

**SUBSTANTIAL EQUIVALENCE DETERMINATION  
DECISION SUMMARY  
ASSAY ONLY TEMPLATE**

**A. 510(k) Number:**

k111928

**B. Purpose for Submission:**

New submission

**C. Measurand:**

Phencyclidine (PCP) in Hair

**D. Type of Test:**

Qualitative Enzyme Immunoassay (EIA)

**E. Applicant:**

Psychemedics Corp.

**F. Proprietary and Established Names:**

Psychemedics Microplate EIA for Phencyclidine in Hair

**G. Regulatory Information:**

Product Code	Classification	Regulation Section	Panel
LCM	Unclassified	Enzyme Immunoassay Phencyclidine	Toxicology (91)

**H. Intended Use:**

1. Intended use(s):

See indication for use below

2. Indication(s) for use:

The Psychemedics Microplate EIA for Phencyclidine is an enzyme immunoassay (EIA) for the preliminary qualitative detection of phencyclidine in human head and body hair samples using a 3 ng/10 mg hair cutoff for the purpose of identifying phencyclidine use. This is an *in vitro* diagnostic device intended exclusively for Psychemedics use only and is not intended for sale to anyone.

The Psychomedics Phencyclidine Enzyme Immunoassay provides only a preliminary analytical result. To confirm presumptive positive results, a more specific alternate chemical method (e.g., GC/MS) must be used. Clinical consideration and professional judgment should be applied to the interpretation of any drug abuse test results.

3. Special conditions for use statement(s):

This assay is for over the counter use.

4. Special instrument requirements:

The device is for use with an automated microplate reader capable of measuring at 450 and 630 nm. Plate washing also requires an instrument specifically designed to effectively and reproducibly wash all wells uniformly.

For confirmation testing, the sponsor uses GC/MS.

**I. 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, the Psychomedics Microplate EIA for Phencyclidine.

The drug is recovered from the hair using a patented method. The screening portion of the test system consists of (1) microplate wells coated with multiple drugs including phencyclidine conjugated to bovine serum albumin (BSA), (2) polyclonal rabbit anti-phencyclidine, (3) goat anti-rabbit secondary antibody conjugated to HRP (horseradish peroxidase), (4) substrate [3, 3', 5, 5' tetramethylbenzidine (TMB)], (5) HCl to acidify the final reaction, and (6) wash buffer for washing the plates (7) controls and calibrators.

Absorbance in the wells is read with a microplate reader.

Standard and control stock solutions are purchased from multiple vendors, prepared in the laboratory, and validated by GC/MS confirmation.

**J. Substantial Equivalence Information:**

1. Predicate device name(s):

Psychomedics RIA Phencyclidine Assay

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

k011275

3. Comparison with predicate:

<b>Similarities and Differences</b>		
<b>Items</b>	<b>Psychomedics Phencyclidine EIA k111928 (Candidate Device)</b>	<b>Psychomedics RIA Phencyclidine Assay k011275 (Predicate Device)</b>
Intended Use	Intended to be used for the qualitative detection of PCP in hair	Same
Cutoff	3 ng PCP/10mg hair	Same
Confirmation method	GC-MS	Same
Test Principle	Competitive EIA	Radioimmunoassay
Method of measurement	Microplate reader	Gamma counter
Extraction method	Non-enzymatic digestion	Enzymatic digestion
Antigens used in the reagent	BSA-benzoyllecgonine, BSA-morphine, BSA-phencyclidine, and BSA-methamphetamine	<sup>125</sup> I-readiolabeled PCP

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

Premarket Submissions and Labeling Recommendations for Drugs of Abuse Screening Tests - Draft Guidance for Industry and FDA Staff, issued on December 2, 2003

**L. Test Principle:**

PCP is first extracted from the hair sample with a patented extraction method. In the screening assay, the hair extracts and the primary antibody are combined in the wells and incubated. During this phase the enzyme-labeled drug conjugate competes with drug in the sample for a limited number of binding sites on the antibody-coated microwells. Subsequently, secondary antibody-HRP and the substrate are added to the reaction sequentially, the excess reagent are removed by washing solution, and after a final incubation, the wells are acidified and read with the microplate reader. Results are normalized by expression as  $B/B_0 \times 100$ . If phencyclidine is present in the sample, less primary antibody will be bound to the solid-phase antigen, thereby resulting in less binding of HRP-labeled secondary antibody; the absorbance produced is inversely proportional to the amount of phencyclidine in the sample (specimen, calibrator or control).

Samples with an absorbance value higher than the Cutoff Calibrator (3 ng PCP/10mg hair) are interpreted as negative. Either the sample does not contain PCP or PCP is present at a concentration below the cutoff level of the assay. Samples with an absorbance value equal to or lower than the Cutoff Calibrator are presumptively positive.

