July 6, 2018

Microgenics Corporation
Emily Chien
Regulatory Affairs Specialist II
46500 Kato Road
Fremont, California 94538

Re: K181499
Trade/Device Name: DRI Cocaine Metabolite Assay
Regulation Number: 21 CFR 862.3250
Regulation Name: Cocaine and cocaine metabolite test system
Regulatory Class: Class II
Product Code: DIO
Dated: June 5, 2018
Received: June 7, 2018

Dear Emily Chien:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801 and Part 809); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820); and if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to http://www.fda.gov/MedicalDevices/Safety/ReportaProblem/default.htm.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/) and CDRH Learn (http://www.fda.gov/Training/CDRHLearn). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (http://www.fda.gov/DICE) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Paula Caposino -S

for Courtney H. Lias, Ph.D.
Director
Division of Chemistry and Toxicology Devices
Office of In Vitro Diagnostics
and Radiological Health
Center for Devices and Radiological Health

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: 06/30/2020
See PRA Statement below.

510(k) Number *(if known)*
K181499

Device Name
DRI Cocaine Metabolite Assay

Indications for Use *(Describe)*

The DRI Cocaine Metabolite Assay is a homogeneous enzyme immunoassay intended for the qualitative and/or semi-quantitative determination of benzoylecgonine (Cocaine Metabolite) in human urine at a cutoff concentration of either 150 ng/mL or 300 ng/mL.

The semi-quantitative mode is for the purpose of enabling laboratories to determine an appropriate dilution of the specimen for confirmation by a confirmatory method such as Liquid Chromatography/tandem mass spectrometry (LC-MS/MS) or permitting laboratories to establish quality control procedures.

The assay provides only a preliminary analytical test result. A more specific alternative chemical method must be used to obtain a confirmed analytical result. Gas chromatography / Mass spectrometry (GC/MS) or Liquid chromatography/ tandem mass spectrometry (LC-MS/MS) is the preferred confirmatory method. Tests for cocaine metabolite cannot distinguish between abused drugs and certain prescribed medications.

Clinical and professional judgment should be applied to any drug of abuse test result, particularly when preliminary results are used. For In Vitro Diagnostic Use Only.

Type of Use *(Select one or both, as applicable)*

☒ Prescription Use (Part 21 CFR 801 Subpart D) ☐ Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

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5. 510(k) Summary

This 510(k) Summary of Safety and Effectiveness is being submitted in accordance with the requirements of Safe Medical Device Act of 1990 and 21 CFR 807.92.

A. Device Information

Category	Comments
Sponsor:	Microgenics Corporation Thermo Fisher Scientific 46500 Kato Road Fremont, CA 94538 Phone: 510-979-5000 FAX: 510-979-5002
Correspondent Contact Information:	Emily Chien Regulatory Affairs Specialist II Email: *Emily.Chien@thermofisher.com* Phone: 510-979-5000 FAX: 510-979-5002
Device Common Name:	Cocaine Metabolite Enzyme Immunoassay
Trade or Proprietary Name	DRI Cocaine Metabolite Assay
Candidate Device Product Code, Classification, Classification Name & Panel	DIO, Class II, 21 CFR 862. 3250 – Cocaine Metabolite Test System, 91 – Toxicology

Predicate Device Information:

Predicate Device:	Cocaine Metabolite Enzyme Immunoassay
Predicate Device Manufacturer:	Diagnostic Reagents, Inc.
Predicate Device Premarket Notification #:	K960187

B. Date Summary Prepared

July 06, 2018

C. Description of Device

The DRI Cocaine Metabolite Assay is a homogeneous enzyme immunoassay using ready-to-use liquid reagents. The assay uses a specific antibody, which can detect benzoylecgonine in urine. The assay is based on the competition of an enzyme glucose-6-phosphate dehydrogenase (G6PDH) labeled drug and the drug from the urine sample for a fixed amount of specific antibody binding sites. In the presence of free drug from the sample, the free drug occupies the antibody binding sites, allowing the drug-labeled G6PDH to interact with the substrate, resulting in enzyme activity. In the absence of drug from the sample, the specific antibody

binds to the drug labeled with G6PDH and the enzyme activity is inhibited. This phenomenon creates a direct relationship between the drug concentration in the urine and the enzyme activity. The enzyme G6PDH activity is determined spectrophotometrically at 340 nm by measuring its ability to convert nicotinamide adenine dinucleotide (NAD) to NADH.

The assay consists of reagents (A and E).

Reagent A: Contains mouse monoclonal anti-benzoylecgonine antibody, glucose-6-phosphate (G6P), and nicotinamide adenine dinucleotide (NAD) in Tris buffer with sodium azide as preservative.

