K131930

10 510(k) Summary

510(k) Summary
BioFire Diagnostics, Inc.

Modification of the JBAIDS Anthrax Detection Kit for use with the IT *1-2-3*™ Platinum Path Sample Purification Kit Accessory

Introduction: According to the requirements of 21 CFR 807.92, the following information provides sufficient detail to understand the basis for a determination of substantial equivalence.

Submitted by:

BioFire Diagnostics, Inc.
390 Wakara Way
Salt Lake City, UT 84108

Telephone: 801-736-6354
Facsimile: 801-588-0507

Contact: Cynthia Phillips, ext. 370

AUG 0 5 2013

Date Submitted: June 24, 2013

Device Name and Classification:

Trade Name: JBAIDS Anthrax Detection Kit

Regulation Number: 21 CFR 866.3045

Classification Name: Reagent Kit: *B. anthracis*, Class II

Product Code: NHT

Predicate Device:

JBAIDS Anthrax Detection Kit (K051713 and K071188)

Intended Use:

The Joint Biological Agent Identification and Diagnostic System (JBAIDS) Anthrax Detection System is a real-time polymerase chain reaction (PCR) test system intended for the qualitative *in vitro* diagnostic (IVD) detection of target DNA sequences on the pXO1

plasmid (Target 1) and the pXO2 plasmid (Target 2) from *Bacillus anthracis*. The system can be used to test the following:

- Human whole blood collected in sodium citrate from individuals suspected of having anthrax
- Positive blood cultures
- Cultured organisms grown on blood agar plates.

The JBAIDS Anthrax Target 2 assay is used as a supplementary test only after a positive result with the Target 1 Assay.

The JBAIDS Anthrax Target 1 and Target 2 Assays are run on the JBAIDS instrument using the Diagnostic Wizard. Results are for the presumptive identification of *B. anthracis,* in conjunction with culture and other laboratory tests. The following considerations also apply:

- The diagnosis of anthrax infection must be made based on history, signs, symptoms, exposure likelihood, and other laboratory evidence, in addition to the identification of pXO1 and pXO2 targets either from cultures or from direct blood specimens.
- The assays have not been evaluated with blood from individuals without clinical signs or symptoms who were presumed exposed and who subsequently developed anthrax (inhalation or other forms of the disease), or from individuals with any form of anthrax (inhalational, cutaneous, or gastrointestinal).
- The level of plasmid targets that would be present in blood from individuals with early systemic infection is unknown.
- The definitive identification of *B. anthracis* from colony growth, liquid blood culture growth, or from blood specimens requires additional testing and confirmation procedures in consultation with public health or other authorities for whom reports are required.

The safety and effectiveness of other types of tests or sample types (not identified as "For in vitro diagnostic use") have not been established.

Device Description:

The Joint Biological Agent Identification and Diagnostic System (JBAIDS) Anthrax Detection System is a fully integrated IVD system composed of the portable JBAIDS instrument, laptop computer and software, the JBAIDS Anthrax Detection Kit with two different freeze-dried PCR assays for detection of pathogenic *Bacillus anthracis* DNA. The system has been validated using four different sample preparation kits for isolating DNA from whole blood (IT *1-2-3*™ Platinum Path, QFLOW^{dna}, FLOW Sample Purification Kits), positive blood cultures (IT *1-2-3*™ SWIPE Sample Purification Kit), and plate cultures (IT *1-2-3*™ Platinum Path and SWIPE Sample Purification Kits). Use of the JBAIDS DNA Extraction Control Kit is also recommended.

