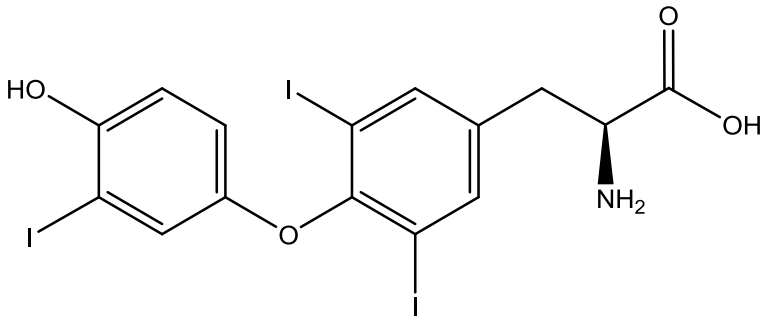
Certificate of Analysis

ISO GUIDE 34
ANAB Cert# AR-1470

ISO/IEC 17025
ANAB Cert# AT-1467

LIOTHYRONINE

CERTIFIED REFERENCE MATERIAL



CERTIFIED PURITY: 99.0%, U_{crm} = ±0.2% k =2
(Mass Balance/ as is basis)

NOMINAL PACKAGE SIZE: 500mg

CATALOG #: PHR1504 **LOT #:** LRAB0433

CERTIFICATE VERSION: LRAB0433.1 **ISSUE DATE:** 06 June 2016
Note: Certificates may be updated due to Pharmacopeial Lot changes or the availability of new data.
Check our website at: www.sigma-aldrich.com *for the most current version.*

CRM EXPIRATION: 31 December 2020 (Proper Storage and Handling Required).

RECEIPT DATE: _____
Note: this space is provided for convenience only and its use is not required.

STORAGE: Store in a Refrigerator/Protect from Light, keep container tightly closed. Attachment of a 20 mm aluminum crimp seal recommended for unused portions.

CHEMICAL FORMULA: $C_{15}H_{12}I_3NO_4$ **MW:** 650.98

PHYSICAL DESCRIPTION: White Solid in Amber Vial **CAS #:** 6893-02-3

HAZARDS: Read Safety Data Sheet before using. All chemical reference materials should be considered potentially hazardous and should be used only by qualified laboratory personnel.

INSTRUCTIONS FOR USE: Do not dry, use on the as is basis. The internal pressure of the container may be slightly different from the atmospheric pressure at the user's location. Open slowly and carefully to avoid dispersion of the material. This material is intended for R&D use only. Not for drug, household or other uses.

TRACEABILITY ASSAY

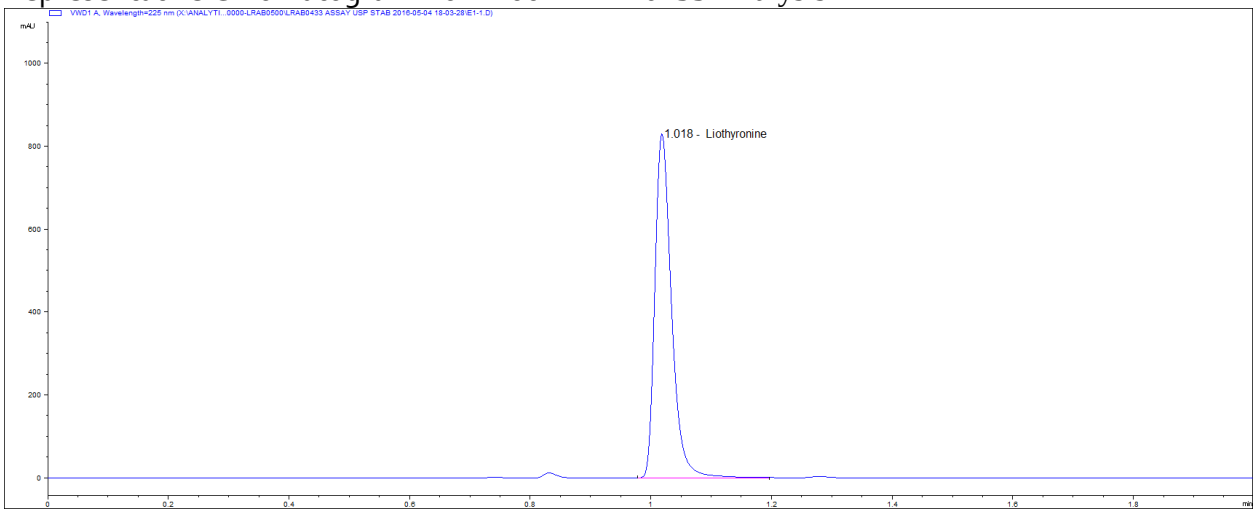
Comparative assay demonstrates direct traceability to Pharmacopeial Standards