Reagent E: Contains benzoylecgonine analog labeled with glucose-6-phosphate dehydrogenase (G6PDH) in HEPES buffer with sodium azide as preservative.

D. Intended Use

The DRI Cocaine Metabolite Assay is a homogeneous enzyme immunoassay intended for the qualitative and/or semi-quantitative determination of benzoylecgonine (Cocaine Metabolite) in human urine at a cutoff concentration of either 150 ng/mL or 300 ng/mL.

The semi-quantitative mode is for the purpose of enabling laboratories to determine an appropriate dilution of the specimen for confirmation by a confirmatory method such as Liquid Chromatography/tandem mass spectrometry (LC-MS/MS) or permitting laboratories to establish quality control procedures.

The assay provides only a preliminary analytical test result. A more specific alternative chemical method must be used to obtain a confirmed analytical result. Gas chromatography / Mass spectrometry (GC/MS) or Liquid chromatography/tandem mass spectrometry (LC-MS/MS) is the preferred confirmatory method. Tests for cocaine metabolite cannot distinguish between abused drugs and certain prescribed medications.

Clinical and professional judgment should be applied to any drug of abuse test result, particularly when preliminary results are used. For *In Vitro Diagnostic* Use Only.

E. Comparison to Predicate Device

Characteristics	**Candidate Device:** DRI Cocaine Metabolite Assay	**Predicate Device:** Cocaine Metabolite Enzyme Immunoassay (K960187)
Intended Use	The DRI Cocaine Metabolite Assay is a homogeneous enzyme immunoassay intended for the qualitative and/or semi-quantitative determination of benzoylecgonine (Cocaine Metabolite) in human urine at a cutoff concentration of either 150 ng/mL or 300 ng/mL.	This homogeneous cocaine metabolite enzyme immunoassay is intended to be used for qualitative and semi-quantitative determination of benzoylecgonine (cocaine metabolite) in human urine with either 300 ng/ml or 150 ng/ml as a cutoff calibrator.
Operating Principle (Technology)	DRI	Same
Measured Analyte	Benzoylecgonine	Same
Test Matrix	Urine	Same
Cut-off Levels	150 ng/mL and 300 ng/mL	Same
Methodology	Homogeneous Enzyme Immunoassay	Same
Reagents Form	Liquid ready-to-use.	Same
Antibody	Mouse monoclonal antibodies	Same
Storage	2–8 °C until expiration date	Same
Principal Operator	Trained professionals	Same
Calibrator Levels for Semi-Quant	5 point calibrator	3 point calibrator

F. Test Principle

The DRI Cocaine Metabolite Assay is a homogeneous enzyme immunoassay using ready-to-use liquid reagents. The assay uses a specific antibody, which can detect benzoylecgonine in urine. The DRI technology is based on the competition of an enzyme glucose-6-phosphate dehydrogenase (G6PDH) labeled drug and the drug from the urine sample for a fixed amount of specific antibody binding sites. In the presence of free drug from the sample, the free drug occupies the antibody binding sites, allowing the drug-labeled G6PDH to interact with the substrate, resulting in enzyme activity. In the absence of drug from the sample, the specific antibody binds to the drug labeled with G6PDH and the enzyme activity is inhibited. This phenomenon creates a direct relationship between the drug concentration in the urine and the enzyme activity. The enzyme G6PDH activity is determined spectrophotometrically at 340 nm by measuring its ability to convert nicotinamide adenine dinucleotide (NAD) to NADH.

G. Summary of Supporting Data

1. **Analytical Performance:**

Performance is evaluated at the manufacturer's site on the Beckman Coulter AU680 clinical analyzer.

a) **Precision**

Precision studies were performed in accordance with CLSI Guideline EP05-A3. Samples were prepared by spiking Benzoylecgonine (Cocaine Metabolite) into drug free urine at the cutoff, 25%, 50%, 75% and 100% above and below the cutoff and tested in both qualitative and semi-quantitative modes. Results presented below were generated by testing all samples in replicates of 2, twice per day for 20 days, total n=80. The results for both cutoffs are summarized in the tables below.