For samples that are presumptive positive by the screening assay, a new aliquot of the hair sample is weighed, washed extensively to remove and evaluate externally-derived methamphetamine contamination on the hair, digested by a different procedure, and confirmed by GC/MS.

**M. Performance Characteristics:**

1. Analytical performance

a. *Precision and Reproducibility*

Hair samples known not to contain phencyclidine or related compounds were spiked in multiples of 15 with phencyclidine at zero, 0.75, 1.5, 2.25, 3, 3.75, 4.5, 5.25, and 6 ng per 10 mg hair and assayed by the EIA procedure. The phencyclidine spike solutions were prepared in methanol from a certified standard solution and confirmed by GC/MS. Intra-assay precision was performed in one run, and inter-assay precision was performed over 5 days. The results are presented in the tables below.

Table 1. Intra-assay Precision

PCP Concentration (ng PCP/10 mg hair)	Number Tested	Number Negative	Number Positive
Zero	15	15	0
0.75 (-75%)	15	15	0
1.5 (-50%)	15	15	0
2.25 (-25%)	15	15	0
3.75 (+25%)	15	0	15
4.5 (+50%)	15	0	15
5.25 (+75%)	15	0	15
6.0 (+100%)	15	0	15

Table 2. Inter-assay Precision

PCP Concentration (ng PCP/10 mg hair)	Number Tested	Number Negative	Number Positive
Zero	75	75	0
0.75 (-75%)	75	75	0
1.5 (-50%)	75	75	0
2.25 (-25%)	75	75	0
3.75 (+25%)	75	0	75
4.5 (+50%)	75	0	75
5.25 (+75%)	75	0	75
6.0 (+100%)	75	0	75

*b. Linearity*

Not applicable. This assay is intended only for qualitative screening determinations.

*c. Traceability and Expected values for controls, calibrators, or methods*

Psychemedics manufactures calibrators and control materials using drug stocks purchased the drugs from a commercial vendor. Each lot of drug is received with its specific certificate of analysis. The commercially obtained stock is made into the calibrators and controls to the desired concentrations. The concentrations are confirmed by GC/MS.

Stability studies for both controls and calibrators have been conducted. Protocols and acceptance criteria were described and found to be acceptable. The manufacturer claims the following expiration date for both controls and calibrators:

The calibrator and control solutions are stable for 1 year when stored frozen (< -10°C).

*d. Detection Limit*

Not required since this is a qualitative test.

*e. Analytical specificity:*

Cross-reactivity was evaluated by spiking each compound to the negative hair samples in the extraction solution and evaluating the result against the cutoff control.

Results are expressed as a concentration of compound required to produce a response approximately equivalent to the cutoff concentration of the assay. The results are presented in the table below:

Table 3. Cross-reactivity of related Compounds in Phencyclidine EIA

Compound	Amount of Compound required to Produce a positive test at the cutoff of 3 ng phencyclidine/10 mg hair	Percent Cross-reactivity
1-(4-Hydroxypiperidino) phenylcyclohexane	1000	0.3
1-(1-Phenylcyclohexyl) morpholine (PCM)	60	5.0
Nicotine	>1000	< 0.5
Cotinine	>1000	< 0.5
Metaphit	10	30
Venlafaxine	>1000	< 0.5
O-Desmethylvenlafaxine	>1000	<0.5
Thioridazine	>1000	< 0.5

Dextromethorphan	5000	< 0.1
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### Structurally unrelated:

