510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY TEMPLATE

A. 510(k) Number:

k162200

B. Purpose for Submission:

New Device

C. Measurand:

Magnesium

D. Type of Test:

Quantitative, photometric assay

E. Applicant:

Randox Laboratories LTD

F. Proprietary and Established Names:

Randox RX Daytona Plus Magnesium (MG)

G. Regulatory Information:

Product Code	Classification	Regulation Section	Panel
JGJ	I, Reserved	862.1495 Magnesium test system	Clinical Chemistry (75)

H. Intended Use:

1. Intended use(s):

   The Randox RX Daytona Plus Magnesium (MG) test system is intended for the quantitative in vitro determination of magnesium concentration in serum, urine and lithium heparin plasma. Magnesium measurements are used in the diagnosis and treatment of hypomagnesemia (abnormally low levels of magnesium) and hypermagnesemia (abnormally high levels of magnesium).

2. Indication(s) for use:

   See intended use(s) above.

3. Special conditions for use statement(s):

   For prescription use only.

4. Special instrument requirements:

   RX Daytona Plus Chemistry Analyzer

I. Device Description:

The Randox RX Daytona Plus Magnesium (MG) assay consists of a ready to use reagent solution R1 Color Reagent with initial concentrations of 0.1 mmol/L xylidyl blue, 0.2 mmol/L Tris buffer, 77 mmol/L potassium carbonate and 0.04 mmol/L EGTA.

J. Substantial Equivalence Information:

1. Predicate device name(s):

   Siemens Magnesium (MG)

2. Predicate 510(k) number(s):

   k991576

3. Comparison with predicate:

Similarities		
Item	Siemens Magnesium (k991576) (Predicate Device)	Randox RX Daytona Plus Magnesium (k162200) (Candidate Device)
Intended Use	For the quantitative in vitro determination of magnesium concentration in human plasma, serum and urine.	Same
Specimen Types	Serum, plasma and urine	Same
Assay Principle	Colorimetric method	Same
Storage (Unopened)	Reagents are stable up to the expiry date when stored unopened at +2 to +8°C	Same

Differences		
Item	Siemens Magnesium (k991576) (Predicate Device)	Randox RX Daytona Plus Magnesium (k162200) (Candidate Device)
Measuring Range	Serum 0.7 - 5.0 mg/dL Urine 0.5 - 25.0 mg/dL	Serum 0.74 - 4.95 mg/dL Urine 1.01 - 23.82 mg/dL
Calibrators	Siemens Chemistry Calibrator REF 09784096 (T03-1291-62)	0.9% NaCl solution and Randox Calibration Sera Level 3 are recommended for calibration
Traceability	Traceable to an atomic absorption method using reference material form NIST	Magnesium reference material NIST 909b
Reagent Composition	Reagent 1 Tris buffer 500 mmol/L Sodium azide 0.09% Reagent 2 Xylidyl blue 0.28 mmol/L Sodium azide 0.09%	R1. Colour Reagent Xylidyl blue 0.1 mmol/L Tris Buffer 0.2 mmol/L Potassium Carbonate 77 mmol/L EGTA 0.04 mmol/L

K. Standard/Guidance Document Referenced (if applicable):

CLSI Guideline, EP07-A2 *Interference Testing in Clinical Chemistry; Approved Guideline - Second Edition*

CLSI Guideline, EP05-A3 Evaluation *of Precision of Quantitative Measurement Procedures; Approved Guideline- Third Edition*

CLSI Guideline, EP06-A *Evaluation of the Linearity of Quantitative Measurement Procedures: A Statistical Approach; Approved Guideline*

CLSI Guideline, EP09-A3 *Measurement Procedure Comparison and Bias Estimation Using Patient Samples; Approved Guideline – Third Edition*

CLSI Guideline, EP17-A2 *Evaluation of Detection Capability for Clinical Laboratory Measurement Procedures: Approved Guideline- Second Edition*

L. Test Principle:

Magnesium ions react with xylidyl blue in an alkaline medium to form a water soluble purple-red chelate, the color intensity is proportional to the concentration of magnesium in the sample. Calcium is excluded from the reaction by complexing with EGTA.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

a. Precision/Reproducibility:

Precision was evaluated according to the CLSI EP05-A3 guideline. For serum precision, three serum based control materials and five human serum sample pools were tested on two RX Daytona plus systems by two operators. For urine precision, two urine based control materials, three human urine sample pools and one linearity sample were tested on two RX Daytona Plus systems by two operators.