Prior to testing, specimens are processed using BioFire Diagnostic's IT *1-2-3* Sample Purification Kits. The resulting purified sample is added to Target 1 Unknown and Target

1 Inhibition Control vials, along with reconstitution buffer. Target 1 Positive Control and Negative Control vials are prepared using reconstitution buffer and water. When *B. anthracis* DNA is present, a fragment of *B. anthracis* DNA is amplified. The amplicon is detected by fluorescence using a specific hydrolysis probe. Each probe is labeled on one end with a fluorescent reporter moiety (6-carboxyfluorescein (6-FAM)) and elsewhere with a quencher moiety (carboxy tetramethylrhodamine (TAMRA)). When the probe is intact, the quencher absorbs the light emitted by the reporter moiety. During PCR, the probe hybridizes to the target sequence before the exonuclease activity of Taq polymerase hydrolyzes the probe, separating the fluorophore from the quencher and permitting detection of the fluorescent signal generated by the reporter. The fluorescent signal increases as additional templates are amplified and more probes are hydrolyzed.

JBAIDS Software analyzes the fluorescence amplification curves and reports results as positive, negative, uncertain or inhibited. A failure of the Positive or Negative Control will result in the entire run being called invalid. Retesting is required to resolve uncertain, invalid or inhibited results. The Target 2 assay is used as a supplementary test only after a positive result is obtained with the Target 1 assay.

Substantial Equivalence:

The JBAIDS Anthrax Detection Kit is substantially equivalent to the previously cleared JBAIDS Anthrax Detection Kit. The following tables compare the modified JBAIDS Anthrax Detection Kit to the previously cleared JBAIDS Anthrax Detection Kits (K051713 and K071188). The first table outlines the similarities between the two systems and the following table outlines the differences.

Table 1. Similarities between the New Device and the Predicate

Element	New Device: JBAIDS Anthrax Detection Kit with addition of Platinum Path Sample Purification Kit	Predicate: JBAIDS Anthrax Detection Kit (K051713 and K071188)
Intended Use	Identification of anthrax infection through the detection of two DNA sequence targets, which are both essential for *Bacillus anthracis* pathogenicity. Results are used in conjunction with clinical information, culture, and other laboratory tests as an aid in the diagnosis of systemic anthrax infection in individuals suspected of having the disease.	Same
Technology	Real-time PCR using hydrolysis probes	Same
Organism Detected	Qualitative *in vitro* detection of *Bacillus anthracis* DNA	Same
Specimen Types	Whole blood (collected in 3.2% sodium citrate), blood culture (grown in soybean-casein digest broth) or bacterial culture (grown on blood agar)	Same

Element	New Device: JBAIDS Anthrax Detection Kit with addition of Platinum Path Sample Purification Kit	Predicate: JBAIDS Anthrax Detection Kit (K051713 and K071188)
Platform	JBAIDS Instrument	Same
Time Required for Analysis of Specimen	Less than 3 hours	Same

Table 2. Differences between the New Device and the Predicate

Element	New Device: JBAIDS Anthrax Detection Kit with addition of Platinum Path Sample Purification Kit	Predicate: JBAIDS Anthrax Detection Kit (K051713 and K071188)
DNA Extraction Methods	Whole blood purified with IT *1-2-3*™ Platinum Path or IT *1-2-3*™ QFLOW^{dna} Sample Purification Kits (or validated equivalent).	Whole blood purified with IT *1-2-3*™ QFLOW^{dna} Sample Purification Kit (or validated equivalent).
	Blood culture purified with IT *1-2-3*™ SWIPE Sample Purification Kit (or validated equivalent).	Same
	Direct bacterial culture purified with IT *1-2-3*™ Platinum Path or IT *1-2-3*™ SWIPE Sample Purification Kit (or validated equivalent).	Direct bacterial culture purified with IT *1-2-3*™ SWIPE Sample Purification Kit (or validated equivalent).

Summary of Performance Data

Clinical Performance

True clinical specimens from patients infected with *Bacillus anthracis* (anthrax), are not available for testing due to the extreme rarity of natural infection with this organism. Therefore, a clinical evaluations using surrogate specimens was performed to validate the use of the IT *1-2-3*™ Platinum Path Sample Purification Kit for use with the JBAIDS Anthrax Detection Kit. Whole blood specimens were prospectively collected from patients with fever, after which the samples were spiked with inactivated *B. anthracis*, purified by both the new and old extraction methods, and then tested.