ASSAY vs. USP REFERENCE STANDARD (as is basis)

ASSAY VALUE	vs. USP LOT
98.1%	**O1L383**
	Labeled Content = 0.997mg/mg

METHOD: HPLC (ref.: Adapted from Liothyronine Sodium, USP 38)
Column: Ascentis Express ES-CN 4.6 x 100mm, 2.7µm
Mobile Phase: Water, Acetonitrile, Phosphoric Acid (600:400:0.5)
Flow Rate: 1.5mL/min
Column Temperature: 25ºC
Injection: 3µL
Detector: 225nm

Representative Chromatogram from Lot: LRAB0433 Analysis



PURITY DETERMINATION BY MASS BALANCE

METHOD: HPLC (ref.: Adapted from Liothyronine Sodium, USP 38)
Column: Ascentis Express ES-CN 4.6 x 100mm, 2.7µm
Mobile Phase A: 0.5% H_3PO_4 in Water
Mobile Phase B: 0.5% H_3PO_4 in Acetonitrile

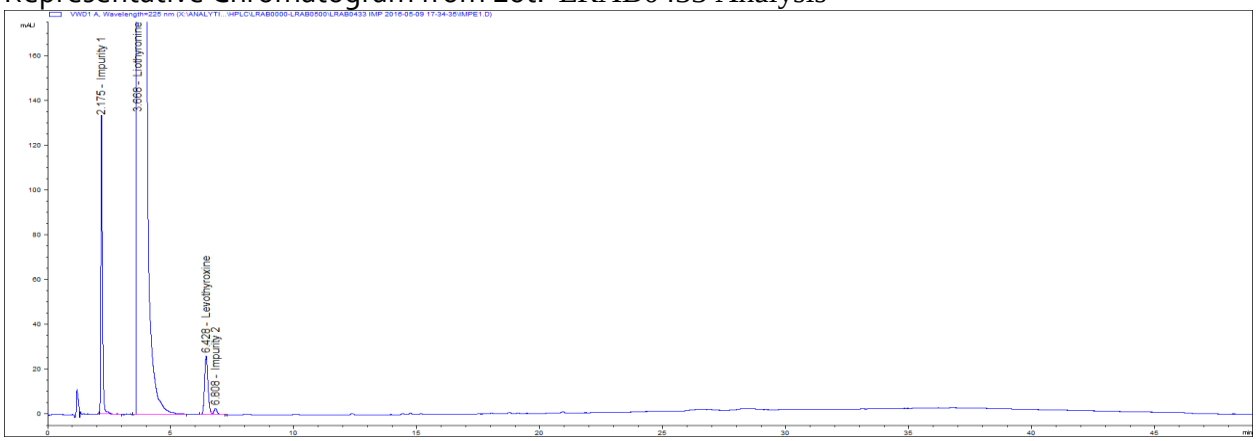
Time (min)	% A	% B
0-8.5	70	30
8.5-35	70-20	30-80
35-44	20	80
44.1-50	70	30

Flow Rate: 1.5mL/min
Column Temperature: 25ºC
Injection: 3µL
Detector: 225nm
Impurities Detected:

Impurity 1:	0.01%	Levothyroxine:	0.8%
Impurity 2:	0.004%		

Total Impurities: **0.8%**

Representative Chromatogram from Lot: LRAB0433 Analysis



RESIDUAL SOLVENTS
Method: GC-MS Headspace (ref.: Adapted from Residual Solvents <467>, USP36)
Column: DB-1301
Carrier gas: He
Flow: 1.2mL/min
Split Ratio: 1:5
Injection/Temperature: 1mL/250°C
Temperature Program: 40°C for 20min, 10°C/min to 240°C, hold 20min

Solvents Detected: None

WATER DETERMINATION
Method: Karl Fisher titration
Mean of three measurements, Water Content = **0.1%**

