Department of Agriculture, Forestry and Fisheries

Notice No. VPN/16/2017-03	

SUBJECT: Standard for microbiological and chemical monitoring of water

This VPN/16/2017-03 replaces VPN/16/2015-01.

Implementation date: Date of signature of the document.

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Acting Director: Veterinary Public Health **Date:** 2017 -01- 31

PART I

DEFINITIONS

Authorised person	any person authorised to exercise or perform any power or duty, or requested to render any service, by the Controlling Authority.
Composite sample	samples from separate sources which are pooled for testing purposes.
Controlling Authority	the authority which is directly responsible for the application of animal health or veterinary public health measures in a specified area of the country.
Designated Laboratory	a laboratory accredited with the national accreditation authority and endorsed by the controlling authority to be used for sample analysis
Establishment	an approved abattoir or processing facility or an approved cutting plant or a unit grouping together several such establishments.
Official Veterinarian	A veterinarian authorised by the Controlling Authority of South Africa to perform certain tasks associated with animal health and/or public health inspections.
Reference Laboratory	Refers to a laboratory authorized by the controlling authority as a confirmatory testing laboratory for the area/country

PART II

INTRODUCTION

MICROBIAL AND CHEMICAL MONITORING IS CURRENTLY ACCEPTED AS PROVIDING A DEGREE OF PROCESS AND HYGIENE ASSURANCE BY PROVIDING HISTORICAL EVIDENCE ALLOWING THE DETECTION OF TRENDS IN PROCESSING. THE MAIN OBJECTIVE OF PERFORMING ANY BACTERIAL COUNT IS TO DETECT ANY DEVIATION FROM THE NORMAL PATTERN

A water-sampling programme must be conducted in such a way as to be representative of the water supply to the establishment. The longer the period over which samples for analyses are taken continuously, the more reliable are the results.

1. Establishments are to implement monitoring programs and documented systems whereby the effectiveness of measures to control the hygiene of production can be validated and verified. Factors that have the potential to adversely affect the safety of meat are rigorously monitored and controlled. The microbiological status of meat is used as an indicator of the adequacy of process interventions and process hygiene. However, these programs are only as valid as the competency and reliability of the laboratory performing the analyses.

2. A Laboratory Approval Program for microbiological testing was designed to provide a credible independent system to verify that laboratories are competent to carry out tests required to verify hygiene of production.

3. The program encompasses all aspects of a microbiological monitoring and verification program, including the development of standardised sampling plans, sampling and transportation procedures and analytical methods and the verification of laboratory proficiency.

PART III

RESPONSIBILITIES

1. ABATTOIR MANAGEMENT

The management of individual establishments must:

1.1 Provide a plan of the premises, indicating the water distribution network and positions of storage tanks and outlets (each should have a unique reference number).
1.2 Test water according to the frequency determined in sections 3, 4 and 5 or as dictated by the Official Veterinarian.
1.3 Keep results of testing as part of the Hygiene Management System.
1.4 Ensure that the laboratory to be used is accredited by the national accreditation authority and endorsed by the controlling authority to perform the tests as required.
1.5 Report the results of own checks, inter-laboratory comparison and proficiency testing programmes to the Official Veterinarian.
1.6 Collect duplicate internal control samples every three months. One specimen must be tested by the designated laboratory and the other specimen by the Reference Laboratory.
1.7 Ensure that the laboratory used for testing takes part in a proficiency testing scheme.
1.8 Meet all costs in this respect.

2. VETERINARY SERVICES

The official veterinarian will be responsible to:

2.1 Receive, evaluate and keep copies of all microbiological testing results.
2.2 Review all testing results received and take these into account in making his/her decision on the suitability of the product for export.
2.3 Inform the management of the establishment and controlling authority of any negative trends.
2.4 Instruct the establishment to conduct additional sampling if deemed necessary.
2.5 Test water according to the frequency determined in paragraph 4.
2.6 Perform investigative sampling when the results of own check, inter-laboratory comparison or proficiency testing microbiological tests are not in compliance.
2.7 Collect official external control samples every 3 months. The results of these tests must verify the results of the internal control tests.
2.8 Stop production and refuse export certification if the regular results are not within the parameters as set in Part III. Production and export certification may be resumed as soon as the parameters are in compliance. (See paragraph 3)