Testing of Surrogate Whole Blood Clinical Specimens

One hundred (100) surrogate whole blood specimens were prepared using prospectively collected specimens that were collected from febrile volunteers from November of 2012 into April of 2013. Fifty (50) of the specimens were spiked with inactivated *B. anthracis* at concentrations near and above the system LoD, while the remaining 50 specimens were not spiked with *B. anthracis*. Samples were then processed using both the new

nucleic acid extraction method (Platinum Path) and the original nucleic acid extraction method (IT *1-2-3*™ QFLOW^{dna} Sample Purification Kit; QFLOW^{dna}) followed by testing with the JBAIDS Anthrax Detection Kit. JBAIDS operators were blinded to the analyte content of the samples. Table 3 presents the Positive Percent Agreement (PPA) and Negative Percent Agreement (NPA) for the surrogate whole blood specimen testing. The combined Target 1 and Target 2 results obtained with the Platinum Path processed samples were compared to the combined Target 1 and Target 2 results obtained with the QFLOW^{dna} processed samples. The JBAIDS result for a sample purified using from the QFLOW^{dna} kit was considered the correct result. The final Anthrax interpretation for samples purified using the Platinum Path kit had a positive percent agreement (PPA) of 100% as compared to samples purified using QFLOW^{dna} (50/50; 95% CI = 92.9-100%). The final JBAIDS Anthrax interpretation for samples purified using Platinum Path was negative for 50 out of 50 samples that were negative when purified using QFLOW^{dna}. This represents a negative percent agreement (NPA) of 100% (50/50; 95% CI = 92.9-100%). The IT *1-2-3* QFLOW^{dna} and Platinum Path Sample Purification Kits performed equivalently with respect to detection of *B. anthracis* in surrogate whole blood specimens tested with the JBAIDS Anthrax Detection Kit.

Table 3. JBAIDS Anthrax Detection Kit Performance on Spiked Whole Blood Samples Processed with the IT *1-2-3* Platinum Path and QFLOW^{dna} Sample Purification Kits

Positive Agreement				Negative Agreement			
QFLOW + Platinum Path +	**QFLOW + Platinum Path -**	**PPA**	**95% CI[a]**	**QFLOW - Platinum Path -**	**QFLOW - Platinum Path +**	**NPA**	**95% CI**
50	0	100% (50/50)	92.9-100%	50	0	100% (50/50)	92.9-100%

[a] C.J. Clopper and E.S. Pearson. 1934. The use of confidence or fiducial limits illustrated in the case of the binomial. Biometrika 26:404-413.

Selected Analytic Studies

Limit of Detection

Twenty out of 20 independent whole blood specimens spiked with *B. anthracis* at the previously established LoD level and processed with the IT *1-2-3* Platinum Path Sample Purification Kit were detected with the JBAIDS Anthrax Detection Kit. This confirmed the LoD of 1000 CFU/mL in whole blood that was originally established for whole blood samples processed using the IT *1-2-3* FLOW Sample Purification Kit and later confirmed with the QFLOW^{dna} Sample Purification Kit.

Table 4. Confirmation of the *B. anthracis* LoD for Platinum Path-Purified Whole Blood Samples Tested with the JBAIDS Anthrax Detection Kit

Anthrax Assay	Spiked *B. anthracis* Concentration (CFU/mL)	# Positive	% Positive	Anthrax Target Assay Mean Cp +/- Std Dev
Target 1	1000	20/20	100.0%	32.12 ± 0.54
Target 2	1000	20/20	100.0%	32.95 ± 0.66

Reproducibility

A multicenter study was performed to determine the overall system reproducibility when whole blood samples were processed with the IT *1-2-3* Platinum Path Sample Purification Kit prior to testing with the JBAIDS Anthrax Detection Kit.
A panel of 12 blood samples was tested twice each day for four days at each of three testing sites. The panel contained four samples spiked with inactivated *B. anthracis* Ames strain at a medium positive (5×LoD) level, four samples spiked at a low positive level (1×LoD), and four samples that were not spiked. Results are summarized in Table 5. The detection rate was 100% for all samples containing *B. anthracis* spiked near or above the LoD, and there were no false positive results for unspiked samples. The JBAIDS Anthrax Detection System is reproducible when used to test whole blood samples processed with the IT *1-2-3* Platinum Path Sample Purification Kit.

