CEDIA™ Benzodiazepine Assay

thermo scientific

IVD **For In Vitro Diagnostic Use**

Rx Only

REF 10016409 (3 x 17 mL Indiko Kit)
100085 (3 x 17 mL Kit)
100094 (65 mL Kit)
1775561 (495 mL Kit)

Intended Use

The CEDIA™ Benzodiazepine Assay is a homogeneous enzyme immunoassay intended for the qualitative and/or semi-quantitative determination of benzodiazepines in human urine at a cutoff concentration of 200 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.[1] Clinical consideration and professional judgement should be applied to any drug of abuse test result, particularly when preliminary positive results are used.

For *In Vitro Diagnostic* Use Only.

Summary and Explanation of the Test

Benzodiazepines belong to a broad classification of CNS-depressant drugs known as sedatives/hypnotics.[2] They are prescribed as anxiolytics, sleeping agents, anticonvulsants, muscle relaxers, and also widely used for preanesthetic medication and to supplement, induce, and maintain anesthesia.[2,3,4]

Although widely prescribed, benzodiazepines are also abused.[3-5] Chronic benzodiazepine use can cause physical dependence, with withdrawal symptoms of insomnia, agitation, irritability, muscle tension, and, in more severe cases, hallucinations, psychosis, and seizures.[2,3]

The CEDIA Benzodiazepine assay uses recombinant DNA technology (US Patent No. 4708929) to produce a unique homogeneous enzyme immunoassay system.[6] This assay is based on the bacterial enzyme β-galactosidase, which has been genetically engineered into two inactive fragments. These fragments spontaneously reassociate to form fully active enzyme that, in the assay format, cleaves a substrate, generating a color change that can be measured spectrophotometrically.

In the assay, drug in the sample competes with drug conjugated to one inactive fragment of β-galactosidase for antibody binding site. If drug is present in the sample, it binds to antibody, leaving the inactive enzyme fragments free to form active enzyme. If drug is not present in the sample, antibody binds to drug conjugated on the inactive fragment, inhibiting the reassociation of inactive β-galactosidase fragments, and no active enzyme is formed. The amount of active enzyme formed and resultant absorbance change are proportional to the amount of drug present in the sample.

Add β-glucuronidase enzyme to the reconstituted EA solution before using the assay. All specimens must be tested with β-glucuronidase. This enzyme will hydrolyze the glucuronidated metabolites of benzodiazepines in the samples, thereby enabling the detection of benzodiazepine glucuronides.[7,8]

Reagents

1 EA Reconstitution Buffer: Contains Piperazine-N, N-bis [2-ethanesulfonic acid], 13.6 µg/mL sheep polyclonal antibodies to benzodiazepine, buffer salts, stabilizer, and preservative.

1a EA Reagent: Contains 0.171 g/L Enzyme Acceptor, buffer salts, detergent, and preservative.

2 ED Reconstitution Buffer: Contains Piperazine-N, N-bis [2-ethanesulfonic acid], buffer salts, and preservative.

2a ED Reagent: Contains 9.7 µg/L Enzyme Donor conjugated to a benzodiazepine derivative, 1.67 g/L chlorophenol red-β-D-galactopyranoside, stabilizer, and preservative.

Additional Materials: Alternative Bar Code Labels (For Cat. Nos. 100085 and 100094. Refer to analyzer specific application sheet for directions on usage). Empty analyzer bottles for EA/ED solution pour-over (Cat. No. 100094). Empty analyzer bottle for ED solution pour-over (Cat. No. 1775561 only).

Additional materials required:

CEDIA Negative Calibrator
Oxazepam 200 ng/mL calibrator
Oxazepam 300 ng/mL calibrator
Oxazepam 800 ng/mL calibrator
Oxazepam 5000 ng/mL calibrator
Oxazepam 150 and 250 ng/mL controls
β-Glucuronidase Enzyme

⚠ Precautions and Warnings

DANGER: Powder reagent contains ≤56% w/w bovine serum albumin (BSA), and ≤2% w/w sodium azide. Liquid reagent contains ≤1.0% bovine serum, ≤0.3% sodium azide and ≤0.1% Drug-specific antibody (Sheep).
H317 - May cause allergic skin reaction.
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled.
EUH032 - Contact with acids liberates very toxic gas.

