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

A. 510(k) Number:
K023626

B. Analyte:
Cocaine

C. Type of Test:
Qualitative

D. Applicant:
Quest Diagnostics

E. Proprietary and Established Names:
Quest Diagnostics HairCheck-DT (Cocaine)

F. Regulatory Information:

1. Regulation section:
   Enzyme Immunoassay, Cocaine and Cocaine Metabolites
   CFR 862.3250

   Calibrators, Drug Specific
   862.3200

   Clinical Toxicology Control Material, Drug Mixture Control Materials
   862.3280

2. Classification:
   II, II, and I (Reserved), respectively

3. Product Code:
   DIO, DLJ, and DIF, respectively

4. Panel:
   Toxicology (91)

G. Intended Use:

1. Intended use(s):
   Refer to Indications for use.

2. Indication(s) for use:

The Quest Diagnostics Hair Check-DT (Cocaine) test system utilizes an Enzyme Linked Immunosorbent Assay (ELISA) for the qualitative detection of cocaine in head hair samples through the measurement of cocaine and cocaine metabolites at concentrations at or above 300 pg/mg hair. This test system has not been evaluated for use with hair specimens from locations other than the head. It is an in vitro diagnostic device intended exclusively for in-house professional use only and is not intended for sale to anyone.

The Quest Diagnostics Hair Check-DT (Cocaine) test system provides only a preliminary analytical test result. To confirm a presumptive screen positive result, a more specific alternate chemical method such as gas chromatograph - mass spectrometer (GC/MS) must be used. Clinical consideration and professional judgment should be applied to any drug of abuse test result, particularly when preliminary positive results are obtained.

Characterization of the performance of the device was limited to two distinct study populations; individuals known to be chronic drug abusers and individuals proclaiming to be non-drug users.

3. Special condition for use statement(s):

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 is the preferred confirmatory method. Other chemical confirmation methods are available. Clinical consideration and professional judgment should be applied to any drug of abuse test result, particularly when preliminary positive results are used.

4. Special instrument Requirements:
The device is for use with an automated microplate reader capable of measuring at 450 and 630 nm.

For confirmation testing, the sponsor uses an Electron Impact GC/MS operating in a Single Ion Monitoring mode.

H. Device Description:

The test consists of two parts; a **pre-analytical** hair treatment procedure (to convert the solid matrix of hair to a measurable liquid matrix) and the **screening assay**, International Diagnostic Systems (IDS) Corporation One-Step ELISA (Enzyme-Linked ImmunoSorbent Assay) Cocaine Kit. The procedures and reagents are briefly described in the "Principle" section, below, but trade secret information was not revealed to FDA during the review. Details of all the procedures and reagents that

were provided have not been reproduced in this review because the product is not intended for sale to others.

The screening portion of the test system consists of micro strip plates coated with rabbit anti-BE polyclonal antibody, enzyme conjugate (horseradish peroxidase conjugated to cocaine), substrate (containing tetramethylbenzidine), and wash solution.

I. **Substantial Equivalence Information:**
1. Predicate device name(s):
   Dade Behring (Syva) EMIT II Cocaine Assay
2. Predicate K number(s):
   K993988
3. Comparison with predicate:

   Both devices are qualitative assays for the detection of cocaine use. Both are immunoassays.

Differences		
Item	**Device**	**Predicate**
Method of measurement	Microplate reader	Spectrophotometer
Matrix	Head hair	Urine
Cutoff concentration	300 pg cocaine/mg hair	300 ng benzoylecgonine/mL urine
Test Principle	ELISA	Competitive EIA

J. **Standard/Guidance Document Referenced (if applicable):**
   The sponsor did not reference any standards.

K. **Test Principle:**

   Pre-Analytical:
   The test utilizes a sample of head hair (approximately 120 strands) that is cut as close as possible to the scalp, preferably from the back of the head at the crown. The amount of hair collected in this manner is such that a 3.9cm long sample should weigh approximately 100 – 120 mg. The hair is stored at room temperature. In the laboratory the specimen is cut at approximately 3.9 cm from the root end, then cut into smaller lengths and mixed to ensure homogeneity.

