



*Be Right™*

# 2014 LABORATORY SYMPOSIUM TNTPLUS™ METHODS AND PROCEDURES

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# WHY IS THE RIGHT LABORATORY METHOD IMPORTANT?

- Lab analysis and trending critical for plant optimization & NPDES reporting
- Daily or weekly sampling and testing bridges the gap if online monitoring is not feasible
  - Ammonia
  - Total Nitrogen
  - Nitrate/Nitrite/TKN
  - Total Phosphorous
- Regulations or Permits
  - Am I in compliance?
  - Nutrient monitoring programs
- Process control
  - Is my plant operating correctly?
  - Issues and troubleshooting



# NUTRIENT & NITROGEN FORMS

## COMMON MEASUREMENT PARAMETERS

Ammonia



Nitrate

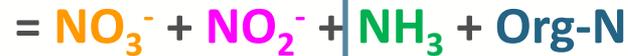


Nitrite



} Most common  
nitrogen compounds

Total Nitrogen



Total Inorganic Nitrogen



Total Kjeldahl Nitrogen



Orthophosphate



Total Phosphorus (TP)



# AMMONIA METHOD WITH MINIMAL SAMPLE PREP

## Method 10205 for Ammonia as N

- Range of 0.015 – 47 mg/L  $\text{NH}_3\text{-N}$
- EPA accepted, equivalent to Method 350.1, 351.1, and 351.2
- 15 minute react time
- Eliminate glassware clean-up and cross-contamination
- Streamlined method can save 5 -10 hours per week in lab



# PHOSPHORUS METHOD WITH MINIMAL SAMPLE PREP

## Method 8190/10210 for orthophosphate and Total P

- Range of 10.0 ppb – 60 mg/L  $\text{PO}_4^{3-}$ - P
- EPA accepted, equivalent to Method 365.3
- Digestion and test completed in one vial
- Unattended Total P digestion at 100°C for 60 minutes
- Eliminate glassware clean-up and cross-contamination
- Streamlined method can save 5 -10 hours per week in lab



# SIMPLIFIED NUTRIENT METHODS

## Total Phosphorus

- 3 ranges that cover 0.010 – 60.0 mg/L PO<sub>4</sub>-P
- EPA compliant

## Nitrate Nitrogen

- 2 ranges that cover 0.23 – 35 mg/L NO<sub>3</sub>-N
- Accepted as ATP

## Nitrite Nitrogen

- 2 ranges that cover 0.015 – 6.0 mg/L NO<sub>2</sub>-N
- EPA compliant

## Total Nitrogen and Simplified Total Kjeldahl Nitrogen (TN and s-TKN)

- Range: 0 – 16 mg/L N
- Easy 1 hr digestion in DRB 200 digital reactor (no special glassware)
- Accepted as ATP

## Ammonia Nitrogen

- 3 ranges that cover 0.015 – 47 mg/L NH<sub>3</sub>-N
- EPA compliant

Significant time, cost, and hazardous waste savings are realized with new, efficient methods for nutrient monitoring



# FOOTPRINT OF TOTAL NITROGEN AND s-TKN DIGESTION BLOCK AND ANALYSIS EQUIPMENT



**No fume hoods, digestion, or distillation units**

# A NEW EFFICIENT METHOD FOR NITRATE MEASUREMENT



## Hach TNTplus Method 10206

- Range of 0.23 – 35 mg/L NO<sub>3</sub><sup>-</sup>-N
- Now approved for reporting in many States
- Results in under 20 minutes with spectrophotometer
- No calibration time required: minimal hands-on time
- Operators can conduct accurate analysis “no voodoo” in making it work – a green chemistry as well



## Demonstration of Method Performance and Lab Capability

Ion Chromatography - 1.0 mg/L Spike

Average % Recovery of 4 Replicates

Precision (SD)