Qualitative Study Analysis for 150 ng/mL cutoff

Spiked Concentration (ng/mL)	% of Cutoff (150 ng/mL)	Total Precision (n=80)	
		# of Determinants	Immunoassay Results (Negative/Positive)
0	-100%	80	80/0
37.5	-75%	80	80/0
75	-50%	80	80/0
112.5	-25%	80	80/0
150	100%	80	22/58
187.5	+25%	80	0/80
225	+50%	80	0/80
262.5	+75%	80	0/80
300	+100%	80	0/80

Qualitative Study Analysis for 300 ng/mL cutoff

Spiked Concentration (ng/mL)	% of Cutoff (300 ng/mL)	Total Precision (n=80)	
		# of Determinants	Immunoassay Results (Negative/Positive)
0	-100%	80	80/0
75	-75%	80	80/0
150	-50%	80	80/0
225	-25%	80	80/0
300	100%	80	31/49
375	+25%	80	0/80
450	+50%	80	0/80
525	+75%	80	0/80
600	+100%	80	0/80

Semi-Quantitative Study Analysis for 150 ng/mL cutoff

Spiked Concentration (ng/mL)	% of Cutoff (150 ng/mL)	Total Precision (n=80)	
		# of Determinants	Immunoassay Results (Negative/Positive)
0	-100%	80	80/0
37.5	-75%	80	80/0
75	-50%	80	80/0
112.5	-25%	80	80/0
150	100%	80	19/61
187.5	+25%	80	0/80
225	+50%	80	0/80
262.5	+75%	80	0/80
300	+100%	80	0/80

Semi-Quantitative Study Analysis for 300 ng/mL cutoff

Spiked Concentration (ng/mL)	% of Cutoff (150 ng/mL)	Total Precision (n=80)	
		# of Determinants	Immunoassay Results (Negative/Positive)
0	-100%	80	80/0
75	-75%	80	80/0
150	-50%	80	80/0
225	-25%	80	80/0
300	100%	80	22/58
375	+25%	80	0/80

Spiked Concentration (ng/mL)	% of Cutoff (150 ng/mL)	Total Precision (n=80)	
		# of Determinants	Immunoassay Results (Negative/Positive)
450	+50%	80	0/80
525	+75%	80	0/80
600	+100%	80	0/80

b) **Spike Recovery**

The study was performed for 21 replicates. This study was carried out by testing spiked samples containing Benzoylecgonine (Cocaine Metabolite) at the cutoff calibrator and control levels. The spiked samples were prepared by spiking Benzoylecgonine (Cocaine Metabolite) into drug free urine. Samples were tested in both qualitative and semi-quantitative mode. The qualitative results for both cutoffs are summarized in the tables below.

Qualitative Data for 150 ng/mL cutoff

Replicates	112.5 ng/mL (n=21)	187.5 ng/mL (n=21)
1	Negative	Positive
2	Negative	Positive
3	Negative	Positive
4	Negative	Positive
5	Negative	Positive
6	Negative	Positive
7	Negative	Positive
8	Negative	Positive
9	Negative	Positive
10	Negative	Positive
11	Negative	Positive
12	Negative	Positive
13	Negative	Positive
14	Negative	Positive
15	Negative	Positive
16	Negative	Positive
17	Negative	Positive
18	Negative	Positive
19	Negative	Positive
20	Negative	Positive
21	Negative	Positive
Overlap	No	No
Relative to C/O	All 21 below C/O	All 21 above C/O

Qualitative Data for 300 ng/mL cutoff

Replicates	225 ng/mL (n=21)	375 ng/mL (n=21)
1	Negative	Positive
2	Negative	Positive
3	Negative	Positive
4	Negative	Positive
5	Negative	Positive
6	Negative	Positive
7	Negative	Positive
8	Negative	Positive
9	Negative	Positive
10	Negative	Positive
11	Negative	Positive
12	Negative	Positive
13	Negative	Positive
14	Negative	Positive
15	Negative	Positive
16	Negative	Positive
17	Negative	Positive
18	Negative	Positive
19	Negative	Positive
20	Negative	Positive
21	Negative	Positive
Overlap	No	No
Relative to C/O	All 21 below C/O	All 21 above C/O

c) **Analytical Recovery and Linearity**

Linearity studies were performed in accordance with CLSI Guideline EP06-A. To demonstrate the dilution linearity for purposes of sample dilution and quality control of the entire assay range, drug free urine was spiked to the high level calibrator using Benzoylecgonine (Cocaine Metabolite) (1000 ng/mL) and diluted with drug free urine to generate 9 intermediate levels.

Each sample was run in replicates of five in semi-quantitative mode and the average was used to determine percent recovery compared to the expected target value. The percent recovery is summarized in the table below.