Negative hair samples were spiked with phencyclidine to -50%, and +50% of the cutoff. Structurally related and unrelated compounds were added to methanol to a concentration of 100 ng/10 mg hair then added to the negative hair sample. The following compounds do not cause interference at +/- 50% of the cutoff; oxazepam, glutethimide, amitriptyline, trimipramine, doxepin, imipramine, nordoxepin, nortriptyline, desipramine, protriptyline, barbital, phenobarbital, amobarbital, butabarbital, hexobarbital, secobarbital, medazepam, lorazepam, diazepam, flurazepam, medazepam, nordiazepam, temazepam, bromazepam, ethosuximide, methsuximide, a-methyl-a-propylsuccimide, metharbital, phensuximide, normethsuximide, mephenytoin, ethotoin, mephobarbital, PEMA, Methyl-PEMA, 10,11-dihydrocarbamezepine, carbamazepine, primidone, 5,5-diphenylhydantoin, 4-methylprimidone, acetaminophen, caffeine, dyphylline, methaqualone, theophylline, phenmetrazine, phenylpropanolamine, amitriptyline, dextromethorphan, lidocaine, methocarbamol, nordoxepin, pentazocine, phenylephrine, triamterene, meprobromate, methylprylon, Anhydroecgonine methyl ester, Atropine, Bupropion, Cotinine, Cannabinol, Chlorpheniramine maleate, O-Desmethyvenlafaxine, Desipramine, Doxylamine succinate, 1S, 2R Ephedrine, Ethosuximide, Ibuprofen, LSD, Haloperidol, Meperidine, Methadone, Methaqualone, Methyl phenidate, Naloxone, Naltrexone, Nicotine, Naproxen, Nortriptyline, Propoxyphene, R,R Pseudoephedrine, Thioridazine, Cis-Tramadol, Venlafaxine hydrochloride, 8(-)-11-nor-9-Carboxy-delta-9 THC, 11-nor-9-Carboxy-delta-9-THC, Delta 8-THC, Streptomycin, Procaine, Benzocaine, Erythromycin, Penicillin G, Mepivacaine, Phendimetrazine bitartrate, Diazepam, Despropionyl fentanyl, Ethylmorphine, Nalorphine, Codeine, Morphine, Hydromorphone, Oxycodone, Glutethimide, Meprobamate, Methyprylon, Flurazepam, Lorazepam, Medazepam, Temazepam, Carbamazepine, Diazepam, Nordiazepam, Oxazepam, Amitriptyline, Dextromethorphan, Lidocaine, Methocarbamol, Nordoxepin, Pentazocine, Phenylephrine, Triamterene, Ethosuximide, a-methyl-a-propylsuccimide, metharbital, barbital, methsuximide, phensuximide, phensuximide, N-Normethsuximide, Mephenytoin, Ethotoin, Mephobarbital, PEMA, Phenobarbital, Methyl PEMA, 10,11-Dihydrocarbamezepine, Primidone, Carbamazepine, 5,5-Diphenylhydantoin, 6, 4-Methylprimidone, Butabarbital, Amobarbital, Secobarbital, Hexobarbital, Phenobarbital, Medazepam, Oxazepam, Lorazepam, Diazepam, Temazepam, Bromazepam, Amitriptyline, Desipramine, Doxepin, Imipramine, Nordoxepin, Nortriptyline, Protriptyline, Trimipramine, Chlorpromazine, Flurazepam, Amoxicillin, Propanolol, Promethazine, Phenmetrazine, Phendimetrazine, Benzocaine, Ecgonine, Metanephrin.

### Cosmetic treatment of hair:

Twenty PCP-negative hair samples were treated with bleach, 20 with permanent wave, 20 with dye, 20 with relaxer, and 20 with shampoo, and the results

compared to the same samples without the treatments. In each case of the 20 samples treated with a type of cosmetic treatment, 10 samples were treated with one brand of a particular product and 10 other samples with a second brand. No significant differences were observed for the negative hair samples before and after the treatments; all samples remained negative after the treatments.

Twelve PCP-positive hair samples were treated with bleach, 12 with permanent wave, 12 with dye, 12 with relaxer, and 12 with shampoo, and the results compared to the same samples without the treatments. In each case of the 12 samples treated with a type of cosmetic treatment, 6 samples were treated with one brand of a particular product and 6 other samples with a second brand. The positive samples showed changes in the  $B/B_0 \times 100$  (% of  $B_0$ ) values between -5.2% to +5.4% for bleach, -5.4% to +3.8% for dye, -2.7% to +5.6% for perm, -7.6% to +9.1% for relaxer, and ---7.0% to +6.3% for shampoo. None of the originally positive samples tested negative by the EIA phencyclidine assay after any of the cosmetic treatments.

Environmental Contamination of hair:

Preliminary positive hair sample results by the screening method could be due to environmental contamination. All positive should be sent for confirmation testing on a reference method to distinguish between true positive and those samples that were positive due to external exposure.

*f. Assay cut-off*

Analytical performance of the device around the claimed cutoff is described in precision section M.1 above. The identified cutoff concentration of the device is consistent with other cleared DOA assays.

2. Comparison studies:

*a. Method comparison with predicate device:*

The study was performed by comparing ELSIA results against the GC/MS results on the same head or body hair samples. A total of 217 donor hair samples were tested (156 negative and 61 positive by GC/MS). The results are shown in the tables below:

Table. Comparison of Positive Samples and Samples around the cutoff by GC/MS

GC/MS:	0	> 0 & <-50% of Cutoff	> -50% of Cutoff & < Cutoff	> Cutoff, & < +50% of Cutoff	> +50% of Cutoff
EIA Positive	0	0	2	8	53
EIA Negative	140	1	13	0	0

Discordant results: There are two discrepant results around the cutoff, the results was shown below:

Cutoff Value (ng/10 mg hair)	Candidate Device (+/-)	Phencyclidine GC/MS value (ng/10 mg hair)
3	pos	2.80
3	pos	1.97

*b. Matrix comparison:*

Not applicable

3. Clinical studies:

*a. Clinical Sensitivity:*

Not applicable

*b. Clinical specificity:*

Not applicable

4. Clinical cut-off:

Not applicable

5. Expected values/Reference range:

No amount of PCP should be found in hair from those who are abstained from PCP use.

**N. Proposed Labeling:**

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

**O. Conclusion:**

At this stage, the submitted information in this premarket notification is complete to supports a substantial equivalence decision.