot be indefinitely increased without adverse effect on the maintenance and the mechanical condition of the locomotives. Cleaner boilers by themselves will lead to better operating efficiency due to less loss of time en route and quicker turnaround, and as such, I do not consider there is any need for extending the interval between washouts at the expense of mechanical maintenance.

APPENDIX D2

Copy of letter No. 1104/RB/74 dated 4/6th February, 1956, from the Chief Mechanical Engineer, South-Eastern Railway, Khargpur, to the Joint Director, Mechanical Engineering (P), Ministry of Railways, Railway Board, New Delhi, copy to R. T. R. C., Chittaranjan.

Sub:—Water-treatment of bad water sections on Indian Railways.

Ref:—Your No. 52/645/M dated 16-11-55.

Internal water-treatment with soda & tannin on the engines was started at Santragachi & Shalimar sheds of the Khargpur district with effect from 10-3-55.

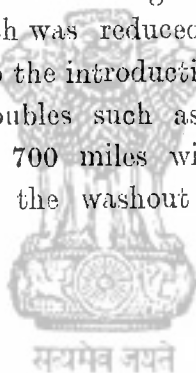
All the 44 engines (out of these 3 or 4 engines are always out of service for P. O. H. and other repairs) based at loco shed at Santragachi and working suburban services from Howrah and shunting & pilot services at Shalimar and Santragachi have been on all-round treatment. Similarly on an average 32 engines belonging to Khargpur loco shed which come into Santragachi daily are being treated for the quantity of water taken at Santragachi. The engines of Khargpur shed coming into Santragachi are not fixed and these engines work on other sections also and, therefore, the treatment in the case of Khargpur shed engines has been only partial. It is, therefore, proposed that instead of only partially treating these Khargpur engines, dosing arrangement will also be made at Khargpur shed for 30 HS & HSM class engines which work the goods services between Chitpur-Khargpur, East Dock-Khargpur & Shalimar-Khargpur, and 12 WP engines working passenger services. These engines will in future receive all-round treatment irrespective of the sections on which they work. Considerable corrosion and pitting was reported on the HX Class engines working in the colliery areas of the Adra district. 12 HX Class engines of Bhojudih loco shed, therefore, have been put on internal treatment with effect from 2-1-56.

Apart from the sections mentioned above, there is no proposal at present to extend this treatment to any other section.

Effect of Treatment :—As the engines of Khargpur shed were being only partially treated at Santragachi, the following remarks do not apply to Khargpur engines treated at Santragachi but only to Santragachi-based engines which were on all-round treatment. As regards the effect of treatment on the 12 engines being treated at Bhojudih, it is too early to give any remarks.

- (i) One of the immediate effects on introduction of the internal treatment has been the practical elimination of the injector troubles.
- (ii) Cases of pitting and corrosion on the water side of the boilers have not been noticed during the periodical inspections of the boilers in sheds.

- (iii) As regards the scale-formation in the boilers, it has been observed that the direct heating surfaces are kept more clear of the scale in comparison with the others. The scales on the casing plates, water space stays and crown stays have not shown much improvement although in a few of the engines there has been considerable improvement. One of the reasons for this, it is felt, is the fact that full dose treatment could not be given to all these engines on account of the tube leakage troubles, especially in the case of WM boilers. The WM boilers have been giving these leakage troubles ever since they were put into service and it has not yet been possible to eliminate them in spite of constant attention in the sheds. The leakages in the fire box are not only confined to tubes but stays, seams, patches, etc. and external seams and rivets are also affected. The cause of these leakages on WM boilers is under further investigation, but in the meantime the water-treatment dose is being controlled to minimise the trouble as far as possible.
- (iv) The washout mileage of WM engines which work the suburban services which was reduced to 500 miles from 700 miles much prior to the introduction of internal treatment, due to various troubles such as scaling, etc., has been again restored to 700 miles with effect from 1-10-55. Further increase in the washout mileage at this stage is not contemplated.



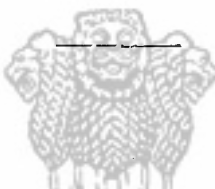
APPENDIX E

Copy of letter No. W. 823. W.3/62 dated 23rd/24th November. 1955 from the Chief Engineer, Central Railway, Bombay V. T., to the Joint Director, Research (M & C), Chittaranjan.

Re: Water-treatment—Minutes of the 8th Water Treatment Sub-committee Meeting.

It is stated that the water supply arrangements at Rechni Road which is the main watering station are being improved. When these improvements are carried out, Bellampalli will not be required to be retained as an auxiliary watering station.

2. As regards Balharshah, the matter is being investigated and a further reply in this respect will follow.



APPENDIX E1

Copy of letter No. W. 823 W1/M-RM dated 18. 1. 56. from the Chief Mechanical Engineer, Central Railway, Bombay V. T., to the Joint Director, Research (M & C), Chittaranjan.

Sub: Water-treatment—Minutes of the 8th Water Treatment Sub-committee Meeting—Item VI—Substitution of highly corrosive waters.

In continuation of this office memo No. W.823 W1/M-RM of 21.12.55, the Chief Engineer, Bombay, advises that it has been decided to use Bhima river water at Pandharpur, and that a proposal to provide a direct intake well in the bed of the river is accordingly being developed. When this scheme is carried out, the well will be put out of use.

2. Investigations are also being made to provide alternative sources of water supply at Balharshah and Bellampalli.

APPENDIX E2

Extract of letter No. MM. 77 dated 8/2/55 from the Chief Mechanical Engineer, Eastern Railway, Calcutta, to the Jt. Director, Research, Chittaranjan.

Sub:—Treatment of waters on trial sections.

Ref:—Your No. KRA/1 dt. 2/12/54.

As regards para (4) of your above quoted letter, I have to inform you that the Calcutta Corporation authorities have already been approached by the Divisional Superintendent, Sealdah, for providing a connection of Calcutta Corporation water at Belliaghata.

APPENDIX E3

Copy of letter No. W/6753/CE/26 dated 13th December, 1955 from the Chief Engineer, Southern Railway, Madras—3, to the Jt. Director, Research (M & C), Chittaranjan.

Sub:—Water-treatment—Minutes of the 8th Water Treatment Sub-committee Meeting.

Ref:—Your No. KRA/1 dated 16/11/55.

With reference to your above, I have to reply you as under, regarding the stations pertaining to this railway contained in Item VI of the minutes :

Bijapur : Proposals are in hand to take water from the Municipality which has been declared fit for loco purposes.

Hotgi : It is proposed to take water from the P. W. D. tank at Hotgi.

Virudhunagar : It is proposed to substitute the existing loco water supply at this station by bringing Arjuna River water which has been declared as fair for loco use. The Arjuna River scheme is already in progress and likely to be completed during 1956.

APPENDIX F

Extract of letter No. 11418/55-R/7 (i) 1 dated 21st December, 1955 from the President, Forest Research Institute & Colleges, New Forest P. O., Dehra Dun, to the Joint Director Research, Railway Testing and Research Centre, Chittaranjan.

Sub:—Indigenous Tannins.

Ref:—Your No. KRA/1 dated the 25th November, 1955.

1. The nature of the tannins present in different sources:—

- (i) Chestnut wood tannin is a quercetin derivative of monogalloyl ellagic acid.
- (ii) Quebracho tannin is reported to be a mixture of two tannins, yielding phloroglucinol and protocatechuic acid on the one hand and vanillic acid and hydroquinone and resorcinol on the other hand.
- (iii) Acacia (Khairwood) contains catechin and catechu-tannic acid.
- (iv) Myrobalan tannin is reported to be a diglucoside of luteoic acid. Chebulinic acid, which is digalloyl glucose, is also present in the myrobalans (*Terminalia Chebula*).

Although the percentage tannin contents in the various raw materials may vary from source, to source, usually a good tan extract contains about 60% tannins on the dry weight of the extract.

2. The nature of the tannin is given, from which one may draw one's own conclusion depending on the specific needs. Both chestnut and myrobalan tannin contain galloyl nucleus.

APPENDIX G

Copy of letter No. 619 dated 17th November 1955 from M/s. D, Augusto Formeni, Yusuf Building, 2nd Floor, Flora Fountain, Bombay, to the Joint Director Research (M & C), Railway Testing & Research Centre, Chittaranjan.

Re: Boiler Water-Treatment Analysis.

With reference to your enquiry No. KRA/1 dated the 31st August, 55, M/s. Ledoga's laboratory replies as follows:

"The determination of alkalinity of a boiler water treated with tannin must be carried out as per usual prescription but instead of using as indicator methyl orange, one has to use the following indicating solution:"

Bromocresol	gr.	0,085
Methyl red	,,	0,014
in 100 c.c. of alcohol 95°		

APPENDIX H

Copy of letter No. MM. 77 dated 4-2-56 from the Chief Mechanical Engineer, Eastern Railway, Calcutta, to the Joint Director Research, Railway Testing & Research Sub-centre, Chittaranjan.

Sub: Water-treatment on Indian Railways.

In accordance with para 11 of the minutes of the 8th meeting of the I. R. C. M. Water-treatment Sub-committee appended is a Progress Report for the six-month period ending December, '55.

On the Eastern Railway, water-treatment with soda-tannin complex is being carried out at the following sheds:

Sealdah Division

Beliaghata
Naihati
Chitpore
Narkeldanga

Howrah Division

Howrah loco shed

Reports submitted by the Chemist & Metallurgist, Jamalpur, indicate that the general condition of boilers is clean.

During the six-month period in question there have been only two engine failures on the Sealdah Division and three on the Howrah Division due to leaky tubes.

The necessity for treating water at Bandel, Gomoh, Gujhandi and Barkakana was investigated and samples of feed-water and boiler water were collected from these sheds and analysed. From the analysis it was found that the quality of water at these sheds was reasonably satisfactory and did not justify treatment. However, those engines of Bandel shed working into Howrah loco on the Howrah-Bandel link will very soon be treated similar to Howrah loco engines. The possibility of treating other outstation engines working into Howrah is also under investigation.

Appended is the total number of engines under treatment at present:

1. Beliaghata ... BTC	...	12	2. Narkeldanga ... HPS 1	...	17
STS	...	17	HPS 2	...	1
SGC2	...	9	HPC 1	...	9
STS	...	8	BTC	...	18
			STS	...	5
		46	SGC 2	...	5
			APC	...	8
			WM	...	19
					82
3. Chitpur ... CWD	...	19	4. Naihati ... SG	...	27
SGS	...	12	BTC	...	2
SGC2	...	11	AWC	...	14
XF	...	3	XF	...	3
		45			46
			5. Howrah loco		
			BTC	...	13
			ST	...	10
			CT	...	32
			SGC	...	10
					65

Monthly annexure reports are being submitted direct to you by the Chemist & Metallurgist, Jamalpur.

APPENDIX I *Report on boiler condition for the month of.....*

Railway	Section	Shed	No. of engines treated	Date of commencement of treatment	Mode of treatment		
					(i) Manual (ii) Automatic	(iii) Type of complex (iv) Rate of dose	No. of engs. under POH—MOH—

No. of engines transferred to other sheds —

GENERAL REMARKS AFTER WASHOUT :

1. Tubes
Flues
 - (1) Clean
 - (2) Slightly scaled (1/16" & below)
 - (3) Scaled between 1/16" & 1/8"
 - (4) Heavily scaled (1/8" & over)

Pitting & corrosion

Bursting : (1) Tubes

(2) Flues

(3) Elements

Number expanded : (1) Tubes

(2) Flues

Number attended otherwise :

No. of tubes taken out for cleaning in between the nest of the tubes: (1) Eng. No.
(2) No. of tubes removed.

2. Stays: 1. Clean.
2. Slightly scaled (1/16" & below)
3. Scale between 1/16" & 1/8"
4. Heavily scaled (1/8" & over).
3. Firebox plates including crown plates: (1) Clean
(2) Scaled (1/8" & below)
(3) Heavily scaled (above 1/8")
4. Firebox casing plates: (1) Clean
(2) Scaled (1/8" & below)
(3) Heavily scaled (above 1/8")
5. Pitting & corrosion on the water side firebox plates.
6. Overheating.
7. Waterways and injectors.
8. Priming & foaming.
9. Other remarks, if any.

Loco Foreman
Date :

APPENDIX J

**Progress of the internal boiler feed water-treatment
on Western Railway**

The following is the up-to-date position of the internal water-treatment trials on this railway:

Region	District	Section	Shed	No. of engines under treatment
Gondal	Jamnagar	Jamnagar—Okha Jamnagar—Rajkot	Jamnagar	26
		Wankanar—Rajkot Wankanar—Virangam	Wankanar	49
	„	Surendranagar—Halvad	Surendranagar	7
	Bhavnagar	Jetalsar—Rajkot Jetalsar—Veravai Jetalsar—Porbunder Jetalsar—Dhola	Jetalsar	45
		Junagadh—Saradiya Junagadh—Khijadiya Junagadh—Visavadar —Talala—Deivada— Kodinar	Junagadh	18
	„			
Ajmer	Abu Road	Mehsana—Abu Road	Mehsana	31
	„	Ahmedabad—Botad Ahmedabad—Khedbrahma	Sabarmati	27
Bombay	Pratap-nagar	Nadiad—Kapadvanj— Badran	Nadiad	10
	„	Champaner Road— Paniminies	Halol	4
Total...				217

After making a survey of loco feed conditions, it is proposed to extend the treatment to (i) other sections of Ajmer region (ii) narrow gauge sections radiating from Dabhoi and (iii) Udhna-Jalgaon

The treatment has given the following distinct benefits:—

- (i) Clean injectors and clack boxes.
- (ii) Reduced scaling in boilers and fireboxes.

In the Jamnagar and Junagadh sheds on the Gondal region, there was an epidemic of burst tubes and leakages which was undoubtedly due to the protective scale coating being dislodged with the treatment. However, it is anticipated that as the boilers are retubed or thoroughly descaled these initial troubles will no longer be experienced.

On certain gradient sections priming is being reported by the drivers. Trials conducted using polyamide emulsion have given relief in this respect and further investigation with this antipriming compound is being conducted.

The Hydrostatic Dosing Gear

- (a) Since the engine crew are considered the most uncertain element in the treatment, automatic devices in the hydrostatic dosing gear have been tried out on two engines on the metre gauge. The preliminary reports are that this type of dosing gear is working satisfactorily but not discharging accurately. Certain changes in the concentration of the solution will be made to suit the discharge rate peculiar to this dosing arrangement.
- (b) In the narrow gauge shed at Nadiad, dosing gears with a lead on injector feed cock have been installed, because these engines have side tanks instead of tenders.

The trials with dosing gear are being closely followed because it is considered necessary to have an automatic foolproof dosing arrangement as early as possible.

Note on the use of the 60/40 tannin-soda ash complex as a descaler prior to a descaling schedule

Trials on this railway were conducted in the Udhna loco shed for a month and it has been found that by the use of the 60/40 tannin-soda ash complex, the accumulated scale tends to loosen and fall off in junks which cannot be readily ejected by means of a wash-out. If the chemicals had a dissolving action, it would have been ideal in the circumstances.

This treatment was primarily tried out with the purpose of obviating the necessity of removing tubes for a descaling schedule. However, this purpose has not been achieved, yet the following distinct economy has been noticed:

- (i) Less number of tubes have to be withdrawn to remove the dislodged scale.
- (ii) Since the treatment softens the scale, less rodding and chiselling has to be done and consequently there is a reduction in man-hours of labour.
- (iii) A few days are saved in the overall time that is normally employed for descaling, making an engine available for traffic earlier.

These three distinct advantages are worth the descaling with tannin-soda ash, on sections which normally do not have more than one or two bad water sources on their engine links.

On the other hand if it is found that engines turned out from POH have a tendency to scale badly in about 3 to 4 months, then it is necessary to investigate:

- (i) whether the wash-out facilities provided in the sheds are adequate,

(ii) whether the engines have sufficient wash-out points on the barrel to permit the washout jet to reach every part of the fire-box tube, plate and tubes, and

(iii) whether the section is a bad water one.

The above are the main lines on which this railway will use the 60/40 tannin-soda ash complex as a descaling agent.

On sections where loco feed waters are alkaline as on the Nadiad-Kapadvanj section and at Sabarmati, only tannin is used at the rate of 1/2 lb. per 1000 gallons of water.

APPENDIX K

Government of India, Ministry of Railways Central Standards Office

Re: Water-treatment on Indian Railways—Minutes of the 8th
Water-treatment Sub-committee meeting of the
I. R. C. & M.

Ref: RTRC u. o. i. No. KRA/1 dated 5. 9. 55.

With reference to item 9 of the above minutes, it is confirmed that a blowdown counter can be fitted on IRS locomotives. The design will incorporate a registering counter actuated by a cylindrical plunger working in a hydraulic dash-pot. By regulating the diameter of the holes in the plunger and the clearance between the plunger and the bore of the hydraulic dash-pot, it would be possible to fix the duration of time required for the vertical drop of the plunger from the highest to the lowest positions. Since the plunger will be connected to the operating handle of the blowdown cock, the time for drop of the plunger on the cylinder, would ensure that the blowdown cock was kept open for a minimum period of time at every application. By reading the counter, one could be satisfied that the blowdown cock was open for at least the minimum period of time during each movement of the operating lever as registered by the counter. In its simplest form, it will not be possible to record the time or distance intervals between successive operations of the blowdown cock handle, unless a clock-work or recording mechanism is introduced. It is suggested that the IRC & M Committee may consider the views expressed above, and confirm that recording of the number of occasions the blowdown cock was open for a limited period of time, would meet the requirements, and the recording of interval between successive openings is not necessary.

(Sd.) R. KRISHNAMURTI
Chief Design Engineer. (Loco)

PART II



Report of the Sub-committee on Water-treatment
appointed by the
INDIAN RAILWAY CHEMISTS & METALLURGISTS COMMITTEE
Vide Item No. 19 of their First Report

Composition of the Sub-committee and terms of reference—The Indian Railway Chemists & Metallurgists Committee recommended against item No. 19 of their First Report a Sub-committee consisting of the Chemists and Metallurgists of the B. B. & C. I. (Convenor), B. N. & G. I. P. Railways and an officer of the Central Standards Office as Secretary to go into the question of standardization of methods for recording results of various water-treatments and formulate their recommendations on the subject for information of the Board. The Sub-committee was also asked to deal with all problems arising out of different types of water softening processes.

Convening of the Meeting—The Sub-committee could not meet before the 12th of March 1951, due to indisposition of some of its members. It met at 11 a. m. on the 12th March, 1951, in the Administrative Block of the Chittaranjan Loco Works under the Chairmanship of Dr. D. R. Malhotra.

The following members attended the meeting:

- (1) Dr. D. R. Malhotra, Chemist and Metallurgist, B. B. & C. I. Railway (*Chairman*).
- (2) Shri K. P. S. Nair, Chemist & Metallurgist, G. I. P. Railway. (*Member*).
- (3) Shri R. G. Bhatawadekar, Research Officer (Metallurgical & Chemical), Central Standards Office. (*Secretary*)

Shri H. B. Deshpande, Chemist & Metallurgist, B. N. Rly., could not attend the meeting due to illness.

Note : Shri T. M. Nair, Assistant Chemist & Metallurgist, Chittaranjan Locomotive Works also attended the meeting by invitation.

Recommendations—The Committee has studied at length the reports submitted by the B. N. and G. I. P. Railways on their water softening experiments. In the case of the B. N. Railway although the figures furnished by them are very valuable, a few conflicting statements are found in their recommendations.

2. In the case of the G. I. P. Railway, although the section from Poona to Raichur has been brought under water softening excepting Sholapur, it is very difficult to come to any definite conclusion until the Sholapur water supply is also softened. From the information submitted so far, it is clear that water softening has shown considerable savings so far as availability of locomotives and the cost of POH and IOH are concerned. It would have been useful, had the information been also available from the B. N. Railway on similar lines as furnished by the G. I. P. Railway. We understand that installation of a plant at Sholapur will take some time and in the meantime, we feel that since all other plants

have been put into commission, some practical means should be adopted for using softened water at Sholapur. This can only be done by taking softened water in the tenders from the two adjoining water softening stations, namely, Akalkot and Mohol. The total consumption of water for loco purposes at Sholapur per day amounts to roughly 33,000 gallons and some method should be adopted to carry softened water in the tenders of locomotives nominated for trial purposes only from the nearest water softener.

