Australian Government
Department of Industry, Science and Resources

National Measurement Institute

NATA
WORLD RECOGNISED ACCREDITATION

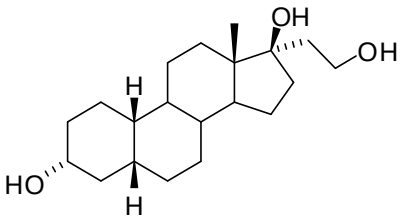
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA S015: 17α-Hydroxyethyl-5β-estrane-3α,17β-diol

Report ID: S015.2025.01 (Ampouled 130326)

Chemical Formula: $C_{20}H_{34}O_3$

Molecular Weight: 322.5 g/mol



Certified value

Batch No.	CAS No.	Mass per ampoule
12-S-03	1245704-40-8	937 ± 8 μg

The uncertainty has been calculated according to ISO Guide 35 and is stated at the 95% confidence limit (k = 2).

Synonyms: Norpregnanetriol.

Expiration of certification: The property values are valid till 16 July 2035, ten years from the date of re-certification provided the **unopened** material is handled and stored in accordance with the recommendations below. The material as issued in the unopened container and stored as recommended below should be suitable for use beyond this date, subject to confirmation of batch stability from the issuing body. The expiry date/shelf life does not apply to ampoules that have been opened. In such cases it is recommended that the end-user conduct their own in-house stability trials.

Description: The compound is supplied as a dried aliquot in a sealed ampoule under an atmosphere of argon. The CRM is intended for a single use to prepare a standard solution containing S015. This material was sourced from an external supplier and certified for identity and purity by NMI Australia.

Intended use: This certified reference material is suitable for use as a primary calibrator.

Instructions for use: Open the ampoule and carefully rinse the interior at least three times with a suitable organic solvent (e.g. methanol). This will transfer 937 ± 8 μg of anhydrous 17α-hydroxyethyl-5β-estrane-3α,17β-diol. The mass of analyte in each ampoule is calculated from the assigned purity of the bulk and the concentration of bulk material in a stock solution used to prepare the ampoules.

Recommended storage: When not in use, this material should be stored at or below 4 ºC in a closed container in a dry, dark area.

Metrological traceability: The certified purity value is traceable to the SI unit for mass (kg) through Australian national standards via balance calibration. In the mass balance approach all impurities are quantified as a mass fraction and subtracted from 100%.

Stability: This material has demonstrated stability over a minimum period of ten years. The measurement uncertainty at the 95% confidence interval includes a stability component which has been estimated from annual stability trials. The long-term stability of the compound in solution has not been examined.

Homogeneity assessment: The homogeneity of the material was assessed using purity assay by GC-FID on seven randomly selected ampoules of the material. The material was judged to be sufficiently homogeneous at this level of sampling as the variation in analysis results between samples was not significantly different at a 95% confidence level from that observed on repeat analysis of the same sample.

Safety: Treat as hazardous substance. Use appropriate work practices when handling to avoid skin or eye contact, ingestion or inhalation of dust. Refer to the provided safety data sheet.

S. R. Davies

Dr Stephen R. Davies,
Team Leader,
Chemical Reference Materials, NMI.
18 July 2025

This report supersedes any issued prior to 18 July 2025.

NATA Accreditation No. 198 / Corporate Site No. 14214.

Legal notice: Terms and Conditions associated with the provision of this reference material can be found on the NMIA website.

Characterisation Report:

GC-FID:	Instrument:	Varian CP3800
	Column:	TG-17 or VF-1 or DB-17, 30 m × 0.32 mm I.D. × 0.25 μm
	Program:	200 °C (1 min), 10 °C/min to 250 °C (8 min), 20 °C/min to 300 °C (3 min)
	Injector:	250 °C
	Detector Temp:	320 °C
	Carrier:	Helium
	Split ratio:	20/1
	Relative mass fraction of main component as the *tris*-TMS derivative:	
	Initial analysis:	Mean = 99.2%, s = 0.01% (5 ampoules in duplicate, April 2013)
	Re-analysis:	Mean = 98.8%, s = 0.06% (5 ampoules in duplicate, May 2014)
	Re-analysis:	Mean = 97.9%, s = 0.3% (5 ampoules in duplicate, June 2015)
	Re-analysis:	Mean = 98.6%, s = 0.14% (5 ampoules in duplicate, June 2018)
	Re-analysis:	Mean = 98.6%, s = 0.25% (5 ampoules in duplicate, May 2021)
	Re-analysis:	Mean = 98.8%, s = 0.12% (5 ampoules in duplicate, July 2025)

The following analytical data was obtained on the bulk material subsequently used in the preparation of the ampoules.

The identity was confirmed by a range of spectroscopic techniques, NMR, IR and MS. The certified purity value was obtained by mass balance from a combination of traditional analytical techniques, including GC-FID, thermogravimetric analysis, Karl Fischer analysis and ^{1}H NMR spectroscopy. The purity value is calculated as per Equation 1.

$$\text{Purity} = (100\ \% - I_{ORG}) \times (100\ \% - I_{VOL} - I_{NVR}) \qquad \text{Equation 1}$$

I_{ORG} = Organic impurities of related structure, I_{VOL} = volatile impurities, I_{NVR} = non-volatile residue.