Testing was conducted with two lots of Randox RX Daytona Plus Magnesium (MG), one lot on each RX Daytona Plus system, twice per day for 20 non-consecutive days. Two replicates per run were performed for each sample for a total of 80 data points per lot.

A representative lot performance for serum is summarized in the following table.

Serum Sample	N	Mean	Within Run		Total	
		(mg/dL)	SD	%CV	SD	%CV
QC1	80	2.36	0.06	0.06	0.07	2.8
QC2	80	4.36	0.12	0.12	0.14	3.3
QC3	80	4.23	0.12	0.12	0.12	2.8
Serum Pool 1	80	0.90	0.02	0.02	0.04	4.1
Serum Pool 2	80	1.17	0.03	0.03	0.05	4.1
Serum Pool 3	80	2.54	0.04	0.04	0.07	2.8
Serum Pool 4	80	3.64	0.06	0.06	0.10	2.8
Serum Pool 5	80	4.43	0.06	0.06	0.10	2.3

A representative lot performance for urine is summarized in the following table.

Urine Samples	N	Mean	Within Run		Total	
		(mg/dL)	SD	%CV	SD	%CV
QC1	80	4.58	0.13	2.9	0.23	5.1
QC2	80	7.68	0.20	2.6	0.32	4.2
Urine Pool 1	80	3.15	0.10	3.3	0.18	5.8
Urine Pool 2	80	9.05	0.19	2.1	0.42	4.7
Urine Pool 3	80	12.42	0.23	1.8	0.73	5.9
LIN	80	21.10	0.27	1.3	1.23	5.8

b. *Linearity/assay reportable range:*

Linearity was evaluated according to the CLSI EP06 guideline. The linearity of the Randox RX Daytona Plus Magnesium (MG) was evaluated by preparing a series of 11 serum samples with analyte concentrations of 0.7, 1.13, 1.56, 1.99, 2.40, 2.85, 3.28, 3.71, 4.14, 4.57 and 5.00 mg/dL, and with 11 urine samples with magnesium concentrations of 0.95, 3.36, 5.76, 8.17, 10.57, 12.98, 15.38, 17.79, 20.19, 20.60 and 25.00 mg/dL. Samples were tested in five replicates with two reagent lots on one RX Daytona Plus system. The linear regression results between the expected values and the observed values are summarized in the following table:

Sample Type	Linear regression	R^2	Concentration range tested
Serum	y = 0.96x + 0.08	0.999	0.70 - 5.0 mg/dL
Urine	y = 0.97x + 0.32	0.998	0.95 - 25.0 mg/dL

The linearity study results support the claimed measuring ranges of 0.74 - 4.95 mg/dL for serum and 1.01 - 23.82 mg/dL for urine.

c. *Traceability, Stability, Expected values (controls, calibrators, or methods):*

Traceability:
The Randox RX Daytona Plus Magnesium (MG) assay is traceable to the Magnesium reference material NIST 909b.

Stability:
Shelf life stability protocol and acceptance criteria for Randox RX Daytona Plus Magnesium (MG) assay were reviewed and determined to be adequate to support a shelf life claim of 24 months at 2-8ºC and an onboard stability claim of 5 days.

The Randox Calibration Serum Level 3 Calibrator was previously cleared in k053153 and the Randox Assayed Multi-sera Level 2 and Level 3 Controls were previously cleared in k942458.

d. *Detection limit:*

Detection limit studies were carried out in accordance with the CLSI EP17-A2 guideline.

The limit of blank (LoB) was determined by running a blank sample in 20 replicates per day over 3 days using two reagent lots on one RX Daytona Plus system. The 95 percentile rank order was assigned as the LOB.

The limit of detection (LoD) was determined by running four low level samples in 20 replicates per day over 3 days using two reagent lots one RX Daytona Plus system. LoD was calculated based on LoB (mean) + 1.65 SD (low sample).

The limit of quantitation (LoQ) was determined by running four low level samples tested in 12 replicates per day over 5 days using two lots of reagents tested on one RX Daytona Plus system. LoQ was defined as the lowest concentration that can be detected with ≤ 20% imprecision and ≤ 20% bias.