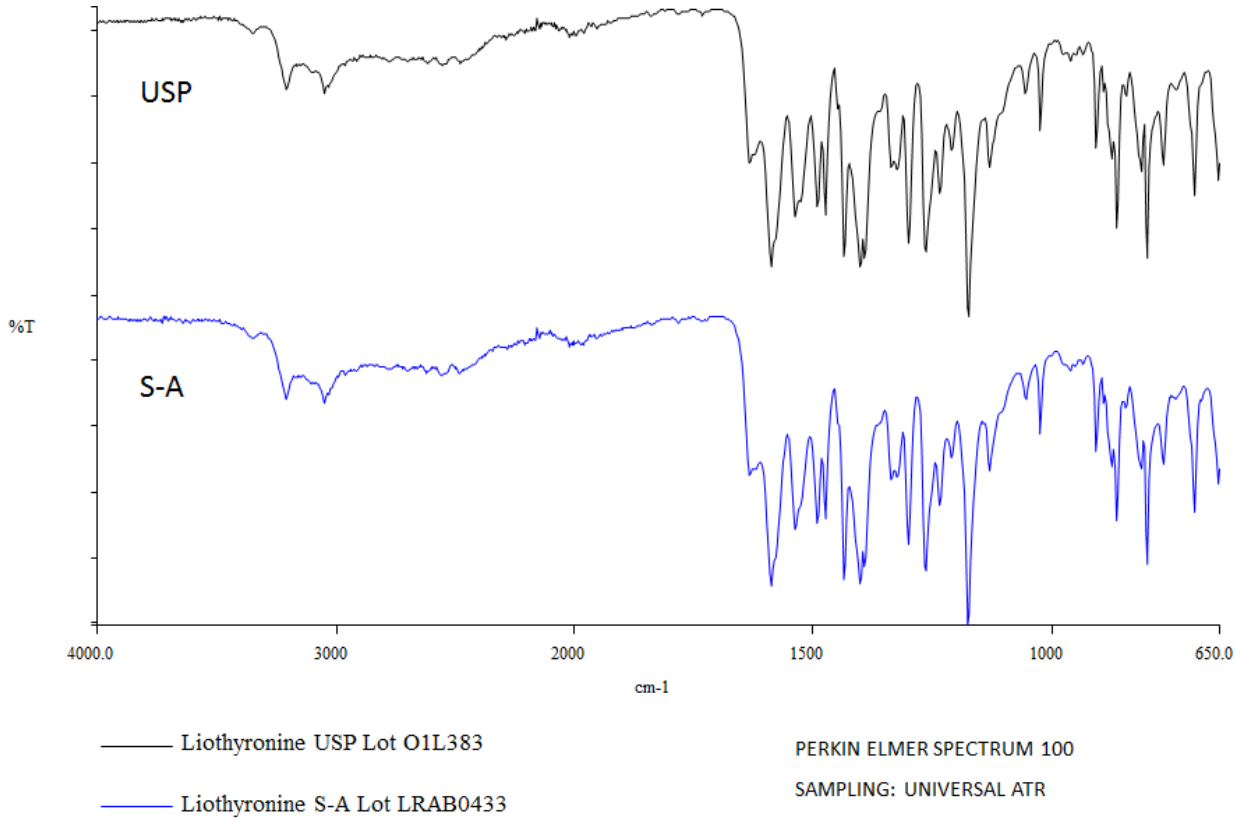
RESIDUE ANALYSIS
Method: Sulfated Ash
Sample Size: 0.1g
Mean of three measurements, Residue = **None**

CERTIFIED PURITY BY MASS BALANCE [100% - Impurities (normalized)]