   Unknown specimens are prepared by weighing out twenty milligrams of hair. Specimens are washed with methanol, decanted, then placed in hot methanol for two hours. The methanol is then transferred to a new tube and evaporated under nitrogen. The tubes are reconstituted with 0.6 mL of phosphate buffer.

To minimize hair matrix effects calibrator and control stock solutions are added to a negative matrix tube prior to analysis. To prepare these tubes hair from non drug-users is weighed and methanol is added. After sitting at room temperature for a period of time the methanol is discarded. Methanol is added to the methanol-washed hair and heated then filtered. The collected methanol is diluted to exactly 1000 mL with methanol. One mL of the methanol containing hair extract is aliquoted into tubes and the tubes are evaporated to dryness. Prior to analysis, 100 µL of prepared stock solutions of calibrator and control are pipetted into a negative hair matrix tube, and 1.9 mL of phosphate buffer is added.

Screening Assay:
Samples are assayed using the ELISA Cocaine Kit. The kit is a solid-phase micro-titer plate immunoassay where there is competition for a limited number of antibody sites by unlabeled cocaine/cocaine metabolites and enzyme labeled drug. The two will bind to the antibody in proportion to their concentration in solution.

A hair sample extract is added to the well, followed by the enzyme conjugate. During this initial phase, the enzyme conjugate competes with the analyte in the sample for binding sites on the antibody-coated microwells. A wash solution is then applied to remove any unbound materials. Enzyme substrate solution containing a chromagen is then added for the final color development process. The reaction is stopped with an acid and the absorbance is read at 450 nm with a reference wavelength of 630 nm using a plate reader. Color intensity is inversely proportional to the amount of analyte present in the sample.

Interpretation of Screening Results:
Negative: Samples with absorbance value higher than the Cutoff Calibrator are negative for cocaine. Either the sample does not contain cocaine or cocaine is present in concentrations below the cutoff level for this assay.

Presumptive Positive: Samples with absorbance value equal to or lower than the Cutoff Calibrator of 300pg/mg of Cocaine are presumptively positive for cocaine. Presumptive positive samples should be confirmed by another non-immunological method such as gas chromatography/mass spectrometry (GC/MS).

Other structurally similar compounds can produce positive results. Compounds that are not structurally similar to cocaine have not been observed to produce positive results, however false positive screening results may occur because of non-specific binding or other technical problems.

Confirmatory Testing:
Confirmation is performed utilizing another aliquot from the original hair specimen. The hair is washed with methanol, then water, then a second time with methanol, then water. The hair is incubated in hot acid for 2 hours, then the acid is transferred to another tube. Phosphate buffer and NaOH are added, followed by acetic acid which is intended to reduce the conversion of cocaine to BE. A solid phase extraction of

cocaine and metabolites is performed. Samples are derivatized and analyzed by Electron Impact GC/MS operating in a Single Ion Monitoring mode utilizing deuterated internal standards.

Interpretation of Confirmatory Testing Results: Samples are considered positive for cocaine use if:

- Cocaine is present at or above 300 pg/mg of hair, and either benzoylecgonine or cocaethylene are present at concentrations of 50pg/mg hair or higher.

- Cocaethylene is present at a concentration equal to or greater than 200 pg/mg hair.
- Benzoylecgonine is present at a concentration equal to or greater than 300 pg/mg hair.

Interpretation of results must take into account that drug concentrations detected in hair from a single individual can vary extensively depending on the site of collection. Positive screening results only indicate the presumptive presence of cocaine, and require additional analysis by mass spectrometry to obtain a confirmed result. A negative screening result does not necessarily rule out the possibility of cocaine use, i.e., time of collection, frequency of use, mode of ingestion, dosage used, hair types and other factors may influence results. It is not possible to document all possible effects due to treatments such as bleaching, straightening and dying. There is a possibility that other substances and/or factors that were not evaluated in the interference studies may interfere with the test and cause false results that cannot be confirmed by mass spectrometry, e.g. technical or procedural errors.