% Recovery

98.5 %

0.58 mg/L

Method 10206 TNTplus 1.0 mg/L Spike

Average % Recovery of 4 Replicates

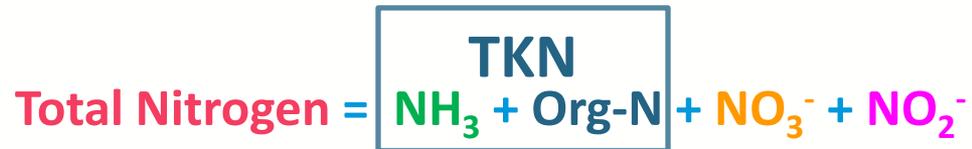
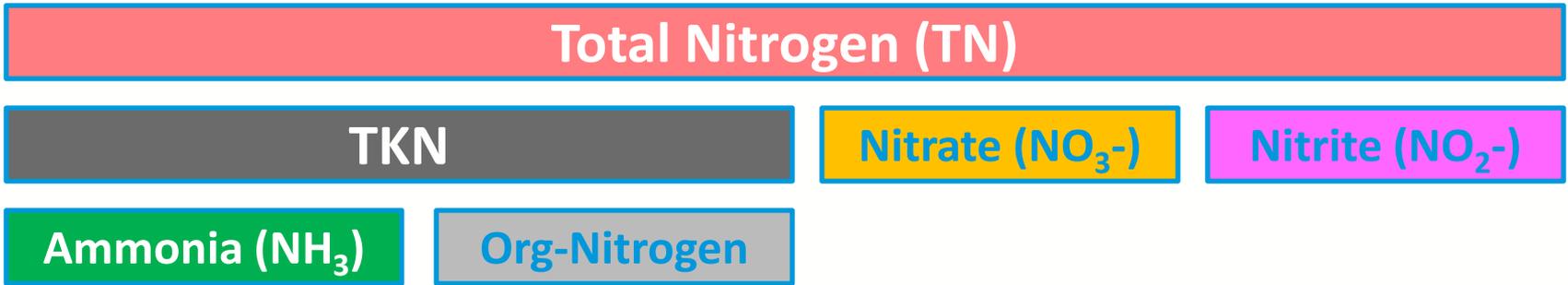
Precision (SD)

% Recovery

95.3 %

0.59 mg/L

# A BRIEF RECAP: FORMS OF NITROGEN



By definition TKN is the sum of organic nitrogen and ammonia.  
Therefore, the above relationship may be re-written as:

$$\begin{aligned} \text{Total Nitrogen} &= \text{TKN} + \text{NO}_3^- + \text{NO}_2^- \\ \text{or} \\ \text{TKN} &= \text{Total Nitrogen} - (\text{NO}_3^- + \text{NO}_2^-) \end{aligned}$$

This calculation allows for a new method for measurement of TKN!

# THE s-TKN™ CALCULATION

- TKN is a component of total nitrogen, and is the sum of organic nitrogen and ammonia. Therefore, the TKN equation may be re-written as:
- **Total Nitrogen** =  $\text{NH}_3$  + **Org-N** +  $\text{NO}_3^-$  +  $\text{NO}_2^-$
- The s-TKN method is based on this nitrogen relationship. s-TKN is defined as the difference between the concentration of TN and Nitrate-Nitrite

$$\text{s-TKN} = \text{Total Nitrogen} - (\text{NO}_3^- + \text{NO}_2^-)$$

## BENEFITS OF THE s-TKN METHOD

- Green dimethylphenol chemistry
- Eliminates the use of hazardous mercury and long digestions
- One hour digestion, no need for fume hood
- Three results in one test: TKN, TN, ( $\text{NO}_2^- + \text{NO}_3^-$ )
- Performance equally effective to other EPA approved TKN methods
- s-TKN Cost per test ~ \$4 per test  
(Traditional TKN Cost - \$25 - > \$50)



# WHERE DO I FIND THE INFORMATION?

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**Express Order Entry**

Part Number	Qty

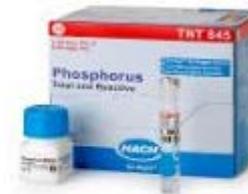
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Phosphorus, Reactive (Ortho) TNTplus  
Product #: TNT846