Avoid breathing dust/mist/vapors/spray. Contaminated work clothing should not be allowed out of the workplace. Wear protective gloves/eye protection/face protection. In case of inadequate ventilation wear respiratory protection. If on skin: Wash with plenty of soap and water. IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. If skin irritation or rash occurs: Get medical advice/attention. If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician. Wash contaminated clothing before reuse. Dispose of contents/container to location in accordance with local/regional/national/international regulations.

Reagent Preparation and Storage

Remove the kit from refrigerated storage immediately prior to preparation of the solutions.

Prepare the solutions in the following order to minimize possible contamination.

R2 Enzyme donor solution: Connect Bottle 2a (ED Reagent) to Bottle 2 (ED Reconstitution Buffer) using one of the enclosed adapters. Mix by gentle inversion, ensuring that all the lyophilized material from Bottle 2a is transferred into Bottle 2. Avoid the formation of foam. Detach Bottle 2a and adapter from Bottle 2 and discard. Cap Bottle 2 and let stand approximately 5 minutes at room temperature (15–25°C). Mix again. Record the reconstitution date on the bottle label.

R1 Enzyme acceptor solution: Connect Bottle 1a (EA Reagent) to Bottle 1 (EA Reconstitution Buffer) using one of the enclosed adapters. Mix by gentle inversion, ensuring that all the lyophilized material from Bottle 1a is transferred into Bottle 1. Avoid the formation of foam. Detach Bottle 1a and adapter from Bottle 1 and discard. Cap Bottle 1 and let stand approximately 5 minutes at room temperature (15–25°C). Mix again. Record the reconstitution date on the bottle label.

Benzodiazepine High Sensitivity: All specimens must be tested with β-glucuronidase. To use the β-Glucuronidase reagent, add 0.09 mL of the β-Glucuronidase for Cat. No.100085 and Cat. No. 10016409, 0.325 mL for Cat. No.100094, and 2.5 mL for Cat. No. 1775561 to the reconstituted EA solution. Mix by gentle inversion. Record on the bottle label that β-Glucuronidase has been added.

NOTE 1 : The components supplied in this kit are intended for use as an integral unit. Do not mix components from different lots.
NOTE 2 : Avoid cross-contamination of reagents by matching reagent stoppers to the proper reagent bottle. The R2 Solution should be yellow-orange in color. A dark red or purple-red color indicates that the reagent has been contaminated and must be discarded.
NOTE 3 : The R1 and R2 Solutions must be at the reagent compartment storage temperature of the analyzer before performing the assay. Refer to the analyzer specific application sheet for additional information.
NOTE 4 : To ensure reconstituted EA reagent stability, protect from prolonged, continuous exposure to bright light.

Store reagents at 2-8°C. **DO NOT FREEZE.** For stability of the unopened components, refer to the box or bottle labels for the expiration date.

R1 Solution: 60 days refrigerated on analyzer or at 2-8°C.
R2 Solution: 60 days refrigerated on analyzer or at 2-8°C.

Specimen Collection and Handling

Collect urine specimens in plastic or glass containers. Care should be taken to preserve the chemical integrity of the urine sample from the time it is collected until the time it is assayed. Specimens kept at room temperature that do not receive initial test within 7 days[9] of arrival at the laboratory may be placed into a secure refrigeration unit at 2 to 8°C for 30 days.[9] For longer storage prior to analysis or for sample retention after analysis, urine specimens may be stored at -20°C.[10]

Laboratories following the SAMHSA mandatory guidelines should refer to SAMHSA "Short-Term Refrigerated Storage" and "Long-Term Storage" requirements.[11]

To protect the integrity of the sample, do not induce foaming and avoid repeated freezing and thawing. An effort should be made to keep pipetted samples free of gross debris. It is recommended that grossly turbid specimens be centrifuged before analysis. Frozen samples should be thawed and mixed prior to analysis. Adulteration of the urine sample may cause erroneous results. If adulteration is suspected, obtain another sample and forward both specimens to the laboratory for testing.

Handle all urine specimens as if they were potentially infectious.

Assay Procedure

Chemistry analyzers which are capable of maintaining a constant temperature, pipetting samples, mixing reagents, measuring enzymatic rates and timing the reaction accurately can be used to perform this assay. Application sheets with specific instrument parameters are available from Microgenics, a part of Thermo Fisher Scientific.