L. Performance Characteristics (if/when applicable):
  1. Analytical performance:
     a. *Precision/Reproducibility:*

Within-Run Precision
The intra-assay analytical precision was determined by analyzing fifteen replicate samples prepared to four different concentrations in one run. To prepare the samples negative hair matrix tubes were spiked with cocaine to concentrations of 0, 150, 300, and 600pg/mg hair. These concentrations are equivalent to the negative control, the cut-off concentration, 50% of the cutoff concentration, and +200% the cutoff concentration.

Within-Run Precision of Cocaine Using Spiked Samples

Spiked Concentration	Negative	50%	100%	200%
Mean	2.122	1.145	0.976	0.837
S.D.	0.057	0.037	0.023	0.038
CV%	2.7%	3.2%	2.3%	4.6%

Mean	2.1223	1.14	0.9758	0.8369
+2 sd	2.2364	1.22	1.0209	0.9131
-2 sd	■	1.07	0.9307	0.7606

Between-Run Precision

The inter-assay analytical precision was determined by assaying the same fifteen samples on each of three days.

Between-Run Precision of Cocaine Using Spiked Samples

Cocaine Spiked Concentration	Negative	50%	100%	200%
Mean	2.107	1.145	0.964	0.823
S.D.	0.072	0.043	0.032	0.044
Mean plus 2 sd	2.25	1.23	1.03	0.91
Mean minus 2 sd	■	1.06	0.90	0.74
CV%	3.4%	3.8%	3.3%	5.3%

Similar precision results were observed when extracts of clinical hair samples were pooled together to achieve the same targeted concentrations and analyzed in the same manner.

To further characterize precision on replicate measurements of hair samples (rather than analysis of pooled extracts, as presented, above) three hair specimens previously found to render absorbance readings close to the absorbance reading of the cutoff calibrator were re-analyzed. Five replicates of two of the specimens and four replicates of one of the specimens were analyzed by the ELISA screening assay in one batch run. The following table depicts the absorbance readings (not normalized) of the analysis along with the absorbance readings of the cutoff calibrator, low control, high control, and blank:

Within-Run Precision of Cocaine on Hair Samples

Specimen	#1	# 2	#3	Calibrator	Low	High	Blank
Replicate 1	1.076	0.940	0.578	1.105	1.236	0.847	2.357
Replicate 2	1.048	0.919	0.756				
Replicate 3	1.050	0.869	0.803				
Replicate 4	0.956	0.913	0.814				
Replicate 5	0.981	0.851					
Mean	1.022	0.898	0.738				
S.D.	0.051022	0.037011	0.10943				
CV%	5.0%	4.1%	14.8%				

b. *Linearity/assay reportable range:*
   Not applicable. The assay is intended for qualitative use.

c. *Traceability (controls, calibrators, or method):*

   Calibrator and control stock solutions are prepared from commercially purchased materials consisting of cocaine in methanol. They are prepared in a similar manner, however, they are made from different reference materials.
   - Positive Calibrator containing 300 pg/mg hair of cocaine
   - Negative Blank Calibrator (negative matrix tube containing 0.0 pg/mg hair of cocaine)
   - Low Control containing 150 pg/mg hair of cocaine
   - High Control containing 600 pg/mg hair of cocaine

   At the time of analysis, prepared calibrator and control stock solutions are pipetted into a negative matrix tube, and diluted with phosphate buffer.

   Assigned values of the gravimetrically prepared calibrators and controls are verified by GC/MS analysis.

   Stability studies are summarized for the calibrator and control stock solutions. Traceability of calibrator and control solutions is established through GC/MS analysis to be within 10% and 20%, respectively.

d. *Detection limit:*

   The minimum detectable concentration (MDC) was derived by testing blank and a low-dose cocaine concentrations (10, 25, 50,

75, 100, 150, and 200 pg/mg). A total of 264 samples were collected. The sample mean of the blank data (2.3483 absorbance units) was lower than that of the cocaine 10pg/mg group (2.3688 absorbance units). Therefore, based on our testing criteria, we concluded that 10 pg/mg is the statistically claimed MDC for cocaine screened by the ELISA device.

e. Analytical specificity:

Cross-Reactivity with structurally unrelated compounds: To determine cross-reactivity each compound was spiked into 46 mm phosphate buffer containing negative hair matrix.