Table 5. Reproducibility of the Anthrax Target 1 and Target 2 Assays in the JBAIDS Anthrax Detection Kit for Whole Blood Samples Purified with the IT *1-2-3* Platinum Path Purification Kit

Blood Spike Level	Test Location	Anthrax Target 1							Anthrax Target 2						
		Number Positive	Number Negative	% Agreement with Expected Result	95% CI	Mean Cp	Std Dev	%CV	Number Positive	Number Negative	% Agreement with Expected Result	95% CI	Mean Cp	Std Dev	%CV
Medium Positive (5xLoD)	Site 1	32/32	0/32	100%		31.59	0.79	2.50	32/32	0/32	100%		31.86	0.71	2.23
	Site 2	32/32	0/32	100%		31.70	0.90	2.84	32/32	0/32	100%		31.96	0.73	2.28
	Site 3	32/32	0/32	100%		30.24	0.73	2.41	32/32	0/32	100%		30.81	0.74	2.40
	All Sites	**96/96**	**0/96**	**100%**	**96.2-100**	**31.18**	**1.05**	**3.37**	**96/96**	**0/96**	**100%**	**96.2-100**	**31.54**	**0.89**	**2.82**
Low Positive (1xLoD)	Site 1	32/32	0/32	100%		34.31	0.76	2.22	32/32	0/32	100%		34.35	0.87	2.53
	Site 2	32/32	0/32	100%		34.21	0.83	2.43	32/32	0/32	100%		34.41	0.78	2.27
	Site 3	32/32	0/32	100%		32.78	0.55	1.68	32/32	0/32	100%		33.29	0.57	1.71
	All Sites	**96/96**	**0/96**	**100%**	**96.2-100**	**33.77**	**1.00**	**2.96**	**96/96**	**0/96**	**100%**	**96.2-100**	**34.02**	**0.91**	**2.67**
Negative	Site 1	0/32	32/32	100%					0/32	32/32	100%				
	Site 2	0/32	32/32	100%					0/32	32/32	100%				
	Site 3	0/32	32/32	100%					0/32	32/32	100%				
	All Sites	**0/96**	**96/96**	**100%**	**96.2-100**				**0/96**	**96/96**	**100%**	**96.2-100**			

Detection of Direct Culture Samples Processed with the IT 1-2-3 Platinum Path Sample Purification Kit

B. anthracis colonies can be detected using a Platinum Path protocol to process the colonies followed by testing with the JBAIDS Anthrax Detection Kit. Ten *Bacillus anthracis* colonies were purified alongside ten non- *B. anthracis* colonies. All ten *B. anthracis* colonies were detected with the JBAIDS Anthrax Detection Kit, while the non-*B. anthracis* colonies were not detected.

Table 6. Anthrax Target 1 and Target 2 Detection from Colonies Purified with Platinum Path

Colony Type	Anthrax Target 1			Anthrax Target 2		
	Positive Results/Total	Cp (cycles)		Positive Results/Total	Cp (cycles)	
		Mean	SD		Mean	SD
B. anthracis	**10/10**	26.62	3.83	**10/10**	27.38	3.73
Non- B. anthracis	**0/10**	-	-	**0/10**	-	-

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Food and Drug Administration
10903 New Hampshire Avenue
Document Control Center – WO66-G609
Silver Spring, MD 20993-0002