Additional barcode labels are provided for semiquantitative determination with the 17 mL and 65 mL kits only. To use, over label each bottle with the correct label.

Quality Control and Calibration[12]

Qualitative analysis

For **qualitative analysis** of samples, use Oxazepam 200 ng/mL calibrators.

Semiquantitative analysis

For **semiquantitative analysis** of samples, use CEDIA Negative Calibrator, Oxazepam 200, 300, 800 and 5000 ng/mL calibrators.

Good laboratory practice suggests that controls be run each day patient samples are tested and each time calibration is performed. It is recommended that two levels of controls be run; one 25% above the selected cutoff; the other 25% below the selected cutoff. Use Oxazepam 150 and 250 ng/mL Controls for quality control. Recalibrate the test if reagents are changed or if control results are outside of established limits. Each laboratory should establish its own control frequency. Base assessment of quality control on the values obtained for the controls, which should fall within specified limits. If any trends or sudden shifts in values are detected, review all operating parameters. Contact Technical Support for further assistance. All quality control requirements should be performed in conformance with local, state and/or federal regulations or accreditation requirements.

Results and Expected Values

Qualitative results

Oxazepam 200 ng/mL calibrator is used as a reference in distinguishing between positive and negative samples. Samples producing a response value equal to or greater than the response value of the calibrator are considered positive. Samples producing a response value less than the value of the calibrator are considered negative. Refer to the analyzer specific application sheet for additional information.

Semiquantitative results

CEDIA Negative Calibrator, Oxazepam 200, 300, 800 and 5000 ng/mL calibrators can be used to estimate relative concentration of benzodiazepines.

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.

Limitations

1. A positive test result indicates the presence of benzodiazepines; it does not indicate or measure intoxication.
2. Other substances and/or factors not listed may interfere with the test and cause false results (e.g., technical or procedural errors).
3. All samples must be run using the β-glucuronidase with the assay.

Specific Performance Characteristics

Typical performance data obtained on the Beckman Coulter AU680 analyzer is shown below.[13] The results obtained in your laboratory may differ.

Precision

Samples were prepared by spiking oxazepam into drug free urine at cutoff (100%), 25%, 50%, 75% and 100% above and below the cutoff and tested in duplicate (n=2) twice per day for 20 days (total n=80 for each level), in both qualitative and semi-quantitative modes. The results of the Precision study is shown below.

Spiked Concentration (ng/mL)	% of cutoff (200 ng/mL)	Total Precision (n=80)		
		# of Determinants	Qualitative Immunoassay Results (Negative/Positive)	Semi-quantitative Immunoassay Results (Negative/Positive)
0	-100	80	80/0	80/0
50	-75	80	80/0	80/0
100	-50	80	80/0	80/0
150	-25	80	80/0	79/1
200	100	80	6/74	1/79
250	+25	80	0/80	0/80
300	+50	80	0/80	0/80
350	+75	80	0/80	0/80
400	+100	80	0/80	0/80

Accuracy

One hundred and twenty eight samples were treated with β-glucuronidase reagent prior to analysis by the CEDIA Benzodiazepine Assay in both qualitative and semi-quantitative modes. The results were compared to LC-MS/MS where samples were also treated with β-glucuronidase.

Qualitative Accuracy Study with LC-MS/MS as Reference Method

Candidate Device Results	< 50% of Cutoff concentration by LC-MS/MS (< 100 ng/mL)	Near Cutoff Negative (Between 50% below the cutoff and the cutoff concentration as determined by LC-MS/MS) (100 – 199.9 ng/mL)	Near Cutoff Positive (Between the cutoff and 50% above the cutoff concentration as determined by LC-MS/MS) (200 – 300 ng/mL)	High Positives (Greater than 50% above cutoff concentration) (> 300 ng/mL)
Positive	0	#Δ4	13	55
Negative	54	2	0	0