3. It is suggested that a water-treatment plant should be installed at Sholapur without any further delay. It is recommended that in the case of base-exchange softening plants, it is necessary to have tannin treatment given to the treated water for the purpose of eliminating any dissolved oxygen present.

4. As regards the B. B. & C. I. Railway, no report has been submitted. C. M. E., B. B. & C. I. Railway's remarks, quoted in the minutes of the C. M. E.'s meeting held at New Delhi on 20th June 1950, categorically state that the water softening has not shown any positive improvement. It would have been much appreciated, had the C. M. E., B. B. & C. I. Railway substantiated these remarks by actual records of performance of these plants and their effects.

5. In view of paucity of facts regarding water softening on Indian Railways, the Sub-committee is not in a position to give any final recommendation. It is proposed to hold another meeting after six months and in the meantime, C. M. E.'s of the three railways, (i. e. B.N., G. I. P. and B. B. & C. I. Railways) should be requested to submit their final reports on the working of their respective softening plants and their effects. The Sub-committee feels that it is highly necessary to maintain complete and detailed records of water softening plants, including the cost of treatment as against reduced cost of maintenance and increased availability of locomotives. Each Chemist and Metallurgist attached to these three railways should collect as much information on this subject as possible from his respective railway and bring that information with him at the next meeting.

6. It may be noted that when calculating the cost of softening, only water used in locomotives may be taken into consideration to the exclusion of water used for domestic purposes. It is recommended that wherever possible the system of water supply for locomotives should be separated from that of domestic use. This will reduce the cost of water softening.

7. The Sub-committee feels that it should deal with the subject in a more comprehensive manner and, therefore, suggests that the title given to Item No. 12 "Water-Treatment" under "Agenda" should be altered as "To study the performance of water softening plants and their effects on locomotive behaviour and make suitable recommendations in respect of efficient water conditioning."

(Sd.) K. P. S. NAIR
Member

(Sd.) R. G. BHATAWADEKAR
Secretary

(Sd.) D. R. MALHOTRA
Chairman

12-3-51

**Minutes of the First Meeting of the Water-treatment
Sub-committee of the Indian Railway
Chemists & Metallurgists Committee**

COMPOSITION OF THE SUB-COMMITTEE

The Convenor of the Sub-committee, Dr. D. R. Malhotra, Chemist & Metallurgist, Western Railway, being on long leave, and the Member representing the ex-B. N. Railway having retired, the Sub-committee has been reconstituted as follows:

1. Shri G. R. Iyengar, C. & M., S. Railway, Madras, (Convenor).
2. Shri K. P. S. Nair, C. & M., C. Railway, Bombay.
3. Shri N. V. Pandit, C. & M., E. Railway, Khargpur.
4. Shri R.G. Bhatawadekar, Research Officer., C.S.O. for Railways,
Member-Secretary, Chittaranjan.

2. As the final reports on the working of water softening plants on the Central and Western Railways have not been received in time, the old Sub-committee was not able to meet and submit its report so far on the comparative merits of various systems. It is regretted, therefore, that the Sub-committee could not submit its report within six months, as desired by the Railway Board.

3. The reports received from ex-B. N., ex. Bikaner, ex. M. S. M., and ex-Jodhpur railways were put before the newly formed Sub-committee and were discussed at length. The report from the Central Railway is expected to be received in about 4 months.

4. After considering these reports from railways and the latest developments in the field of feed water-treatment on railways in foreign countries, the Sub-committee came to the following conclusions :

- (i) Future extension of water-treatment on the Indian Railways should, as far as possible, be based on the principle of Internal Treatment of feed water with chemical complexes which are generally made from soda ash, tannins (preferably indigenous) and anti-foams; this takes into consideration the fact that the average quality of the water supplies over a link is what actually matters in practice, in contrast to the old mode of treating individual water supplies externally.
- (ii) In order that water-treatment be successful, it is considered desirable to adopt a method of dosing feed water with chemicals added to the tender, or during its passage to the boiler through the injector. The Sub-committee consider that, in adopting any method of internal treatment of water supplies in this manner, the human element should be eliminated entirely, in order to ensure success. For this purpose, it recommends the adoption of any one of the three methods suggested below :

- (a) Automatic introduction of chemical dosage into the feed-water stream when the injector-lever is opened. The chemical solution is stored in containers kept in the cab.
- (b) Introduction of chemical solution stored at ground level near water-column simultaneously in the feed-water, every time water-column valve is opened.
- (c) Automatic hydrostatic dosing device used as the tanks or tenders of locomotives are filled.

The drawings of the three devices are enclosed.

- (iii) It is essential for the success of this system that regular blow-downs be given so as to get rid of sludge and reduce total dissolved mineral matter in the boiler. For this purpose, they consider it necessary that blow-down should not be left to the discretion of the engine crew but it should be operated from the cab, according to a prescribed schedule, and registered by means of an automatic recorder.
- (iv) The Sub-committee recommend that, normally, only those feed-water supplies, the hardness of which exceeds 25 parts per 100,000 and where the consumption for loco purposes at any individual station exceeds 100,000 gallons per day, be treated externally.

5. The Sub-committee considered in detail the oscilameter type of treatment proposed for the North-East section of the ex-M. S. M. Railway and is of the opinion that these plants only serve the purpose of a dosing mechanism by which sodium bicarbonate alone is mixed with feed water and that tannins, which are very essential, cannot be added to high level water tanks, as in most cases, they are common for both drinking and loco purposes. Thus the oscilameters are capable of only partial and inadequate treatment.

6. The Sub-committee has noted the extreme urgency of treating the feed waters on the North-East section of the ex-M.S.M. Railway in a more satisfactory manner, because of very heavy corrosion noticed on TELCO boilers and recommend that it is essential that the proposed oscilameter treatment be supplemented by tannin dosage and systematic blow-down as mentioned in para 4 (ii) and 4 (iii) above, so as to prevent further damage to the boilers.

7. The Sub-committee further recommends that internal treatment, as described in para 4 above, be adopted on ex-Scindia State Railway as a trial and that the results obtained together with the cost of treatment, be reported in due course to the Committee.

8. This report covers the suggestions made by Loco Standards and Track Standards Sub-committee of July 1951, in respect of the T.I.A. system.

The C. S. O. will provide the necessary drawings for automatic
introducers and blow-down recorders.

(Sd.) G. R. IYENGAR,
Chemist and Metallurgist, Southern Railway.
(Convenor)
July 1952

(Sd.) K. P. S. NAIR,	(Sd.) N. V. PANDIT,
C. & M., C. Rly.	C. & M., E. Rly.
Bombay	Khargpur
July 1952	July 1952

(Sd.) R. G. BHATAWADEKAR,
Research Officer,
C. S. O. for Railways,
Chittaranjan
July 1952



**Minutes of the Second Meeting of the Water-treatment
Sub-committee of the Indian Railway Chemists
& Metallurgists Committee**

The meeting of the Sub-committee was held at Chittaranjan on 20/21-11-52 with the following members present. Mr. S. Ramanujam, Research Officer (M & C)-II, was present by invitation.

- (1) Shri G. R. Iyengar, C & M, Southern Rly. (Convenor).
- (2) „ K. P. S. Nair, C & M, Central Rly.
- (3) „ N. V. Pandit, C & M, Eastern Rly.
- (4) „ R. G. Bhatawadekar, RO (M & C), CSO for Rlys.,
(Member-Secretary)

1. Dosing Gears.

The various designs of different automatic dosing gears were carefully studied. The committee selected three dosing gears as most suitable for the purpose in view and their blue prints are attached with these minutes. The committee recommend the L. S. C. to study them and prescribe any or each of them for a specific type of locomotive and service.

The Committee, however, are of the opinion that the dosing gear given in proposal No. 1 is the simplest, least expensive, fully automatic and foolproof; they consider that this type is suitable for adoption on all types of locomotives, the capacity of the chemical solution tank being altered to suit individual types of engines.

2. Blow-Down.

The committee recommend installing in the cab a blow-down counter, a drawing of which is attached herewith. It may be noted that this type of counter does not record the time interval between consecutive blow-downs. The committee suggest that designing a recorder to show the number of blow-downs simultaneously with the time interval may be left to a later stage when the L. S. C. will adopt speedometers for locomotives.

As a definite blow-down schedule is essential for the success of the internal treatment, it is necessary that all boilers are fitted with intermittent blow-off cocks. As blow-down not only removes the sludge deposited in the boiler but also lowers the concentration of the boiler water to the desired limit, the committee are of the opinion that 'Alfloc' continuous blow-down valves need not be operated simultaneously with the blow-off cocks.

The committee note that the latest design of blow-off cocks are fitted with levers which can be conveniently operated from ground level. It is not therefore considered essential to provide the lever of the blow-off cocks in the cab of old locomotives, because of the considerable expense involved in the modification.

3. Sections recommended for internal treatment.

The composition of the water supplies on some of the sections known for bad boiler feed water on Southern, Central and Eastern Rail-

ways were examined and the committee recommend internal treatment for the following sections:

Southern Railway.

(a) *Gadag-Sholapur Section (MG).*

Dosing gears should be installed on all the locomotives on this section.

(b) *Madras-Waltair Section (BG).*

The sub-committee note that oscilameters have been installed at six watering stations on this section and that they are likely to be put in commission shortly. As the oscilameter treatment is designed only to increase the alkalinity of feed water by addition of soda-bi-carb., the committee consider that this is not adequate to inhibit corrosion and scaling. They therefore recommend again dosing gears for all the locomotives on this section, to enable the addition of tannin, which is supplementary to plain soda-bi-carb. treatment by means of oscilameter. It may be mentioned that tannin cannot be added directly into the storage tanks as the water is used for both loco and drinking purposes in most places.

(c) *Madura District (MG).*

The sub-committee note that a large majority of the locomotives on this district are not fitted with blow-off cocks with the result that no blow-down is possible between two consecutive wash-outs. It is understood that this was promptly brought to the notice of the CME/SR by the C & M of the railway and that action is now being taken to fit these engines with blow-off cocks. The committee recommend that simultaneously dosing gears also should be fitted in the cabs of all the locomotives in this district.

Central Railway.

(a) *Poona—Raichur Section.*

The feed water on this section requires supplementary treatment with tannin after treating with lime-soda and base-exchange plants. The sub-committee therefore recommend the installation of dosing gears on all the locomotives on this section.

(b) *Water-treatment plant at Sholapur.*

A water-treatment plant was previously recommended for Sholapur. The position, however, has now changed. It is learnt that the local municipality has agreed to supply the entire daily loco requirements of feed water, viz., about 1,20,000 gallons. The municipal supply is quite suitable for locomotives without external softening. There is no harm even if this water is mixed with the other well supply in an emergency. There are also separate storage tanks for loco and domestic supplies.

The sub-committee therefore recommend that the municipal supply be set apart wholly for loco purposes and Motibagh well supply for domestic purposes only. If this is done, the committee do not consider it essential to instal the lime-soda plant which is under consideration.

(c) (i) *Sholapur-Tantpur-Sirmuttra (NG).*

(ii) *Gwalior-Shivpuri, Gwalior-Sheopur & Kalan Gwalior-Bhind (NG).*

(iii) *Jhansi-Kanpur, Jhansi-Manikpur & Bhimsen-Khairada (BG).*

It is recommended that dosing gears should be fitted on all the locomotives working on the above three bad water sections. The proprietary brand of boiler compound called "Stop Seal", at present in use on the narrow gauge engines, should be replaced by the complex recommended by the sub-committee in para 4 below.

Eastern Railway.

(a) *South Sealdah Section (Beliaghata Loco Shed).*

- (i) All the engines on this section should be fitted with dosing gears.
- (ii) Beliaghata water supply is very bad. The sub-committee recommend external softening, with the spare base-exchange softener available at site.

4. *Treatment Complex.*

The sub-committee recommend the following composition:

Tannin Extract	...	60%
Soda Ash	...	35%
Sodium Aluminate	...	5%

The sub-committee recommend the addition of the above complex at the rate of 1 lb per thousand gallons, subject to small variations depending upon the nature of the water supplies.

In exceptional cases such as a supply showing free alkalinity, the committee recommend the addition of pure tannin at the rate of 1/2 lb per thousand gallons.

The tannin extract should preferably be of Quebracho or Chestnut variety. The sub-committee are not in favour of the use of proprietary boiler compounds.

5. *Treatment Control Staff.*

In order to obtain the desired results from internal treatment, the sub-committee recommend the appointment of a Treatment Controller at each shed. His duties will mainly be:

- (i) to prepare and charge the chemical solution tank in the cab,
- (ii) to vary the dosage according to requirements,
- (iii) to observe and maintain a record of the effect of internal treatment on the condition of boiler tubes and plates,
- (iv) to recommend variations in wash-out mileage as a result of his observations,
- (v) to maintain and check a record of blow-downs given on the run to each locomotive,
- (vi) to examine the boiler concentrate periodically and take suitable steps in regard to alteration of the dosage,
- (vii) to be in touch generally with the various branches of the loco shed with a view to fixing wash-out mileage, so as to synchronise wash-outs with regular maintenance overhauls and boiler examinations and

(viii) to find out which of the problems connected with the treatment are within his own perview and which he should refer to the C & M for investigation and further action.

6. *Shed control of the treatment.*

The senior most Boilermaker Chargeman of the shed should be made responsible for the control of this treatment. He should be sufficiently conversant with the scientific background of the treatment and its effect on the condition of the boiler and its components. He should have sufficient initiative and drive to ensure that the system of internal treatment is made a success.

In order to assist him in the discharge of his duties, he will be given one Boilermaker Mistry either of grade Rs. 100-180 or 80-160 and an unskilled Workman on Rs. 30-35. As the locomotives come in and go out of the shed all the twenty-four hours, this additional staff will have to be provided for three shifts.

(Sd.) G. R. IYENGAR,
Chemist & Metallurgist,
Southern Rly. (*Convenor*)
21-11-52

(Sd.) K. P. S. NAIR,
C. & M., Central Rly.
(*Member*)

(Sd.) N. V. PANDIT,
C. & M. Eastern Rly.
(*Member*)

(Sd.) R. G. BHATAWADEKAR,
Research Officer C. S. O.
(*Member-Secy.*)

**Minutes of the Third Meeting of the Water-treatment
Sub-committee of the Indian Railway Chemists
& Metallurgists Committee**

The meeting of the sub-committee was held in the committee room of the Central Railway at Victoria Terminus on 6th April, 1953. The following members were present. Mr. S. Ramanujam, Research Officer, was present by invitation.

- (1) Shri G. R. Iyengar, Chemist and Metallurgist, Southern Railway
(Convenor).
- (2) „ K. P. S. Nair, Chemist & Metallurgist, Central Railway.
- (3) „ N. V. Pandit, Chemist & Metallurgist, Eastern Railway.
- (4) „ R. G. Bhatawadekar, Research Officer (Metallurgical & Chemical), Railway Testing & Research Sub-centre, Chittaranjan (Member-Secretary).

The committee discussed in detail the recommendation made by the 33rd meeting of the Loco Standards Committee, held at Chittaranjan. The position on each railway in regard to the progress made on water-treatment on the lines suggested in their previous report was reviewed.

1. Dosing Gears.

The committee recommend adoption of the sketches prepared for broad gauge engines (WP and WG class) on the lines of Proposal No.1, and for metre gauge engines (YD class) on the lines of Central Standards Office sketch No. L.200, which are enclosed. These sketches represent the recommendation of the committee to be adopted on all BG and MG engines respectively. The committee further recommend that Chief Mechanical Engineers concerned should go into this question in detail and modify these proposals to suit any non-Indian Railway Standards Locomotives nominated for this treatment.

2. Blow-Down.

The committee learn that all the engines in the Madura district have not yet been fitted with blow-off cocks as recommended in their previous report. The committee consider this as an essential preliminary step before starting the proposed trial in this district. They therefore recommend that top priority should be given to fitting the blow-off cocks at least on all the engines which are intended for trial on this district. The committee were further informed that serious corrosion troubles have been reported to Central Standards Office from this district and therefore urge the Chief Mechanical Engineer, Southern Railway, to expedite fitting dosing gears on locomotives nominated for trial on this district. The committee would also request the Southern Railway to send progress report in this connection, at an interval of three months, to the Member-Secretary for the information of the committee,

3. Sections recommended for internal treatment.

In view of the discussion that have taken place at the 33rd Loco Standards Committee Meeting, this committee recommend that not less than 15 locomotives should be put on trial on each section.

Southern Railway.

(a) *Madura District (MG).*

The committee recommend 4 engines each of M, B, SG and YD class for trial for six months. Dosing gears should be fitted to all these locomotives on top priority basis. The financial implication of this proposal is enclosed as Appendix 'A'.

(b) *Gadag-Sholapur Section (MG).*

The committee recommend five engines each of PS, FM, and GS, class for trial for six months on this section. All these engines should be fitted with dosing gears on the lines of the Central Standards Office sketch No. L 200 for YD locomotive, which is enclosed. The financial implication of this proposal is enclosed as Appendix 'A'.

Central Railway.

(a) *Poona-Raichur Section.*

The committee learn that the water softening plants on this section have started operation. The results obtained in respect of extended wash-out period, savings on tubes and plates, coal consumption, engine performance, etc., may be submitted to the committee as early as possible for their information.

(b) (i) *Dholpur-Tantpur-Sirmuttra (NG).*

(ii) *Gwalior-Shivpuri, Gwalior-Sheopur-Kalan & Gwalior-Bhind (NG).*

(iii) *Jhansi-Kanpur, Jhansi-Manikpur & Bhimsen-Khairada (BG).*

The committee learn that no concrete action has been taken on the recommendation of the previous meeting on the metre gauge and narrow gauge sections mentioned above. The committee feel that early action should be taken to treat the loco waters on these sections with the boiler complex recommended by this committee and the results obtained reported to them.

Eastern Railway.

South Sealdah Section.

The committee learn that the base-exchange plant proposed in their previous report for Beliaghata will entail considerable expense before it is reconditioned and put into operation. It is, therefore, recommended that the extensive repairs and reconditioning reported to be necessary for this plant be kept in abeyance and internal treatment, as recommended by this committee, be resorted to on this section in an intensive measure.

The committee, therefore, recommend that, on the South Sealdah section, 15 engines of specified types be set apart for trial with internal treatment. Early steps should be taken to fit them with dosing gears and the trial commenced as early as possible. The financial implication for treating 15 engines on this section is enclosed as Appendix 'B'.

The committee further recommend that this section should also be considered as a trial section for the purpose of the proposed internal treatment.

4. *Cost of Treatment.*

It is computed that the cost of treating 1000 gallons by the method proposed by this committee works out to 8.8 annas on the metre gauge section of the South Sealdah Section.

It may be noted that the treatment cost will be reduced as and when more number of engines are fitted with dosing gears, the overhead cost, which will remain constant, will be distributed over a larger number of engines.

5. *Nadiad-Kapadvanj Section of Western Railway.*

(i) The committee considered the extract of D.O. letter No. M568/1/1 dated 2-3-53 from Mr. B. Venkataraman, Chief Mechanical Engineer, Chittaranjan, regarding the most suitable method of treating Nadiad water on the Western Railway. In this connection, the committee considered the report by Getz Broz. & Co., Bombay, on the trial conducted by them on this section, submitted to the Chairman and Members of the Railway Board. It is noted that high hardness (37.7 parts per 100,000) is shown against water supplies treated by lime-soda softener. The Chemist & Metallurgist, Western Railway, informed the Committee that this is due to the necessity of mixing raw and soft water supplies to cope with excess demands of narrow gauge engines at Nadiad. It is further noted that the Nadiad water is highly corrosive owing to the presence of nitrates. The committee are, however, of the opinion that the hardness of the Nadiad water supply can be brought down considerably, say to about 3 degrees, by working the lime-soda plants efficiently. In addition, corrosion due to nitrates can be inhibited by internal conditioning by the addition of suitable tannins in adequate quantity. The committee are therefore of the opinion that it is of primary importance first to investigate why the lime-soda plant is not now functioning properly and to take such steps as are necessary to put it into proper working condition. It may be added that imperfect softening is considered worse than no softening at all.

(ii) As stated in their previous report, the committee are not in favour of adopting any boiler compound of a proprietary nature, especially if it is imported. They therefore do not recommend the adoption of the ABB-T treatment advocated by Messrs Getz Broz. & Co., Bombay.