Level	Expected Concentration (ng/mL)	Observed Concentration (ng/mL)	Recovery (%)
1	0	0.6	N/A

Level	Expected Concentration (ng/mL)	Observed Concentration (ng/mL)	Recovery (%)
2	102.5	103.6	101.1
3	205.0	213.6	104.2
4	307.5	294.8	95.9
5	410.0	413.8	100.9
6	512.5	510.4	99.6
7	615.0	640.6	104.2
8	717.5	781.4	108.9
9	820.0	880.0	107.3
10	922.5	952.0	103.2
11	1025.0	1025.0	100.0

d) **Method Comparison and Accuracy**

The method comparison study was performed in accordance with CLSI Guideline EP09-A3. One hundred patient samples were analyzed by the DRI Cocaine Metabolite Assay in both qualitative and semi-quantitative modes and the results were compared to LC-MS/MS. The overall concordance between LC-MS/MS and DRI Cocaine Metabolite Assay is 100%. The qualitative and semi-quantitative results for both cutoffs are summarized in the tables below.

Semi-Quantitative Mode Accuracy study with LC-MS/MS as reference method for 150 ng/mL cutoff

Candidate Device Results	Negative by LC-MS/MS	< 50% of Cutoff concentration by LC-MS/MS (< 75 ng/mL)	Near Cutoff Negative (Between 50% below the cutoff and the cutoff concentration as determined by LC-MS/MS) (75-149 ng/mL)	Near Cutoff Positive (Between the cutoff and 50% above the cutoff concentration as determined by LC-MS/MS) (150-225 ng/mL)	High Positives (Greater than 50% above cutoff concentration (> 225 ng/mL)
Positive	0	0	0	6	44
Negative	45	0	5	0	0

Agreement among Positives: 50/50 = 100%
Agreement among Negative: 50/50 = 100%

Semi-Quantitative Mode Accuracy study with LC-MS/MS as reference method for 300 ng/mL cutoff

Candidate Device Results	Negative by LC-MS/MS	< 50% of Cutoff concentration by LC-MS/MS (< 150 ng/mL)	Near Cutoff Negative (Between 50% below the cutoff and the cutoff concentration as determined by LC-MS/MS) (150-299 ng/mL)	Near Cutoff Positive (Between the cutoff and 50% above the cutoff concentration as determined by LC-MS/MS) (300-450 ng/mL)	High Positives (Greater than 50% above cutoff concentration (> 450 ng/mL)
Positive	0	0	0	6	44
Negative	45	0	5	0	0

Agreement among Positives: 50/50 = 100%
Agreement among Negative: 50/50 = 100%

Qualitative Accuracy study with LC-MS/MS as reference method for 150 ng/mL cutoff

Candidate Device Results	Negative by LC-MS/MS	< 50% of Cutoff concentration by LC-MS/MS (< 75 ng/mL)	Near Cutoff Negative (Between 50% below the cutoff and the cutoff concentration as determined by LC-MS/MS) (75 – 149 ng/mL)	Near Cutoff Positive (Between the cutoff and 50% above the cutoff concentration as determined by LC-MS/MS) (150-225 ng/mL)	High Positives (Greater than 50% above cutoff concentration (> 225 ng/mL)
Positive	0	0	0	6	44
Negative	45	0	5	0	0

Agreement among Positives: 50/50 = 100%
Agreement among Negative: 50/50 = 100%

Qualitative Accuracy study with LC-MS/MS as reference method for 300 ng/mL cutoff

Candidate Device Results	Negative by LC-MS/MS	< 50% of Cutoff concentration by LC-MS/MS (< 150 ng/mL)	Near Cutoff Negative (Between 50% below the cutoff and the cutoff concentration as determined by LC-MS/MS) (150-299 ng/mL)	Near Cutoff Positive (Between the cutoff and 50% above the cutoff concentration as determined by LC-MS/MS) (300-450 ng/mL)	High Positives (Greater than 50% above cutoff concentration (> 450 ng/mL)
Positive	0	0	0	6	44
Negative	45	0	5	0	0

Agreement among Positives: 50/50 = 100%
Agreement among Negative: 50/50 = 100%

e) **Specificity**

The cross-reactivity of Cocaine and its metabolites were evaluated by adding known amounts of each compound to drug-free negative urine. The results are summarized in the tables below.