Serial dilutions of each compound were prepared and analyzed. Resulting absorbance readings were plotted against the prepared concentration. The concentration of each compound that generated the same absorbance reading as the cutoff calibrator was extrapolated from the graph. The concentration of cocaine in the cutoff calibrator was divided by the extrapolated concentration of the structurally similar compound and then multiplied by 100. (For example if it took 600 pg/mg of a structurally similar compound to equal the absorbance value of 300 pg/mg of cocaine then the cross reactivity would be 300/600 x 100% = 50%.)

Percent Cross-reactivity of Structurally Related Compounds

Compound	Percent Cross-Reactivity	Amount of Cocaine Analog equivalent to produce a positive result at the cut-off of 300 pg/mg (pg/mg)
Cocaethylene	143.00	209.8
Benzoylecgonine isopropyl ester	**111.1**	**270.0**
Cocaine*	100.00	300.0
Meta-Hydroxybenzoylecgonine	95.33	314.7
Benzoylecgonine	47.67	629.4
Tropacocaine	4.09	7335.0
Ecgonine methyl ester	**<1.0**	**>30000.0**
Norcocaine	0.95	31578.9
Norcocaethylene	**<0.7**	**>42857.1**
Norbenzoylecgonine	0.36	83333.3
Ecgonine	0.20	150000.0
Anydroecgonine methyl ester	<0.14	>200000.0
Anhydroecgonine	<0.14	>200000.0

Cross-Reactivity with structurally unrelated compounds: Several (156) structurally unrelated compounds were added to 46 mm phosphate buffer to a concentration of 10,000 ng/mL then added to negative hair matrix tubes (equivalent to 300,000 pg/mg). Samples were analyzed along with replicates of blank negative hair matrix tubes. Based on the

observation that the mean absorbance readings from the samples were within 5% of the mean absorbance readings of the blank negative hair matrix tubes, it is concluded that none of those compounds show reactivity with the assay:

Effect of Interfering Compounds: The above referenced structurally unrelated compounds were also tested for possible positive and negative interference with the cocaine ELISA assay. Two sets of negative hair matrix were prepared by adding cocaine to achieve concentrations of at 200, 300, and 400 pg/mg hair. The second set of tubes were additionally spiked with the above structurally unrelated compounds to a concentration of 300,000 pg/mg hair.   Absorbance readings of the tubes spiked with the structurally un-related compound were within 5% of the absorbance readings of the negative hair matrix tube without the compound added. It is therefore concluded that none of the compounds produced an interference effect on the assay.

   f. *Assay cut-off:*

> The Substance Abuse and Mental Health Services Administration has not yet recognized hair testing in the Federal Workplace Drug Testing program. Preliminary recommendations, however, suggest the use of a 500 pg/mg cut-off level for cocaine as the initial screening level.

> A screening cutoff of 300 pg/mg of cocaine is used by Quest Diagnostics. Retrospective analyses seem to support that a lower cutoff concentration may be more appropriate, but the sponsor has chosen to select the more conservative cutoff concentration.

> Characterization of how the device performs analytically around the claimed cutoff concentration appears in the precision section, above.

   g. *Effectiveness of wash procedure used prior to confirmatory testing on Crack Cocaine contaminated hair samples.*

> A volunteer with a history of cocaine use took multiple hits from a crack cocaine pipe, each time exhaling into a bag containing drug free hair. The bags were tied, labeled A-E, and sent to the lab. Samples were analyzed 3 days later. Two sets of experiments were done with the samples, one utilizing a single methanol and water wash, and the second with two sets of methanol and water washes.

> In the single wash experiment, two hair aliquots were removed from each bag. One of the aliquots from each bag was analyzed by GC/MS for Cocaine (Coc), Cocaethylene (CE) and Benzoylecgonine (BE) without any type of wash procedure to document the extent of contamination. The results for this analysis are shown in the column labeled UNWASHED SAMPLE. The

other aliquots from each bag were washed once with methanol and once with water. Each of the washes were also analyzed by GC/MS for the three compounds. The data from this study is presented in the table below.