Semi-Quantitative Accuracy Study with LC-MS/MS as Reference Method

Candidate Device Results	< 50% of Cutoff concentration by LC-MS/MS (< 100 ng/mL)	Near Cutoff Negative (Between 50% below the cutoff and the cutoff concentration as determined by LC-MS/MS) (100 – 199.9 ng/mL)	Near Cutoff Positive (Between the cutoff and 50% above the cutoff concentration as determined by LC-MS/MS) (200 – 300 ng/mL)	High Positives (Greater than 50% above cutoff concentration) (> 300 ng/mL)
Positive	0	#Δ4	13	55
Negative	54	2	0	0

Discordant Result Table for Discrepant Samples

Sample ID	EIA		LC-MS/MS
	Qualitative Mode	Semi-quantitative Mode	Total Benzodiazepine Parent Only (ng/mL)
# CA160606-045	Positive	Positive	111
# CA170605-001	Positive	Positive	171
# CA160926-057	Positive	Positive	199
Δ CA180820-014	Positive	Positive	197

These 3 samples are discordant due to the presence of Benzodiazepine metabolites.
Sample CA160606-045 contains 3155 ng/mL of 7-aminoclonazepam
Sample CA170605-001 contains 560 ng/mL of 7-aminoclonazepam
Samples CA160926-057 contains 411 ng/mL of 7-aminoclonazepam and 13 ng/mL of α-hydroxyalprazolam
Δ Sample CA180820-014 is near cutoff LC-MS/MS negative sample that the assay reported as near cutoff positive immunoassay results.

Analytical Recovery and Dilution Linearity

Five replicates of each level indicated below were tested in semi-quantitative mode, and the average was used to determine percent recovery compared to the expected target value. The assay demonstrated linearity up to 800 ng/mL.

Dilution Linearity

Level	Target Concentration (ng/mL)	Observed Concentration (ng/mL)	Average Recovery (%)	Range of Recovery (%)
1	0	0	N/A	95.2 - 107.8
2	100	107.8	107.8	
3	200	205.8	102.9	
4	300	289.4	96.5	
5	400	412.4	103.1	
6	500	517.2	103.4	
7	600	595.0	99.2	
8	700	666.2	95.2	
9	800	766.2	95.8	

Specificity
Structurally similar drugs were spiked into drug-free urine at 200 ng/mL cutoff and percent cross-reactivity was evaluated according to CLSI EP07-A2[10].

% Cross-reactivity = (Cutoff concentration / Lowest concentration of cross-reactant causing a positive result) X 100.

The following benzodiazepines and metabolites, when tested with CEDIA Benzodiazepine High Sensitivity 200 ng/mL Assay (with β-Glucuronidase), yielded a response approximately equivalent to the cutoff response.

Cross Reactivity of Benzodiazepines and Metabolites

Benzodiazepines and metabolites	Tested Concentration (ng/mL)	Positive/ Negative	Cross-reactivity (%)
α-Hydroxyalprazolam	110	Positive	182
α-Hydroxytriazolam	140	Positive	143
Alprazolam	100	Positive	200
7-Aminoclonazepam	800	Positive	25
7-Aminoflunitrazepam	225	Positive	89
7-Aminonitrazepam	500	Positive	40
Bromazepam	300	Positive	67
Chlordiazepoxide	2000	Positive	10
Clobazam	450	Positive	44
Clonazepam	350	Positive	57
Clorazepate	100	Positive	200
Delorazepam	100	Positive	200
Demoxepam	1500	Positive	13
Desalkylflurazepam (Norfludiazepam)	110	Positive	182
Diazepam	80	Positive	250
Estazolam	115	Positive	174
Flunitrazepam	125	Positive	160
Flurazepam	70	Positive	286
Lorazepam	250	Positive	80
Lorazepam glucuronide	400	Positive	50
Lormetazepam	175	Positive	114
Medazepam	200	Positive	100
Nitrazepam	290	Positive	69
Nordiazepam (Desmethyldiazepam)	70	Positive	286
Oxazepam	200	Positive	100
Oxazepam glucuronide	350	Positive	57
Prazepam	140	Positive	143
Temazepam	130	Positive	154
Temazepam glucuronide	250	Positive	80
Triazolam	90	Positive	222

Structurally unrelated compounds and/or concurrently used drugs were evaluated by adding each substance to oxazepam spiked at low (150 ng/mL) and high (250 ng/mL) controls at the concentration indicated. As shown in the tables below, the Controls were detected accurately, Low Control as Negative and High Control as Positive for the 200 ng/mL cutoff, indicating that all the compounds evaluated exhibited minimal cross-reactivity at the concentrations tested.