PART IV

MICROBIOLOGICAL & CHEMICAL VALUES AND SAMPLING STANDARDS

3. MICROBIOLOGICAL PARAMETERS FOR WEEKLY OWN CHECK BY THE MANAGEMENT OF THE ESTABLISHMENT

Parameter	Parametric value	
	EU value	RSA value
E.coli 44° C incubation 24hrs	0 / 100 ml	0 / 100 ml
Total coliform 35° C incubation 20-22 hrs	0 / 100 ml	0 / 100 ml
Enterococci	0/100 ml	-
Clostridium perfringens (including spores)	0/100ml	-
Total Plate Count 35 ± 2°C incubation 48 hrs	≤100 / ml	≤100 / ml

N.B. Incubation temperatures may vary depending on the test method used.

4. PHYSICO-CHEMICAL PARAMETERS FOR ANNUAL OWN CHECKS BY THE MANAGEMENT OF THE ESTABLISHMENT

Parameter	Parametric value	Unit	Notes
Acrylamide	0,10	µg/l	Note 1
Antimony	5,0	µg/l	
Arsenic	10	µg/l	
Benzene	1,0	µg/l	
Benzo (a) pyrene	0,010	µg/l	
Boron	1,0	mg/l	
Bromate	10	µg/l	Note 2
Cadmium	5,0	µg/l	
Chromium	50	µg/l	
Copper	2,0	mg/l	Note 3
Cyanide	50	µg/l	
1,2-dichloroethane	3,0	µg/l	
Epichlorohydrin	0,10	µg/l	Note 1
Fluoride	1,5	mg/l	
Lead	10	µg/l	Notes 3
Mercury	1,0	µg/l	
Nickel	20	µg/l	Note 3
Nitrate	50	mg/l	Note 5
Nitrite	0,50	mg/l	Note 5
Pesticides	0,10	µg/l	Notes 6 and 7
Pesticides – Total	0,50	µg/l	Notes 6 and 8

Parameter	Parametric value	Unit	Notes
Polycylic aromatic hydrocarbons	0,10	µg/l	Sum of concentrations of specified compounds; Note 9
Selenium	10	µg/l	
Tetrachloroethene and Trichloroethene	10	µg/l	Sum of concentrations of specified parameters
Trihalomethanes – Total	100	µg/l	Sum of concentrations of specified compounds Note 10
Vinyl chloride	0,50	µg/l	Note 1

Note 1: The parametric value refers to the residual monomer concentration in the water as calculated according to specifications of the maximum release from the corresponding polymer in contact with the water.

Note 2: Where possible, without compromising disinfection, a lower value should be strived for.

Note 3: The value applies to a sample of water intended for human consumption obtained by an adequate sampling method as prescribed in Council Directive 98/83/EC ([1]) at the tap and taken so as to be representative of average value ingested by consumers.

Note 5: Must ensure that the condition that (nitrate)/50 + (nitrite)/3 ≤ 1, the square brackets signifying the concentration in mg/l for nitrate (NO_3) and nitrite (NO_2), is complied with and that the value of 0,10 mg/l for nitrites is complied with from water treatment works.

Note 6: 'Pesticides' means:

- organic insecticides,
- organic herbicides,
- Organic fungicides,
- Organic nematocides,
- Organic acaricides,
- Organic algicides,
- Organic rodenticides,
- Organic slimicides,
- related products (*inter alia*, growth regulators)

and their relevant metabolites, degradation and reaction products.

Only those pesticides which are likely to be present in a given supply need be monitored.

Note 7: The parametric value applies to each individual pesticide. In the case of aldrin, dieldrin, heptachlor and heptachlor expoxide the parametric value is 0,03 µg/l.

Note 8: 'Pesticides – Total' means the sum of all individual pesticides detected and quantified in the monitoring procedure.

Note 9: The specified compounds are:

- benzo(b)fluoranthene,
- benzo(k)fluoranthene,
- benzo(ghi)perylene,
- Indeno(1,2,3-cd)pyrene.

Note 10: Where possible, without compromising disinfection, a lower value should be strived.

The specified compounds are: chloroform, bromoform, dibromochloromethane, bromodichloromethane.

