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

A. 510(k) Number:

k121864

B. Purpose for Submission:

New device

C. Measurand:

Not applicable – whole blood collection system

D. Type of Test:

Not applicable

E. Applicant:

PerkinElmer Inc.

F. Proprietary and Established Names:

PerkinElmer 226 Sample Collection Device

G. Regulatory Information:

1. Regulation section:

   21CFR 862.1675 (Blood specimen collection device)

2. Classification:

   Class II

3. Product code:

   JKA

4. Panel:

   75 (Chemistry)

H. Intended Use:

1. Intended use(s):

   See Indication for use below.

2. Indication(s) for use:

   The PerkinElmer 226 Sample Collection Devices are intended to be used as a medium to collect and transport whole blood specimen spots to a laboratory, in newborn screening. The device includes a tear-apart form for the collection of demographic information.

3. Special conditions for use statement(s):

   For prescription use only.

4. Special instrument requirements:

   Not applicable.

I. Device Description:

PerkinElmer 226 Sample Collection Device is designed to provide a uniform surface for the collection of dried blood spots (DBS). The collection paper is in the format of a printed card that may be incorporated along with a tear-apart form for the collection of demographic information. A drop of blood is applied to the filter paper and allowed to soak through the paper. The sample is then air dried and sent to a laboratory for analysis in newborn screening.

J. Substantial Equivalence Information:

1. Predicate device name(s):

   Ahlstrom 226 filter paper

2. Predicate K number(s):

   k062932

3. Comparison with predicate:

Similarities		
Item	Candidate device-PerkinElmer 226	Predicate device-Ahlstrom 226
Intended Use	Intended to be used as a medium to collect and transport whole blood specimen spots to a laboratory, in newborn screening.	same
Description	Filter paper printed and affixed to a carrier with a tear-apart form.	same
Matrix	Whole blood	same
Storage conditions for unused cards	Store in a cool dry space away from direct sunlight.	same
Specimen drying time	3-4 hours	same

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

CLSI LA4 – A4: Blood Collection on Filter Paper for Newborn Screening Programs; Approved Standard

L. Test Principle:

The PerkinElmer 226 Sample Collection Device is intended to be used directly as a blood collection device for newborn screening. The device is filter paper card printed with circles and affixed to a rigid carrier device. The filter paper is touched to a sufficiently large blood drop to completely fill a preprinted circle. Blood should be applied to only one side of the filter paper and allowed to uniformly penetrate and fully saturate the filter paper. The filter paper is then placed in the horizontal position and allowed to air dry at room temperature away from direct sunlight.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:
   a. Precision/Reproducibility:

   Not applicable

   b. Linearity/assay reportable range:

   Not applicable

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

The filter paper was shown to conform to Consensus Standard – CLSI LA4-A4: Blood Collection on Filter Paper for Newborn Screening Programs; Approved Standard.

The filter paper's physical composition was evaluated internally and results are summarized below:

Lot #	Basis Weight (110 ± 5%) lbs /ream	pH (5.7 – 7.5)	Ash Percent
5431001	111.24	7	0.047
6050501	110.05	7.5	0.04357
6460701	108.43	7.2	0.047
Test Method Reference	ASTM D4646-96	ISO 6588.1981	ASTM D586-97a Method A

Testing was performed to assess the absorption characteristics of the filter paper based on CLSI LA4-A4, Appendix B. Results for the PKI 226 paper are summarized below.

Lot #	Mean blood absorption time (5-30 s/100 uL)	Mean blood spot diameter (15-17 mm)	Mean serum absorption volume (1.37-1.71 uL/punch)	Homogeneity ($p > 0.05$)
5431001	7.4	16.1	1.42	p=0.937
6050501	14.1	16.3	1.47	p=0.607
6460701	16.2	17.0	1.49	p=0.984

d. Detection limit:

Not applicable

e. Analytical specificity:

An interference study was performed to show that printing ink used to manufacture the device would not interfere with newborn screening assays across representative platform and assay types. TSH, 17 α-OH-progesterone, T4 and total galactose assays (incorporating immunometric, competitive and enzymatic test methods) were run with samples punched to exclude (control) or include ink on commercially available platforms. Samples were DBS prepared from heparinized whole blood adjusted to a hematocrit of 47.5% spiked with analyte concentrations at low, high and near the relevant clinical decision point. Each concentration was tested in replicates of 12. Results of the study are summarized in the table below.

Analyte	Target Concentration	% Interference From Ink
TSH (µU/mL)	5	7.9
	15	0.3
	100	-7.5
17-OHP (ng/mL)	10	0.3
	45	-0.9
	100	-4.4
T4 (µg/dL)	3	1.5
	7	-1.9
	15	0.8
TGal (mg/dL)	4	11.8
	8	1.1
	20	3.9

The sponsor also provided an additional analysis of the interference study data demonstrating that sample means and within-sample variation were not statistically different for unfinished paper, the finished device in the absence of ink, and the finished device in the presence of ink.

f. Assay cut-off:

Not applicable

2. Comparison studies:

a. Method comparison with predicate device:

A method comparison study performed by an independent laboratory used adult whole blood adjusted to a hematocrit of 55% supplemented with various analytes spotted on both a commercially available device and PKI 226 and then tested with assays that screen for congenital adrenal hyperplasia (CAH), hypothyroidism, cystic fibrosis (CF), maple syrup urine disease, fatty acid oxidation disorders (FAO), and disorders of amino acid metabolism including phenylketonuria, tyrosinemia, and citrulinemia. The analytes were added at concentrations below, at, and above relevant clinical cutoffs. Dried blood spot samples on PKI 226 and the comparator were prepared at a central laboratory.