Structurally Unrelated Compounds Spiked into Low and High Controls

Structurally Unrelated Compounds	Tested Concentration (ng/mL)	200 ng/mL cutoff	
		Low Control (150 ng/mL)	High Control (250 ng/mL)
6-Acetyl Morphine	100,000	Negative	Positive
10,11 Dihydrocarbamazepine	100,000	Negative	Positive
11-nor-Δ9-THC-COOH	100,000	Negative	Positive
Acetaminophen	100,000	Negative	Positive
Acetylsalicylic Acid	100,000	Negative	Positive
Amitriptyline	75,000	Negative	Positive
Amoxicillin	100,000	Negative	Positive
Amphetamine	100,000	Negative	Positive
Benzoylecgonine	100,000	Negative	Positive
Brompheniramine	100,000	Negative	Positive
Buprenorphine	100,000	Negative	Positive
Caffeine	100,000	Negative	Positive
Captopril	100,000	Negative	Positive
Cimetidine	100,000	Negative	Positive
Codeine	100,000	Negative	Positive
Desipramine	100,000	Negative	Positive
Dextromethorphan	100,000	Negative	Positive
Digoxin	100,000	Negative	Positive
Diphenhydramine	30,000	Negative	Positive
EDDP	100,000	Negative	Positive
EMDP	3,000	Negative	Positive
Fentanyl	100,000	Negative	Positive
Fluoxetine	75,000	Negative	Positive
Fluphenazine	75,000	Negative	Positive
Haloperidol	100,000	Negative	Positive
Heroin	100,000	Negative	Positive
Hydrocodone	100,000	Negative	Positive
Hydromorphone	100,000	Negative	Positive
Ibuprofen	100,000	Negative	Positive
Levorphanol	100,000	Negative	Positive
Levothyroxine	75,000	Negative	Positive
Meperidine	100,000	Negative	Positive
Methadone	75,000	Negative	Positive
Methamphetamine	100,000	Negative	Positive
Morphine	100,000	Negative	Positive
Morhpine-3β-D-glucuronide	100,000	Negative	Positive
Morhpine-6β-D-glucuronide	100,000	Negative	Positive
Nalbuphine	100,000	Negative	Positive
Nalorphine	100,000	Negative	Positive
Naloxone	100,000	Negative	Positive
Naltrexone	100,000	Negative	Positive
Naproxen	100,000	Negative	Positive
Nifedipine	100,000	Negative	Positive
Oxaprozin	5,000	Negative	Positive
Oxycodone	100,000	Negative	Positive
Oxymorphone	100,000	Negative	Positive

Table continued

Structurally Unrelated Compounds	Tested Concentration (ng/mL)	200 ng/mL cutoff	
		Low Control (150 ng/mL)	High Control (250 ng/mL)
Perphenazine	30,000	Negative	Positive
Phencyclidine	90,000	Negative	Positive
Phenobarbital	100,000	Negative	Positive
Procyclidine	100,000	Negative	Positive
Propoxyphene	100,000	Negative	Positive
Ranitidine	100,000	Negative	Positive
Secobarbital	100,000	Negative	Positive
Sertraline	7,000	Negative	Positive
Sulpiride	100,000	Negative	Positive
Tapentadol	100,000	Negative	Positive
Thioridazine	100,000	Negative	Positive
Tramadol	100,000	Negative	Positive
Triprolidine	40,000	Negative	Positive
Verapamil	100,000	Negative	Positive
Zolpidem	40,000	Negative	Positive
Enalapril	100,000	Negative	Positive
Salicyluric Acid	100,000	Negative	Positive
Tolmetin	100,000	Negative	Positive

Interference

The potential interference of endogenous, exogenous, physiological substances, and pH on the recovery of oxazepam using CEDIA Benzodiazepine Assay was assessed. Potentially interfering substances were spiked into the low (150 ng/mL) and high (250 ng/mL) controls at the concentration indicated. As shown in the tables below, the Controls were detected accurately, Low Control as Negative and High Control as Positive for 200 ng/mL cutoffs, indicating that all these compounds did not show interference in the assay.