5. Frequency of verification and or sampling by the controlling authority (official) and the management of the establishment (own checks)

Test	Official (frequency)	Own sampling (frequency)
Heavy metals		Annual
Pesticides		Annual
Polycyclic Aromatic Hydrocarbons		Annual
Total coliforms	3 monthly	Weekly*
Enterococci	3 monthly	Weekly*
Clostridium perfringens (including spores)	3 monthly	Weekly*
Escherichia coli	3 monthly	Weekly*
TPC	3 monthly	Weekly*
Protozoan parasites		Annual
Residual chlorine (0,2 - 0,5 ppm)	3 monthly	Daily
Nitrates, Nitrites & Ammonium (depending on risk)		Annual

NB: * Where compliance has been demonstrated over a minimum period of six months at Cold Stores, testing frequency maybe reduced to three months (quarterly) or less.

6. Checklist for the controlling authority and the management of the establishment for the chlorination of water:

				Comments
	Yes	**No**	**N/A**	
Source: Public supplier				
Own source				
Chlorinating in the plant				
Chloride after chlorinating (max. 1,5 ppm)				
Alarm system for chlorination available				
Alarm correctly placed and audible				
Water and chlorine contact time (½ hour)				
Intermediate storage				
Time of storage				
Cleaning of the reservoir				
Frequency of cleaning				

6. SAMPLING FREQUENCY AND INTERPRETATION OF RESULTS

a. Records of sampling and results must be inspected by the Official Veterinarian who must investigate and take appropriate action when the sampling and results are not within acceptable ranges.
b. Sufficient samples must be collected by the official veterinarian in official investigations.
c. Official sampling may not replace own sampling by the management.

6.1 Establishment

a. Microbiological tests

Test the water once a week at the reservoir (where available) outlet (this will test the chlorinating procedure), as well as one water point (tap) on rotation. All the taps supplying "food contact water", equipment and hand wash water in the establishment must be included in the testing programme.

b. Chlorination tests

(i) Storage tank - once a day
(ii) Distant water point (tap) - four times a day

c. Physico-chemical tests

Tests are performed at least once a year. Refer to the schedule in paragraph 4.

6.2 Interpretation of results:

a. Microbiological tests

Use the geometric mean[1] of the results from the previous 3 weeks to comply with the requirements for the total plate count.

Plot the results on a graph to view the trends.

i. Antilog of the arithmetic mean of the log of the values.

Excel formulae:
Log = LN
Antilog = EXP

See example in last paragraph of this Part

b. Physico-chemical tests

The results are judged on their own merit by the Official Veterinarian.

7. EVALUATION OF RESULTS

7.1 Only acceptable laboratory techniques should be used for the analyses to enable accurate evaluation and consistency of the results.

7.2 The results of microbiological water tests must be demonstrated graphically and compared with the results of microbiological tests of the product and the environment.

7.3 The global picture of the microbiological status of the establishment and its products must always be available and, by using the geometric mean of previous results, it is the preferred way of evaluating the results of individual tests.

7.4 Parameters that deviate from maximum acceptable levels must be investigated as soon as individual results and / or the trendline indicate an increase in the microorganism. Samples must then be collected daily and an attempt must be made to find the cause before the maximum acceptable geometric mean levels are reached.

7.5 The Official Veterinarian may stop production and refuse export certification if the geometric mean of the regular microbiological results is not within the parameters as set in Part III.

The Geometric mean and the **trendline** are both **indicators** of increase in bacteriological contamination only.

The exact date from which export certification may cease is the first day that unacceptable results are reported. Production and export certification may be resumed on the day that the parameters return to levels of compliance.

Refer example on page 8.

a. The first geometric mean result over 100 is on Week 6 (cell I 11). Production stops on Week 6. The first individual results over 100 is Week 5 (cell C 10). The production from Week 5 cannot be certified for export. Production and certification resumes on Week 7 (cell C 30).

b. The second geometric mean result over 100 is on Week 11 (cell I 16). Production stops on Week 11. The first individual results over 100 is Week 9 (cell C 14). The production from Week 9 cannot be certified for export. Production and certification resumes on Week 12 (cell C 17).