Results of the Single Wash Study

	UNWASHED SAMPLE			METHANOL WASH			WATER WASH			WASHED SAMPLE		
	Coc Pg/mg	CE Pg/mg	BE Pg/mg	Coc Pg/mg	CE Pg/mg	BE Pg/mg	Coc Pg/mg	CE Pg/mg	BE Pg/mg	Coc Pg/mg	CE Pg/mg	BE Pg/mg
A	12240	0	205	11149	0	55	591	0	88	2553	0	33
B	44469	0	1084	31321	0	220	2296	0	374	11476	0	110
C	34182	0	1064	38517	0	299	2671	0	440	11064	0	0
D	8953	0	148	8846	0	0	529	0	84	2262	0	0
E	1247	0	0	860	0	0	0	0	0	161	0	0

A single wash of methanol and water removed an average of 76% of the cocaine and 86% of the benzoylecgonine. Using a single wash, specimen "B" would have been reported out as positive using the reporting criteria of greater than 300 pg/mg cocaine and at least 50 pg/mg benzoylecgonine or cocaethylene.

A second study experiment was conducted on sample "B." The study shows the effects of a double wash procedure, which is currently used prior to confirmation testing. The double wash removed drug from the sample such that it would be reported as a negative sample.

Results of the double wash study, Bag "B"

		COCAINE Pg/mg	COCAETHYLENE Pg/mg	BENZOYECGONINE Pg/mg
Methanol wash #1		37692	0	243
Water wash #1		3387	0	449
Methanol wash #2		7414	0	0
Water wash #2		72 *	0	0
Double Washed sample "B"		2967	0	0

Note:
The bags holding the hair samples were not air tight.
Samples were not evaluated by the ELISA screening assay.

h. Stability Study

Fifty samples previously screened positive and analyzed by GC/MS for cocaine and cocaine metabolites. Samples were stored in a climate controlled space then analyzed a second time approximately 13 months later.

The following table illustrates the mean concentration of cocaine, cocaethylene and benzoylecgonine in the samples. Based on the data in specimens, which are stored in a climate controlled space; cocaine and its primary metabolites are stable in hair over a 13-month period using confirmation by GC/MS.

Results From Stability Study on Forty-nine Samples

Study Observation	Cocaine	Cocaethylene	Benzoylecgonine
Average Concentration, pg/mg hair, Baseline	7314	607	894
Mean Change in %	- 29 %	- 8 %	+ 5 %
Range in concentration, pg/mg hair	364-55452	0-5681	28-5019
Largest decrease in %	-96%	-66%	-55%
Largest increase in %	+469%	+67%	+131%
Number that increased in concentration	4	11	23
Number that decreased in concentration	45	20	26

Drugs rendering a 0 pg/mg hair result at initial or repeat testing were excluded from calculations involving a percent change.

The sponsor expressed the thought that the general trend of decreasing cocaine and increasing Benzoylecgonine may be consistent with a non-enzymatic hydrolysis of cocaine to Benzoylecgonine.

i. Hair Treatment Effect on Positive Hair Sample for Cocaine

The effects of various hair treatments (i.e. bleaching, dyeing, shampooing) on the ELISA screening for cocaine/metabolites were examined. Ninety previously screened and confirmed positive hair specimens were randomly assigned into one of three groups (thirty in each group). Each group was

subjected to one of three treatment experiments (bleach, dye, or shampoo). Absorbance readings after treatment were compared to absorbance readings prior to treatment, with the resulting change and direction of change being observed. The resulting changes in ELISA test results (if any) are also noted, and are included in the table below. (Absorbance values are normalized to the absorbance value of the cutoff calibrator absorbance value.)

	Bleaching	Dyeing	Shampooing
Average Absorbance Value of Untreated Group	0.644	0.599	0.529
Average Absorbance Value of Treated Group	0.597	0.732	0.529
Percent change in Absorbance Value	-7.31	22.31	0
# samples increasing in Abs. Value	11	20	14
# samples decreasing in Abs. Value	19	10	16
# positive samples tested that remained positive	27	24	30
# positive samples tested that became negative	0	2	0
# negative samples tested that remained negative	2	4	0
# negative samples tested that became positive	1	0	0

In a separate study, 30 previously screened and confirmed negative samples were subjected to bleaching, dyeing, and shampooing. All samples remained negative. Absorbance values of treated hair were compared to absorbance values of the untreated hair. The percent difference between the absorbance values of the two groups went up in all three treatments groups, by 12.7%, 12.6%, and 18%, respectively.