CYNTHIA PHILLIPS, Ph.D.
MANAGER, JBAIDS REGULATED PRODUCTS
BIOFIRE DIAGNOSTICS, INC.
390 WAKARA WAY
SALT LAKE CITY UT 84108

August 5, 2013

Re: K131930
Trade/Device Name: JBAIDS Anthrax Detection Kit
Regulation Number: 21 CFR 866.3045
Regulation Name: In vitro diagnostic device for Bacillus spp. detection
Regulatory Class: II
Product Code: NHT
Dated: June 24, 2013
Received: June 27, 2013

Dear Dr. Phillips:

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 Parts 801 and 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.

If you desire specific advice for your device on our labeling regulations (21 CFR Parts 801 and 809), please contact the Division of Small Manufacturers, International and Consumer Assistance at its toll-free number (800) 638 2041 or (301) 796-7100 or at its Internet address http://www.fda.gov/MedicalDevices/ResourcesforYou/Industry/default.htm. Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21CFR 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 the CDRH's Office of Surveillance and Biometrics/Division of Postmarket Surveillance.

You may obtain other general information on your responsibilities under the Act from the Division of Small Manufacturers, International and Consumer Assistance at its toll-free number (800) 638-2041 or (301) 796-7100 or at its Internet address http://www.fda.gov/MedicalDevices/ResourcesforYou/Industry/default.htm.

Sincerely yours,

Uwe Scherf -S for

Sally A. Hojvat, M.Sc., Ph.D.
Director, Division of Microbiology Devices
Office of In Vitro Diagnostics
and Radiological Health
Center for Devices and Radiological Health

Enclosure

Indications for Use

510(k) Number: K131930
Device Name: JBAIDS Anthrax Detection System

The Joint Biological Agent Identification and Diagnostic System (JBAIDS) Anthrax Detection System is a real-time polymerase chain reaction (PCR) test system intended for the qualitative *in vitro* diagnostic (IVD) detection of target DNA sequences on the pXO1 plasmid (Target 1) and the pXO2 plasmid (Target 2) from *Bacillus anthracis.* The system can be used to test the following:

- Human whole blood collected in sodium citrate from individuals suspected of having anthrax
- Positive blood cultures
- Cultured organisms grown on blood agar plates.

The JBAIDS Anthrax Target 2 assay is used as a supplementary test only after a positive result with the Target 1 Assay.

The JBAIDS Anthrax Target 1 and Target 2 Assays are run on the JBAIDS instrument using the Diagnostic Wizard. Results are for the presumptive identification of *B. anthracis,* in conjunction with culture and other laboratory tests. The following considerations also apply:

- The diagnosis of anthrax infection must be made based on history, signs, symptoms, exposure likelihood, and other laboratory evidence, in addition to the identification of pXO1 and pXO2 targets either from cultures or from direct blood specimens.
- The assays have not been evaluated with blood from individuals without clinical signs or symptoms who were presumed exposed and who subsequently developed anthrax (inhalation or other forms of the disease), or from individuals with any form of anthrax (inhalational, cutaneous, or gastrointestinal).
- The level of plasmid targets that would be present in blood from individuals with early systemic infection is unknown.
- The definitive identification of *B. anthracis* from colony growth, liquid blood culture growth, or from blood specimens requires additional testing and confirmation procedures in consultation with public health or other authorities for whom reports are required.

The safety and effectiveness of other types of tests or sample types (not identified as "For in vitro diagnostic use") have not been established.

Prescription Use ___X____ (Part 21 CFR 801 Subpart D)	AND/OR	Over-The-Counter Use _____ (21 CFR 801 Subpart C)

(PLEASE DO NOT WRITE BELOW THIS LINE-CONTINUE ON ANOTHER PAGE IF NEEDED)

Concurrence of CDRH, Office of *In Vitro* Diagnostics and Radiological Health (OIR)

John Hobson -S
2013.07.31 12:50:19
-04'00'