It is therefore important to increase the sampling frequency from weekly to daily as soon as unacceptable levels are reported for individual days.

8. SAMPLE COLLECTION

Sampling programs should normally cover only cold water or mixed hot- and cold-water distribution systems within the plant. However, where there is reason to believe that hot water systems may have been exposed to contamination, e.g. through leaks or inadequate maintenance of water temperatures, these will also need to be included.

For this sampling to be carried out in an organised way, the sampling procedure will have to be described and documented. The technician or inspector responsible for the taking of samples will have to follow this prescribed procedure meticulously. The handling of the sample at the laboratory must be described and documented.

The inspector collecting the samples must:

a. collect samples in a sterile container.

b. run the water point to be sampled for long enough to completely flush the pipe supplying the tap but not for less than 30 seconds.

c. identify the sample as to the point of collection and the time and date of collection. Samples shall be registered and matched to the results received from the laboratory.

It is important that all traces of chlorine in the sample should be neutralised immediately after collection. A sterile 0.1 ml of 2% solution of sodium thiophosphate per 100 mℓ of sample shall be used for this purpose.

The transport procedure of the sample to the laboratory must be documented and followed precisely.

In the case where the sample will be analysed 3 hours or more after sampling the samples will have to be kept on ice until the time of analysis.

PART V

9. LABORATORIES

When laboratories analyze establishment samples, it is the responsibility of the regulated establishment to ensure that testing methodologies and practices meet their needs.

Establishments that select a laboratory that does not apply appropriate testing methods or effective Quality Assurance (QA) practices may not receive reliable or useful testing results.

Establishments must ensure that they use a laboratory accredited by the national accreditation authority.

Subcontracting of any portion of the analyses to another approved laboratory meeting the guidelines of an accredited laboratory may be acceptable.

Where no method of analysis is specified, the most recent available validated methods complying with relevant national and or internationally recognised rules or protocols shall be used.

9.1 Handling of samples and records

Study all records and correspondence related to the required sample and ensures that all the relevant information has been supplied and is legible.

NB: Record the temperature of the sample and time of arrival and include it in the laboratory report.

Always store split samples to maintain integrity for follow-up analyses or validation of the system.

It is important that the analyst has a thorough knowledge of the physical characteristics of both the normal and the abnormal products, either by techniques or experience.

Samples must be of known volume to be able to report the microbial count as number of organisms per millilitre

9.2 Laboratory report

The laboratory report should contain the following details

a. Time and date of receipt of the sample at the laboratory and temperature of sample.
b. Proper identification of the sample especially pertaining to the point of collection.
c. Confirmation that the prescribed collection method was followed in the collection of the sample (If the sample is collected by personnel of the laboratory doing the analysis)
d. Confirmation that the prescribed transport steps were followed.

e. Confirmation that the correct handling procedures were followed at the laboratory.
f. Date and time of analysis at the laboratory.
g. Time of reading results
h. Results of the analysis.
i. Range of criteria for evaluation.