Cross reactivity of Cocaine and its metabolites for 150 ng/mL cut off

Cocaine and metabolites	Tested Concentration (ng/mL)	Cross-reactivity (%)
Benzoylecgonine	150	100
Cocaine	25,000	0.6
Cocaethylene	30,000	0.5
Ecgonine	90,000	0.17
Ecgonine Methyl Ester	100,000	<0.15
m-hydroxybenzoylecgonine	300	50
Norcocaine	100,000	<0.15

Cross reactivity of Cocaine and its metabolites for 300 ng/mL cut-off

Cocaine and metabolites	Tested Concentration (ng/mL)	Cross-reactivity (%)
Benzoylecgonine	300	100
Cocaine	50,000	0.6
Cocaethylene	60,000	0.5
Ecgonine	160,000	0.19
Ecgonine Methyl Ester	100,000	<0.3
m-hydroxybenzoylecgonine	600	50
Norcocaine	100,000	<0.3

Structurally unrelated compounds were evaluated by adding each substance to Benzoylecgonine spiked at 112.5 ng/mL (-25% of the 150 ng/mL cutoff concentration), 187.5 ng/mL (+25% of the 150

ng/mL cutoff concentration), 225 ng/mL (-25% of the 300 ng/mL cutoff concentration) and 375 ng/mL (+25% of the 300 ng/mL cutoff concentration), at the concentrations indicated. As shown in the table below, the controls were detected accurately, low control as negative and the high control as positive, indicating that all the compounds evaluated exhibited no significant cross-reactivity at the concentrations tested.

Structurally unrelated compounds spiked at the concentration listed below into Low and High control urine for 150 ng/mL cut-off

Structurally Unrelated Compounds	Tested Concentration (ng/mL)	Spiked Benzoylecgonine Level	
		Low Control	High Control
		Positive/ Negative	Positive/ Negative
11-nor-Δ^9 -THC-COOH	100,000	Negative	Positive
1R,2S(-)-Ephedrine	100,000	Negative	Positive
1S,2R(+)-Ephedrine	100,000	Negative	Positive
Acetaminophen	1,000,000	Negative	Positive
Acetylsalicylic acid	1,000,000	Negative	Positive
Acyclovir	75,000	Negative	Positive
Albuterol	1,000,000	Negative	Positive
Amikacin	1,000,000	Negative	Positive
Amitriptyline	100,000	Negative	Positive
Amobarbital	100,000	Negative	Positive
Amoxicillin	1,000,000	Negative	Positive
Amphetamine	1,000,000	Negative	Positive
Azithromycin	75,000	Negative	Positive
Benzocaine	1,000,000	Negative	Positive
Buprenorphine	100,000	Negative	Positive
Bupropion	100,000	Negative	Positive
Caffeine	100,000	Negative	Positive
Calcium Carbonate	5,000,000	Negative	Positive
Carbamazepine	100,000	Negative	Positive
Carisoprodol	100,000	Negative	Positive
Chlorpromazine	500,000	Negative	Positive
Chlorzoxazone	1,000,000	Negative	Positive
cis-Tramadol	1,000,000	Negative	Positive
Clomipramine	100,000	Negative	Positive
Clonidine	100,000	Negative	Positive
Codeine	1,000,000	Negative	Positive
Cotinine	100,000	Negative	Positive
Dapsone	100,000	Negative	Positive
Desipramine	100,000	Negative	Positive
Dextromethorphan	100,000	Negative	Positive
Dihydrocodeine	100,000	Negative	Positive
Diphenhydramine	1,000,000	Negative	Positive

Structurally Unrelated Compounds	Tested Concentration (ng/mL)	Spiked Benzoylecgonine Level	
		Low Control	High Control
		Positive/ Negative	Positive/ Negative
Doxepine	500,000	Negative	Positive
Doxycycline Hyclate	100,000	Negative	Positive
EDDP	100,000	Negative	Positive
Ethyl β-D-glucuronide	100,000	Negative	Positive
Fentanyl	100,000	Negative	Positive
Fluconazole	100,000	Negative	Positive
Fluoxetine	50,000	Negative	Positive
Gabapentin	100,000	Negative	Positive
Gentamicin	100,000	Negative	Positive
Haloperidol	100,000	Negative	Positive
Heroin	100,000	Negative	Positive
Hydrocodone	100,000	Negative	Positive
Hydromorphone	100,000	Negative	Positive
Hydroxyzine	100,000	Negative	Positive
Hyoscyamine HCl	75,000	Negative	Positive
Ibuprofen	5,000,000	Negative	Positive
Imipramine	100,000	Negative	Positive
Indomethacin	75,000	Negative	Positive
Lamotrigine	1,000,000	Negative	Positive
Levofloxacin	75,000	Negative	Positive
Lidocaine	1,000,000	Negative	Positive
Lithium heparin	5,000,000	Negative	Positive
Loratadine	500,000	Negative	Positive
LSD	100,000	Negative	Positive
Maprotiline	100,000	Negative	Positive
Meperidine	1,000,000	Negative	Positive
Mesoridazine	1,000,000	Negative	Positive
Methadone	1,000,000	Negative	Positive
Methamphetamine	100,000	Negative	Positive
Methylphenidate	100,000	Negative	Positive
Metoclopramide	1,000,000	Negative	Positive
Metronidazole	100,000	Negative	Positive
Morphine	200,000	Negative	Positive
Morphine-3β-D-glucuronide	100,000	Negative	Positive
Morphine-6β-D-glucuronide	100,000	Negative	Positive
Nalbuphine	1,000,000	Negative	Positive
Nalorphine	100,000	Negative	Positive
Naloxone	100,000	Negative	Positive
Naltrexone	1,000,000	Negative	Positive