(iii) The committee considered the D.O. letter No. L/K/394 dated 19-3-53 of Dr. Malhotra, Chemist & Metallurgist, Western Railway, to Mr. Bhatawadekar, giving the results obtained after using a boiler compound made in his laboratory of the following composition:

Tannin	...	...	20 %
Soda ash	...	...	70 %
Tri-sodium phosphate	...	...	10 %

It is noted that the trials conducted with the use of this compound on this section have not proved successful, especially in respect of corrosion. The committee are of the opinion that corrosion would be eliminated if adequate quantity of tannin is used in the boiler compound as the presence of excess tannin in treated water is a pre-requisite for successfully treating this type of water.

(iv) For treating Nadiad loco water, the committee therefore recommended:

- (a) working the lime-soda plant at Nadiad efficiently, and
- (b) dosing the softened water with adequate quantity of tannin necessary to inhibit corrosion.

(Sd.) G. R. IYENGAR

Chemist & Metallurgist, Southern Railway,

(Convenor).

6-4-53.

(Sd.) K. P. S. NAIR

Chemist & Metallurgist, Central
Railway.

6-4-53

(Sd.) N. V. PANDIT

Chemist & Metallurgist, Eastern
Railway.

6-4-53

(Sd.) R. G. BHATAWADEKAR

Research Officer (M & C) Railway Testing &
Research Sub-centre, Chittaranjan.

6-4-53.

APPENDIX "A"

FINANCIAL STATEMENT

(a) *Madura District.*

It is proposed to place 4 engines each of M, B, SG and YD class on trial for six months.

<i>Capital Cost.</i>	Rs.	As.	P.
(i) Cost of dosing gears and fitting ...	1,040	0	0
(ii) Cost of solution preparation tank in shed and necessary accessories ...	100	0	0
<i>Recurring Cost.</i>			
(i) Cost of Chemicals required to treat 16 engines for six months. ...	3,412	0	0
(ii) Cost of labour ...	3,600	0	0
TOTAL	8,152	0	0

(b) *Gadag-Sholapur Section*

It is proposed to place 5 engines of each type PS, FM and GS class on trial for six months. The financial implication is:

<i>Capital Cost.</i>	Rs.	As.	P.
(i) Cost of dosing gear and fitting ...	975	0	0
(ii) Cost of solution preparing tank ...	100	0	0
<i>Recurring Cost.</i>			
(i) Cost of chemicals required to treat 15 engines for six months ...	3,399	6	0
(ii) Cost of labour ...	3,600	0	0
TOTAL	8,074	6	0

N.B. The estimated staff requirement in each shed:

2 Boilermakers on Rs. 80-160 grade.

2 Unskilled Khalasis.

The estimate is prepared on the basis of the maximum of the two grades.

APPENDIX "B"
FINANCIAL STATEMENT

South Sealdah District.

The number of engines which will be put on trial is as follows:
10 BTC. + 5 (SGS-APC)

<i>Capital Cost.</i>	Rs.	As.	P.
(i) Cost of dosing gears and fitting for the above	...	1,200	0 0
(ii) Chemical solution preparation tank	...	100	0 0
TOTAL		1,300	0 0

Recurring Cost.

(i) Cost of Chemicals required to water treat 15 engines for six months	...	16,200	0 0
(ii) Cost of labour	...	3,600	0 0
TOTAL		19,800	0 0
Grand total for cost of treatment for six months		21,100	0 0

Cost per 1000 gallons of the treated water, taking into account the depreciation on the Capital Cost, comes to approximately 11 annas.

**Minutes of the Fourth Meeting of the Water-treatment
Sub-committee of the Indian Railway Chemists
& Metallurgists Committee**

Present :

- Shri G. R. Iyengar (*Convenor*)... C & M, Southern Railway.
 „ N. V. Pandit ... C & M, Eastern Rly., Khargpur.
 „ K. P. S. Nair ... C & M, Central Railway.
 „ R. G. Bhatawadekar ... Research Officer (M & C)
 (*Member-Secretary*) Rly. Testing & Research
 Sub-centre, Chittaranjan.
- Shri K. C. Choudhuri, C & M, Eastern Railway, Jamalpur, and
 „ M. N. Bhide, Assistant Research Officer (M & C), R. T. & R. C.,
 Chittaranjan, were also present by invitation.

Minutes of discussion held on 21-8-53 and 24-8-53.

1. Dosing Gears.

(i) *Southern Railway.*

It is reported that necessary instructions have been issued to the Works Managers concerned to fabricate and instal the dosing gears on the basis of proposal No. 1 of the previous meeting. C. M. E., Southern Railway, has also asked the Works Managers to accord top priority to this work without waiting for the locomotives to come into the shops for their normal POH.

(ii) *Eastern Railway.*

It is understood that D. M. E., Sealdah, has indented for the necessary materials, viz. pipes, drums, etc., for the manufacture of dosing gears in the sheds, and it is expected that the dosing gears will be turned out within a fortnight of the receipt of the materials.

It is desirable that the C. M. E's should put down a target date for completion of this work on the sections under trial, in order to be able to start the trials as early as possible.

2. Blow-off Cocks.

(i) *Southern Railway.*

The engines nominated for trial on the Madura district have been fitted with blow-off cocks.

(ii) *Eastern Railway.*

All the engines on the southern section of Sealdah division are already equipped with blow-off cocks.

3. Blow-Down Counter.

The recommendation of the sub-committee meeting held on 20-21/11/52 that blow-down counters should be installed in the proposed trial engines, has not yet been implemented. It is considered necessary that some type of counter should be fitted. Though it may not show the

time interval between consecutive blow-downs, the number of blow-downs during a run is also considered important in successful water-treatment.

Although it is considered necessary to have blow-down counters, the committee is of the opinion that if there is any delay in providing them, the trials need not be held up on that account.

4. *Treatment Complex.*

It is recommended that the Chemists & Metallurgists of Railways should be made responsible for preparing and distributing the basis complex to sheds concerned. Actual preparation of the chemical complex solution will be done according to their recommendation and under their supervision in the sheds.

Some of the members of the Sub-committee remarked that considerable delay is being experienced in getting tannin extract and soda ash required for the manufacture of the complex. C. M. E.'s of the railways concerned are requested to urge the Controllers of Stores to give top priority in the matter of purchasing the above ingredients so that trials may be started with the minimum possible delay.

5. *Staff.*

Secretary, water-treatment sub-committee, informed the members that D. M. E. questioned the justification for having a Boilermaker Mistry in Gr. Rs. 100-180 or Rs. 80-160, with an additional unskilled workman, entirely for the purpose of this treatment. It is the opinion of this sub-committee that internal treatment has not succeeded anywhere without intense personal supervision. The duties of the Shed Boilermaker, who will control this treatment are eight-fold, as specified in the minutes of the water-treatment sub-committee meeting held on 20-21/11/52. If it can be guaranteed that these duties will be adequately and properly discharged, there should not be any objection to altering the previous recommendations in this respect.

6. *Western Railway.*

In December 1952, the Western Railway suggested the inclusion of Sabarmati-homed engines and Nadiad-Kapadvanj (NG) sections for trials with internal treatment. For this purpose, the Secretary requested the Western Railway to furnish him with information regarding chemical composition and quantities of feed water used on those sections. This information, however, was not forthcoming till May 1953, and when it came, information regarding a few watering stations, viz., Siddhapur, Palanpur and Abu Road had been left out.

Regarding Nadiad-Kapadvanj section, it would appear that mixing of raw and softened waters at Nadiad has been found necessary owing to the existence of common storage tanks, in order to cope with the demand by both broad and narrow gauge engines. The Committee is of the opinion that during the trial period N. G. engines on this section should be fed at Nadiad exclusively on fully softened water, treated additionally with a modified complex. Alternatively, Nadiad water supply may be cut out altogether and all NG engines be fed on Torna water alone, carried in auxiliary tanks if necessary. It may be noted that Torna water is of average quality and may not require any treatment for loco purposes.

7. Northern Railway.

The reply from the Northern Railway to the International Railway Congress was considered and the following comments are offered:

The cost of internal treatment is relatively lower than that of external softening either by lime-soda or base-exchange process. The cost of external softening increases with the increase in the quantity of water treated and is directly proportional to the volume, whereas in the case of internal treatment, the overall cost is low as the treatment is not proportional to the volume treated.

Regarding loss of heat by blowing down, this is inevitable in the case of steam locomotives and is essential whether the feed water is softened externally or treated internally. In special circumstances, the loss of heat may work out to be slightly less in the case of externally softened water, but the high initial cost of the softening plants and the high cost of their maintenance have to be borne in mind.



**Minutes of the Fifth Meeting of the Water-treatment
Sub-committee of the Indian Railway Chemists
& Metallurgists Committee**

*Minutes of the fifth Sub-committee meeting on water-treatment
held at Secunderabad on the 27th Feb., 1954.*

Present :

Sri G. R. Iyengar	....	Chemist & Metallurgist, Southern Railway, (<i>Convenor</i>).
Sri N. V. Pandit	....	Chemist & Metallurgist, Eastern Railway, (<i>Member</i>).
Sri K. P. S. Nair	....	Chemist & Metallurgist, Central Railway, (<i>Member</i>).
Sri R. G. Bhatawadekar	....	Jt. Director Research (<i>M & C</i>) RT & RC, Chittaranjan (<i>Ex-officio member</i>).
Sri S. Ramanujam	....	Research Officer (<i>M & C</i>), RT & RC Chittaranjan (<i>Member-Secretary</i>).

The Sub-committee reviewed the position regarding the proposed trials.

Southern Railway.

At Gadag, 8 GS class engines and 5 FM class engines have been fitted with dosing gears on the basis of proposal No. 1 of the second sub-committee meeting. At Madura, 5 engines, each of B & M classes have been fitted. Further 5 YG's have been nominated for this purpose; it is reported that they will not be fitted with dosing gears till a decision is arrived at by the water-treatment Sub-committee regarding the best design for automatic arrangement.

In some of the above engines, the solution pipe was connected to the feed pipe near the injector, and in some on the injector barrel. During extensive trials conducted on both these types, it was noticed that chemical solution was satisfactorily sucked when the injector worked, but syphoning action continued after the injector stopped functioning. It was further noticed that the pipe joint at the injector barrel gets loose during the run, with the result that there is a grave risk of air getting into the injector barrel rendering it inoperative. It was therefore, decided that brazing the solution pipe to injector barrel should not be adopted as a standard practice.

A further defect noticed during trials was that the copper pipe connection developed leaks frequently due to loose joint resulting from vibration of the engine. Considerable wear was also noticed as a result of abrasion with metal parts. These defects can be minimised by reducing the length of piping to the minimum.

On all the engines referred to above:

- (i) the solution tank was placed just beyond left side view glass,
- (ii) non-return valve of the ball and flap types were tried at the end of the pipe in the solution tank,
- (iii) a control plug was fitted to the pipe near the solution tank,
- (iv) an air vent also was provided at the top of the solution tank,
- (v) the lid on the tank was clamped by means of a wing-nut so as to prevent the solution from spilling and dust and other extraneous matter entering into the tank during the run, and
- (vi) to clean the solution tank periodically, a plug cock was provided at its bottom.

As the dosing gears cannot be made to work automatically at this stage, drivers have been permitted to open the solution plug cock when the injector is open and to close it when the injector is closed. The object is to prevent wastage of chemical solution due to syphoning action that occurs when the injector does not work.

Eastern Railway.

All the fittings required for the dosing gear on the engines are ready for installing. They have not been fitted to the engines, because the necessary chemicals have not yet been received. The bottle-neck in the progress of trials lies therefore, in the supply of chemicals.

2. Supply position of tannin and soda ash.

On the Southern Railway, there was considerable delay in getting chestnut extract powder and soda ash at the initial stage. After considerable effort, supplies have been arranged for both these chemicals. No further difficulty is anticipated in future in procuring them.

On the Eastern and Central Railways, the supply position has not been satisfactory.

The Sub-committee suggest that top priority be accorded to procure these essential materials. The Southern Railway is obtaining all the requirements of chestnut extract powder from M/S D-Augusto Formenti, Yusuf Buildings, Flora Fountain, Bombay-1; soda ash is obtained on rate contract.

3. Progress with regard to trials with dosing gear.

On the Southern Railway, several modifications for the dosing gear wear examined with a view to overcome the defect of syphoning that persists when the injector is closed. The arrangement shown in the sketch which is enclosed, is expected to work automatically. It is proposed to give effect to it in case the loco design section of the Central Standards Office reports favourably on it, particularly with reference to the non-return valve. The main features of this modification are:

- (i) The solution tank is kept in the tender above the maximum level of the water in the tender tank.
- (ii) Syphoning action is avoided by gravity feed. The solution pipe from the bottom of the solution tank is connected to the feed water pipe near the tender feed water cock.
- (iii) Provision is made for a non-return valve in the feed pipe between the solution pipe joint and tender for allowing feed water to flow in the direction of injector when tender feed cock is opened and to prevent chemical solution from flowing into tender tank when tender feed cock is closed.

This is expected to work satisfactorily on the Southern Railway where the practice in working the injector is to open and close the tender feed cock as required and to keep the engine adjusting feed cock always in the open position.

- (iv) The capacity of solution will be as large as possible, say 50 to 60 gallons, so that the solution may last for the entire round trip.
- (v) It is considered adequate to connect the solution pipe only to the left side, as the left side injector only is normally worked; if the right side injector is worked occasionally, the chemicals already inside the boiler will take care of the water thus injected.

Another modification suggested is given in the enclosed sketches CMT 1 & CMT 2.

4. C.S.O. Sketches No. L235 & L249.

The sub-committee carefully studied the above sketches. The sketch No. L235 represents modification to engine feed cock whereas it is stated in the Central Standards Office letter dated 4.1.54 that it refers to tender feed cock, which is probably a typographical error.

In this connection it is to be noted that the practice on some railways is to open and close the tender feed cock as required, keeping the engine adjusting feed cock always open. In other railways, the practice is the reverse, i.e., to operate the engine feed cock, keeping the tender feed cock always open.

The arrangement shown in C.S.O. sketches No. L.235 and L.249 is workable, only in the case where the practice is to open and close the engine feed water cock, keeping the tender feed cock always open. On the other hand, where the practice is the reverse, this arrangement is not considered applicable.

The sub-committee, therefore, recommend that the Central Standards Office design section examine the two modifications to the dosing gear suggested in para 3 above, together with their sketches No. L 235 and L 249 and evolve a final design or designs that will work satisfactorily under either method of operation of feed cocks.

5. Water-treatment of feed water on Sealdah Suburban sections.

The analysis of the water supplied at HLO Depot, Narikeldanga and Chitpur, furnished by the chief Mechanical Engineer, Eastern

Railway, were studied. The sub-committee recommend the complex suggested by them previously for their treatment. Pending the finalisation of the dosing gear, the complex may be added to the tender tank in the proportion of one lb per 1,000 gallons of water at the initial stage, suitably reducing the quantity subsequently, depending upon the internal condition of boiler. Care is to be taken to add this complex also into the boiler when it is filled after wash-out.

6. *Bad water sections.*

Trials were conducted on the Central and Southern Railways by adding manually the chemical complex previously recommended into tender tanks. The previous practice on the Central Railway was to add "Stop-Seal" which is a proprietary article. This was substituted by chestnut extract powder and the results are reported to be very satisfactory.

The sub-committee recommend that similar treatment be given to the following bad water sections of Central Railway:

- (i) Dhond-Manmad.
- (ii) Jhansi-Kanpur-Manikpur.
- (iii) Wardha-Balharshah

The initial dose recommended is one lb per 1,000 gallons of water; this may be reduced later as required.

On Southern Railway, chemical complex is being used on some bad water section by manual addition to tenders and also to boilers after washing out. The results are reported to be very satisfactory. A circular has been issued to all the bad water districts on the Railways to use this complex particularly during the coming hot weather.

The sub-committee recommend manual addition into tenders of chemical complex at the rate of 1 lb per 1,000 gallons of water, on all bad water sections, as an interim measure, pending the finalisation of the automatic design of the dosing gear.

7. *Complex composition of:*

Experience gained so far in using this method of treatment shows that there is no necessity for the addition of sodium aluminate proposed previously; instead, the quantity of soda ash is to be increased proportionately.

Sd. G. R. IYENGAR
Chemist & Metallurgist,
Southern Railway,
(Convenor).

Sd. N. V. PANDIT
Chemist & Metallurgist,
Eastern Railway,
(Member)

Sd. K. P. S. NAIR
Chemist & Metallurgist,
Central Railway,
(Member).

Sd. R. G. BHATAWADEKAR
Joint Director Research (M & C),
Rly. Testing & Research Sub-centre,
(ex-officio Member).

Sd. S. RAMANUJAM
Research Officer (M & C),
Railway Testing & Research Sub-centre,
(Member-Secretary).

**Minutes of the Sixth Meeting of the Water-treatment
Sub-committee of the Indian Railway Chemists &
Metallurgists Committee**

*Minutes of Sixth Sub-committee Meeting of Water-treatment held
at Bombay on the 11th and 12th August, 1954.*

Present :

Shri G. R. Iyengar	....	Chemist and Metallurgist, Southern Railway, (<i>Convenor</i>).
Shri N. V. Pandit	...	Chemists and Metallurgist, Eastern Railway, (<i>Member</i>).
Shri K. P. S. Nair	...	Chemists and Metallurgist, Central Railway, (<i>Member</i>).
Shri R. G. Bhatawadekar	...	Joint Director Research, (M & C) Railway Testing and Research Sub-centre, Chittaranjan (<i>ex- Officio Member</i>).
Shri S. Ramanujam	....	Deputy Director, Research (M & C), Railway Testing and Research Sub-centre, Chittaran- jan (<i>Member-Secretary</i>).

1. Tannin Soda ash complex trials.

In accordance with the recommendations of the fifth meeting of the water-treatment sub-committee, Chittaranjan, the Central Standards Office, Loco Design Section, finalised the design of the automatic dosing gear according to C. S. O. sketches No. L235 and L249 (copies enclosed for ready reference). A note in this connection was forwarded to all railways under Railway Testing and Research Sub-centre, Chittaranjan, letter No. KRA/1, dated 14/15th June, 1954.

2. Pending its finalisation, it was decided with the approval of the Railway Board that, wherever dosing gear was not available, the railways were to treat bad feed water supplies in the tender manually with the chemical complex, particularly during the hot weather.

3. Progress Reports.

Eastern Railway.

South Sealdah Section.

Trials were conducted on 15 engines of BTC and SG classes on the South Sealdah Section from 1-6-54. The treatment is progressing satisfactorily.

When using dosing gears in accordance with C.S.O. sketches No. L235 and L249, the rate of flow of solution was not uniform owing to choking of orifice of the dosing arrangement. The complex, therefore, was added manually into the tender.

Two boilermaker mistries were appointed to control the day-to-day treatment and to maintain proper records in connection with the trials.

The preliminary reports regarding the effect of treatment on the boilers are very favourable with respect to cleanliness of boilers owing to

freedom from adherent scale and free steaming of boilers in general. Bookings to the injectors have been completely eliminated; injector incrustations were a serious problem on the South Sealdah Section prior to the introduction of the treatment. (For details see Annexure No. 1)

Southern Railway.

(a) *Gadag Shed.*

Of the 28 engines allotted, 15 engines were fitted with dosing gears; out of these, 9 had copper fire-boxes.

The remaining 13 engines were treated manually by addition of the complex into the tender according to a prescribed schedule. It was also added to the boilers after every wash-out.

Thirteen engines fitted with dosing gear to old design started operating from 8-3-54 and the remaining two from 15-5-54.

In spite of the admittedly imperfect manner of treatment owing to the human element involved therein, it is observed that the arrest of corrosion, reduction of scale formation and elimination of tube leakages are remarkable, vide reports of Loco Foreman and District Mechanical Engineers (see Annexure No. 2). The Chief Mechanical Engineer, Southern Railway, has reported to the Railway Testing and Research Sub-centre, Chittaranjan, that "one great achievement is that we do not have boiler troubles as we had before the water-treatment."

During the last summer there was only one engine failure due to tube leakage in contrast to a number of engine failures during previous summers. This failure occurred on an engine not fitted with the dosing gear.

There was no injector trouble, whereas previously injectors had to be cleaned regularly in the home-shed and at destination.

The scale formation was so slight that the engines were not required to be sent for descaling at six-monthly intervals as was the procedure laid down prior to water-treatment.

(b) *Madura Shed.*

Of the 83 engines allotted, 10 engines were fitted with dosing gear, the remaining being treated manually by addition of the complex into the tender in the shed and at some of the water columns *enroute*. The results noticed by the shed staff were satisfactory in respect of scale formation, corrosion and tube leakage, as may be seen from Annexure No. 2. Advantage has been taken of the clean condition of boilers resulting from this treatment for increasing mileage between wash-outs.