9.3 Example for determining the geometric mean

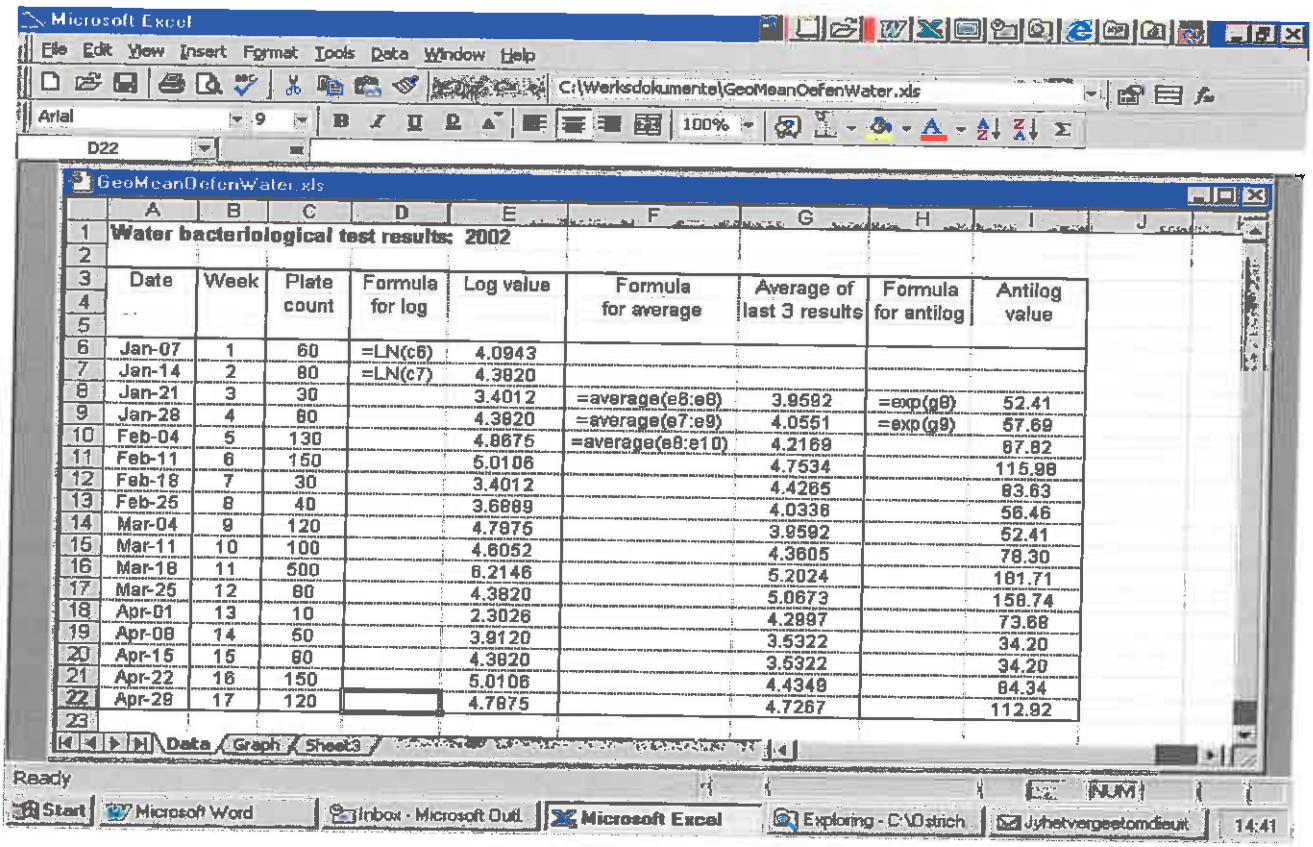
(The formulae and manipulations refer to a Microsoft Excel worksheet)

Geometric mean is the antilog of the arithmetic mean (average) of the log of the individual values.

9.4 References

9.4.1 Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption.