Six external laboratories performed testing in duplicate using routine testing assays and provided the line data to the independent lab for statistical analysis of mean and standard deviation. The assays tested included direct and

competitive immunoassays using both fluorometric and colorimetric readouts as well as mass spectrometric-based assay methodologies.

All data from PKI 226 for each analyte shows a strong overlap at one standard deviation with the data derived with samples collected with the comparator device with a difference of 4-5%. Concurrent longitudinal testing of mean serum volume testing on six lots of the PKI 226 device showed a similar lot-to-lot variability (4.66%), therefore the difference between newborn screening assay data from the two DBS cards is not dissimilar from the lot-to-lot variability detected for the proposed device.

b. Matrix comparison:

Not applicable

3. Clinical studies:

a. Clinical Sensitivity:

Not applicable

b. Clinical specificity:

Not applicable

c. Other clinical supportive data (when a. and b. are not applicable):

To support the use of PKI 226 in the intended use setting by the intended users with clinical patient samples, results from a clinical study were provided. In this study a central laboratory received dried blood spot samples collected by nurses and/or phlebomists from newborns in a hospital. These samples provided a population comparison study using 2000 randomly selected patient samples per disorder that included screening assays for biotinidase deficiency, congenital adrenal hyperplasia, hypothyroidism, cystic fibrosis, galactosemia, homocystinuria, maple syrup urine disease, phenylketonuria, tyrosinemia, citrulinemia, and hemoglobinopathies. The assays tested included direct and competitive immunoassays using fluorometry, mass spectrometry, and high performance liquid chromatography assay methodologies. The testing results for each assay were analyzed for the mean, median value of each analyte and SD as well as the observed ranges for the 2000 samples. Results for samples from PKI 226 and a commercially available device were compared based on the difference between their calculated medians for the 2000 samples. The median of each analyte for the PKI 226 data exhibits a percent difference from the predicate that's within 2-6% for the immunoassays and 2-10% for the mass spectrometric assays. PKI 226 Data and descriptive statistics are included below.

Disease	Galactosemia		Hypothyroidism	
Filter Paper	PKI 226	Comparator	PKI 226	Comparator
% Difference between medians	4%		6%	
Median	9.1	9.5	14.6	15.6
Mean	9.1	9.5	14.5	15.7
SD	1.7	1.9	4.4	4.7
Observed Ranges; Lower and Upper Percentiles				
Disease	Galactosemia		Hypothyroidism	
Filter Paper	PKI 226	Comparator	PKI 226	Comparator
2.5%	6.0	5.6	5.6	6.4
5%	6.6	6.4	7.0	7.9
10%	7.1	7.2	8.7	9.7
90%	11.2	11.7	19.9	21.7
95%	11.9	12.5	21.5	23.8
97.5%	12.6	13.1	23.2	25.7

Disease	Biotinidase Deficiency		CF		CAH	
Filter Paper	PKI 226	Comparator	PKI 226	Comparator	PKI 226	Comparator
% Difference between medians	5%		2%		5%	
Median	192	201	25.8	26.2	5.2	5.5
Mean	197.4	206.4	30.9	32.1	7.69	7.35
SD	49.1	52.4	18.0	22.9	8.61	6.96
Observed Ranges; Lower and Upper Percentiles						
Disease	Biotinidase Deficiency		CF		CAH	
Filter Paper	PKI 226	Comparator	PKI 226	Comparator	PKI 226	Comparator
2.5%	111	116	16.3	16.4	2.0	2.0
5%	127	126	16.7	16.7	2.3	2.4
10%	141	142	17.5	17.6	2.7	2.9
90%	265	278	49.1	50.9	14.9	13.2
95%	291	302	60.2	64.1	22.9	18.2
97.5%	314	320	75.4	81.9	29.4	26.8

Disease	Citrulinemia		Maple Syrup Urine Disease	
Filter Paper	PKI 226	Comparator	PKI 226	Comparator
% Difference between medians	6%		2%	
Median	16	17	102	104
Mean	16.8	18.2	11	113
SD	5.5	6.4	39.3	41.8
Observed Ranges; Lower and Upper Percentiles				
Disease	Citrulinemia		Maple Syrup Urine Disease	
Filter Paper	PKI 226	Comparator	PKI 226	Comparator
2.5%	9	9	62	62
5%	10	11	67	68
10%	11	12	74	74
90%	24	25	155	159
95%	26	28	179	189
97.5%	29	32	200	224

Disease	Homocystinuria		Phenylketonuria		Tyrosinemia	
Filter Paper	PKI 226	Comparator	PKI 226	Comparator	PKI 226	Comparator
% Difference between medians	5%		5%		5%	
Median	19	20	55	58	89	94
Mean	20.0	21.3	57.2	60.4	95.6	101
SD	6.7	9.7	14.3	17.5	4.9	43.1
Observed Ranges; Lower and Upper Percentiles						
Disease	Homocystinuria		Phenylketonuria		Tyrosinemia	
Filter Paper	PKI 226	Comparator	PKI 226	Comparator	PKI 226	Comparator
2.5%	11	12	36	38	40	44
5%	12	13	39	41	45	51
10%	13	14	42	44	53	58
90%	27	29	75	79	147	154
95%	31	33	82	87	168	180
97.5%	35	38	90	98	193	205

This population comparison study was also used to provide results to show

that PKI 226 appears to recover the same results for hemoglobinopathies. From a larger population, 2000 samples were randomly selected for PKI 226 and a commercially available paper for comparison in an HPLC-based method to detect hemoglobinopathies. The frequency results showed that the 95% confidence intervals for each paper overlapped and had no significant statistical differences.

4. Clinical cut-off**:**

   Not applicable

5. Expected values/Reference range:

   Not applicable

N. Proposed Labeling:

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

O. Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.