Compare  
Phosphorus TNTplus, LR Reactive and Total  
Product #: TNT843



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Phosphorus TNTplus, UHR Reactive and Total  
Product #: TNT845

# WHERE DO I FIND A COMPLETE LIST OF THE TNT+ FAMILY?

## Phosphorus TNTplus, LR Reactive and Total

[Overview](#) [Details](#) [Parameter/Reagent](#) [Downloads](#) [Video](#) [Accessories](#) [Similar Products](#)



Product #: TNT843

Quantity

Datasheets/Brochures	Type	Language	Size	Date	Edition
<a href="#">Methods Quick Reference Guide Data Sheet Lit 2353</a>		English US	100 KB	2011-04	Rev 1
<a href="#">TNT Plus® Vial Chemistries Data Sheet LIT2484</a>		English US	176 KB	2012-09	Rev 5

# WHERE DO I FIND A COMPLETE LIST OF THE TNT+ FAMILY?

## Specifications and Ordering Information\*

Product Number	Parameter	Range (mg/L)	# per Package	USEPA Status	Chemical Method	Shelf Life (months)	Storage Temp (°C)
TNT870	Alkalinity, Total	25 to 400 as CaCO <sub>3</sub>	25		Colorimetric	12	15 to 25
TNT848	Aluminum	0.02 to 0.50	24		Chromazurol S	18	15 to 25
TNT830	Ammonia, ULR	0.015 to 2.00 as NH <sub>3</sub> -N	25	Equivalent	Salicylate	18	2 to 8
TNT831	Ammonia, LR	1 to 12 as NH <sub>3</sub> -N	25	Equivalent	Salicylate	18	2 to 8
TNT832	Ammonia, HR	2 to 47 as NH <sub>3</sub> -N	25	Equivalent	Salicylate	18	2 to 8
TNT852	Cadmium <sup>‡</sup> *	0.02 to 0.30	25		Cadion	12	2 to 8
TNT820	COD, ULR	1 to 60	24		Dichromate	12	15 to 25
TNT82006	COD, ULR	1 to 60	144		Dichromate	12	15 to 25
TNT821	COD, LR	3 to 150	25	Approved	Dichromate	60	15 to 25
TNT82106	COD, LR	3 to 150	150	Approved	Dichromate	60	15 to 25
TNT822	COD, HR	20 to 1500	25	Approved	Dichromate	60	15 to 25
TNT82206	COD, HR	20 to 1500	150	Approved	Dichromate	60	15 to 25
TNT823	COD, UHR	250 to 15000	25		Dichromate	30	15 to 25
TNT82306	COD, UHR	250 to 15000	150		Dichromate	30	15 to 25
TNT825	COD, Mercury-Free HR	25 to 1000	25		Dichromate	30	15 to 25
TNT866	Chlorine, Free	0.05 to 2.00	24	Equivalent	DPD	12	2 to 8
TNT867	Chlorine, Free and Total	0.05 to 2.00	24	Equivalent	DPD	12	2 to 8
TNT854	Chromium (VI and Total <sup>†</sup> )	0.03 to 1.00	25	Accepted	Diphenylcarbohydrazide	12	2 to 8
TNT860	Copper <sup>‡</sup>	0.1 to 8.0	25		Bathocuproine	24	15 to 25
TNT858	Iron <sup>‡</sup>	0.2 to 6.0	25	Equivalent	Phenanthroline	30	2 to 8
TNT850	Lead <sup>‡</sup>	0.1 to 2.0	25		PAR	12	15 to 25
TNT890	Metals Prep Set	for Fe, Pb, Cd, Ni digestion	50		Acid Persulfate Digestion	36	15 to 25
TNT856	Nickel <sup>‡</sup>	0.1 to 6.0	25		Dimethylglyoxime	24	15 to 25
TNT835	Nitrate, LR	0.23 to 13.5 as NO <sub>3</sub> -N	25	Approved	Dimethylphenol	24	15 to 25
TNT836	Nitrate, HR	5 to 35 as NO <sub>3</sub> -N	25	Approved	Dimethylphenol	24	15 to 25
TNT839	Nitrite, LR	0.015 to 0.600 as NO <sub>2</sub> -N	25	Equivalent	Diazotization	24	2 to 8
TNT840	Nitrite, HR	0.6 to 6.0 as NO <sub>2</sub> -N	25		Diazotization	24	15 to 25
TNT826	Nitrogen, Total, LR <sup>†</sup>	1 to 16	25		Persulfate Digestion	18	15 to 25
TNT827	Nitrogen, Total, HR <sup>†</sup>	5 to 40	25		Persulfate Digestion	18	15 to 25
TNT828	Nitrogen, Total, UHR <sup>†</sup>	20 to 100	25		Persulfate Digestion	18	15 to 25
TNT880	Nitrogen, Simplified Total Kjeldahl	0 to 16	25		Simplified TKN	18	15 to 25
TNT843	Phosphate, Total <sup>†</sup> and Ortho, LR	0.05 to 1.5 as PO <sub>4</sub> -P	25	Equivalent	Ascorbic Acid	24	15 to 25
TNT844	Phosphate, Total <sup>†</sup> and Ortho, LR	0.5 to 5.0 as PO <sub>4</sub> -P	25	Equivalent	Ascorbic Acid	24	15 to 25
TNT845	Phosphate, Total <sup>†</sup> and Ortho, LR	2 to 20 as PO <sub>4</sub> -P	25	Equivalent	Ascorbic Acid	24	15 to 25
TNT846	Phosphate, Ortho only	1.6 to 30 as PO <sub>4</sub> -P	25		Molybdovanadate	36	15 to 25
TNT864	Sulfate, LR	40 to 150 as SO <sub>4</sub>	25		Turbidimetric	36	15 to 25
TNT865	Sulfate, HR	150 to 900 as SO <sub>4</sub>	25		Turbidimetric	24	15 to 25
TNT872	Volatile Acids	50 to 2500 as CH <sub>3</sub> COOH	25		Esterification	12	5 to 25