Dosing gear to the final C.S.O. design.

One engine No. FM 527 has been turned out of Hubli shops on 21-7-54 fitted with dosing gear to the final design in accordance with C.S.O. sketches No. L249 & L235. Two more engines in the shops are being fitted similarly.

In the Golden Rock Workshops engines No. YC2526 and 2540 are being fitted with the dosing gear to the final design.

Central Railway.

Dhond-Manmad section.

Trials on two engines were started from 18-4-54, by dosing 9 lbs of 40/40 tannin soda ash mixture at 3 points *enroute*.

By 3-6-54, both these engines were withdrawn from trial owing to adverse reports from D. B. I., in respect of scorching and cushioning of copper plates and leakage of tubes, flues and copper stays.

Another engine No. 409 H/4 turned out after POH was put under trial from 22-5-54, with an initial dosage of 1 lb for thousand gallons, but this was halved from 26-5-54.

By 26-6-54, this engine also had to be withdrawn due to persistence of leaky tubes and flues and slight cushioning of plates.

Though the treatment resulted in reduced hardness, increased mileage between wash-outs and less priming, the benefits were offset by such defects as leaky tubes and flues.

In view of the above, a fresh trial was started on engine No. 878 with a copper fire-box from 1-7-54, treating it with 75/25 soda ash tannin mixture.

The following further trials have been arranged:

- (a) Engine No. 987 also fitted with copper fire-box to be treated with tannin alone.
- (b) Engine No. 406 with steel fire-box to be treated with a 75/25 soda ash tannin mixture, the dose in this case being increased to 2 lbs/1000 gals. (For details please see Annexure No. 3.)

4. Sub-committee's recommendations.

After a study of the progress reports received from the railways, the sub-committee makes the following specific recommendation to the general recommendations made in para No. 5 below.

Eastern Railway.

South Sealdah section.

In view of the excessive magnesium hardness in the feed water in South Sealdah section, it is recommended that Calcutta Corporation water be used for preparing the treatment complex; meanwhile, manual addition of the complex to the tender be continued. It is further recommended that the addition of sodium aluminate be discontinued as has already been suggested in para 7 of the report of the 5th Sub-committee meeting.

Southern Railway.

(1) Madura & Gadag sections.

In view of the satisfactory reports regarding cleanliness of boilers, freedom from tube leaks and injector troubles, it is suggested that the present wash-out mileages be doubled, to start with, on six engines in each shed and the condition of boilers of these engines be compared with that

on other engines with the existing normal wash-out mileages. It is essential in this connection that regular blow-down schedules should be adopted *enroute*.

Central Railway.

The sub-committee is of the opinion that the cushioning of plates is the result of localised excessive heating owing to accumulation of scale on the water side of fire-box plates in the water leg portion; this scale prevents efficient conduction of heat away from the plates which is aggravated by obstruction to free circulation of water which is known to be already poor in water legs. Though an engine may have come back from POH in shops, it is possible that the pre-existing scale has been only partially removed on those surfaces which are inaccessible in normal cleaning operations.

The sub-committee is of the opinion that leaky tubes and stay joints are incidental to this method of treatment in the initial stages, as already existing leaks are made bare by the removal of scale. This can be minimised by giving smaller dosages of the 60/40 tannin soda ash complex in the initial stage but at more frequent intervals instead of addition of larger dosages at two points as at present.

The Chemist & Metallurgist, Central Railway, however, considers that on sections like Dhond-Manmad where the water is deficient in free alkalinity, sufficient soda ash should be introduced into the boiler so as to maintain the free alkalinity in the boiler concentrate at all times at about 15 parts per 100,000. Further, the amount of tannin to be added in conjunction with soda ash need not be more than $\frac{1}{4}$ to $\frac{1}{3}$ the weight of soda ash. Though the minimum alkalinity could be obtained by increasing the dose of the 60/40 complex, this will result in simply increasing the cost since the same results could be achieved by increasing the soda ash content of the complex. Such mixtures will be particularly suitable for engines fitted with steel fire-boxes.

The other members of the sub-committee do not agree with this view, as the actual problem on Dhond-Manmad section is that of copper fire-boxes which, unlike steel, are corroded by alkali. Maintaining free alkalinity in the boiler concentrate at all times at about 15 parts per 100,000 is neither possible nor necessary. Further, whenever the boiler is showing severe scaling or when expanded areas of the tubes are not fluid-tight it is advisable to increase the alkalinity very cautiously at the beginning to avoid a too quick descaling resulting in excessive leakages. They, therefore, recommend that the trials be conducted again, using the 60/40 tannin soda ash complex which should be added at every water column, the quantity (weight of complex per thousand gallons) being varied to suit the hardness of individual feed water supplies. For example Ahmadnagar and Rahuri supplies call for increased dosages.

Leaky tubes and stay joints are attributed primarily to mechanical defects in the repair shop practice. The leaky tubes experienced on the Dhond-Manmad section are, in the committee's opinion, not due to corrosive action of the complex. A study of the method of fitting tubes into smoke-box and fire-box plates in the Parel workshops has revealed

that the practice on the Central Railway is different from that followed by Jamalpur workshops of the Eastern Railway. Tubes are serrated before fitting in the flue holes. The serrations on tubes bite into the tube-plate during the process of expanding making a leak-proof joint. It is recommended that the note on mechanical causes for leaky flues and tubes (Annexure No. 4) be referred to in this connection. Cushioning and scorching of plates noticed in boilers on Dhond-Manmad section under trial are attributed to the presence of old scale left over after the POH. The sub-committee recommends that the Central Railway adopts the method followed in Jamalpur workshops of fitting tubes on trial engines with copper fire-boxes.

5. General Recommendations.

The following general recommendations are applicable to all trial sections:

- (i) Early steps should be taken to fit 15 engines with the dosing gears to the final design of the Central Standards Office sketches Nos. L235 & L249 on the Gadag-Sholapur, Madura and South Sealdah sections; 5 engines are to be thus fitted on the Dhond-Manmad section.
- (ii) The remaining engines on these sections should be treated manually by the addition of the chemical complex in the tender in accordance with the recommendations contained in para. 6 of the report of the 5th sub-committee meeting.
- (iii) The progress reports in regard to fitting of engines with the dosing gears to the final C. S. O. design should be forwarded to the Railway Testing & Research Sub-centre, Chittaranjan, every two months.
- (iv) In order to compare the results obtained on the trial engines on all the railways, a uniform *pro forma* (Annexure No. 5) be adopted for reporting of boiler conditions noticed at each boiler examination.
- (v) Copies of boiler inspector's report on the condition of boilers under trial should be obtained at every inspection and forwarded to the Railway Testing & Research Sub-centre, Chittaranjan, as per *pro forma* attached.
- (vi) Boiler concentrates should be tested on all trial engines as frequently as possible; this should not be less than one test per fortnight for each trial engine. The tests will include phenolphthalein alkalinity, total alkalinity, total hardness and chlorides as NaCl (Sodium Chloride).

II. (a) Priming on Poona-Raichur section.

The Chemist & Metallurgist, Central Railway, stated that loco feed waters on Poona-Raichur section give rise to priming troubles in spite of existing external treatment especially during hot weather. The sub-committee, therefore, recommends the addition of 4 ozs of tannin to 1000 gallons of water on this section during such periods. Reports of results obtained should be made to the sub-committee regularly.

(b) *Bhusaval Division.*

According to the Chemist & Metallurgist, Central Railway, trials on one WG and one AWE engines using 1/8 lb of tannin and 1/2 oz of Calgon per 1,000 gallons of water on Bhusaval Division (Bhusaval-Nagpur section) have been very successful. As a result of this treatment, the wash-out mileage has been increased from 1,000 to 1,500 miles. The sub-committee, however, recommends that the addition of Calgon be omitted. Instead, the dosage of tannin should be increased to 4 ozs per 1000 gallons. Reports of results obtained should be made to the sub-committee regularly.

III. *"Carbion" Zoe-Carb Treatment.*

The sub-committee notes that the Railway Testing & Research Sub-centre, Chittaranjan, has arranged to conduct trials on the new carbion base-exchange process developed by the Fuel Research Institute, Dhanbad. The results of these trials will be communicated by the Sub-centre to the sub-committee in due course. This trial will be independent of the trials at present being conducted with the chemical complex and is not to be taken as an alternative to it.

IV. *Collection of data of feed water supplies on Indian Railways.*

The sub-committee has studied the questionnaire issued by E. C. A. F. E. and is of the opinion that it is not feasible to submit all the information required in this connection. The sub-committee, however, feels that data on the analysis of loco feed water supplies in bad water sections on different railways should be collected so as to obtain an overall picture of water supplies on the Indian Railways. The Chemists and Metallurgists of the Indian Railways will collect and furnish necessary information in this connection to the Railway Testing & Research Sub-centre, Chittaranjan.

V. *"Aquastat" Process.*

The sub-committee notes that the Railway Testing & Research Sub-centre, Chittaranjan, is arranging to conduct trials with the "Aquastat" process. The results obtained will be submitted to the sub-committee in due course.

(Sd.) G. R. IYENGAR
Chemist & Metallurgist,
Southern Railway,
(Convenor).

(Sd.) N. V. PANDIT
Chemist & Metallurgist,
Eastern Railway,
(Member).

(Sd.) K. P. S. NAIR
Chemist & Metallurgist,
Central Railway,
(Member.)

(Sd.) R. G. BHATAWADEKAR
Joint Director Research (MC),
Railway Testing & Research Sub-centre,
Chittaranjan.
(ex-officio Member).

(Sd.) S. RAMANUJAM
Deputy Director Research (MC)
Railway Testing & Research
Sub-centre, Chittaranjan,
(Member-Secretary).

ANNEXURE No. 1

PROGRESS REPORT FROM THE EASTERN RAILWAY.

N. V. PANDIT.
Chemist & Metallurgist.

D. O. No. 2216/1/2165
Khargpur, Date 26/28-7-54.

My dear Ramanujam.

Re: Water-treatment on Railways.

Ref: your D. O. No. KRA/1 dt. 21-7-54.

Water-treatment trials with chemical complex on South Sealdah section of this railway have been started with effect from 1-6-54. I give below the details in this connection.

(1) *Number of engines under trials*— The following 15 engines are undergoing treatment with the chemical complex.

BTC Class (10 engines)

603, 610, 613, 601, 605, 579, 623, 581, 639 & 646.

SG Class (5 engines)

232, 235, 274, 309, & 321.

All the above engines are fitted with copper fire-boxes.

(2) *Chemical complex*—The Chemical complex of the following composition is being used, the dose being 2 lbs per 1000 gallons;

Soda Ash	....	65%
Tannin extract	...	30%
Sodium Aluminate	...	5%

The reasons for adopting the above composition were discussed by me in our last meeting. As the permanent hardness of the Belliaghata water is extremely high, it was considered necessary to use a higher proportion of soda ash in the mixture. By giving a dose of 2 lbs per 1000 gallons of the above composition the, quantity of tannin used per 1000 gallons would be the same as recommended by the Committee, where as the quantity of soda ash used per 1000 gallons would be more. It was further considered necessary to keep the sodium aluminate in the mixture as per original recommendations. The waters in the South Sealdah section contain a considerable proportion of magnesium hardness and the use of sodium aluminate is found to be helpful in coagulation of the magnesium hydroxide precipitate.

(3) *Method of dosing*—Before the commencement of the water-treatment, extensive were trials carried out with the dosing gears (using water in the drums), as per this office drawing No. 10885 showing the alternative arrangement and also as per C.S.O. sketches Nos. L235 & L249. nipple was used to control the rate of flow of the solution, as the higher size nipple would have a very high rate of flow of the solution. With these trials it was established that the rate of flow of the solution from the drum was about 9 gallons per 1,000 gallons of water consumed.

During the actual trials with the chemical complex however, the arrangement did not function at all. Due to the high permanent hardness of the Belliaghata water a heavy precipitate is formed on addition of the chemical complex and this resulted in choking of the nozzle of the solution pipe and the flow of solution was being interrupted thereby. Attempts to filter the solution before it was filled into the drums were not successful. The use of dosing gear has, therefore, been abandoned, and the addition of the chemical complex is being made into the tenders at the rate of 2 lbs per 1000 gallons for the full round trip. As the round trips of the engines on the South Sealdah section are not very long, this arrangement is working very satisfactorily.

(4) *Control of treatment*—The two Boilermaker mistries who have been appointed for this purpose have been instructed to maintain the Log Book in the following form:

Date.	Eng No.	Train No.	Milage after POH	Milage after last W.O.	Blow-down time & duration	Time, the engine leaves shed	Quantity of chemical complex added	Remarks Re: priming or any other bookings to the engine.	Chemical analysis H P M Cl.
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Two engines (639BTC & 309SG), one from each link, have been selected for detailed observations such as daily boiler water tests, boiler inspection reports etc. Copies of the weekly statements in the above form are being sent to this office. Similarly boiler inspection reports at the time of every wash-out of the above 2 engines are being submitted to this office by boilermaker chargemen in the *pro forma* which has been made for this purpose. Copies of the boiler inspection reports on this *pro forma* for these two engines are enclosed herewith for your information.

(5) *Effects of treatment*—Although it is too early to arrive at any definite conclusions regarding the effect of the treatment, the preliminary reports about the treatment are indeed very favourable. The following effects have been noticed immediately after the treatment has been started.

- (i) Booking to the injector have been completely eliminated. Prior to the treatment, the injector incrustation was a serious problem, as the injectors had to be often cleaned in between the wash-out periods.
- (ii) The general steaming of the engines has improved considerably. The time from lighting up to the steaming has been considerably reduced.
- (iii) The general condition of the boilers has considerably improved. There is no appreciable building up of fresh scales in the

boiler. The old pre-existing scale is found to be disintegrating due to the action of the chemical complex. This effect is very much in evidence on the copper surfaces which are fairly clean. The steel surfaces, however are, not yet as clean as they should be, although much of the pre-existing scale has come off.

After a certain period of trial, it is proposed to conduct trials on the actual fuel consumption so as to find out if any saving on the fuel consumption can be effected. Boiler inspector's half-yearly inspection reports of the boilers will be forwarded to you as and when they are available.

Yours sincerely,

Encl: Statements in
10 sheets.

Sd/-

S. RAMANUJAM, Esqr.
Dy. Director Research (M&C),
Chittaranjan.



ANNEXURE No. 1 **Period of Treatment**

Engine No. 639 BTC	Details on 14th June, 1954	Details on 23rd July, 1954	Depot BGA General Remarks on 14th June, 1954 on 23rd July, 1954
POH 20th March, 1953 (re-tubed)			
(1) Mileage since re-tubing		
(2) " " previous W. O.		
(3) Next W. O. due		
<i>Observations before W. O.</i>			
(4) Under firedoor	Clean loose scale on stays.	Loose and flaky scale on plates and stay bodies.
(5) Back corners	Flaky scale deposit.	Roof stays slightly scaly at base.
(6) Front corners	Loose scaly deposit on stays.	
(7) Boiler barrel	Sludge and loose scale at bottom.	
(8) Nature of deposits	Flaky and loose.	
<i>Observations after W. O.</i>			
(9) Tubes	Very slight scale deposit on surfaces.	Loose scale & sludge easily washed away.
(10) Stays-side	Clean.	General condition of water surfaces—good.
(11) Stays-roof	Slightly scaly at base.	Gen. condition clean.
(12) Boiler barrel	Clean.	
(13) Fire-box plates	Clean.	
(14) Injector cones		
(15) Clack valves		
(16) Corrosion		
			Date of wash-out 16-7-54 Signed B. M. Ch. man. Date 16-7-54
			Date of wash-out 7-6-54 Signed/B. M. Ch. man Date 7-6-54

ANNEXURE No. 1 **Period of Treatment**

Engine No. 309 SG	Details on 19th June, 1954	Details on 29th July, 1954	Depot BGA General Remarks	
			on 19th June, 1954	on 29th July, 1954
POH 8th September, 1952 re-tubed (1) Mileage since re-tubing. (2) " " previous W. O. (3) Next W. O. due.	...	19th June, 1954	29th July, 1954	
<i>Observations before W. O.</i>				
(4) Under firedoor	Hard scale on casing plates.	Clean, slight loose scale on stays.	Steel casing plates heavily scaly at Lt. & Rt. side and back casing.	Pre-existing hard scale on casing plates. and on roof stays gradually dropping off.
(5) Back corners	Hard scale on casing plates.	Clean.		
(6) Front corners	Clean.	Clean, loose scale on stay bodies	Copper surfaces clean.	
(7) Boiler barrel	Loose scale and sludge deposit.	Sludge & loose scale deposits at bottom.		
(8) Nature of deposits	Hard thick scaly on casing plates.	Loose & easily washed away.		
<i>Observations after W. O.</i>				
(9) Tubes	Slightly scale on tubes.	Slight scale deposit on surfaces.	Barrel scaly at top feed inlet around Inspection Jt. holes.	Scale dropping off from plates & stays of both Lt. & Rt. waterways. Boiler very much cleaner.
(10) Stays-side	Clean.	Clean.		
(11) Stays-roof	Heavily scaly at bottom.	Slightly scaled at base.	Engine put u/r for descaling.	
(12) Boiler barrel	Clean.	Clean.		
(13) Fire-box plates	Clean at copper surfaces.	Clean.		
(14) Injector cones				
(15) Clack valves				
(16) Corrosion				
			Date of wash-out 12-6-54 Signed B. M. Ch. man. Date 12-6-54	Date of wash-out 22-7-54 Signed B. M. Ch. man. Date 27-7-54

PROGRESS REPORT FROM THE SOUTHERN RAILWAY.

Gadag Shed.

Out of 28 engines allotted to Gadag shed, the following 15 were fitted with dosing gear :

GS: 92, 274, 238, 279, 281, 283, 284 & 286.

FM: 107, 112, 116, 184, 195, 200, & 327.

Of these 15 engines, 9 were fitted with copper fire-boxes. The remaining 13 engines not fitted with dosing gear were ordered to be treated with Boiler Compound by manual addition in accordance with the C. M. E's Repair Method Instruction No. 130, a copy of which is enclosed.

After prolonged initial trials, 13 engines fitted with dosing gear started regularly operating then from 8-3-54 and the remaining two engines from 15-5-54.

Madura Shed.

There are 83 engines of which the following 10 engines were fitted with dosing gears :

M. 7, 36, 38, 52, 53, 25, 28, 78, 95 & 122.

The remaining engines were ordered to be treated with boiler compound by hand addition into the tender in accordance with the Repair Method Instruction No. 130 referred to above.

2. *Treatment method*—As the siphoning action in the dosing gear could not be arrested, the control cock fitted in the solution pipe had to be manipulated by the engine crew every time the injector was operated. Although the engine crew were apprised of the great advantages accruing from this arrangement and that they should therefore operate the solution control cock simultaneously with the injector, it is possible that this method might not have been adopted all the time. If the driver does not close the solution control cock simultaneously with the feed cock, there is a risk of the solution siphoning out and going to waste. Also as the engines are pooled and consequently, as there are several changes of engine crew *enroute* from the home shed to the destination, it becomes impossible to allocate responsibility for any negligence on any particular set of crew. These defects were known to be inherent in operating the dosing gear as originally designed, but it was felt that even partial treatment would result in considerable improvement in the boiler condition. Therefore, every effort was made to work the system as far as possible.

It should, however, be mentioned that the engine crew and shed staff were also enthusiastic to adopt these measures in order to avoid the frequent troubles such as engines failure due to tube leakages, bulging of fire-box plates, bursting of flue-tubes etc.

It cannot be stated with any certainty that the remaining engines not fitted with dosing gear were treated with Boiler Compound at every water-column as stated in the R. M. I. 130 referred to above. Arrangements were, however, made in Madura District, at Tinnevely, Tuticorin, Palani, Pollachi, to add the Boiler Compound. At other stations, similar arrangements are yet to be made.

In the Gadag-Sholapur section it is stated that Boiler Complex is added at each watering station.

3. *Chemical Complex*—The composition of the chemical complex is :

Tannin (Chestnut Extract Powder)	...	60%
Soda Ash	...	40%
Dosage.	one lb per 1000 gallons.	