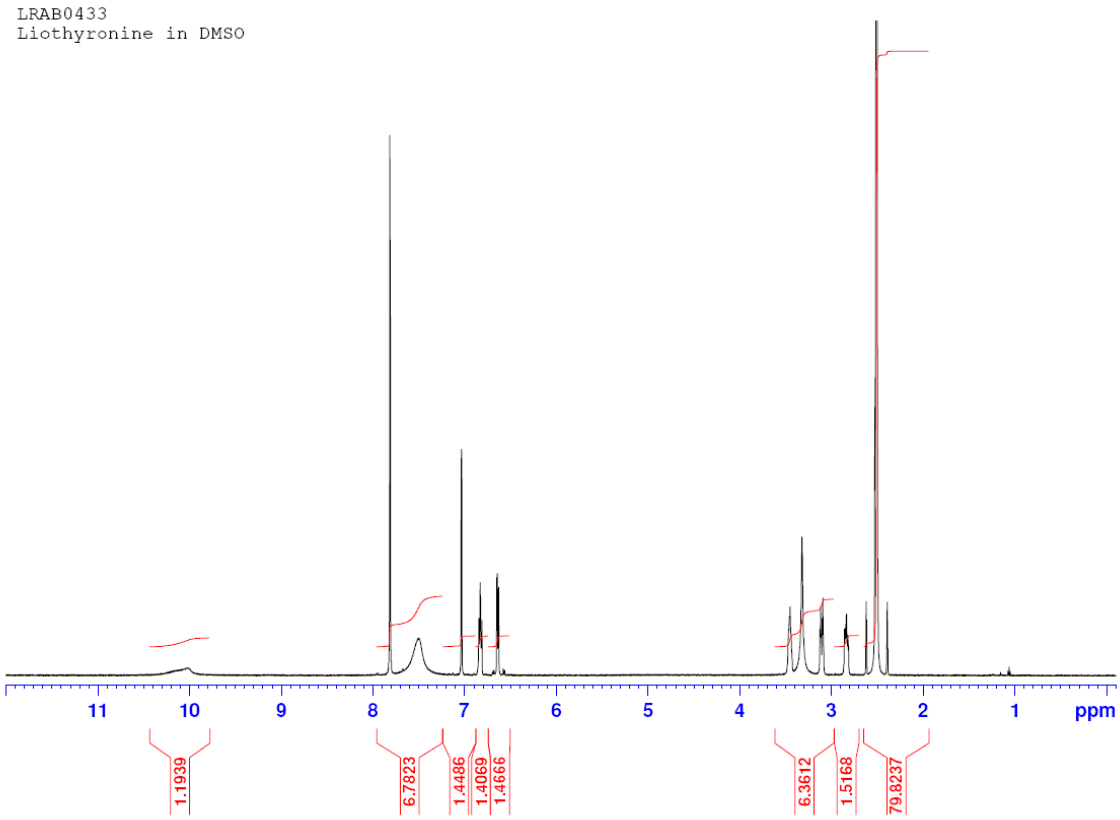
99.0% U_{crm} = ±0.2%, k =2
(as is basis)

IDENTIFICATION TESTS

INFRARED SPECTROPHOTOMETRY (Comparative identification analysis demonstrates direct traceability to Pharmacopeial standards)



^{1}H NMR (Data provided by an external laboratory; not in scope of accreditation)



Consistent with structure

HOMOGENEITY ASSESSMENT

Homogeneity was assessed in accordance with ISO Guide 35. Completed units were sampled using a random stratified sampling protocol. The results of chemical analysis were then compared by Single Factor Analysis of Variance (ANOVA). The uncertainty due to homogeneity was derived from the ANOVA. Heterogeneity was not detected under the conditions of the ANOVA.

Analytical Method: HPLC Sample size: ~20mg

UNCERTAINTY STATEMENT

Uncertainty values in this document are expressed as Expanded Uncertainty (U_{crm}) corresponding to the 95% confidence interval. U_{crm} is derived from the combined standard uncertainty multiplied by the coverage factor k, which is obtained from a *t*-distribution and degrees of freedom. The components of combined standard uncertainty include the uncertainties due to characterization, homogeneity, long term stability, and short term stability (transport). The components due to stability are generally considered to be negligible unless otherwise indicated by stability studies.

STABILITY ASSESSMENT

Significance of the stability assessment will be demonstrated if the analytical result of the study and the range of values represented by the Expanded Uncertainty do not overlap the result of the original assay and the range of its values represented by the Expanded Uncertainty. The method employed will usually be the same method used to characterize the assay value in the initial evaluation.

Long Term Stability Evaluation - An assessment, or re-test, versus a Compendial Reference Standard may be scheduled, within the 3 year anniversary date of a release of a Secondary Standard. The re-test interval will be determined on a case-by-case basis.

Short Term Stability Study - It is useful to assess stability under reasonably anticipated, short term transport conditions by simulating exposure of the product to humidity and temperature stress. This type of study is conducted under controlled conditions of elevated temperature and humidity.

QC Supervisor

QA Supervisor

APPENDIX

Original Release Date: 06 June 2016

Manufactured and certified by Sigma-Aldrich RTC, Inc.
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ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY

ANAB ACCREDITED ISO GUIDE 34 REFERENCE MATERIAL PRODUCER