March 27, 2019

Ortho-Clinical Diagnostics, Inc.
Alexandra Chamberlain
Senior Regulatory Associate, Regulatory Affairs
100 Indigo Creek Drive
Rochester, NY 14626

Re: K190490
Trade/Device Name: VITROS XT Chemistry Products TRIG-CHOL Slides
Regulation Number: 21 CFR 862.1175
Regulation Name: Cholesterol (total) test system
Regulatory Class: Class I, meets the limitation to the exemption 21 CFR 862.9 (c)(4)
Product Code: CHH, CDT
Dated: February 27, 2019
Received: February 28, 2019

Dear Alexandra Chamberlain:

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. Although this letter refers to your product as a device, please be aware that some cleared products may instead be combination products. The 510(k) Premarket Notification Database located at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm identifies combination product submissions. 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 Part 801 and Part 809); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803) for devices or post marketing safety reporting (21 CFR 4, Subpart B) for combination products (see https://www.fda.gov/CombinationProducts/GuidanceRegulatoryInformation/ucm597488.htm); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820) for devices or current good manufacturing practices (21 CFR 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR 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 comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/) and CDRH Learn (http://www.fda.gov/Training/CDRHLearn). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (http://www.fda.gov/DICE) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Kellie B. Kelm -S

for Courtney H. Lias, Ph.D.
Director
Division of Chemistry and Toxicology Devices
Office of In Vitro Diagnostics
and Radiological Health
Center for Devices and Radiological Health

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: 06/30/2020
See PRA Statement below.

510(k) Number *(if known)*
K190490

Device Name
VITROS XT Chemistry Products TRIG-CHOL Slides

Indications for Use *(Describe)*
Rx Only
For in vitro diagnostic use only

The TRIG test within the VITROS XT Chemistry Products TRIG-CHOL Slides quantitatively measure triglyceride (TRIG) concentration in serum and plasma using VITROS XT 7600 Integrated Systems. Triglyceride measurements are used in the diagnosis and treatment of patients with diabetes mellitus, nephrosis, liver obstruction, other diseases involving lipid metabolism, or various endocrine disorders.

The CHOL test within the VITROS XT Chemistry Products TRIG-CHOL Slides quantitatively measure cholesterol (CHOL) concentration in serum and plasma using VITROS XT 7600 Integrated Systems. Lipoprotein measurements are used in the diagnosis and treatment of lipid disorders (such as diabetes mellitus), atherosclerosis, and various liver and renal diseases.

Type of Use *(Select one or both, as applicable)*

☒ Prescription Use (Part 21 CFR 801 Subpart D) ☐ Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

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5. 510(k) Summary

This summary of 510(k) safety and effectiveness information is being submitted in accordance with the requirements of SMDA 1990 and 21 CFR 807.92.

The assigned 510(k) number is**:** K190490

Submitter's Information

Ortho-Clinical Diagnostics, Inc.
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Contact Person

Alexandra Chamberlain, RAC
Senior Regulatory Associate, Regulatory Affairs

Date of Preparation March 22, 2019

Device Proprietary Name(s)

VITROS XT Chemistry Products TRIG-CHOL Slides

Common Names

Triglyceride assay
Cholesterol assay

Classification Names

VITROS	Product Code	Class	Regulation Section	Panel
TRIG	CDT	Class I*	21 CFR 862.1705 Triglyceride test system	Clinical Chemistry (75)
CHOL	CHH	Class I*	21 CFR 862.1175 Cholesterol (total) test system	

*Meet the limitations of exemptions per 21 CFR 862.9(c) (4) and will require a premarket notification because both analytes are used in assessing the risk of cardiovascular diseases.