Actual check at the sheds of the quantity of solution used up from dosing tanks showed that the consumption is not constant for every round trip. It is possible that some of the solution might have been allowed to siphon out and run to waste, or the solution control cock might not have been opened sometimes simultaneously with the feed cock. In the circumstance, the exact quantity injected into the boiler cannot therefore, be assessed with any degree of accuracy.

4. *The effect of internal treatment :*

- (i) In Gadag shed, the D. M. E. has reported to the R. M. E. on engines fitted with dosing gear that "on examination it was noticed that the scale formation is much less when compared with other engines at Gadag shed which are not fitted with dosing gear", vide his letter No. T217/B of 28/29-7-54.

- (ii) The LE/Gadag has reported as under :

"(iv) The relative condition of the boilers fitted with copper and steel fire-boxes in respect of scaling, corrosion and the tube leakage is as given below :

<i>Scaling</i>	<i>Corrosion</i>	<i>Tube Leakage.</i>
<i>Copper fire-box</i>		
There is an improvement in the formation of scale.	Nil	There is an improvement in the leakage of tubes but this tendency is more than in steel fire-boxes.
<i>Steel fire-box</i>		
There is an improvement in the formation of scale.	Corrosion on steel fire-boxes has been arrested to a great extent.	Improvement in the leakage of tubes.

vide LE/GDG's letter No. G. 50 of 28-7-54.

- (iii) It is the normal procedure for Gadag engines to be sent to shops for descaling every six months. When engine Nos. GS. 278 and GS. 279 were sent to shops recently, the FO/B/UBL has reported to WM/UBL as under :

"I have personally examined these boilers, There is no accumulation of scale on the crown sheet and at water-side; neither is there any accumulation of scale on the tube, door sheet or casing on water-sides.

As regards tubes, there is no accumulation of scale on tubes and flues at the tube plate-end, but there is scaling of 1/16 in. to 1/8 in. towards the smoke-box and, which is due to overhead feeding.

On my personal examination of the boilers of the above two locomotives, I find no signs of corrosion, pittings, grooving, etc. on the fire-box wrapper, tube-sheet and door-sheets on the water-side.

On examination of the tubes removed from these boilers no signs of corrosion and pittings were noticed, though the scaling noticed was considered normal.

I may here add that our previous trouble at GDG was leaky tubes and not of pitted, corroded or burst tubes, the cause of collapsing of tube-ends at fire-box tube-plates being due to excessive scaling on tubes and the tube-plate at water-side due to overhauling." vide FO/B/UBL No. B/5/1290 of 6-8-54 to WM/UBL.

(iv) On receipt of the above report from FO/B/UBL regarding the relatively good condition of the boilers after internal treatment the WM/UBL addressed the DME/UBL regarding the desirability of not sending the engines for descaling every six months as was done hitherto and that the boilers be thoroughly examined and sent to shops for descaling only if the boiler condition warrants such action.

(v) I have personally examined three engines at GDG shed during my last inspections and I found that the longitudinal and cross-stays in the boiler treated with dosing gear are clean and free from scale and that the surface of tubes from fire-box tube plates to about half their length is free from scaling but at the smoke-box end the tubes were covered with 1/16 in. scale. There is, however, no sign of corrosion anywhere in the boiler. The scaling on the tube plates is in places only about 1/16 in.

The boiler scale which was about 1/2 in. thick before treatment commenced could be removed in the shops only after reeling and pickling; now the scales which have softened after the chemical treatment are removed easily by tapping. No acid treatment is now necessary to remove even the old scale.

(vi) The LF/GDG reports that engine failures due to tube leakages during the last summer, this year have been reduced to only one. This locomotive was not however fitted with dosing gear.

(vii) *Extract from the report of the BMC to DME/MDU;*

"From a close watch during boiler examination and cold water wash-outs, the following aspects are noticed in the boiler:

- (i) Scale condition in the water ways has come down.
- (ii) It appears that the further development of corrosion and pitting on the steel, tubeplates and crown plates and on the water-side is being arrested.
- (iii) There has been a decrease in the leakages inside the fire-box.

- (d) The engines are now being made to run with an increased mileage between wash-outs and its further increase will be watched and report submitted."

(viii) *Injector troubles*—The injector troubles which were frequent both at GDG and MDU sheds are reduced to almost NIL after this treatment.

(ix) *Saving in tube consumption*—According to the procedure laid down previous to the introduction of the internal treatment, periodical removal and examination of flue-tubes from boilers at monthly boiler examination is necessary and re-tubing of the entire boiler is ordered at six-monthly intervals. The Boiler Inspecting staff have not yet deviated from this procedure, even though the condition of the boilers has now admittedly improved.

Arrangements are being made for CME to issue instructions to the Boiler Inspection staff to desist from removing tubes from boilers during monthly inspection and sending boilers for retubing according to schedule, if their condition is known to be satisfactory.

5. *Modified dosing arrangement*

One engine No. FM. 327 was fitted with modified dosing gear arrangement in accordance with the C. S. O. sketch No. L. 249 and turned out of Hubli shops on 21-7-54. Owing to lack of supervisory staff in the Gadag shed, it is reported that practical trials in service have not yet been conducted. Two other engines GS. 278 and 279 are being fitted, with this modified arrangement in UBL shop, vide WM/UBL's No. W. 504/6 WT/12374/F of 2-8-54.

The WM/GOC vide his No. CW. 3826/144 of 2-8-54, reports that the modification to engines Nos. YG. 2528 and 2640 which are in shops is being dealt with in accordance with the C. S. O.'s latest sketch.

6. *Remarks*

With the remarkable reduction in engine failures due to tube-leaks and injector troubles, resulting from the admittedly partial and imperfect internal treatment now being followed, the engine crew and shed staff have begun to place full confidence in the method and are looking forward to making it more effective and foolproof. And this can be done only when all the engines are fitted with the modified arrangement according to the C. S. O. sketch No. 1 L. 249, thus rendering the dosing operation fully automatic.

(Sd.) G. R. IYENGAR,
Chemist and Metallurgist, Southern Railway.
(Convenor)
9th August, 1954

ANNEXURE No. 3**PROGRESS REPORT FROM THE CENTRAL RAILWAY.**

Two engines Nos. 877 and 943/H4 were selected for trial on the Dhond-Manmad section. The treatment complex consisted of 60% tannin and 40% soda ash. The proportion was fixed at one lb of compound per thousand gallons of water evaporated. The water consumption between DD-NGN and back being in the region of 27,000 gallons, the dose per trip was fixed at 27 lbs per round trip. Dhond and Puntamba were selected as stations where the compound could be administered satisfactorily and the dose was 9 lbs whenever the engine passed these stations. At Dhond when the engine was given a wash-out, 3 lbs of the complex were put directly into the boiler and the ballance 6 lbs into the tender. The trials were commenced on 10-4-54. As engine No. 885/H4 was adversely reported on for its steaming qualities, it was replaced by engine No. 943/H4 on 18-4-54.

2. When engine No. 943/H4 was brought to Dhond on 24-4-54 for a cold water wash-out, flue tubes and stays were reported to be leaking. On 2-5-54, the engine was stopped at Manmad for flues, tubes and crown stays leaking. From 7-5-54, the dose was halved and the addition of the complex directly into the boiler after a wash-out was discontinued. On 9-5-54, the engine failed at Puntamba due to flue tubes leaking into the fire-box. On 11-5-54, engine failed again at VBR on account of flues and crown stays leaking into the fire-box. On 13-5-54 when the engine was given a cold water wash-out, in addition to flue tubes and copper stays leaking into the fire-box, the Distt. Boiler Inspector reported cushioning of both side plates below the midsection and a crack in the wrapper crown plate along the margin of fire-box tube plate. The engine was withdrawn from trial.

3. As regards engine No. 877/H4, on 23-4-54, when it was taken for a cold water wash-out, several copper stays were found leaking on both sides. On 29-4-54, the engine was detained at Manmad for leaky copper stays. On 4-5-54, the following troubles were noticed:

- (i) Flue tubes and crown stays leaking.
- (ii) Cushioning of the sides.
- (iii) Burning of six crown stay heads.
- (iv) Scorching at certain places in the cushioned area.

4. On 13-5-54, the cushioning was reported to have increased. On 18-5-54, crown stays were reported leaking. On 26-5-54, cushioning was reported to have increased still further. Scorching in the sides was also observed and 3 copper stays in left side wall patch were found broken. On 31-5-54, the engine was stopped at NNG for leaky stays. On 3-6-54, cushioning in wrapper plates became very pronounced and the crown plate also in places showed cushioning. The engine was withdrawn from water-treatment trials.

5. Engine No. 409/H4 freshly turned out from shops after a POH was next nominated for trials. The dose given was what was initially fixed; viz., 1 lb per 1000 gallons. The trials were commenced on 22-5-54, but from 26-5-54 the dose was halved again. On 1-6-54, crown stays were reported leaking. On 6-6-54, the engine failed on

section due to tubes and flues leaking. On 15-6-54, when the engine was taken for a cold water wash-out, wrapper sides and crown plates were reported as showing slight cushioning. On 26-6-54, crown stays and flues were reported leaking into the fire-box. The engine was withdrawn from trial.

6. On the credit side, the treatment resulted in a healthier boiler concentrate, i. e. , less hardness and more alkalinity and reduced priming so that whereas without treatment, priming commenced after one round trip, with treatment two rounds trips could be taken without priming.

7. Thus internal treatment on Dhond-Manmad section during the last hot weather using 60/40 tannin soda ash mixture in the proportion of 1 lb per thousand gallons as well as $\frac{1}{2}$ lb per thousand gallons of water, was not much of a success. Although with treatment, the wash-out mileages could be increased and the boilers appeared cleaner, these benefits were offset by an increase in leaky tubes and flues, scorching and cushioning of plates. Leaky tubes and flues were expected in the case of engines which have been in service before the treatment was commenced, but things came to a head when the same troubles were observed in the case of an engine newly sent out of the shops after a POH. The Distt. Boiler inspector attributed all these troubles to tannin, while the Joint Director, Research(M&C), seemed to be under the impression that they were due to excessive soda ash. It is difficult to subscribe to either of these views. Tannin has no adverse effect on copper and the percentage of soda ash in the concentrate was far below the limiting value for copper corrosion. Even though there was any possibility of such corrosion in the beginning, it was prevented by the tannin percentage of the mixture.

8. A fresh trial was therefore started using 75/25 soda ash tannin mixture in lieu of the 40/60 mixture recommended by the Sub-committee. The object in altering the composition was two-fold firstly, I wanted to confer a higher alkalinity to the boiler concentrate, secondly, it was thought that tannin in such a small dose, while preventing the deposition of fresh scales, would not act too quickly on existing scales and cause leaky tubes. I was further actuated to try the above mixture after my experience with 40/60 soda ash-tannin mixture on the ex. B. L. Railway where they have been using 80/20 mixture previously. Even with 80/20 mixture, the boiler concentrates from those NG engines were deficient in alkalinity and with the reduction of soda ash content in the mixture to 40%, there has been a definite hardening of the scales deposited on the tube.

9. Engine No. 878 fitted with copper fire-box and newly turned out from shops was put on trial with the modified water-treatment complex (75% soda ash : 25% tannin) for one month (from 26-6-54 to 29-7-54). Treatment was at first given at two points viz., Dhond and ANG and later at every water station and the quantity of complex used was about 1 lb per 1000 gallons of water evaporated. During this period the engine did 13 round trips between Dhond and Nandgaon and there was no booking at any time for troubles generally ascribed to "bad water".

10. When the engine was given a cold wash-out on 29-7-54, nothing abnormal was observed. At the root of a few of the crown stays small patches of bright copper on water side were noticed but their presence does not seem to be in any way connected with the treatment.

11. As far as the benefits of the treatment are concerned, it is too early to be noticed. It would appear that even if the water receives no treatment, during this season, the condition of the boiler of an engine at the first cold water wash-out after a POH, will be as good as what has been observed in this case. Thus, for the present, it can only be stated that the 75/25 soda ash tannin treatment has none of the adverse effects reported previously, when a complex consisting of 60% tannin and 40% soda ash was used.

12. In consultation with the District Mechanical Engineer, Sholapur, the following trials have now been arranged from 1-8-54 :

- (a) Treatment for engine No. 878 with 75/25 soda ash tannin mixture to continue, but the engine will try to take three round trips before a hot water wash-out instead of two as at present.
- (b) To treat engine No. 987 fitted with copper fire-box with tannin only.
- (c) To nominate engine No. 406 fitted with steel fire-box for trials between Dhond and Manmad. The mixture for this engine will be 75% soda ash plus 25% tannin, but the dose will be 2 lbs per 1000 gallons of water evaporated. The addition will be tried at first at Dhond and Ahmadnagar and thereafter at every watering station.

13. Trials on one WG and one AWE engines using 1/8 lb of tannin and 1/2 oz of Calgon per 1000 gallons of water on Bhusaval Division (Bhusaval-Nagpur section) have been very successful. As a result of this treatment, the wash-out mileage has been increased from 1000 to 1500 miles. The reason for the success of this treatment with such a low dose of tannin is considered to be due to the highly alkaline nature of the water available on Bhusaval-Nagpur section as reflected in the analysis of the boiler concentrates taken from engine working on that section at the time of wash-out. The average alklinity figure of the boiler concentrates was found to be 50 parts per 1,00,000.

Sd/- K. P. S. Nair,
Chemist & Metallurgist,
Central Railway, Parel.

12-8-54.

ANNEXURE No. 4

A note on mechanical causes for leaky flues and tubes

Leaky flues & tubes may be due to :

- (i) Excessive and careless expanding in sheds.
- (ii) Moving an engine in shed after dropping fire keeping dampers open.
- (iii) The bad practice of putting on both injectors while keeping fire doors, dampers and smoke-box door open even at times when the safety valves are blowing.
- (iv) Washing out a hot boiler without allowing sufficient time for cooling, especially when power is badly required,
- (v) Excessive clearance between flues and flue-holes before expanding and improper annealing of flue ends after repairs.
- (vi) Improper truing up flue holes especially top corner ones.
- (vii) Defective design of expansion stays at tube-plate end of fire-box crown,
- (viii) The trouble of leaky flues is stated to be more in those boilers where the flue ends are plain than in those fitted with serrated flue ends as is the practice in the British Railways. Although new copper fire-box boilers come fitted with serrated flue ends, the majority of railways do not follow this practice during POH. At Jamalpur the flue ends are not only serrated, but thin copper liners are also fitted in the flue holes to prevent damage to copper tube plates. By serration, the flue end bites into the tube-plate during the process of expanding forming a very efficient joint.

2. It will be seen, therefore, that unless precautions are taken with respect to the above, leaky flues and tubes may occur which cannot in any way be connected with the tannin soda ash treatment.

ANNEXURE No. 5.
Report on Boiler Condition.

Engine No.	Details on	Shed	
		General	Remarks
		On	On

POH Re-tubed.

- (1) Mileage since re-tubing.
- (2) " " previous W. O.
- (3) Next W. O. due.

Observations Before W. O.

- (4) Under firedoor.
- (5) Back corners.
- (6) Front corners.
- (7) Boiler barrel.
- (8) Nature of deposits.

Observations After W. O.

- (9) Tubes.
- (10) Stays-side.
- (11) Stays-roof.
- (12) Boiler barrel.
- (13) Fire-box plates.
- (14) Injector cones.
- (15) Clack valves.
- (16) Corrosion.

Date of wash-out
Signed. B. M. Ch. man,
Date.



**Minutes of the Seventh Meeting of the Water-treatment
Sub-committee of the Indian Railway Chemists
& Metallurgists Committee**

*Minutes of the seventh Sub-committee meeting on water-treatment
held at Mysore on the 21st & 22nd Feb., 1955.*

Present:

Sri G. R. Iyengar	....	Chemist & Metallurgist, Southern Railway, (<i>Convenor</i>).
Sri N. V. Pandit	....	Chemist & Metallurgist, Eastern Railway, (<i>Member</i>).
Sri K. P. S. Nair	....	Chemist & Metallurgist, Central Railway, (<i>Member</i>).
Sri R. G. Bhatawadekar	....	Jt. Director Research (<i>M & C</i>) RT & RC, Chittaranjan (<i>Ex-officio member</i>).

N. B.—Sri K. C. Choudhuri, Chemist & Metallurgist, Chittaranjan Locomotive Works and Shri B. D. Agarwal, Asstt. Chemist & Metallurgist, Western Railway, attended the meeting of the Sub-committee on 22-2-55 and 21/22-2-55 respectively, with the permission of the Convenor.

Sri S. Ramanujam, Member-Secretary, was unable to attend the meeting owing to other pressing official engagements.

I. Tannin-soda ash complex trials.

(i) Progress of treatment by manual dosing.

The following engines are under treatment with the chemical complex added manually:

Railway	Division/District	Sections	Gauge	Engines
Southern	(i) Madura	All	.... Meter	134
"	(ii) Hubli	Gadag-Sholapur	.... "	23
Eastern	(i) Sealdah	South Sealdah	.... Broad	35
"	"	Chitpur	.... "	40
Central	(i) Sholapur	Dhond-Manmad	.... "	6
"	(ii) Jhansi	Gwalior-Sheopur Kalan.	Narrow	24
"	"	Gwalior-Shivpuri		
"	"	Gwalior-Bhind		
"	(iii) Sholapur	Kurduwaji-Miraj	Narrow	24
"	"	" -Latur		
Total				286

(ii) Progress of treatment by automatic dosing gear.

Railway	Division/District	Sections	Gauge	Engines
Southern	Madura	All	.... Meter	3
"	Hubli	Gadag-Sholapur	.... "	5
Central	Sholapur	Dhond-Manmad	.... Broad	9
Total				17

The total number of engines under treatment on Indian Railways is, therefore, 303.

Certain difficulties have been experienced with regard to the automatic dosing gear of the latest design submitted by the Central Standards Office vide CSO sketches Nos. L235 & L249. The Sub-committee notes that Central Standards Office and Railway Testing & Research Sub-centre, Chittaranjan, are jointly investigating the difficulties with the object of overcoming them by evolving a modified design of the dosing gear, if necessary.

(iii) *Results of treatment.*

All the engines under both types of trial have shown remarkable improvement in respect of scaling, corrosion and priming. Wash-out mileages and engine availability have been considerably improved. In some sheds, a 5 % increase in mileage has been ordered and in others it has been doubled. Works, shed and boiler inspection staff have endorsed these improvements from the point of view of operation and maintenance. A study of the reports on wash-out mileages received from railways shows that boiler inspection is sometimes carried out shortly after the previous scheduled wash-out. This is considered as uneconomical. It is, therefore, strongly recommended that the two should be synchronised, so that benefits from water-treatment can be fully realised, particularly in regard to better power utilisation.

II. *Progress reports.*

Eastern Railway.

South Sealdah section—As compared with 15 locomotives under treatment during the period of the last report, a total of 35 locomotives are now receiving the treatment.

Besides, 40 more locomotives have been brought under the treatment in the Sealdah division.

Central Railway.

During the period covered by this report, 16 engines were brought under treatment on the Dhond-Manmad section out of which 9 are fitted with dosing gear. Their solution pipe is fitted to the left side feed cock only.

24 engines on the ex-Scindia State section and 24 engines on the ex-Barsi Light section are brought under the treatment by manual addition.

Wash-out mileages have been doubled in the case of engines working on the Dhond-Manmad section.

Southern Railway.

(a) *Gadag Shed*—All the 28 engines allotted to this shed are receiving treatment.

Though 5 engines are fitted with the dosing gear to the latest design of the Central Standards Office, the same has not been tried out

as the engines haul goods trains and take considerable time to earn substantial mileage.

Wash-out mileages now vary between 800 and 1,112 miles, whereas previous to the introduction of the chemical treatment, it was 346 miles.

From November 1954, many engines in the shed were operating without brick arches apparently due to lack of stocks of firebricks. This has resulted in very high incidence of tube and flue leakages and their consequent expansion. The number of tubes expanded in November 1954, was approximately 705 smoke tubes and 82 flue tubes against 230 and 30 respectively, in the month of September.

(b) *Madura*—All the 137 engines are taking treated water. Three engines have been fitted and are running with automatic dosing gear to the latest design of the Central Standards Office. As a consequence, an increase of 50% in wash-out mileage has been ordered.

It is reported that engines are sometimes washed out for boiler examination shortly after their scheduled periods owing to the wash-out being done on mileage basis, while boiler examination is carried out on period basis.

YP & YG engines allotted to this shed and receiving internal treatment are operating with 'Alfloc' continuous blow-down valves along with intermittent blowoff cocks. It is noted that action has been taken by the Chief Mechanical Engineer to dummy these 'Alfloc' blow-down valves and operate only with intermittent blowoff cocks.

