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

A. 510(k) Number:
k111915

B. Purpose for Submission:
New device

C. Measurand:
Magnesium

D. Type of Test:
Quantitative photometric method

E. Applicant:
Sekisui Diagnostics P.E.I. Inc.

F. Proprietary and Established Names:
Magnesium Assay

G. Regulatory Information:

Measurand	Regulation Section	Classification	Product Code	Panel
Magnesium	21CFR862.1495	Class I, reserved	JGJ- Photometric	(75) Clinical Chemistry

H. Intended Use:

1. Intended use(s):
   See Indications for use below.

2. Indication(s) for use:
   The Sekisui Magnesium Assay is intended for the quantitative measurement of magnesium in human serum and plasma (Lithium Heparin) on automated clinical chemistry analyzers. Magnesium measurements are used in the diagnosis and treatment of hypomagnesemia and hypermagnesemia. This device is intended for professional use and IN VITRO diagnostic use only.

3. Special conditions for use statement(s):
   Prescription use only

4. Special instrument requirements:
   All performance studies were conducted on the Hitachi 717 analyzer.

I. Device Description:

The Sekisui Magnesium Assay kit consists of the following: Magnesium Reagent: A solution containing buffer (pH 11.2 at 25°C), 0.014 mmol/L xylidyl blue – 1, 0.1 EGTA and a surfactant. This Reagent is in ready-for use liquid form.

J. Substantial Equivalence Information:

1. Predicate Device Name(s):
   Olympus Magnesium Reagent

2. Predicate 510(k) number(s):
   k944407

3. Comparison with predicate:

Similarities and Differences		
Item	Candidate Device Magnesium Assay	Predicate Device (k944407) Olympus Magnesium Reagent
Intended Use	For the In Vitro quantitative measurement of magnesium in serum and plasma (Lithium heparin)	Same
Specimen Type	Serum and LiHeparin plasma	Serum and LiHeparin plasma and urine
Reagent Type	Liquid ready-for-use	Same
Assay Principle	Colorimetric-xylidyl blue	Same
Measuring Range	0.3 – 8 mg/dL	0.5 – 8 mg/dL

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

- **CLSI Guideline, EP5-A2** *Evaluation of Precision Performance of Clinical Chemistry Devices – Second Edition*
- **CLSI Guideline, EP6-A2** *Evaluation of the Linearity of Quantitative Measurement Procedures: A Statistical Approach*
- **CLSI Guideline, EP7-A2** *Interference Testing in Clinical Chemistry*
- **CLSI Guideline, EP9-A2** *Method Comparison and Bias Estimation Using Patient Samples – Second Edition*
- **CLSI Guideline, EP17-A2** *Protocols for Determination of Limits of Detection*

and Limits of Quantitation

- **CLSI Guideline, C28-A** *How to Define and Determine Reference Interval in the Clinical Laboratory*

L. Test Principle:

Under the alkaline conditions of the Magnesium reagent, magnesium present in the sample, when mixed with the reagent, forms a red complex with the diazonium salt of xylidyl blue. The concentration of magnesium in the sample is directly proportional to the amount of xylidyl blue – magnesium complex formed and can be measured spectrophotometrically by the decrease in absorbance measured at 660 nm.

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M. Performance Characteristics (if/when applicable):

1. Analytical performance:

All the performance studies were conducted using the Hitachi 717 analyzer.

a. Precision/Reproducibility:

Precision was evaluated according to the CLSI Document EP5-A2, *Evaluation of Precision Performance of Quantitative Measurement Methods*. Total precision and within-run precision were established by assaying human serum pool materials, twice a day for 20 days using two reagent lots at one site.

	N	Mean (mg/dL)	Total		Within Run	
			SD	%CV	SD	%CV
Sample 1	40	0.8	0.05	6.1	0.04	5.2
Sample 2	40	2.0	0.07	3.7	0.04	2.2
Sample 3	40	4.7	0.15	3.2	0.08	1.6

b. Linearity/assay reportable range:

The measuring range of the assay is 0.3 to 8.0 mg/dL. Linearity was evaluated according to the CLSI Document EP6-A2, *Evaluation of the Linearity of quantitative Measurement Procedures: A Statistical Approach*. A high concentration sample obtained by spiking magnesium chloride in serum was diluted to produce eleven concentrations across the measuring range. Each sample was assayed in quadruplicate. The resulting mean concentrations of each sample were compared to predicted concentrations and yielded a linear regression of $y=1.01 x + 0.013$. Recovery was from 90% to 100%. Results of the study support the sponsor's claim that the assay is linear from 0.3 to 8.0 mg/dL.