Supporting evidence is provided by qualitative elemental microanalysis.

GC-FID:	Instrument:	Varian CP3800
	Column:	TG-17, 30 m × 0.32 mm I.D. × 0.25 μm
	Program:	200 °C (1 min), 10 °C/min to 250 °C (8 min), 20 °C/min to 300 °C (3 min)
	Injector:	250 °C
	Detector Temp:	320 °C
	Carrier:	Helium
	Split ratio:	20/1
	Relative mass fraction of main component as the *tris*-TMS derivative:	
	Initial analysis:	Mean = 99.2%, s = 0.07% (10 sub samples in duplicate, September 2012)
HPLC:	Instrument:	Shimadzu Binary pump LC-20AB, SIL-20 A HT autosampler
	Column:	Alltima C-18, 5 μm (4.6 mm x 150 mm)
	Column oven:	30 °C
	Mobile Phase:	Acetonitrile/Milli-Q water (40:60)
	Flow rate:	1 mL/min
	Detector:	ELSD
	Relative mass fraction of main component:	
	Initial analysis:	Mean = 99.4%, s = 0.15% (7 sub samples in duplicate, August 2012)
Thermogravimetric analysis:		Volatile content 4.1% and non volatile residue < 0.2% mass fraction (July 2012)
Karl Fischer analysis:		Moisture content 5.2% mass fraction (July 2012)

Spectroscopic and other characterisation data

ESI-MS:	Instrument:	Micromass Quatro Micro
	Operation:	Negative ion mode, direct infusion at 5 μL/min
	Ionisation:	ESI spray voltage at 3.2 kV negative ion
	EM voltage:	650 V
	Cone voltage:	20 V
	Peak:	321 $(M-H)^-$ m/z
GC-MS:	Parent compound:	
	Instrument:	Agilent 6890/5973
	Column:	TG1-MS, 30 m x 0.25 mm I.D. x 0.25 μm
	Program:	260 °C (15 min), 20 °C/min to 300 °C (5 min)
	Injector:	250 °C Transfer line temp: 280 °C
	Carrier:	Helium, 1.0 mL/min Split ratio: 20/1
	Tris-TMS derivative:	
	Instrument:	Shimadzu GC-2010 plus/GCMS-QP2010 Ultra
	Column:	HP Ultra 1, 17 m × 0.22 mm I.D. × 0.11 μm
	Program:	183 °C (0.2 min), 3 °C/min to 234 °C, 10 °C/min to 265, 30 °C/min to 310 (3 min)
	Injector:	250 °C
	Transfer line temp:	250 °C
	Carrier:	Helium, 1.0 mL/min
	Split ratio:	15/1
	The retention times of the parent compound and *tris*-TMS derivative are reported along with the major peaks in the mass spectra. The latter are reported as mass/charge ratios and (in brackets) as a percentage relative to the base peak.	
	Parent (9.4 min):	322 (M^+, 2), 304 (13), 286 (29), 277 (34), 259 (49), 241 (23), 232 (44), 216 (77), 201 (71), 147 (40), 133 (43), 121 (54), 107 (42), 101 (100), 91 (72), 81 (65) *m/z*
	Tris-TMS (15.7 min):	538 (M^+, < 1), 421 (37), 331 (33), 304 (4), 268 (7), 245 (73), 241 (30), 232 (17), 217 (61), 199 (7), 173 (5), 155 (49), 147 (24), 103 (76), 73 (100) *m/z*
IR:	Instrument:	Biorad FTS3000MX FT-IR
	Range:	4000-400 cm^{-1}, KBr powder
	Peaks:	3496, 3253, 2928, 2870, 1443, 1362, 1062, 1042, 953, 841 cm^{-1}
^{1}H NMR:	Instrument:	Bruker Avance III-400
	Field strength:	400 MHz
	Solvent:	DMSO-d_6 (2.50 ppm)
	Spectral data:	δ 0.74 (3H, s), 0.93-1.73 (22H, m), 1.78-1.88 (2H, m), 3.37 (1H, m), 3.57-3.70 (2H, m), 4.11 (1H, s), 4.40-4.44 (2H, m) ppm
^{13}C NMR:	Instrument:	Bruker Avance III-400
	Field strength:	101 MHz
	Solvent:	DMSO-d_6 (39.5 ppm)
	Spectral data:	δ 14.2, 23.4, 25.0, 25.8, 29.5, 31.3, 31.4, 33.5, 35.3, 36.3, 38.1, 38.5, 42.4, 46.3, 49.0, 58.1, 69.8, 81.8 ppm
Microanalysis:	Found:	C = 70.8%; H = 10.9% (July 2012)
	Calculated:	C = 74.5%; H = 10.6% (Calculated for $C_{20}H_{34}O_3$)
	Calculated:	C = 70.1%; H = 10.5% (Calculated for $C_{20}H_{34}O_3$ + 5.2% water)