Structurally Unrelated Compounds	Tested Concentration (ng/mL)	Spiked Benzoylecgonine Level	
		Low Control	High Control
		Positive/ Negative	Positive/ Negative
Naproxen	5,000,000	Negative	Positive
Nitrazepam	100,000	Negative	Positive
Norbuprenorphine	100,000	Negative	Positive
Norcodeine	100,000	Negative	Positive
Nordiazepam	100,000	Negative	Positive
Norfluoxetine HCl	1,000,000	Negative	Positive
Norketamine	100,000	Negative	Positive
Norproxyphene	100,000	Negative	Positive
Nortriptyline	100,000	Negative	Positive
Ofloxacin	100,000	Negative	Positive
Omeprazole	75,000	Negative	Positive
Oxazepam	1,000,000	Negative	Positive
Oxycodone	100,000	Negative	Positive
Oxymorphone	100,000	Negative	Positive
Paroxetine	100,000	Negative	Positive
PCP	1,000,000	Negative	Positive
Phenelzine	75,000	Negative	Positive
Phenobarbital	1,000,000	Negative	Positive
Promethazine	100,000	Negative	Positive
Propoxyphene	750,000	Negative	Positive
Ranitidine	100,000	Negative	Positive
Risperidone	100,000	Negative	Positive
Scopolamine	1,000,000	Negative	Positive
Secobarbital	1,000,000	Negative	Positive
Sertraline	100,000	Negative	Positive
Spironolactone	750,000	Negative	Positive
Stavudine	100,000	Negative	Positive
Tapentadol	100,000	Negative	Positive
Terbinafine	750,000	Negative	Positive
Thiopental	1,000,000	Negative	Positive
Thioridazine	750,000	Negative	Positive
Tobramycin	1,000,000	Negative	Positive
Tolmetin	750,000	Negative	Positive
Trazodone	1,000,000	Negative	Positive
Trimethoprim	1,000,000	Negative	Positive
Vancomycin	1,000,000	Negative	Positive
Venlafaxine	1,000,000	Negative	Positive
Verapamil	100,000	Negative	Positive
Zolpidem Tartrate	100,000	Negative	Positive

Structurally unrelated compounds spiked at the concentration listed below into Low and High control urine for 300 ng/mL cut-off

Structurally Unrelated Compounds	Tested Concentration (ng/mL)	Spiked Benzoylecgonine Level	
		Low Control	High Control
		Positive/ Negative	Positive/ Negative
11-nor-Δ^9-THC-COOH	100,000	Negative	Positive
1R,2S(-)-Ephedrine	100,000	Negative	Positive
1S,2R(+)-Ephedrine	100,000	Negative	Positive
Acetaminophen	1,000,000	Negative	Positive
Acetylsalicylic acid	1,000,000	Negative	Positive
Acyclovir	75,000	Negative	Positive
Albuterol	1,000,000	Negative	Positive
Amikacin	1,000,000	Negative	Positive
Amitriptyline	100,000	Negative	Positive
Amobarbital	100,000	Negative	Positive
Amoxicillin	1,000,000	Negative	Positive
Amphetamine	1,000,000	Negative	Positive
Azithromycin	75,000	Negative	Positive
Benzocaine	1,000,000	Negative	Positive
Buprenorphine	100,000	Negative	Positive
Bupropion	100,000	Negative	Positive
Caffeine	100,000	Negative	Positive
Calcium Carbonate	5,000,000	Negative	Positive
Carbamazepine	100,000	Negative	Positive
Carisoprodol	100,000	Negative	Positive
Chlorpromazine	500,000	Negative	Positive
Chlorzoxazone	1,000,000	Negative	Positive
cis-Tramadol	1,000,000	Negative	Positive
Clomipramine	100,000	Negative	Positive
Clonidine	100,000	Negative	Positive
Codeine	1,000,000	Negative	Positive
Cotinine	100,000	Negative	Positive
Dapsone	100,000	Negative	Positive
Desipramine	100,000	Negative	Positive
Dextromethorphan	100,000	Negative	Positive
Dihydrocodeine	100,000	Negative	Positive
Diphenhydramine	1,000,000	Negative	Positive
Doxepine	500,000	Negative	Positive
Doxycycline Hyclate	100,000	Negative	Positive
EDDP	100,000	Negative	Positive
Ethyl β-D-glucuronide	100,000	Negative	Positive
Fentanyl	100,000	Negative	Positive
Fluconazole	100,000	Negative	Positive