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

Calibrators and controls were cleared under k882258 and k874772 and are sold separately.

The sponsor performed reagent stability studies and protocol and acceptance criteria and found them to be adequate. Accelerated stability studies were performed to simulate 24 months stability of the reagent when stored at 2°C to 8°C. Real time stability studies are still on-going.

d. *Detection limit:*
The Limit of the Blank (LoB), Limit of Detection (LoD) and Limit of Quantitation (LoQ) were established following the CLSI guideline EP17-A: *Protocols for Determination of Limits of Detection and Limits of Quantitation*. The LoB was determined to be 0.15 mg/dL based on 60 determinations of 5 blank samples. The LoD was determined to be 0.25 mg/dL based on 60 determinations of 5 low level samples. Limit of Quantitation (LoQ) is the lowest concentration of Mg that can be measured with CV≤20%. The observed LoQ of the Mg assay is 0.3 mg/dL.

The Mg assay has a measuring range of 0.3 to 8.0 mg/dL.

e. *Analytical specificity:*
The sponsor performed studies to evaluate effect of different compounds (such as ascorbic acid, hemoglobin, intralipid, unconjugated and conjugated bilirubin) on the performance of the Magnesium assay, following CLSI EP7-A2, *Interference Testing in Clinical Chemistry; Approved Guideline*. Testing was done in the presence of three levels of Magnesium (~2 mg/dL, 4.2 mg/dL and ~7.2 mg/dL) and different concentrations of the listed compounds. Percent recovery was calculated relative to control samples containing Magnesium without spiked compounds. The table below lists all substances tested at concentrations with non-significant interference (defined by the sponsor as < 10%) :

Concentration of Mg	Substance Tested	Concentration with <10% interference (mg/dL)
Level 1	Hemoglobin	1000 mg/dL
Level 2		1000 mg/dL
Level 3		1000 mg/dL
Level 1	Conjugated Bilirubin	40 mg/dL
Level 2		40 mg/dL
Level 3		40 mg/dL
Level 1	Unconjugated Bilirubin	40 mg/dL
Level 2		40 mg/dL
Level 3		40 mg/dL
Level 1	Ascorbic Acid	3 mg/dL

Level 2		3 mg/dL
Level 3		3 mg/dL
Level 1	Intralipid	800 mg/dL
Level 2		1000 mg/dL
Level 3		1000 mg/dL

f. Assay cut-off:

Not applicable.

2. Comparison studies:

a. Method comparison with predicate device:

The sponsor performed studies to compare the performance of the Magnesium assay with the performance of the predicate assay (k9444076) following CLSI EP9-A2 *Method Comparison and Bias Estimation Using Patient Samples*. A total of 100 specimens in the range of 0.5 to 7.3 mg/dL, were used in this comparison. A small number of the samples (5%) were altered (spiked) in order to span the measuring range. Regression analysis was based on single measurements of the candidate device and the average of duplicates for the predicate device. Results of regression analysis are summarized below:

Deming Regression:

x axis	y axis	n	r	Slope	Intercept
Predicate	Candidate	100	0.98	0.981 (CI:0.947,1.016)	0.00 (CI:-0.09, 0.09)

Linear regression:

b. Matrix comparison:

The sponsor performed a matrix study to compare the performance of the assay when different sample types (serum vs. LiHeparin plasma) were tested. The study was completed with human plasma (LiHeparin) and serum samples spanning the linear range of the assay and following the CLSI EP9-A2 *Method Comparison and Bias Estimation Using Patient Samples* guidance. A total of 54 unaltered patient samples were tested in the range of 0.5 to 5.4 mg/dL. One single set of plasma samples was used as test samples, while duplicate serum samples were used as references. Results of regression analysis are summarized below:

x axis	y axis	n	r	Slope	Intercept
Serum samples	Plasma samples	54	0.99	1.009 (CI:0.941,0.971)	-0.12 (CI:-0.07,0.01)

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:

Reference range of 1.6 – 2.6 mg/dL is provided in the labeling from the following literature:
Tietz, N.W. Clinical Guide to Laboratory Tests, W.B. Saunders Company, p. 338; 1983

N. Proposed Labeling:

The labeling is sufficient and does satisfy 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.