<sup>†</sup>Requires digestion.

<sup>‡</sup>As listed, test determines soluble metal. Order Metals Prep Set TNT 890 to determine total metal.

\*Add Calcium Separation Set TNT892 when calcium or magnesium concentrations are higher than 50 mg/L.

\*Specifications subject to change without notice.

# NOW THAT I HAVE FOUND MY TEST, WHERE DO I FIND THE METHOD/PROCEDURE?

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Compare

Phosphorus TNTplus,  
LR Reactive and Total  
Product #: TNT843

## Phosphorus TNTplus, LR Reactive and Total

Overview

Details

Parameter/Reagent

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Similar Products



Product #: TNT843

Quantity

# NOW THAT I HAVE FOUND MY TEST, WHERE DO I FIND THE METHOD/PROCEDURE?

Methods/Procedures	Type	Language	Size	Date	Edition
<a href="#">Hach Methods 10209 and 10210-TNT plus™ 843/844/845. Spectrophotometric Measurement of Phosphorus in Water and Wastewater</a> Comparison of Hach TNTplus Phosphorus and EPA Method 365.3/SM 4500-P. E.		English US	71 KB	2013-05	Revised
<a href="#">Phosphorus, Reactive (Orthophosphate) Method 10209 and Total Phosphorus Method 10210, LR Ascorbic Acid Method using TNTplus™ 843</a> DOC316.53.01124 From the Hach Water Analysis Handbook		English US	317 KB	2014-01	Ed 8
<a href="#">TNTplus™ 843 Phosphorus Total and Reactive (Ortho), Low Range, Short Working Procedure</a> HCPE843B		English US, French, Spanish	217 KB	2005-07	Ed 1

# NOW THAT I HAVE FOUND MY TEST, WHERE DO I FIND THE METHOD/PROCEDURE?



## TNT 843

Phosphorus Total  
Phosphorus Reactive (ortho)

pH of sample: 2 – 10

Temperature of sample/reagent: 15 – 25°C

0.05 – 1.50 mg/L PO<sub>4</sub>-P

0.15 – 4.50 mg/L PO<sub>4</sub>  
Low Range

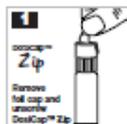


Special Notes (For more detailed information: HACH Procedure Manual)