Compounds	Tested Conc. (mg/dL)	200 ng/mL cutoff	
		Low Control (150 ng/mL)	High Control (250 ng/mL)
Acetaminophen	10	Negative	Positive
Acetone	500	Negative	Positive
Acetyl Salicylic Acid	10	Negative	Positive
Ascorbic Acid	150	Negative	Positive
Caffeine	5	Negative	Positive
Creatinine	400	Negative	Positive
Ethanol	1000	Negative	Positive
Galactose	5	Negative	Positive
Glucose	1000	Negative	Positive
Hemoglobin	150	Negative	Positive
Human Serum Albumin	200	Negative	Positive
Ibuprofen	10	Negative	Positive
Oxalic acid	50	Negative	Positive
Riboflavin	3	Negative	Positive
Sodium Chloride	1000	Negative	Positive
Urea	1000	Negative	Positive

pH	200 ng/mL cutoff	
	Low Control (150 ng/mL)	High Control (250 ng/mL)
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

Specific Gravity

Drug free urine samples with specific gravity ranging in value from 1.002 to 1.029 were split and spiked with oxazepam to a final concentration of 150 ng/mL and 250 ng/mL. These samples were then evaluated in qualitative and semi-quantitative modes. The Controls were detected accurately, indicating no interference was observed.

Specific Gravity	200 ng/mL cutoff	
	Low Control (150 ng/mL)	High Control (250 ng/mL)
1.002	Negative	Positive
1.004	Negative	Positive
1.005	Negative	Positive
1.007	Negative	Positive
1.010	Negative	Positive
1.012	Negative	Positive
1.014	Negative	Positive
1.019	Negative	Positive
1.023	Negative	Positive
1.025	Negative	Positive
1.029	Negative	Positive

References

1. Hawks RL. Analytical methodology. In: Hawks RL, Chiang CN, eds. Urine testing for drugs of abuse. NIDA Research Monograph. 1986; 73: 30-41.
2. Katzung BG, ed. Basic and clinical pharmacology. 5th ed. Norwalk, Conn: Appleton & Lange, 1992.
3. Julien RM.. A primer of drug action. 6th ed. New York, NY: W.H. Freeman & Co; 1992.
4. Goodman and Gilman's The Pharmacological basis of therapeutics. 8th ed. New York, NY: Pergamon Press, 1990.
5. Adams EH. Prevalence of prescription drug abuse: Data from the National Institute on Drug Abuse. NY State J Med 199; 91 (suppl 11): 32s-36s.
6. Henderson DR, Friedman SB, Harris JD et al. CEDIA™, a new homogeneous immunoassay system. Clin Chem. 1986; 32: 1637-1641.
7. Beck O, Lafolle P, Hjemdahl P et al. Detection of Benzodiazepine Intake in Therapeutic Doses by Immunoanalysis of Urine: Two Techniques Evaluated and Modified for Improved Performance. Clin Chem. 1992; 38: 271-275.
8. Simonsson P, Liden A, Lindberg S. Effect of a-Glucuronidase on Urinary Benzodiazepine Concentrations Determined by Flourescence Polarization Immunossay. Clin Chem. 1995; 41: 920-923.
9. Dixon RB, Mbeunkui F, Wiegel JW. Stability study of opioids and benzodiazepines in urine samples by liquid chromatography tandem mass spectrometry. *Journal of Analytical Science and Technology* (2015) 6:17.
10. C52-A2, Toxicology and Drug Testing in the Clinical Laboratory; Approved Guideline – Second Edition, *Clinical and Laboratory Standards Institute (CLSI)* (April 2007).
11. *Notice of Mandatory Guidelines for Federal Workplace Drug Testing Program: Final Guidelines; Federal Register,* Substance Abuse and Mental Health Administration (SAMHSA), (1994) 110 (June 9):11983.
12. Data on traceability are on file at Microgenics Corporation, a part of Thermo Fisher Scientific.
13. Data on file at Microgenics Corporation, a part of Thermo Fisher Scientific.

Glossary:

http://www.thermofisher.com/symbols-glossary

Microgenics Corporation
46500 Kato Road
Fremont, CA 94538 USA
US Customer and
Technical Support:
1-800-232-3342

For insert updates go to:
www.thermofisher.com/diagnostics

10027650-0
2020 02

thermo scientific