III. *Extension of treatment.*

The sub-committee noted the contents of letter No. KRA/1 dated 30/31-8-54 issued by the Research Sub-centre, Chittaranjan, on the subject of extension of water-treatment on Indian Railways, and the proposals submitted by railways in response to it. They were studied in detail and the following sections are recommended for extension of treatment in the immediate future. The details of dosing will be recommended by the Chemists & Metallurgists of the Railways, in accordance with the instructions laid down in the previous sub-committee reports.

Eastern Railway.

- (i) All engines homed at Bamangachi shed of Howrah division.
- (ii) Engines homed at Santragachi, Shalimar and Khargpur sheds, running suburban, goods, shunting, pilot and launch services in the Khargpur district.

Central Railway.

All 45 engines on the Jhansi-Kanpur-Manikpur section.

In regard to Wardha-Balharshah section, the sub-committee considers it necessary to study the details regarding normal linkages of locomotives running on this section before it can recommend it for treatment.

Southern Railway.

(i) All the 8 engines on the Bangalore-Bangarapet narrow gauge section.

(ii) Two engines on the Chitaldroog-Chikjajur section.

Further details will be collected regarding the isolated water supplies reported to be bad by the railway before the sections including them can be recommended for extension of treatment.

Western Railway.

(i) Jetalsar-Rajkot section.

(ii) Jetalsar-Veraval section.

(iii) Jetalsar-Porbandar section.

(iv) Jetalsar-Dhola section.

(v) Rajkot-Okha section.

(vi) Ahmedabad-Betad section.

(vii) Ahmedabad-Khedbrahama section.

(viii) Nadiad-Kapadvanj section.

(ix) Nadiad-Bhadran section.

It is recommended that the Asstt. Chemist & Metallurgist, Western Railway, furnish to the Research Sub-centre, Chittaranjan, analytical data regarding some of the water supplies on these sections which are not available to the sub-committee. On receipt of the data, the Research Sub-centre, Chittaranjan, will recommend the dosage in order to bring them under treatment.

The linkages of engines on sections radiating from Mehsana will be studied along with analytical data to be furnished by the Asstt. Chemist & Metallurgist, Western Railway to the Research Sub-centre, Chittaranjan who will recommend a suitable treatment.

Northern Railway.

All 15 engines on the Delhi-Jind section.

It is recommended that water supply from well No. 2 out of the 4 wells at Shakurbasti should not be used for loco purposes, if possible.

The Research Sub-centre, Chittaranjan, will recommend necessary treatment for the other sections proposed, on obtaining more details from the railway regarding engine linkages and analytical data.

IV. Water-treatment trials initiated by the railways other than that of chemical complex.

(i) It is learnt that some railways are experimenting with proprietary brands of boiler compounds and other equipment with a view to treat loco feed waters. The sub-committee views with disfavour any trials initiated in this manner and strongly recommends that railways should advise the Research Sub-centre, Chittaranjan, of any proposal of contemplated water treatment. The Research Sub-centre, Chittaranjan,

will consider the proposals on merit, if necessary in consultation with the sub-committee, and communicate the decision to the railway as to whether the proposed trials should be undertaken. In this connection, the sub-committee refers the railways to item No. 4 of the minutes of the 2nd meeting of the Water-treatment Sub-committee.

(ii) The sub-committee notes from the reports received from the railways that some engines under treatment are fitted with 'Alfloc' blow-down valves. For internal treatment, it is not necessary to operate these valves along with the intermittent blowoff cocks. It is strongly recommended that the 'Alfloc' blow-down valves, where fitted, should be dummied and only the intermittent blowoff cocks operated, vide item 2 of the report of the 2nd Water-treatment Sub-committee meeting dated 20/21-11-52. For internal treatment, the intermittent blow-off cocks are more effective in removing scale and sludge deposited in boiler as well as in deconcentrating boiler water to the desired extent.

V. Formation of scale in smoke and flue tubes.

It is recommended that deflectors in the top feed delivery inlets be fitted so as to deflect the water around the bank of tubes in boilers. Railways experiencing heavy scaling of tubes at the smokebox end should adopt this procedure.

VI. Use of indigenous tanins.

The sub-committee has considered the desirability of using indigenous tannins in place of the imported material used at present. Complete details regarding the quality of the indigenous products and their availability are not known. It is noted that the Research Sub-centre, Chittaranjan, is in correspondence with the Director, Forest Research Institute, on the subject, particularly to find out whether supplies of indigenous tannin have the same characteristics as those of imported variety. Till a final report from the Research Sub-centre, Chittaranjan, on this aspect, is available to the sub-committee, the present supplies be continued.

VII. Trials with other treatment processes.

The reports from the Research Sub-centre, Chittaranjan, on the progress made in respect of trials using 'Carbion' Zeo-carb and the Aquastat equipment, are awaited.

VIII. Collection of data on feed water supplies on Indian Railways.

Some railways have not yet furnished the information called for in the questionnaire issued by the Research Sub-centre, Chittaranjan, in this connection vide letter No. KRA/1 of 11/13th December, 1954. All such railways are requested to expedite submission of the data at a very early date, in view of the importance of the information, to the sub-committee.

IX. Blow-down counters.

No progress has been made in regard to fitting blow-down counters in the cabs of engines under trial. It is recommended that the Central Standards Office (Design Section) evolve a suitable design and circulate it to the railways for adoption. This should be given a high priority.

X. Brick arches.

It is considered essential to have brick arches in fire-boxes of all the engines under treatment. Absence of brick arches leads inevitably to leakage of smoke and flue tube-ends owing to excessive over-heating, which is very often incorrectly attributed to the action of bad feed water or inefficient treatment of feed water supplies. In order to obtain the maximum benefits from water treatment, viz., engine availability, reduction in repair cost and economy in fuel and tube consumption, it is emphasised that brick arches should be provided forthwith wherever water treatment has been initiated.

XI. Other recommendations.

- (i) It is noted that in some dosing gear fittings the solution pipe is fitted only to the left side feed cock. In order to enable engine crew to operate both injectors freely, it is recommended that the solution pipe be fitted to the right side feed cock as well.
- (ii) It is reported that regular blow-downs are not being given at present at some stations on certain railways, as quarters, latrines and other structures are situated nearby. It is, therefore, recommended that suitable sleeper-stage walls are erected at convenient places against which drivers may blow-down.
- (iii) As it is learnt that localities near some stations complain about noise nuisance due to engine blow-downs, it is recommended that silencers be fitted to the blow-down cocks, for which the Central Standards Office (Designs Section) should evolve a suitable design and circulate it to the Chief Mechanical Engineers of all railways.
- (iv) The Chemists and Metallurgists, Eastern Railway, Khargpur, and Central Railway, Parel, will continue to analyse boiler concentrates and obtain comparable results of their alkalinities by a standard method, the details of which will be worked out by themselves after mutual consultation. A report of their findings should be submitted for consideration at the next sub-committee meeting.
- (v) In order to assess the results of water-treatment, it is recommended that a monthly report be submitted on boiler condition by each shed on the *pro forma* enclosed as Annexure I. Also, the actual wash-out mileages for a maximum of 20 engines representative of all types of engines undergoing treatment in the shed should be reported monthly on the *pro forma* enclosed as Annexure II.

The above two *pro forma* supercede the present ones introduced by the last meeting of the sub-committee. The Chief Mechanical Engineers are requested to instruct the sheds to forward these reports, in duplicate.

to the Chemists and Metallurgists of the respective railways, without fail, in the first week of every month for onward transmission to the Research Sub-centre, Chittaranjan.

Encls: Two.

BSS.

G. R. Iyengar
Chemist and Metallurgist,
Southern Railway,
(*Convenor*).

N. V. Pandit
Chemist and Metallurgist,
Eastern Railway, Khargpur,
(*Member*).

K. P. S. Nair
Chemist and Metallurgist,
Central Railway,
(*Member*).

R. G. Bhatwadekar
Joint Director Research (M & C),
Rly. Testing and Research Sub-
centre Chittaranjan.
(*ex-officio Member*)



ANNEXURE I

Report on Boiler Condition for the month of.....

Railway	Section	Shed	No. of engines treated	Date of commencement of treatment	Mode of treatment		
					(i) Manual (ii) Automatic	(iii) Type of complex. (iv) Rate of dose.	

General remarks after wash-out on condition of:

1. Tubes: Clean
Flues: Slightly scaled (1/16 in. and below)

Heavily scaled (1/8 in. and over)

Pitting

Corrosion

Bursting

Number expanded during month

2. Stays: Clean

Slightly Scaled (1/16 in. and below)

Heavily scaled (1/8 in. and over)

3. Fire-box plates: Scale, pitting or corrosion

4. Fire-box casing Do.

Plates:

5. Waterways and Injectors

6. Whether priming and foaming is experienced

7. Other remarks, if any



Loco Foreman
Date:

ANNEXURE II.
Report on wash-out mileage.

Month.....

Railway.....

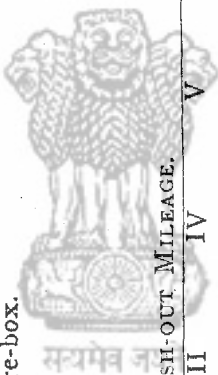
Section.....

Shed.....

- No. of engines.
- No. with steel fire-box.
- No. with copper fire-box.
- No. with composite fire-box.

Type and No. of
Engine.

WASH-OUT MILEAGE.
I II III IV V VI



Chlorides as Sodium Chloride (To be entered
by the C & M on receipt of boiler
concentrate).

Loco Foreman.
Date.....

**Minutes of the Eighth Meeting of the Water-treatment
Sub-committee of the Indian Railway Chemists
& Metallurgists Committee**

*Minutes of the 8th Sub-committee Meeting on Water-treatment
held at Poona on the 18th & 19th August, 1955.*

Present :

1. Shri G. R. Iyengar, C & M, Southern Railway (*Convenor*).
2. Shri N. V. Pandit C & M, South-Eastern Rly. (*Member*).
3. Shri K. P. S. Nair C & M, Central Railway (*Member*).
4. Shri S. Ramanujam, Dy. Director Research (M & C)
(*Member Secretary*)
5. Shri R. G. Bhatawadekar, Joint Director Research (M & C)
(*ex-officio Member*).

Shri S. L. Kumar, Director Research, addressed the members on the 19th August, 1955.

Members of the Sub-committee visited Dhond shed on the 20th August, 1955.

I. Tannin soda ash complex trials.

(i) Progress of treatment by manual dosing.

The following engines are under treatment with the chemical complex added manually:

Railway	Divn./Distt.	Section	No. of engines
Central	Sholapur Jhansi	Dhond-Manmad	3
		Jhansi-Manikpur-Kanpur	46
		Gwalior-Sheopur	24
		„ -Shivpuri	
Eastern	Sealdah	„ -Bhind	22
		South Sealdah	
	Howrah	Chitpur	45
		Howrah-Burdwan	60
		Howrah-Bandel	
		Howrah-Tarakeswar	
South-Eastern	Khargpur	Howrah-Sealdah	74
		Howrah-Khargpur	
		Chitpur-Khargpur	
		Shalimar-Khargpur	
Southern	Madura Hubli Bangalore	East Dock-Khargpur	136
		All	
		Gadag-Sholapur	
		Bangalore-Bangarapet	
		Chikjajur-Chitaldroog	
Western	Abu Road	Ahmedabad-Botad	24
		Ahmedabad-Khedbrahma	
		Abu Road-Mehsana	20
	Pratapnagar Bhavnagar	Nadiad-Kapadvanj-Bhadran	9
		Jetalsar	36
		Jamnagar	20

(ii) Progress of treatment by automatic dosing gear.

Central	Sholapur	Dhond-Manmad	17
Southern	Madura	Madura	5
	Hubli	Gadag-Sholapur	17

The total number of engines under treatment on Indian Railways is as under :

Central	....	90
Eastern	...	127
Southern	...	189
South-Eastern	...	74
Western	...	109
		—
Total	...	588

II. Results of trials.

All the members of the Water-treatment Sub-committee expressed the opinion that internal treatment has given very satisfactory results in all the sections under treatment so far.

III. Progress with regard to automatic dosing gear.

The dosing gear based on the sketches Nos. L235 and L249 given by the Central Standards Office has not proved entirely automatic. In order to make it automatic, it is recommended that the hydrostatic method of dosing be studied and a suitable design based on it be evolved by the Central Standards Office. The Railway Testing & Research Sub-centre, Chittaranjan, will pursue this subject.

It is further recommended that no more engines be fitted with automatic dosing gear till it is finalised.

Wherever the dosing gears have not been installed or found defective in operation, it is recommended that manual dosing be resorted to.

IV. Extension of trials.

It is recommended that internal treatment be extended to the following sections :

Central Railway.

- (a) Wardha - Balharshah.
- (b) Balharshah - Kazipet.
- (c) Kurduwadi - Miraj - Latur.

It is noted that one engine on the Kurduwadi - Miraj - Latur section has been under trial with 60/40 tannin soda ash complex. As no decision can be taken on the results obtained on one engine, the sub-committee recommends that a larger number of engines be brought under this treatment and the results watched carefully.

Western Railway.

Gondal region—All the sections on this region are recommended for treatment.

All railways are urged to investigate whether there are any additional sections which require treatment and intimate the same to the Railway Testing & Research Sub-centre, Chittaranjan.

V. Wash-out mileage.

It is noticed that wash-out mileages of a number of engines under treatment have been increased, but a few engines will remain to be brought under increased wash-out mileage. It is recommended that an effort should be made by the Operating Departments to take advantage of better boiler conditions as a result of treatment, to increase the wash-out mileage to the maximum extent possible.

In order to assess the improvement in performance of the engines under treatment, it is recommended that Annexure II issued with the minutes of the 7th sub-committee meeting should include the following information.

- (i) Scheduled wash-out mileage.
- (ii) Reasons for deviating from the schedule.

VI. Substitution of highly corrosive waters.

Wherever highly corrosive feed water supplies exist, which are not amenable to effective internal treatment, the Committee recommends that steps be taken to substitute them by alternative better supplies. The following stations demand urgent attention :

Central Railway.

- (i) Pandharpur.
- (ii) Belampalli.
- (iii) Balharshah colliery water.

Eastern Railway.

- (i) Beliaghata.

Southern Railway.

- (i) Rijapur.
- (ii) Hotgi.
- (iii) Virudhnagar.

South-Eastern Railway.

- (i) Shalimar.

VII. Review of the business arising out the last meeting.

With regard to collection of data on bad feed water supplies on Indian Railways, the sub-committee notes that no replies have been received from the Northern, North-Eastern and Southern Railways on the questionnaire issued by the Research Sub-centre, Chittaranjan, vide their letter No. KRA/1 dated 12/13-12-54.

VIII. Use of indigenous tannins.

It is noted that Railway Testing & Research Sub-centre, Chittaranjan, is pursuing this subject.

IX. Blow-down counters.

It is recommended that the Railway Testing & Research Sub-centre, Chittaranjan, pursue this further in consultation with the Loco Design Section of the Central Standards Office.



X. Determination of alkalinity in boiler waters.

The Railway Testing & Research Sub-centre, Chittaranjan, will obtain a standard method of analysis of boiler concentrates containing organic matter like tannins, and circulate it to all railways.

XI. Progress Reports.

The Sub-committee recommends that the Chief Mechanical Engineers prepare a report of their appraisal of the results on sections undergoing internal water-treatment.

These reports may be sent to the Railway Testing & Research Sub-centre, Chittaranjan, by the 15th of January and 15th of July every year.

(Sd.) G. R. Iyengar
Chemist and Metallurgist,
Southern Railway,
(Convenor)

(Sd.) N. V. Pandit,
C. & M., S. E. Rly.
Khargpur (Member)

(Sd.) K. P. S. Nair,
C. & M., C. Rly.
(Member)

(Sd.) S. Ramanujam
Dy. Director (M&C), Railway
Testing & Research Sub-centre,
Chittaranjan (Member-Secy.)

(Sd.) R. G. Bhatawadekar,
Joint Director Research (M&C)
Railway Testing & Research Sub-centre,
Chittaranjan (*ex-officio* Member).

**REPORT OF THE SECOND MEETING
OF THE
WATER TREATMENT COMMITTEE**

(With Railway Board's Orders)



August, 1957

For official use only

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II. Agenda for the Second Meeting of the Water Treatment Committee of the Indian Railways
III. List of Appendices
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<i>Item No.</i>	<i>Description</i>			
I.	Progress of Water-Treatment
II.	Scaling in Boilers
III.	Automatic Dosing Gear
IV.	Trials with Indigenous Tannins	..	..	..
V.	Aquastat Process	..	..	..
VI.	Progress Reports	..	..	..
VII.	Review of Business arising out of the Minutes of the last Meeting			..
VIII.	Any other Business	..	..	..

II. Agenda for the Second Meeting of the Water Treatment Committee of the Indian Railways

<i>Item No.</i>	<i>Subject</i>		
I.	To review the progress of water-treatment on the Central, Eastern, South-Eastern, Southern and Western Railways for the period March to July 1956	..	
II.	To consider the problem of (a) scaling on tubes of locomotive boilers in certain sections under treatment; and (b) trials with Dewrance and Gestra automatic desalting and desludging devices to minimise the same	..	..
III.	To consider the progress made in respect of automatic dosing gear	..	
IV.	To consider the progress of trials with indigenous tannins	..	
V.	To review the progress of trials with Aquastat process of water-treatment		
VI.	To consider the half-yearly reports on progress of internal treatment received from the Chief Mechanical Engineers of Railways	..	..
VII.	To review action arising out of the minutes of the last meeting	..	
VIII.	To discuss any other relevant subject

III. List of Appendices

<i>Appendix No.</i>	<i>Referred to in Item No.</i>	<i>Heading</i>	<i>Page</i>
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INTRODUCTION

The Water Treatment Committee of the Indian Railways held its second meeting on the 28th August 1956 at Madras and herewith submits its minutes.

The Committee consisted of the following :

- | | |
|---|----------------------------|
| (1) Shri R.G. Bhatawadekar,
Joint Director Research (M&C),
Railway Testing & Research Subcentre,
Chittaranjan. | <i>Chairman</i> |
| (2) Shri M.S. Murthi,
Divisional Supdt., Bezwada. | <i>Co-opted
Member</i> |
| (3) Shri G.R. Iyengar,
Chemist & Metallurgist, Southern Railway
(on leave) represented by
Shri V.R. Subramanian,
Chemist & Metallurgist, Southern Railway,
Perambur. | <i>Member</i> |
| (4) Shri N.V. Pandit,
Chemist & Metallurgist,
South-Eastern Railway,
Khargpur. | <i>Member</i> |
| (5) Shri K.P.S. Nair
Chemist & Metallurgist,
Central Railway,
Parel. | <i>Member</i> |
| (6) Shri S. Ramanujam,
Dy. Director Research (M&C),
Railway Testing & Research Subcentre,
Chittaranjan. | <i>Secretary</i> |

Shri L. R. Fialho, Assistant Chemist & Metallurgist (WS), Western Railway, Bombay, attended the meeting by invitation.

Some of the members of the Committee visited the Loco Shed at Madura on 27.8.56.

(Sd.) R. G. Bhatawadekar
Chairman

(Sd.) M. S. Murti
Co-opted Member

(Sd.) N. V. Pandit
Member

(Sd.) V. R. Subramanian
Member

(Sd.) K. P. S. Nair
Member

(Sd.) S. Ramanujam
Secretary

MINUTES OF THE SECOND MEETING OF THE WATER TREATMENT COMMITTEE OF THE INDIAN RAILWAYS

(August 1956)

ITEM I : PROGRESS OF WATER-TREATMENT

AGENDA : To review the progress of water-treatment on the Central, Eastern, South-Eastern, Southern and Western Railways for the period March to July 1956.

NOTES BY THE SECRETARY

1. (a) The up to date position of the number of engines receiving treatment in the Central, Eastern, South-Eastern, Southern and Western Railways is given in Appendix A.

(b) The main observations from the reports collected from the various railways are as follows :

(1) Central Railway

Dhond-Manmad : Treatment is continuing satisfactorily in this section.

While the treatment has been effective in preventing scale formation on the firebox area, it has been observed during M. O. H. (after 20,000 miles) that the boiler barrels of even those engines turned out from P.O.H. are congested with loose scales. This has necessitated removal of tubes for descaling of the boilers.