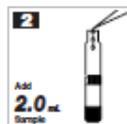
- Please read **Safety Advice** and **Expiration Date** on package.
- **Range of applications:** For wastewater, drinking water, boiler water, surface water and process analysis.
- If test is not performed at the **recommended temperature** an **incorrect result** may be obtained.
- A blue color will develop if phosphorus is present.



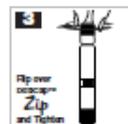
For Phosphorus Total perform steps 1 – 9. For Phosphorus Reactive (ortho) perform steps 2 and 6 – 9.



1 Carefully remove the foil from the DosiCap™ Zip and unscrew cap.



2 Pipet 2.0 mL of sample into the vial.



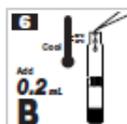
3 Screw the DosiCap™ Zip back on.



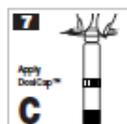
4 Shake firmly 2 – 3 times.



5 Heat one hour at 100°C in the reactor.



6 Pipet into the cooled vial: 0.2 mL Reagent B. Close Reagent B immediately after use.



7 Screw a gray DosiCap™ C onto the vial.



8 Invert 2 – 3 times. After 10 minutes invert again 2 – 3 times.



9 Read Thoroughly clean the outside of the vial and insert it into the photometer. The barcode is identified, an automatic evaluation is carried out after the vial is inserted.

Principle	Interferences		
Phosphate ions react with molybdate and antimony ions in an acidic solution to form an antimony phosphomolybdate complex, which is reduced by ascorbic acid to phosphomolybdenum blue.	The ions listed below have been individually checked up to the given concentrations and do not cause interferences. We have not determined cumulative effects and the influence of other ions. Measurement results can be verified using sample dilutions or standard additions.		
	5000 mg/L: SO <sub>4</sub> <sup>2-</sup>	250 mg/L: Cu <sup>2+</sup>	5 mg/L: Sn <sup>4+</sup> , Hg <sup>2+</sup>
	2000 mg/L: Cl <sup>-</sup>	100 mg/L: Mg <sup>2+</sup>	2.5 mg/L: Ag <sup>+</sup> , Pb <sup>2+</sup>
	1000 mg/L: K <sup>+</sup> , Na <sup>+</sup>	50 mg/L: Co <sup>2+</sup> , Fe <sup>2+</sup> , Fe <sup>3+</sup> , Zn <sup>2+</sup> , Cu <sup>2+</sup> , Ni <sup>2+</sup> , I <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , Cd <sup>2+</sup> , Ni <sup>4+</sup> , Mn <sup>2+</sup> , Al <sup>3+</sup> , CO <sub>3</sub> <sup>2-</sup> , SO <sub>3</sub> <sup>2-</sup>	1 mg/L: Cr <sup>3+</sup>
500 mg/L: NO <sub>2</sub> <sup>-</sup>		0.5 mg/L: Cr <sup>6+</sup>	

Note: For more detailed information see the HACH Procedure Manual.

# WHERE DO I FIND SAFETY INFORMATION?



## Format/Language

(choose languages in a single format for each catalog number entry)

**OSHA (USA)**  English  Spanish

**Brazilian**  Portuguese

**WHMIS (Canada)**  English  French

**EEC (Europe)**  Dutch  English  French  Danish  
 German  Italian  Spanish  Swedish

**Hach Catalog Number:** (Please enter the complete catalog number.)

TNT843

**Status:** ready for request

# WHERE DO I FIND SAFETY INFORMATION?

Current Request List: (count: )

Save	Catalog Number Entered	Related Catalog Number	Format	Language	Description
<input checked="" type="checkbox"/>	TNT843	TNT843C	ROWGHS	English	Phosphorus LR TNT Reagent C

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## QUESTIONS?

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