The results are summarized in the table below:

Sample Type	Serum, mg/dL	Urine, mg/dL
LoB	0.28	0.44
LoD	0.39	0.68
LoQ	0.55	0.95

The detection limit studies support the claimed measuring range of 0.74 - 4.95 mg/dL for serum and 1.01 - 23.82 mg/dl for urine samples.

e. *Analytical specificity:*

The Randox RX Daytona Plus Magnesium (MG) was evaluated for interference according to the CLSI EP07-A2 guideline. Potential interfering compounds were spiked into serum or urine samples at magnesium levels of 3.89 mg/dL and 6.32 mg/dL for serum, and 4.87mg/dL and 24.33 mg/dL for urine, respectively. Bias was defined as the difference in results between the control sample (without the interferent) and the mean value of test sample (containing the interferent) expressed in percent. The sponsor considered interference significant when bias exceeded 10%.

The highest concentration of substances tested that did not cause significant interference is summarized in the tables below.

Interference testing results for serum:

Substance tested	Highest concentration tested that did not show significant interference
Hemoglobin	1000 mg/dL
Bilirubin (unconjugated)	60 mg/dL
Bilirubin (conjugated)	60 mg/dL
Triglycerides	2000 mg/dL
Intralipid	500 mg/dL
Ascorbic acid	6 mg/dL

Interference testing results for urine:

Substance tested	Highest concentration tested that did not show significant interference
Direct Bilirubin	60 mg/dL
Total Bilirubin	60 mg/dL
Hemoglobin	250 mg/dL

Substance tested	Highest concentration tested that did not show significant interference
G-Globulin	500 mg/dL
Glucose	2000 mg/dL
Ascorbic Acid	200 mg/dL
Human Serum Albumin	500 mg/dL
Oxalate	100 mg/dL
Ethanol	1000 mg/dL
Boric Acid	750 mg/dL
Sodium Chloride	4000 mg/dL
Sodium Fluoride	25 mg/dL

f. Assay cut-off:

Not applicable.

2. Comparison studies:

a. Method comparison with predicate device:

Method comparison testing was conducted in accordance with the CLSI EP09-A3 guideline. A total of 108 serum samples (100 native samples and 8 spiked samples) with concentration ranges of 0.85 to 4.54 mg/dL were evaluated using the Randox RX Daytona Plus Magnesium on RX Daytona Plus system (candidate) versus the Siemens Magnesium assay on the ADVIA 1800 system (predicate). In addition, 108 urine samples (100 native samples and 8 altered samples) with concentration ranges of 1.15 to 23.12 mg/dL were tested by two operators using two lots of Randox RX Daytona Plus Magnesium reagent on one RX Daytona Plus system (candidate) versus the Siemens Magnesium assay on the ADVIA 1800 system (predicate). Testing was performed for 3 working days and each sample was tested in singlicate.

The test method was compared to the predicate device and the following linear regression equations were obtained:

Sample type	N	Sample range (mg/dL)	Slope	Intercept	R
Serum	108	0.80 - 4.54	0.994	0.050	0.992
Urine	108	1.15 - 23.12	0.990	0.067	0.999

b. Matrix comparison:

Matrix comparison between serum and lithium heparin plasma samples were tested by one operator on one RX Daytona plus analyzer using two lots of Randox RX Daytona Plus Magnesium reagents. A total of 42 matched patient sample pairs were analyzed spanning the concentration ranges of 0.75 to 4.13 mg/dL.

The following linear regression equation was obtained between the two matrices:

$$y = 0.96x + 0.09, R = 0.992$$

The results of the matrix comparison study support the sponsor claim that serum and lithium heparin plasma samples can be tested with this assay.

3. Clinical studies:

   a. Clinical Sensitivity:

   Not Applicable

   b. Clinical specificity:

   Not Applicable

   c. Other clinical supportive data (when a. and b. are not applicable):

   Not Applicable

4. Clinical cut-off**:**

   Not Applicable

5. Expected values/Reference range:

   Serum/plasma: 1.70-2.70 mg/dL [1, 2]
   Urine: 12-291 mg/24 hr [1, 2]

[1]Lau, K-K., Yu, W-C., Chu, C-M., Lau, S-T., Sheng, B. and Yuen, K-Y. Possible Central Nervous System Infection by SARS Caronavirus. Emerging Infectious Diseases. Vol 10 No 2. (2004) p342-344.

[2]Wu AH. Tietz Clinical Guide to Laboratory Tests, 4th ed. Philadelphia, PA: WB Saunders; 2006: 706-8.

N. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

O. Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.