



# REAGECON TURBIFORM™ STABILISED FORMAZIN TURBIDITY STANDARDS

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# Reagecon Turbiform™

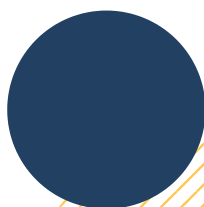
## Stabilised Formazin Turbidity Standards

Like all comparative analytical measurements, a nephelometric turbidity meter must be routinely calibrated, with a light scattering standard of known turbidimetric value. Such a standard, should fulfil several criteria:

- Provide traceability.
- Demonstrate the accuracy of results obtained.
- Calibrate the equipment and methodology.
- Monitor the user performance.
- Validate the test method.
- Facilitate comparability i.e. to ensure that when the correct procedures have been followed the same analysis of the same materials will produce results that agree with each other whenever they are performed and wherever they are performed.

These standards and reference materials must fulfil several other criteria that includes:

- Characterised, produced and tested in a technically competent manner.
- Material be homogenous and of proven stability.
- Material needs to be certified and have computed, through an uncertainty budget, a known uncertainty of measurement.





In 1996 Barron(1)(2) conducted a detailed critical review of the only two standards available to analysts that were recognised and approved by such regulatory bodies as US EPA, Standard Methods, ASTM and other regulatory bodies. These standards were formazin and AMCO APEA-1. A summary of the different characteristics, features and benefits were summarised by Barron(1)(2) and are presented here in Table 1 (with permission).

## A Summary of Characteristics of AMCO APEA-1 and Formazin Turbidity Standards

Feature	AMCO APEA-1	Formazin
<b>Toxicity</b>	Non-toxic. No special handling or disposal requirements.	Very toxic, contains a known carcinogen. Requires special handling and disposal.
<b>Particle shape &amp; size</b>	Well defined spherical shape. Mean diameter is 0.06µm with a distribution between 0.01 and 0.2µm.	Irregular shape and distribution. Mean diameter is 3µm with a distribution between 1 and 20µm.
<b>Shelf life</b>	Does not deteriorate or settle out. A long stable shelf life at all concentrations.	Flocculates and deteriorates. Lower concentrations change value within days, or hours, after preparation.
<b>Particle suspension</b>	Particles stay in suspension. Mixing is discouraged as it entrains air.	Particles settle quickly, suspension must be continuously mixed. Mixing induces shearing.
<b>Traceability</b>	Certified traceable to NIST Reference Material 1690	Non traceable
<b>Precision (batch to batch)</b>	Mean of SD's $0 \pm 0.00$	Mean of SD's $0.9 \pm 0.2$
<b>Inter-instrument reproducibility</b>	$0.5 \pm 0.0$	$0.8 \pm 0.2$
<b>Stability</b>	0.1 – 4000 NTU (1 year)	4000 NTU (3 months). Need for dilutions to be prepared daily or weekly.
<b>Accuracy</b>	$\pm 1\%$ (all values)	$\pm 10\%$ (4000 NTUs) up to $\pm 30\%$ for dilute working standards.

Table 1



Since the 1996 publications, significant additional work on Turbidity Standards was carried out by Sadar (1998)(3) and Sadar et al (1998)(4). The principle thrust of this very successful work was to eliminate such shortcomings in formazin standards as instability, toxicity and high uncertainty of measurement, particularly in low NTU formazin standards. This work resulted in the commercialisation of the Stablcal™ Stabilised Formazin range by Hach®.

In the meantime, the Reagecon Research and Development team have developed a new proprietary synthetic process, that produces a family of products, that combine most of the positive attributes of the formazin and AMCO APEA-1 ranges of standards, whilst eliminating most of the shortcomings. Most importantly, this new process, does not interfere adversely with the status of formazin as the recognised primary standard, because the new material is derived from the same 4000 NTU formazin standard base, and all of the individual products are dilutions of that base material.

### **Reagecon Turbiform™ Stabilised Formazin Turbidity Standards are:**

- Ready to use at 13 different NTU values
- Completely safe – not subject to any regulations
- EPA approved
- Stable (at least 2 years shelf life) for the higher values
- Accurate -  $\pm 5\%$  at any value
- Exhibit a wide range of particle sizes and shapes (similar to formazin), that have a particle size distribution of 1 to 20  $\mu\text{m}$ , which is similar to the particle size distribution found in most sample types
- The products save labour costs, time, eliminate hazards and require minimum handling in the users laboratory
- Can be used to calibrate, control, validate or qualify almost any make or model of instrument





# Comparison Between Reagecon Turbiform™ Stabilised Formazin and Formazin Turbidity Standards

Features	Turbiform™	Formazin
<b>Toxicity</b>	Non-toxic. No special handling or disposal requirements.	Very toxic, contains a known carcinogen. Requires special handling and disposal.
<b>Particle shape &amp; size</b>	Irregular shape and distribution. Mean diameter is 3µm with a distribution of between 1 micron and 20 microns.	Irregular shape and distribution. Mean diameter is 3µm with a distribution of between 1 micron and 20 microns.
<b>Particle suspension</b>	Does not deteriorate, but like all colloidal suspensions, it does settle out. User instructions must be followed meticulously.	Flocculates and deteriorates. Lower concentrations change value within days or hours after preparation.
<b>Traceability</b>	Certified traceable to NIST Reference Material 1690 and 1691.	Certified traceable to NIST Reference Material 1690 and 1691.
<b>Stability</b>	0 – 1 NTU: 1 Year 10 – 4000 NTU: 2 Years	4000 NTU: 3 Months For lower values, dilutions need to be prepared daily or weekly.
<b>Accuracy</b>	± 5% (all values)	4000 NTU ± 10% Dilute working standards up to ± 30%

Table 2





# Reagecon Turbiform™ Stabilised Formazin Turbidity Standards

NTU Value	100mls	500mls	Shelf Life
0	RSTFMZ001	RSTFMZ005	1 Year
0.1	RSTFMZ0101	RSTFMZ0105	1 Year
0.3	RSTFMZ0301	RSTFMZ0305	1 Year
0.5	RSTFMZ0501	RSTFMZ0505	1 Year
1.0	RSTFMZ101	RSTFMZ105	1 Year
10	RSTFMZ1001	RSTFMZ1005	2 Years
20	RSTFMZ2001	RSTFMZ2005	2 Years
40	RSTFMZ4001	RSTFMZ4005	2 Years
100	RSTFMZ10001	RSTFMZ10005	2 Years
200	RSTFMZ20001	RSTFMZ20005	2 Years
800	RSTFMZ80001	RSTFMZ80005	2 Years
1000	RSTFMZ1M01	RSTFMZ1M05	2 Years
4000	RSTFMZ4M01	RSTFMZ4M05	2 Years



## Bibliography

- (1) Barron. J., (1996). "Turbidity Standards and Reference Materials". Self published, Reagecon Technical Paper. Available from Reagecons ecommerce facility and knowledge centre [www.reagecon.com](http://www.reagecon.com)
- (2) Barron. J., Papacosta. K., (1997). Poster presentation, Pittcon Conference, New Orleans, USA
- (3) Sadar. M., (1998). "Turbidity Standards". Self published, Hach company document.
- (4) Sadar. M., Foster. A., Gustafson. D., Schlegel. J., (1998). "Safety of Formazin and Stablcal™ Stabilised Formazin as Primary Turbidity Standards". Technical note, Hach™ Company, Loveland, Colorado.





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