Structurally Unrelated Compounds	Tested Concentration (ng/mL)	Spiked Benzoylecgonine Level	
		Low Control	High Control
		Positive/ Negative	Positive/ Negative
Fluoxetine	50,000	Negative	Positive
Gabapentin	100,000	Negative	Positive
Gentamicin	100,000	Negative	Positive
Haloperidol	100,000	Negative	Positive
Heroin	100,000	Negative	Positive
Hydrocodone	100,000	Negative	Positive
Hydromorphone	100,000	Negative	Positive
Hydroxyzine	100,000	Negative	Positive
Hyoscyamine HCl	75,000	Negative	Positive
Ibuprofen	5,000,000	Negative	Positive
Imipramine	100,000	Negative	Positive
Indomethacin	75,000	Negative	Positive
Lamotrigine	1,000,000	Negative	Positive
Levofloxacin	75,000	Negative	Positive
Lidocaine	1,000,000	Negative	Positive
Lithium heparin	5,000,000	Negative	Positive
Loratadine	500,000	Negative	Positive
LSD	100,000	Negative	Positive
Maprotiline	100,000	Negative	Positive
Meperidine	1,000,000	Negative	Positive
Mesoridazine	1,000,000	Negative	Positive
Methadone	1,000,000	Negative	Positive
Methamphetamine	100,000	Negative	Positive
Methylphenidate	100,000	Negative	Positive
Metoclopramide	1,000,000	Negative	Positive
Metronidazole	100,000	Negative	Positive
Morphine	200,000	Negative	Positive
Morphine-3β-D-glucuronide	100,000	Negative	Positive
Morphine-6β-D-glucuronide	100,000	Negative	Positive
Nalbuphine	1,000,000	Negative	Positive
Nalorphine	100,000	Negative	Positive
Naloxone	100,000	Negative	Positive
Naltrexone	1,000,000	Negative	Positive
Naproxen	5,000,000	Negative	Positive
Nitrazepam	100,000	Negative	Positive
Norbuprenorphine	100,000	Negative	Positive
Norcodeine	100,000	Negative	Positive
Nordiazepam	100,000	Negative	Positive
Norfluoxetine HCl	1,000,000	Negative	Positive

Structurally Unrelated Compounds	Tested Concentration (ng/mL)	Spiked Benzoylecgonine Level	
		Low Control	High Control
		Positive/ Negative	Positive/ Negative
Norketamine	100,000	Negative	Positive
Norproxyphene	100,000	Negative	Positive
Nortriptyline	100,000	Negative	Positive
Ofloxacin	100,000	Negative	Positive
Omeprazole	75,000	Negative	Positive
Oxazepam	1,000,000	Negative	Positive
Oxycodone	100,000	Negative	Positive
Oxymorphone	100,000	Negative	Positive
Paroxetine	100,000	Negative	Positive
PCP	1,000,000	Negative	Positive
Phenelzine	75,000	Negative	Positive
Phenobarbital	1,000,000	Negative	Positive
Promethazine	100,000	Negative	Positive
Propoxyphene	750,000	Negative	Positive
Ranitidine	100,000	Negative	Positive
Risperidone	100,000	Negative	Positive
Scopolamine	1,000,000	Negative	Positive
Secobarbital	1,000,000	Negative	Positive
Sertraline	100,000	Negative	Positive
Spironolactone	750,000	Negative	Positive
Stavudine	100,000	Negative	Positive
Tapentadol	100,000	Negative	Positive
Terbinafine	750,000	Negative	Positive
Thiopental	1,000,000	Negative	Positive
Thioridazine	750,000	Negative	Positive
Tobramycin	1,000,000	Negative	Positive
Tolmetin	750,000	Negative	Positive
Trazodone	1,000,000	Negative	Positive
Trimethoprim	1,000,000	Negative	Positive
Vancomycin	1,000,000	Negative	Positive
Venlafaxine	1,000,000	Negative	Positive
Verapamil	100,000	Negative	Positive
Zolpidem Tartrate	100,000	Negative	Positive

f) **Interference**

The interference studies were performed in accordance with CLSI Guideline EP07-A2, using both qualitative and semi-quantitative modes. The potential interference of pH, endogenous and exogenous physiologic substances on recovery of Benzoylecgonine using DRI Cocaine Metabolite Assay was assessed by spiking known compounds of potentially interfering substances into the low control, 112.5 ng/mL (-25% of the cutoff concentration of 150 ng/mL)

and 225 ng/mL (-25% of the cutoff concentration of 300 ng/mL) and high control, 187.5 ng/mL (+25% of the cutoff concentration of 150 ng/mL) and 375 ng/mL (+25% of the cutoff concentration of 300 ng/mL). In the presence of the compounds listed below, the controls were detected accurately, indicating that these compounds did not show interference in the assay.