The effects of hair treatment with shampoo, bleach, or dye made the screen absorbance readings significantly more negative for the

negative hair samples, and slightly less positive for the positive hair samples.

2. Comparison studies:
    a. *Method comparison with predicate device:*
       Because the candidate device was compared to results from a reference method, GC/MS, it was not compared to a predicate device.
       Number of study sites: one
       Description of the site(s): Manufacturer's facility
       Type of study site: Manufacturer's staff
       Operator description: Manufacturer's staff

Agreement Studies
Clinical performance was evaluated with two studies, one involving individuals known to be chronic cocaine users and one involving self-reported non-drug users.

Positive Agreement Study

The study enrolled 83 subjects known to be chronic cocaine users and who admitted using cocaine. Almost all participants reported last using cocaine within a day of the study. Participants also indicated they had been using cocaine for anywhere from 2 to 35 years. Each subject provided a urine and head hair sample.

Of the eighty-three volunteer subjects 70 were Caucasian, 6 were African American and 7 were Hispanic. They ranged in ages from 17 to 48. Of the 83 hair samples 23 were black, 33 were dark brown and 27 were medium brown. The curvature ranged from 30 straight, 37 curly and 10 kinky. There was not enough hair to evaluate three of the samples as to curvature.

Sixty-nine were positive for cocaine in their urine using EMIT (300ng/mL cutoff). The urines were not confirmed by GC/MS. Eighty-one of the hair samples screened positive using ELISA (300 pg/mg hair cutoff). All eighty-three of the hair samples confirmed positive for cocaine use.

Cocaine concentrations in the 83 samples ranged from 2,701 to 179,810 pg/mg hair and benzoyleconine concentrations ranged from 177 to 32,133 pg/mg hair. Forty-seven of the samples also contained cocaethylene, ranging in concentration from 57 to 13,902 pg/mg hair.

The following table describes the findings of the study.

Positive Agreement Study Results

Number of subjects	Urine Results	Hair Screening Results	Hair GC/MS Results
68	+	+	+
1	+	-	+
13	-	+	+
1	-	-	+

ELISA study raw absorbance value information:
Absorbance of the cutoff calibrator was 0.803
Absorbance range of 81 screened positive samples was 0.162 to 0.764
Average absorbance value of all 83 enrollees is 0.317
Absorbance of the 2 samples that screened negative were 0.851 and 0.816

Negative Agreement Study

Eighty-two individuals who self-reported that they were non-drug users were enrolled in the study. Subjects provided a urine and a hair sample.

Of the eighty-two samples only thirty had race recorded. Twenty-three were Caucasian, 4 were African-American and 3 were Hispanic. No ages were collected on any of the volunteers. Of the eighty-two hair specimens 14 were black, 23 were dark brown, 20 were medium brown, 11 were light brown, 12 were blond and 2 were red. The curvature ranged from 45 straight, 32 curly, and 5 kinky.

All eighty-two urine samples screened negative for cocaine using EMIT (300ng/mL cutoff). The urines were not confirmed by GC/MS. Eighty-two of the hair samples screened negative using ELISA (300 pg/mg hair cutoff).

Eighty-one of the 82 samples, upon analyis by GC/MS contained no measurable amounts of cocaine or cocaine metabolites. One sample that screened negative contained 1303 pg/mg hair of cocaine, and 279 pg/mg hair of BE.

Negative Agreement Study Results

Number of Subjects	Urine Results Screen	Hair Results Screen	Hair GC/MS Result
1	-	-	+
82	-	-	-

ELISA study absorbance value information:

There were two runs included in the negative agreement study. The absorbance of the cutoff calibrator in the first run was 0.640. The range of absorbance values for the samples in that run was 1.350 to 2.006, with an average absorbance value of 1.702.

The absorbance of the cutoff calibrator in the second run was 1.095. Samples in this run (excluding the sample that confirmed positive) ranged from 2.362 to 2.671, with an average absorbance value of 2.553. The absorbance value of the sample that confirmed positive in this run was 1.163.