9.4.2 South African Standard for Drinking Water: SABS 241 (2015)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GeoMeanOefenWater.xls
Water bacteriological test results: 2002
Date | Week | Plate count | Formula for log | Log value | Formula for average | Average of last 3 results | Formula for antilog | Antilog value
Jan-07 | 1 | 60 | =LN(c6) | 4.0943
Jan-14 | 2 | 80 | =LN(c7) | 4.3820
Jan-21 | 3 | 30 | 3.4012 | =average(e8:e8) | 3.9592 | =exp(g8) | 52.41
Jan-28 | 4 | 80 | 4.3820 | =average(e7:e9) | 4.0551 | =exp(g9) | 57.69
Feb-04 | 5 | 130 | 4.8675 | =average(e8:e10) | 4.2169 | | 67.82
Feb-11 | 6 | 150 | 5.0106 | | 4.7534 | | 116.98
Feb-18 | 7 | 30 | 3.4012 | | 4.4265 | | 83.63
Feb-25 | 8 | 40 | 3.6889 | | 4.0336 | | 56.46
Mar-04 | 9 | 120 | 4.7875 | | 3.9592 | | 52.41
Mar-11 | 10 | 100 | 4.6052 | | 4.3605 | | 78.30
Mar-18 | 11 | 500 | 6.2146 | | 5.2024 | | 181.71
Mar-25 | 12 | 80 | 4.3820 | | 5.0673 | | 158.74
Apr-01 | 13 | 10 | 2.3026 | | 4.2997 | | 73.68
Apr-08 | 14 | 60 | 3.9120 | | 3.5322 | | 34.20
Apr-15 | 15 | 80 | 4.3820 | | 3.5322 | | 34.20
Apr-22 | 16 | 150 | 5.0106 | | 4.4349 | | 84.34
Apr-29 | 17 | 120 | 4.7875 | | 4.7267 | | 112.92
Data Graph Sheet3
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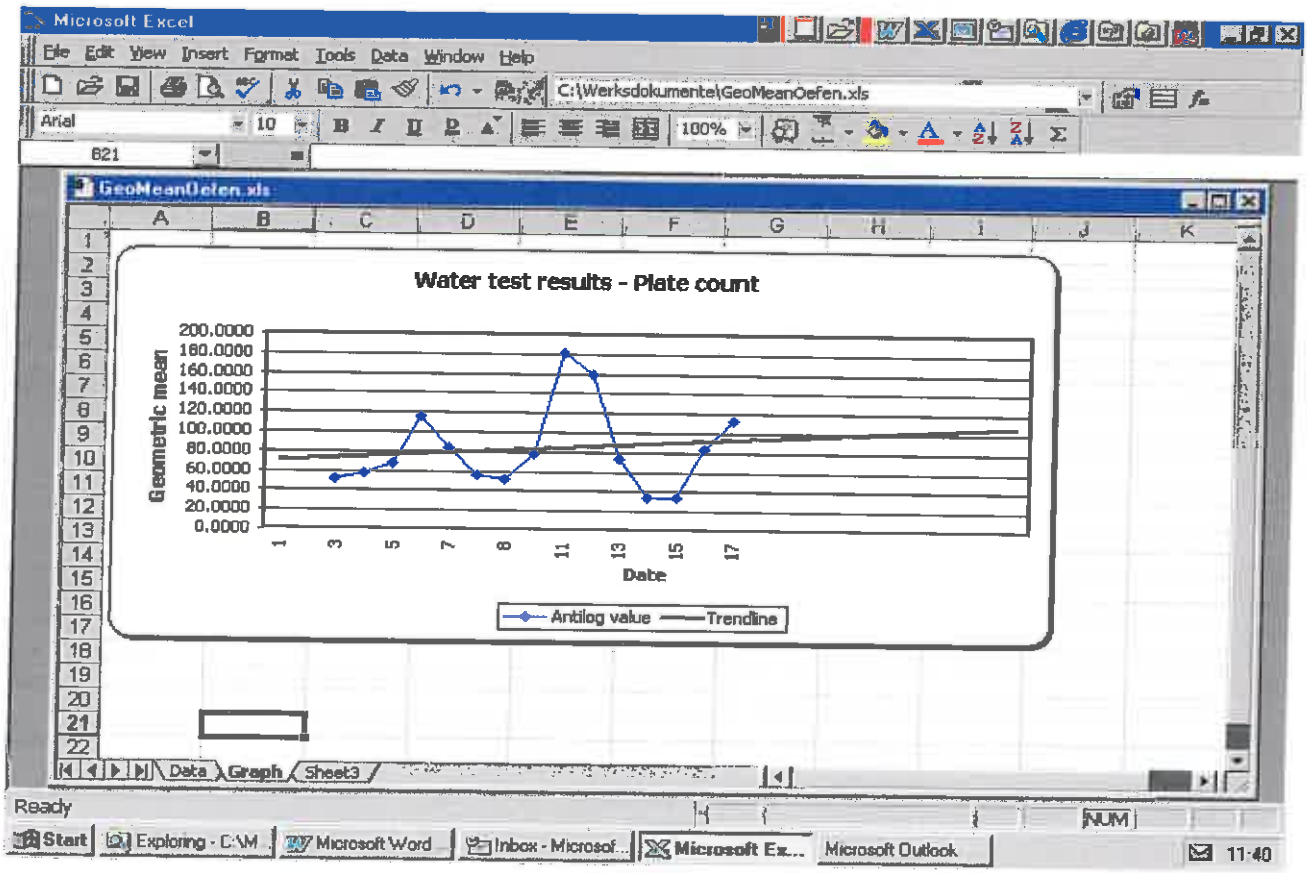
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Geometric mean
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Date
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