Interference substances for 150 ng/mL cut-off

Compound	Tested Concentration (mg/dL)	Spiked Benzoylecgonine Level	
		Low Control -25% of cutoff (112.5 ng/mL)	High Control +25% of cutoff (187.5 ng/mL)
Acetaminophen	10	Negative	Positive
Acetone	1000	Negative	Positive
Ascorbic Acid	1000	Negative	Positive
Aspirin	10	Negative	Positive
Caffeine	10	Negative	Positive
Creatinine	500	Negative	Positive
Ethanol	1000	Negative	Positive
Galactose	10	Negative	Positive
γ-Globulin	500	Negative	Positive
Glucose	3000	Negative	Positive
Hemoglobin	150	Negative	Positive
Human Serum Albumin	500	Negative	Positive
Ibuprofen	10	Negative	Positive
Oxalic Acid	100	Negative	Positive
Riboflavin	7.5	Negative	Positive
Sodium Chloride	1000	Negative	Positive
Urea	1250	Negative	Positive
pH			
pH	3	Negative	Positive
pH	4	Negative	Positive
pH	5	Negative	Positive
pH	6	Negative	Positive
pH	7	Negative	Positive
pH	8	Negative	Positive
pH	9	Negative	Positive
pH	10	Negative	Positive
pH	11	Negative	Positive

Interference substances for 300 ng/mL cut-off

Compound	Tested Concentration (mg/dL)	Spiked Benzoylecgonine Level	
		Low Control -25% of cutoff (225 ng/mL)	High Control +25% of cutoff (375 ng/mL)
Acetaminophen	10	Negative	Positive
Acetone	1000	Negative	Positive
Ascorbic Acid	1000	Negative	Positive
Aspirin	10	Negative	Positive
Caffeine	10	Negative	Positive
Creatinine	500	Negative	Positive
Ethanol	1000	Negative	Positive
Galactose	10	Negative	Positive
γ-Globulin	500	Negative	Positive
Glucose	3000	Negative	Positive
Hemoglobin	150	Negative	Positive
Human Serum Albumin	500	Negative	Positive
Ibuprofen	10	Negative	Positive
Oxalic Acid	100	Negative	Positive
Riboflavin	7.5	Negative	Positive
Sodium Chloride	1000	Negative	Positive
Urea	1250	Negative	Positive
pH			
pH	3	Negative	Positive
pH	4	Negative	Positive
pH	5	Negative	Positive
pH	6	Negative	Positive
pH	7	Negative	Positive
pH	8	Negative	Positive
pH	9	Negative	Positive
pH	10	Negative	Positive
pH	11	Negative	Positive

g) Specific Gravity

Drug free urine samples with specific gravity ranging in value within 1.000 to 1.030 were split and spiked with Benzoylecgonine to a final concentration of either 112.5 ng/mL or 225 ng/mL (the low control concentrations) or 187.5 ng/mL or 375 ng/mL (high control concentrations).

These samples were then evaluated in both qualitative and semi-quantitative modes. The controls were detected accurately, indicating that no interference was observed.

Specific gravity interference data for 150 ng/mL cut-off

Specific Gravity	Spiked Benzoylecgonine Level	
	Low Control	High Control
1.004	Negative	Positive
1.005	Negative	Positive
1.007	Negative	Positive
1.010	Negative	Positive
1.011	Negative	Positive
1.013	Negative	Positive
1.019	Negative	Positive
1.023	Negative	Positive
1.025	Negative	Positive
1.029	Negative	Positive

Specific gravity interference data for 300 ng/mL cut-off

Specific Gravity	Spiked Benzoylecgonine Level	
	Low Control	High Control
1.004	Negative	Positive
1.005	Negative	Positive
1.007	Negative	Positive
1.010	Negative	Positive
1.011	Negative	Positive
1.013	Negative	Positive
1.019	Negative	Positive
1.023	Negative	Positive
1.025	Negative	Positive
1.029	Negative	Positive

H. Conclusion

The information supports a determination of substantial equivalence between DRI Cocaine Metabolite Assay and the predicate device Cocaine Metabolite Enzyme Immunoassay (K960187).