Kurduwadi-Miraj-Latur : A total of only nine engines out of a fleet of 24 belonging to Kurduwadi and Pandharpur sheds has so far been brought under internal treatment with 60 : 40 tannin-soda ash complex. The rest are receiving treatment with Alfloc. It is recommended that the use of the proprietary compound be discontinued and the engines brought under tannin treatment as early as possible.

Gwalior Shed : Analytical reports received from the Chemist & Metallurgist, Central Railway, on boiler concentrates from engines under treatment in this shed are given in Appendix B. On the basis of analysis of boiler waters from engines working on the Gwalior-Shivpuri section, the Chemist & Metallurgist, Central Railway, has recommended the use of 60 : 40 tannin-soda ash complex in this section in place of pure tannin used so far. The rest of the sections are being treated with pure tannin as before.

Priming was reported in a number of engines of this shed at mileages less than the normal washout mileage, during the months of January and February, resulting in a temporary reduction of the washout mileage from 600 to 500. Polyamide emulsion was successfully used to combat the troubles.

Wardha-Balharshah-Kazipet : All engines of this section are stated to be now under internal treatment with tannin-soda ash complex. The treatment is giving satisfactory results. The previous practice of washing out engines after ten days irrespective of mileage has been abandoned. At present, the washouts are done on a mileage basis. It is reported that no priming or injector trouble or tube leakage is experienced even on working beyond the normal washout mileage of 1000. In view of this, it is recommended that the washout mileages be increased to 1500 for all engines of this section.

(2) Eastern Railway

Howrah Loco Shed : Owing to inadequate supplies of chemicals for internal water treatment, the dosage for engines of this shed had to be restricted to 1/4 lb. per thousand gallons of water. During last March, 4 engines out of a fleet of 65 were, however, given an increased dosage of 1/2 lb. of the boiler complex. In June, the dosage had to be reduced temporarily to the original 1/4 lb. level to bring under control tube leakages experienced on these engines. This will be restored to the original dosage of 1/2 lb./1000 gallons on engines as and when they are free from such leakage troubles and when sufficient stocks of chemicals are available.

Narkeldanga Shed : Treatment is done in this shed manually with a dose of 1 lb. of tannin-soda ash complex for every 1000 gallons of water taken in the tender.

In the case of WM class engines, cracking of tubes longitudinally along tube mouth was reported in May. Heavy scaling in the tube nest and frequent tube leakages have also been experienced in these engines.

In all the other sheds on this railway, treatment is progressing satisfactorily.

(3) South-Eastern Railway

Bhojudih Colliery areas : Twelve engines out of a total of 25 in this section are receiving treatment. Corrosion in boilers which was the main trouble has been effectively brought under check.

It is recommended that the treatment be extended to the rest of the engines also as early as possible.

Santragachi Shed : Internal treatment in this shed suffered a setback on account of too frequent leakages in WM class of engines. The dosages of $\frac{1}{2}$ lb. of tannin-soda ash complex was found inadequate to arrest scaling in the boiler. On the other hand, an increased dosage of 1 lb., though effective in preventing scale formation, was reported to aggravate leakage of tubes, stays and seams, which led to dislocation of normal services. It was, therefore, decided in April last to keep under observation two engines which were given an increased dose of one lb. of boiler compound while the remainder were given only $\frac{1}{2}$ of the dosage. (See Appendices C & D.) Subsequently, to prevent any dislocation in train services, the treatment was suspended from 25.4.56. It is reported that as a result, scaling in boilers, priming and injector troubles have started all over again.

An investigation of the problem made by the Chemist and Metallurgist, South-Eastern Railway (see Appendix E) showed that the leakages were due to cracking of tube welds arising from various factors. After a discussion of the problem with the Chemist and Metallurgist, South-Eastern Railway, it was concluded that water-treatment is not the direct cause of tube leakage for the following reasons:—

- (1) Such leakages were existing ever since the WM class engines were put into service. Internal water treatment by effecting the removal of old scale will, however, expose existing leaks which were temporarily sealed by scale, thus aggravating the trouble. To get the best benefits from water-treatment, it is, therefore, essential to have leak-proof engines.
- (2) Since the engines at Santragachi have been working for the first three years without any treatment, scale-formation has been heavy which may have resulted in eventual tube leakages (see Appendix F).
- (3) Water-treatment cannot cause cracking of welds.

Since water-treatment in the present circumstances would aggravate tube leakages, action on the following lines has been recommended:—

- (i) As most of these engines have developed star cracks from the stay holes in the bottom half of the firebox side plates, these should be brought into sheds one by one and fitted with a new half-side patch.
- (ii) While these engines are being attended to in shops for fitting patches, the boiler should be thoroughly descaled so that the treatment can be started on cleaned boilers.
- (iii) The practice of welding flues and tubes should be further investigated and the welding expert from Chittaranjan Locomotive Works may be sent to Khargpur to see if there is any room for improvement in the welding technique. In this connection, it is suggested that flues and tubes should extend at least $\frac{3}{16}$ " as against the present $\frac{1}{8}$ " inside the firebox so that a stronger fillet weld can be made.
- (iv) In the initial stage, one or two engines thus attended to should be put to work in shops and kept under observation. During this period, a dose of half lb. of chemical complex per thousand gallons of water should be administered so as to ensure that no scale formation takes place. When these engines are sent to sheds they should be put on a dose of one lb. per thousand gallons.
- (v) In order to ensure that there is no fresh scale formation, one flue tube and one smoke tube should be removed from the boilers once every two months and observations made regarding the rate of scale formation.
- (vi) These engines should be specially watched by a responsible supervisor during the washout, etc. in the sheds.
- (vii) At the first sign of any leaks developing on these boilers, the matter should be reported immediately to the Central Standards Office, Chittaranjan, so that an officer from that office can go and examine the condition of the boilers.

- (viii) Railway Testing and Research Subcentre, Chittaranjan, to investigate if the quality of steel used is in any way responsible for the development of cracks.

It is understood that similar troubles, though on a smaller scale, are being experienced with WM class engines homed at Bandel and Sealdah sheds.

In this connection, it may be stated that there are a few WM class engines working in the Bezwada-Rajahmundry section. The Chemist and Metallurgist, Southern Railway, may please offer comments on their working for information of members.

(4) Southern Railway

Satisfactory results are reported from all the sections under treatment on this railway.

(5) Western Railway

Sabarmati Shed : Treatment is progressing satisfactorily.

Polyamide is being used successfully to arrest priming experienced in engines which are worked over 600 miles. Recently, trials with polyamide emulsion are reported to have been undertaken with a view to increase the mileage between washouts to 1000.

Nadiad: Dosing of the boiler compound is being done by means of automatic dosing gears in the case of four engines. The rest are treated manually in the tender.

Junagadh and Jamnagar Sheds: Treatment in Jamnagar and Junagadh sheds commenced in June and September, 1955, respectively. Since the commencement of treatment, a number of incidence of bursting of tubes and elements has been reported. It is understood that the corroded condition of the tubes and elements of the engines prior to treatment is the main cause of the troubles. The tubes are being gradually replaced.

Satisfactory results have been reported from the rest of the sections under treatment on this railway.

RECOMMENDATIONS BY THE COMMITTEE

(1) Progress of internal treatment with tannin-soda ash complex

It is noted that the number of locomotives under treatment is as follows:—

Railway	Division/Dist.	Section	No. of engines	
Central	Sholapur	Dhond-Manmad	20	
		Dhond-Baramati	2	
		Kurduwadi-Miraj-I.atur	9	
	Jhansi	Jhansi-Kanpur		
		Jhansi-Manikpur	49	
		Gwalior-Sheopurkalan		
		Gwalior-Shivpuri	25	
		Gwalior-Bhind		
	Nagpur	Wardha-Balharshah	19	
				124
Eastern	Sealdah	Beliaghata		
		Narkeldanga	135	
		Chitpur	62	
		Naihati	46	
	Howrah	Bamangachi	59	
				302
South-Eastern	Adra	Bhojudih Colliery area	12	
		Khargpur	23	
		Santragachi	27	
	Khargpur			62
Southern	Madura	All sections	141	
	Hubli	Gadag-Sholapur	58	
	Bangalore	Bangalore-Bangarapet	8	
	Mysore	Chickjajur-Chitaldroog	2	
				209

Western	Baroda	Sabarmati	30
		Nadiad	10
		Dabhoi	20
		Halol	4
	Bhavnagar	Jetalsar	43
		Junagadh	22
	Rajkot	Jamnagar	30
		Wankaner	43
		Surendranagar	27
		Mehsana	30
			259
	Grand Total :		956

(2) Defects in WM class engines on the South-Eastern Railway

In regard to the troubles experienced with WM class engines of Santragachi shed on the South-Eastern Railway, the following remedial measures are recommended :—

- (i) All WM class engines should be brought into shops one by one and fitted with new half-side patches.
- (ii) While these engines are being attended to in shops for fitting patches the boiler should be thoroughly descaled so that the treatment can be started on cleaned boilers.
- (iii) After the engines are thus attended to, the full dose treatment should be given to these engines.
- (iv) The practice of welding flues and tubes should be further investigated in order to see if there is any room for improvement in the welding technique. In order to obtain a stronger fillet weld, it is recommended that in the case of one or two engines, the flues and tubes should be extended inside the firebox to at least $3/16''$ as against the present $1/8''$.
- (v) In order to ensure that there is no fresh scale formation, one flue tube and one smoke tube should be removed from the boilers once every two months and observations made regarding the rate of scale formation.

(3) Priming of engines homed at Gwalior

The Chemist and Metallurgist, Central Railway, should investigate the cause of priming experienced at low mileages in engines of this shed and forward his report to the Railway Testing & Research Subcentre, Chittaranjan. In the meantime, the addition of polyamide may be continued to overcome priming as a strictly temporary measure.

RAILWAY BOARD'S ORDERS

Para 1 : Noted.

Para 2 : Approved. This should be done during P. O. H.

Para 3 : Central Railway to take action.

ITEM II: SCALING IN BOILERS

AGENDA : To consider the problem of (a) scaling on tubes of locomotive boilers in certain sections under treatment; and (b) trials with Dewrance and Gestra automatic desalting and desludging devices to minimise the same.

NOTES BY THE SECRETARY

In the various sections under internal treatment, it is found that the heating surfaces of boilers are generally clean, as a result of treatment. On the other hand, accumulation of scale still occurs though slowly on tubes and flues, particularly towards the smoke-box end. The scale is usually of the order of $1/8''$ in thickness, soft and non-adherent in character. However, the scale formed is much thicker at the bottom of the boiler and also at locations immediately below the top feed in the case of engines having no deflector plates. During washouts of engines, portions inside the boiler accessible to the water jet are cleaned free of scale. While no accumulation of scale occurs in these places, in places not accessible to washing by water jets, scale formation continues till a stage is reached when the congestion in the boiler has to be cleared by dropping a few tubes and scrubbing. Data available for the Dhond-Manmad Section of the Central Railway regarding date of P. O. H., the

number of tubes and flues removed, together with the weight of scale dislodged during M. O. H. of engines are given in Appendix G. Though no such detailed information is available with regard to other sections under treatment, it is gathered from the monthly reports that the experience is similar.

It is felt that the dosages at present administered in the various sections are either not enough to keep the sludge formed in a sufficiently fluid form or the blowdowns are not timed to eliminate the free flowing sludge before it gets baked on the tubes.

Members may please state their experience and offer comments with regard to this matter.

In this connection, a German valve type device for automatic salt and sludge removal from boilers merits consideration. It is stated to function like a pair of shears in cutting up or crushing pieces of scale, etc. settling in the boiler barrel (which may even be extremely hard). As such, it is claimed to be more suitable for desludging of boilers than the conventional cock or slide valve type of blowdown equipments. By providing a sludge ejector to the blowdown valve, extraction of sludge from the bottom of the boiler over its entire length is possible with the minimum loss of boiler water. As efficient sludge removal is a necessary adjunct to internal water-treatment, it may be advisable to carry out trials with such a device. Literature regarding this will be tabled at the meeting for consideration by the members.

A summary of the main advantages is enclosed in Appendix H.

While the above is of the intermittent type with the minimum loss of water, it has been claimed that heat losses can be saved and efficient action provided by Dewrance automatic desludging and deconcentrating valve now made in India by M/s Kilburn & Co., Ltd., Calcutta. This is, however, of the continuous type. A letter received in this connection from the Loco Design Section of the Central Standards Office, together with the reply thereto is enclosed as Appendices I & J for the information of members. Though, as stated therein, the intermittent blowdown has important advantages, it may be advisable to carry out trials with this gadget side by side with the German device referred to above to assess the relative efficiency. The former has also the advantage of functioning like an injector valve as referred to later under item III. Members may please take a decision with regard to carrying out exploratory trials with the above types of automatic desludging valves.

RECOMMENDATIONS BY THE COMMITTEE

(1) Washout procedure

In order to avoid baking of scale on tubes after a boiler has been emptied before a washout, it is recommended that the South-Eastern Railway conduct trials with the boiler washout method suggested by the American Boiler Makers' Association and report the results to the Railway Testing & Research Subcentre, Chittaranjan, in due course.

(2) Prevention of scale in boilers

If boiler tubes are initially coated with a film of tannin, scale in the tube area is likely to be reduced to a large extent. It is, therefore, recommended that the Railway Testing & Research Subcentre, Chittaranjan, prepare a suitable tannin composition to conduct trials on selected railways.

(3) It is recommended that trials with Gestra automatic salt and sludge removal device and Dewrance automatic desludging and deconcentrating valve be organised by the Railway Testing & Research Subcentre, Chittaranjan.

RAILWAY BOARD'S ORDERS

- Para 1 : Approved. South-Eastern Railway to carry out trials on the lines indicated and report results.
- Para 2 : Noted. Railway Testing & Research Subcentre, Chittaranjan, to take necessary action.
- Para 3 : Railway Testing & Research Subcentre, Chittaranjan, to pursue.

ITEM III : AUTOMATIC DOSING GEAR

AGENDA : To consider the progress made in respect of automatic dosing gear.

NOTES BY THE SECRETARY

The trials conducted by the Western Railway with the hydrostatic dosing arrangement fitted to metre gauge engines are reported to be very successful.

The blue print of the design will be tabled at the meeting.

It is understood that action is being taken to provide automatic dosing arrangements to 200 engines under treatment in the Gondal region.

Members may please comment on the progress made with regard to this subject in their respective railways.

It has been stated that the Dewrance automatic continuous desludging and deconcentrating valve now made in India can also be successfully used as an injector valve for the water-treatment solution fed from a gravity feed tank. The design together with literature will be tabled at the meeting. Members may please offer comments as to the advisability of carrying out trials with this double purpose gadget.

RECOMMENDATIONS BY THE COMMITTEE

Hydrostatic dosing gear

(1) Trials with hydrostatic dosing gears fitted to three locomotives in Bhavnagar and Rajkot Divisions are continuing on the Western Railway. The results of the trials to date are satisfactory and the Committee was informed that the Western Railway proposed to fit 200 locos with similar automatic dosing gears.

(2) It is recommended that all railways should go ahead with the installation of these gears.

RAILWAY BOARD'S ORDERS

Para 1 : Noted.

Para 2 : Approved. Railways to take action.

ITEM IV : TRIALS WITH INDIGENOUS TANNINS

AGENDA : To consider the progress of trials with indigenous tannins.

NOTES BY THE SECRETARY

Three tannins, myrobalan, acacia catechu and copper vat catch, were so far tried in the stationary boiler at Rahuri on the Dhond-Manmad section.

The analyses of the three tannins used are given in Appendix K.

While scaling in the boiler was not prevented by the use of myrobalan tannin, a heavy mud-like deposit at the bottom of the boiler resulted when ordinary acacia catechu was used. This could not be eliminated by the normal blowdowns. Preliminary results obtained with copper vat catch which is a refined variety of acacia catechu containing about 59% tannin (against 55% in the ordinary variety) has, however, been satisfactory. There was no scale formation in the boiler while the heavy deposit observed with the use of ordinary variety of acacia catechu was absent. It is presumed that this is due to the higher percentage of tannins as also the removal of non-tannins by chilling. With none of the varieties, priming was evident.

Trials are, therefore, being continued with the copper vat catch in the Rahuri boiler. A re-trial is also in progress with myrobalan tannin in the stationary boiler at Puntamba in order to confirm the results obtained with its use in the Rahuri boiler. It is also proposed to try the copper vat catch in a few locomotives before it can be recommended for general adoption on the railways.

RECOMMENDATIONS BY THE COMMITTEE

It is recommended that the Central Railway undertake trials with acacia catechu (copper vat variety) in two locomotives with a view to exploring the possibilities of substituting the imported tannin used in the 60 : 40 tannin-soda ash mixture.

It is also recommended that similar trials be conducted on the South Sealdah Section of the Eastern Railway.

RAILWAY BOARD'S ORDERS

Approved. Central and Eastern Railways to take early action.

ITEM V : AQUASTAT PROCESS

AGENDA : To review the progress of trials with Aquastat process of water-treatment.

NOTES BY THE SECRETARY

Trials with Aquastat process of water-conditioning referred to in item V of the minutes of the 6th Water-Treatment Sub-committee meeting, could not be progressed so far since the Blue Star Engineering Company, which was to supply the unit for trials, did not have ready stock of a suitable unit. The Deputy Chief Mechanical Engineer, Central Railway, has, however, informed (vide letter No. M 265. S. 238 dated 5th July 1956 enclosed as Appendix L) that the unit has since been received from the firm. Arrangements are being made to fit the unit to one of the H class engines of the Dhond-Manmad section under P. O. H. in Parel shops. The trials will be followed by the Railway Testing & Research Subcentre, Chittaranjan.

RECOMMENDATIONS BY THE COMMITTEE

The Committee noted the progress made.

RAILWAY BOARD'S ORDERS

Noted.

ITEM VI : PROGRESS REPORTS

AGENDA : To consider the half-yearly reports on progress of internal treatment received from the Chief Mechanical Engineers of railways.

NOTES BY THE SECRETARY

Progress report for the six-month period ending July 1956 received from the Chief Mechanical Engineer, Western Railway, is at Appendix M.

Reports from other railways, if received, will be tabled at the meeting.

RECOMMENDATIONS BY THE COMMITTEE

The half-yearly reports were considered by the Committee and recorded.

RAILWAY BOARD'S ORDERS

Noted.

ITEM VII : REVIEW OF BUSINESS ARISING OUT OF THE MINUTES OF THE LAST MEETING

AGENDA : To review action arising out of the minutes of the last meeting.

NOTES BY THE SECRETARY

Washout mileages—Item II—Members may please give progress, if any, in the extension of washout mileages in sections under treatment.

Internal treatment on the Northern Railway—Item IV (i)—Arrangements are being made by the Northern Railway to start internal treatment on all the recommended sections on the Bikaner Division. 47 engines are expected to be under such treatment. In other divisions, treatment could not be initiated as supplies of tannin and soda ash have not yet been received from the stores.

Blowdown counter—Item VII (iii)—The design of the blowdown counter has not been received from the Central Standards Office, Chittaranjan. If received before the time of meeting, it will be tabled for perusal by members.

Replies to the questionnaire from the North-Eastern Railway—Item VI—The North-Eastern Railway has forwarded data in regard to four isolated water supply sources of that railway which are stated to be bad. No information has, however, been given as to the engine links and other feed water sources on the links. It is therefore not possible to take action on the data supplied. The Chief Mechanical Engineer, North-Eastern Railway, has been requested to forward the required information early.

RECOMMENDATIONS BY THE COMMITTEE

(1) Washout mileages

Jhansi-Kanpur-Manikpur—On this section, washout mileages from 1000 to 1200 are in vogue as a trial measure and preliminary reports indicate that they have been successfully carried out.

Wardha-Balharshah—Washout mileage on this section has been increased from 1000 to 1500 recently with satisfactory results.

(2) Blowdown counter

The design is still awaited from the Central Standards Office (Loco), Chittaranjan.

(3) Replies to the questionnaire

It is recommended that the North-Eastern Railway be asked to submit full information as required in the questionnaire so that essential information is available to the Committee for recommending suitable treatment on the railway.

RAILWAY BOARD'S ORDERS

Para 1 : Noted.

Para 2 : Central Standards Office, Chittaranjan, to expedite the design.

Para 3 : North-Eastern Railway to expedite information to Railway Testing & Research Subcentre, Chittaranjan.