Normalized Absorbance Readings from two populations:
The following table displays the normalized absorbance readings from samples from a chronic drug using population (taken from the positive agreement study) and a drug-free population (taken from the negative agreement study).

Normalized Data From Agreement Studies With The 1 False Negative Donor Omitted:

	Negative % Agreement	Positive % Agreement
Mean Absorbance	2.453	0.395
Lowest Absorbance	2.109	0.152
Highest Absorbance	3.134	1.060
Standard Deviation	0.240	0.213
95% Confidence Level	0.053	0.047
Mean ABS ± 2 SDs	2.453±0.480	0.395±0.426

The formula for calculating the normalized absorbance value of unknown samples is:

(1/absorbance value of cutoff calibrator) x absorbance value of unknown

Distribution of Cocaine ELISA Absorbance Values: Clinical Positive/Negative Agreement Study

Number of Samples
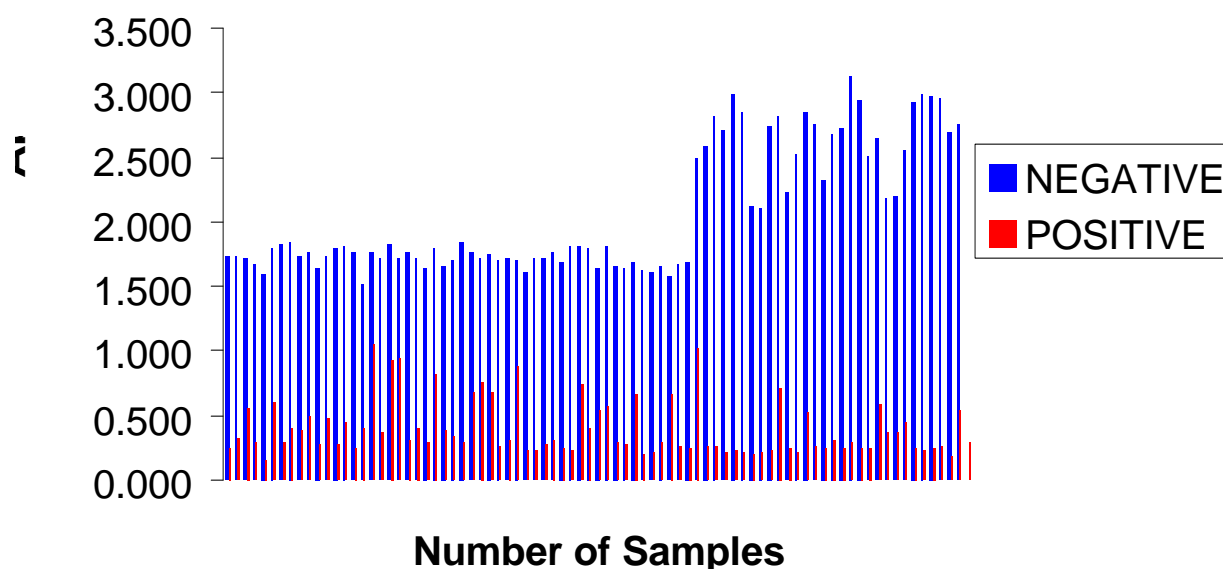
b. *Matrix comparison:*
   Not applicable. The assay is intended for only one sample matrix.

3. Clinical studies:
   a. *Clinical sensitivity:*
      Refer to "c," below.
   b. *Clinical specificity:*
      Refer to "c," below.
   c. *Other clinical supportive data (when a and b are not applicable):*
   Clinical performance of the device is limited to characterization of the device as tested in two distinct subject populations; subjects known to be chronic drug abusers and subjects proclaiming themselves to be drug-free. See the method comparison section, above. Because of the ethical and logistical difficulty in knowing with absolute certainty the clinical condition of specimen donors, FDA previously made the decision to accept this study design.

4. Clinical cut-off:
   The sponsor has demonstrated that the screening cutoff concentration for their assay is adequate for identifying chronic cocaine abusers. There is no data available to demonstrate it's effectiveness in other populations.

5. Expected values/Reference range:
   Cocaine should not normally appear in human hair.

M. Conclusion:

I recommend that this device be found substantially equivalent to the predicate device.