ITEM VIII: ANY OTHER BUSINESS

AGENDA : To discuss any other relevant subject.

NOTES BY THE SECRETARY

It is understood that despite the existing water-treatment arrangements, performance of engines homed at Bitragunta is not satisfactory. Besides the oscillameter treatment, it is reported that additions of tannin-soda ash boiler compound are also made in certain watering columns on this section. The Chemist & Metallurgist, Southern Railway, may please offer comments with regard to this.

RECOMMENDATIONS BY THE COMMITTEE

(1) Scaling & corrosion of loco boilers at Bitragunta

The Chemist & Metallurgist, Southern Railway, should investigate and furnish the Railway Testing & Research Subcentre, Chittaranjan, with a report regarding the boiler performance of the engines homed at the Bitragunta loco shed, particularly in regard to corrosion and formation of scale.

(2) Hot water washouts on the Southern Railway

Hot water washout on the Southern Railway should be revived with a view to augmenting the power position. Sheds where there are hot water washout facilities should immediately bring the same into operation.

(3) Supervisory staff for internal treatment on Madura Division

As the success of the treatment depends on intensive supervision, it is recommended that five supervisors in the grade Rs. 100-185 be appointed in the Madura Division which has a total of 140 engines under treatment.

(4) Substitution of corrosive feed water at Beliaghata (Eastern Railway)

Eastern Railway should make early arrangements to substitute the loco feed water at Beliaghata on the South Sealdah section.

(5) Monthly boiler reports

It is recommended that

(a) data regarding the schedule washout mileages for various classes of engines be also included while forwarding annexures for the months of April & October.

(b) Item 10 of the present proforma on boiler condition should read as follows :

"10. Other remarks, if any, such as engine failures due to boiler troubles, etc."

(6) *Extension of internal treatment on railways*

In addition to the existing system of water-treatment, internal treatment with pure tannin is recommended for the following sections :—

Central Railway

Poona - Raichur Section.

Southern Railway

Madras - Waltair Section.

It is recommended that the present oscillameter treatment on the Madras-Waltair Section be so modified as to bring it in line with the standard treatment recommended by the Committee for the Madura District. This may be implemented by introducing 1/2 lb. of tannin per thousand gallons of feed water taken in the engine tender.

Wherever the water supply is common for drinking as well as loco purposes, it is recommended that the tannin addition be made through a bypass feeder.

South-Eastern Railway

The remaining engines in the Bhojudih shed should be brought under internal treatment as early as possible.

RAILWAY BOARD'S ORDERS

Paras 1 to 3 : Southern Railway to take early action.

Para 4 : Eastern Railway to take action.

Para 5 : Approved.

Para 6 : Approved. The Central, Southern & South-Eastern Railways to take action.



APPENDIX A

<i>Railway</i>	<i>Division/Distt.</i>	<i>Section</i>	<i>No. of engines</i>	
Central	Sholapur	Dhond-Manmad	20	
		Dhond-Baramati	2	
		Kurduwadi-Miraj-Latur	9	
	Jhansi	Jhansi-Kanpur)	49	
		Jhansi-Manikpur)		
		Gwalior-Sheopurkalan)	25	
		Gwalior-Shivpuri)		
		Gwalior-Bhind)		
	Nagpur	Wardha-Balharshah)	43	
		Balharshah-Kazipet)		
			<hr/>	
Eastern	Sealdah	Beliaghata)	135	
		Narkeldanga)		
		Chitpur	62	
		Nailhati	46	
	Howrah	Bamangachi	59	
South-Eastern	Adra	Bhojudih Colliery Area	12	
	Khargpur	(Treatment suspended with effect from 25.4.56)		
				<hr/>
Southern	Madura	All sections	141	
	Hubli	Gadag-Sholapur	38	
	Bangalore	Bangalore-Bangarapet	8	
	Mysore	Chickjajur-Chitaldroog	2	
				<hr/>
Western	Baroda	Sabarmati	30	
		Nadiad	10	
		Dabhoi	20	
		Halol	4	
	Bhavnagar	Jetalsar	43	
		Junagadh	22	
	Rajkot	Jamnagar	30	
		Wankaner	43	
		Surendranagar	27	
		Mehsana	30	
				<hr/>
				259
Grand total :			910	

APPENDIX B

Copy of analysis of boiler concentrates from engines working in Gwalior Section.

Section	Shivpuri	Bhind	Sheopurkalan
Eng. No	32	35	39
Mileage	300	458	366
Date recd.	7-12-55	7-12-55	7-12-55
Colour	Nil	Nil	Light amber
Lab. No.	W-385	W-386	W-387

IN PARTS PER 100,000

T. D. S. (By A. T.)	190	195	215
Hydrometer)			
Ph. alkalinity	Nil	7.5	20.5
Total alkalinity	3.0	20.0	45.5
Chlorides (Cl)	58.2	54.0	46.4
Temp. hardness	3.0	2.1	1.1
Perm. hardness	20.6	Nil	Nil
Total hardness	23.6	2.1	1.1
(M—H)	(—) 20.6	17.9	44.4

Engines working on Gwalior-Shivpuri section should be treated with tannin-soda ash mixture instead of neat tannin.

APPENDIX C

Extract from Letter No. 1104/9931 dated 5-3-56 from the Chemist & Metallurgist, South-Eastern Railway, Khargpur, to the Joint Director, Research, Railway Testing & Research Subcentre Chittaranjan.

Sub : *Annexure Reports from Santragachi Loco Shed.*

Ref : Your No. KRA/1 dated 1st March, 1956.

Internal treatment on Santragachi engines started with effect from 10-3-55 with an original dosage of $\frac{1}{2}$ lb. per 1000 gallons. The WM engines of Santragachi had been giving leakage troubles ever since they were put into service. After the introduction of internal water-treatment, however, this trouble was aggravated and within a few months the dose was further reduced for sometime, and again brought up to the original dose after a few months. On account of this fact the descaling effect on these engines has not been as effective as it ought to be. In December, '55, it was decided that all the engines which had done P.O.H. during 1955 should be given a dose of 1 lb. per 1000 gallons to effect more efficient descaling. The remaining WM engines have also been brought under a dose of 1 lb. per 1000 gallons with effect from the first week of Feb. '56 and it is expected that this dose would now reduce the scale-formation considerably.

The internal treatment, even though carried out at a smaller dose at the earlier stage, has been loosening scales in the boiler and it was suspected that the loosened scale getting lodged in between the nest of tubes was to a certain extent responsible for leakage troubles and, therefore, one by one these engines were stopped in sheds to remove the scale which was lodged in between the nest of tubes. This is done by taking off a few tubes in between to allow for the removal of the accumulated scales in between the tubes, as it is not possible to remove the scale by operating from the inspection holes alone.

The WM engines had originally come with poor washout facilities. Therefore, additional washout plugs have been provided in the smoke box tube plates. A few of the engines have thus been converted; others will be converted as and when they go to the shops. This arrangement, however, is for the normal washouts and is not expected to be effective in removing the old scale which gets lodged in between the nest of tubes.

APPENDIX D

Copy of Letter No. 1104/17156 dated 20/22 April, 1956 from the Chief Mechanical Engineer, South-Eastern Railway, Khargpur, to the Joint Director, Research, Railway Testing & Research Subcentre, Chittaranjan.

Sub : *Internal Water-treatment at Santragachi Loco Shed.*

Ref : Your letter No. KRA/1 dated 1st March '56 to Chemist & Metallurgist, Khargpur, and C & M's letter No. CMT/1104/9931 dated 5-3-56 in reply to that.

Please refer to your above quoted letter. The original dose of $\frac{1}{2}$ lb. per 1000 gallons of chemical complex was increased to 1 lb. per 1000 gallons in December '55 in the case of a few engines and from the 1st week of February, 1956 in the case of the remaining engines at Santragachi. This had the effect of considerable reduction in scale formation and the boilers are fairly clean. Recently, however, there has been an epidemic of heavy leakages of tubes and stays on these engines, with the result that it has become impossible to run the services punctually.

Therefore, in order to minimise the dislocation of services, it has been decided to keep only one or two engines on a dose of 1 lb. per 1000 gallons and to reduce the dose to the original $\frac{1}{2}$ lb. per 1000 gallons in the case of the remaining engines. This is, however, likely to result in a somewhat increased scale formation but in view of the practical difficulties there seems to be no other alternative at present.

APPENDIX E

Extract from investigation report on WM Class of engines of Santragachi shed from the Chemist & Metallurgist, South-Eastern Railway, Khargpur.

The defects regarding leakage of tubes and stays have been in existence on the WM engines ever since they were put into service about 3 years back. Originally, these engines came with their tubes expanded with copper ferrules and beaded over but not welded. Subsequently, all the boilers have been retubed by expanding without copper ferrule and welded according to our standard practice, but contrary to our expectation, even this practice has not given us any relief. The fact that even in the case of engine retubed and welded, leakage troubles start within one week of its being put into operation is quite significant and, in my opinion, the reason for this is not far to seek. In the case of welded tubes, leaks can start only when the welds crack and it is, therefore, evident that the factors which cause the welds to crack are alone responsible for this trouble. Since the question of scale-formation does not arise in this case, the only factor which can cause welds to crack is the local contraction and distortion of the tube plate. The solution for the trouble, therefore, lies in eliminating such local contraction and distortion of the tube plate during the operation of the locomotive. Violent temperature changes in the firebox plates resulting from a too rapid cooling or steaming which may occur during the working of the locomotive or at the time of washout, are the main cause of distortion of tube plates. If during operation of the locomotive relatively cool air is permitted to be drawn through or over the fire, it causes local drop in temperature on coming into direct contact with the tube plate and thus sets up local contraction and distortion resulting in welds cracking and the tubes begin to leak. Frequent and improper cleaning of the fire as well as the practice of running an engine with the fire-hole door fully open will allow cool air to be drawn in and impinge directly on the tube plate. Similarly the practice of moving an engine in the shed in its own steam after dropping fire, keeping dampers and fire-hole doors open and subsequently opening smoke-box door for cleaning the smoke-box ashes can cause immense damage in this respect.

APPENDIX F

Extract from U. O. I. No. KRA/1 dated 22-5-56 from the Joint Director, Research (M&C), Railway Testing & Research Subcentre, Chittaranjan, to the Chief Design Engineer (L), Central Standards Office, Chittaranjan.

Sub : WM Class Loco Boilers.

Ref : Your note dated 18/5/56 (page 4/n) on-CSO/CRJ file No. SL/WM/BR.

It is well known that scaling is one of the factors responsible for boiler leakages. Due to local overheating caused by scaled tubes and their expansion, there is a pressure on the tube plate. Further, pressure exerted on the water side will also cause zones of the tube plate overheated by the scales to bulge. These will give rise to leakage. This may be protected for some time by deposits of scale but will become evident when the scale is removed. The remedy is, therefore, to bring an engine under treatment as soon as it returns from P. O. H.

APPENDIX G

Data regarding number of flues and tubes and weight of scale removed during M. O. H. of engines of Dhond-Manmad section.

Month	Engine No.	Mileage completed	Date of P. O. H.	No. of tubes removed	Weight of scale
August '55	878 H/4	47,914	not given	26	not given
September	406 D/4	not given	"	57	"
	987 H/4			42	
October	1323 H/4	30,521	1/55	7 flues & 41 tubes	8 Cwts.
November	1316 H/4	29,000	2/55	40	6 "
December	989 H/4	32,203	2/55	45	6 "
January '56	1325 H/4	26,813	5/55	30	5 "
	1343 H/4	51,547	10/54	46	6 "
	1334 H/4	27,772	5/55	24	4 "
February	966 H/4	22,977	7/55	36	5 "
	1348 H/4	46,496	10/54	58	12 "
March	1321 H/4	45,105	1/55	7 flues & 46 tubes	16 Cwts & 3 Qrs.
	406 D/4	172,384	completed 95,546 miles before treatment.	74 tubes & 13 flues	1 Ton, 7 Cwts & 2 Qrs.
April	1327 H/4	63,596	8/54	49	13 Cwts, 1 Qr.
May	1323 H/4	52,006	1/55	40	8 Cwts, 3 Qrs.

APPENDIX H

Summary of the main advantages claimed for the "Gestra" automatic salt & sludge removal device (pamphlet obtained by Sri R. G. da Costa, Railway Adviser to the High Commissioner for India in U. K.)

A closing force of 2000 kg (4400 lb.) generated by a "closing force multiplier" device, ensures automatic closing of the valve.

Narrow and sharp sealing surfaces of wear and corrosion resistant steel act like shears or punch against fragments of scale, etc. which may affect the proper working of the closing mechanism.

Hand wheel operated closing force mechanism which gives an additional force of 2000 kg (4400 lb.) thereby providing for a total force of 4000 kg (8800 lb.) may be used, for example, in the event of a thick wire being jammed between seat and cone, which has to be cut off.

The above safety features confer a feeling of security on the boiler attendants, thereby removing any cause for hesitancy in operating the blowdown device as many times as necessary.

A reserve closing device, when closed, permits disassembly of the entire automatic sludge & salt removal device under full boiler pressure.

The operation time necessary to obtain full opening for a given period is much less with this valve, when compared with other types of valves of equal area.

The water loss resulting from the operation of the quick closing Gestra valve is much less when compared with the other types of valve.

The Gestra sludge ejector connected to the Gestra blowdown valve provides for efficient sludge removal from the bottom of the entire length of the boiler.

It does not get clogged. This is on account of the strong suction force developed in it when the valve is operated. Automatic cleaning of the device with return water has been provided.

Gestra blow-down valves are in use on the German Federal Railways, as well as those of the Union of South America, Argentina and Iran.

APPENDIX I

Copy of D. O. Letter No. SL/SR dated 27th March, 1956 from Sri R. K. Sethi, Dy. Chief Design Engineer (Loco), Central Standards Office, Chittaranjan, to Sri S. Ramanujam, Dy. Director, Research (M&C), R. T. & R. C., Chittaranjan.

Re : *Continuous Blowdown Valves.*

I am enclosing herewith in original a note handed over to me this morning by the representative of Messrs. Kilburn & Co., Ltd., Calcutta, on the use of continuous blowdown valves for steam locomotive boilers.

I shall be obliged if you would let me have your views on the proposal and whether you consider it preferable to have a continuous or an intermittent blowdown on our locomotives, specially those which are being subjected to water-treatment.

When done with, kindly return the article for record in this office.

APPENDIX J

Copy of U. O. I. No. KRA/1 dated 28-7-56 from Jt. Director, Research (M&C) R. T. & R. C./Chittaranjan to C. D. E. (L)/C. S. O/Chittaranjan.

Sub : *Continuous Blowdown Valves.*

Ref : Sri Sethi's D. O. No. SL/SR dated 22/27-3-56 to Shri Ramanujam.

The pamphlet on continuous blowdown valves sent with the above quoted letter, has been read with great interest.

2. The Water Treatment Sub-Committee have gone at length into the subject of blowdown valves and have recommended intermittent valves as more suitable for engines receiving internal treatment. In fact, in the Madura District of the S. Railway, the Alfloc continuous blow down valves fitted to engines were dummied soon after internal treatment was started. Instead, intermittent valves were provided. The same has been the experience in the South-Eastern Railway where the valve referred to above was found to be incapable of coping up with the large amount of sludge formed.

3. In internal treatment, tannins are added to keep the sludges formed from the scale forming salts in a free-flowing form. They must, however, be removed as soon as they are formed, by boiler blowdown to prevent them from baking on the heated surfaces in considerable quantities. Further, any accumulation of sludge at the bottom will effect heat transfer. Hence, the efficient elimination of sludge is of the greatest importance.

4. It has been stated that continuous blowdown will give far more certain results than a valve which can be manipulated and is thus susceptible to forgetfulness on the one hand and over-enthusiasm on the other. The second aspect involves wastage of heat. Since the heat lost in such blowdowns cannot be recovered, the thermal efficiency is thereby reduced resulting in increased fuel cost. Further, with a continuous blowdown valve, an effective heat conservation apparatus can be arranged to deal with the small but continuous efflux, though this is not possible when the same total quantity is discharged over a period of a few seconds.

5. It must, however, be noted that the violent action of an intermittent valve is more conducive to an effective removal of sludge from the boiler than the slow-acting continuous blowdown arrangement. Further, the intermittent blowdown valves operated from the cab by steam permit of necessary blowdown being made in the shed to control the treatment as also extra blowdowns to stop priming on line. The French Railways have found that not more than one per cent of useful heat is normally lost by this process which is more than balanced by the benefits arising from this procedure, viz. clean boilers and extended washout mileage. Due to a defect of the strainer a bit of scale, etc. might enter the valve and be stuck between the poppet and its seat. This defect due to the failure of the poppet to close was remedied by using a double poppet valve where the water blown off had to go through the poppets fitted in series, successively. The pressure in the boiler had always the tendency to shut down both of these. Since the second poppet lifts up higher than the first one, any solid succeeding in passing through the latter could also pass through the former. Thus, the risks of an incomplete closing of the valve were very few. Engine crews, therefore, fully trusted the blowdown valve which had at first made them fear engine failures owing to the possibility of emptying the boiler through the blowdown valve.

6. It is noted that the Dewrance automatic combined desludging and de-concentrating valve has been tried as an injection valve for the water treatment solution fed from a gravity feed tank. As this is interesting, the Loco Design Section may study the details of the arrangement to see if this is in any way better than the dosing gear already evolved.

7. It is proposed to discuss this subject during the next meeting of the Water Treatment Committee in the light of experience gained by the various railways.

APPENDIX K

Analysis of Tannins

	<i>Acacia Catechu (Khair)</i>	<i>Myrobalan Tannin</i>	<i>Copper Vat Cutch</i>
Tannins	54.93%	61.50%	58.45%
Non-tannins (Sugary matter, organic acids, soluble mineral salts)	31.07%	32.50%	27.80%
Insolubles	1.75%	2.00%	3.25%
Moisture	12.25%	4.00%	10.50%

APPENDIX L

Copy of letter No. M 265 S-238 dated 5-7-56 from the Chief Mechanical Engineer, Central Railway, Bombay V. T., to the Joint Director Research (M&C), Railway Testing and Research Subcentre, Chittaranjan.

Re : Aquastat process of water softening

The Sub-committee on Water Treatment which held their 6th Meeting at Bombay on the 11th & 12th August 1954 recorded vide Item 5 that it was being arranged to conduct trials with the aquastat process of water softening. In this connexion I have to inform you that early in 1954 the Bombay agents of aquastat plants visited this office and offered to supply free of charge one aquastat unit for trial on a locomotive unconditionally. This offer was accepted and the firm has only now been able to obtain the unit from the manufacturers. It is proposed to be fitted on a H class engine operating on the Dhond-Manmad Section of this Railway which is notorious for bad water and ascertain the utility of the unit. I am mentioning this as you may desire to associate your office with this trial and combine it with any you may have on hand of a similar unit.

APPENDIX M

Copy of letter No. M. 268/18 dated 10-8-56 from the Chief Mechanical Engineer, Western Railway, Churchgate, Bombay, to the Joint Director Research, Railway Testing and Research Subcentre, Chittaranjan.

Sub : *Water Treatment on Indian Railways*

Ref : Item XI of the minutes of the 8th meeting of the Water Treatment Sub-Committee of the IRMC.

A report on the progress of the internal boiler feed water treatment with tannin & soda ash, as required in the above mentioned reference, is being forwarded herewith.

Progress of the Internal Boiler Feed Water Treatment on Western Railway for the period 1-3-56 to 31-7-56.

The following table gives the up to date position of the internal water-treatment trials on this Railway :—

<i>Division</i>	<i>Shed</i>	<i>No. of engines</i>
Baroda	Sabarmati	30
	Nadiad	10
	Dabhoi	20
	Halol	4
Bhavnagar	Jetalsar	43
	Junagadh	22
Rajkot	Jamnagar	30
	Wankaner	43
	Surendranagar	27
	Mehsana	30
Total		259

General Observations

2. The progress of the treatment during the crucial summer months of 1956 has revealed that the internal tannin treatment has conclusively established its merits so far as clean injectors and clack boxes are concerned.

Failures of engines due to scaled injectors are now rare on sections where internal treatment is in vogue.

3. It has, however, been noticed that in certain sheds like Jamnagar, Surendranagar and Mehsana, scale accumulation in the tube area has not been very appreciably reduced, and hence, descaling becomes necessary. It is conceded that the scale is much softer than otherwise would be encountered on such section, but the fact that tubes have still to be removed limits the availability that could otherwise have been expected from engines.