Predicate Device(s)

Predicate Devices	FDA 510(k) Number
VITROS Chemistry Products TRIG Slides	K130332
VITROS Chemistry Products CHOL Slides	K820263

Intended Use Statement(s)

VITROS XT Chemistry Products TRIG-CHOL Slides

Rx Only

For *in vitro* diagnostic use only

The TRIG test within the VITROS XT Chemistry Products TRIG-CHOL Slides quantitatively measure triglyceride (TRIG) concentration in serum and plasma using VITROS XT 7600 Integrated Systems. Triglyceride measurements are used in the diagnosis and treatment of patients with diabetes mellitus, nephrosis, liver obstruction, other diseases involving lipid metabolism, or various endocrine disorders.

The CHOL test within the VITROS XT Chemistry Products TRIG-CHOL Slides quantitatively measure cholesterol (CHOL) concentration in serum and plasma using VITROS XT 7600 Integrated Systems. Lipoprotein measurements are used in the diagnosis and treatment of lipid disorders (such as diabetes mellitus), atherosclerosis, and various liver and renal diseases.

Device Description

The new device, the VITROS XT Chemistry Products TRIG-CHOL Slide is a single device that contains both a TRIG test and a CHOL test multilayered, analytical elements coated on a polyester support separated by a plastic barrier sealed within a single slide frame. In this format, individual reactions occur and test results are generated for each analyte independently of the other analyte.

To perform the TRIG test, a drop of patient sample is deposited on the slide and is evenly distributed by the spreading layer to the underlying layers. The Triton X-100 surfactant in the spreading layer aids in dissociating the triglycerides from lipoprotein complexes present in the sample. The triglyceride molecules are then hydrolyzed by lipase to yield glycerol and fatty acids. Glycerol diffuses to the reagent layer, where it is phosphorylated by glycerol kinase in the presence of adenosine triphosphate (ATP). In the presence of L-α-glycerol-phosphate oxidase, L-α-glycerophosphate is then oxidized to dihydroxyacetone phosphate and hydrogen peroxide. The final reaction involves the oxidation of a leuco dye by hydrogen peroxide, catalyzed by peroxidase, to produce a dye. The density of the dye formed is proportional to the triglyceride concentration present in the sample and is measured by reflectance spectrophotometry.

To perform the CHOL test, a drop of patient sample is deposited on the slide and is evenly distributed by the spreading layer to the underlying layers. The Triton X-100 (TX100) surfactant in the spreading layer aids in dissociating the cholesterol and cholesterol esters from lipoprotein complexes present in the sample. Hydrolysis of the cholesterol esters to cholesterol is catalyzed by cholesterol ester hydrolase. Free cholesterol is then oxidized in the presence of cholesterol oxidase to form cholestenone and hydrogen peroxide. Finally, hydrogen peroxide oxidizes a leuco dye in the presence of peroxidase to generate a colored dye. The density of dye formed is proportional to the cholesterol concentration present in the sample and is measured by reflectance spectrophotometry.

Comparison to Predicate Devices

The following tables show similarities and differences between the new and predicate devices.

Summary of the technological characteristics of the device compared to the predicate device		
Device Characteristic	**New Device** **VITROS XT TRIG-CHOL Slide (New)**	**Predicate Devices** **VITROS TRIG Slide [K130332]** **VITROS CHOL Slide [K820263]** **(Current)**
Intended Use	Same for each individual test For *in vitro* diagnostic use only. The TRIG test within the VITROS XT Chemistry Products TRIG-CHOL Slides quantitatively measure triglyceride (TRIG) concentration in serum and plasma. The CHOL test within the VITROS XT Chemistry Products TRIG-CHOL Slides quantitatively measure cholesterol (CHOL) concentration in serum and plasma.	 For *in vitro* diagnostic use only. VITROS Chemistry Products TRIG Slides quantitatively measure triglyceride (TRIG) concentration in serum and plasma. VITROS Chemistry Products CHOL Slides quantitatively measure cholesterol (CHOL) concentration in serum and plasma.
Device Description	No Change	Multilayered, analytical element coated on a polyester support
Basic Principle	No Change	TRIG Colorimetric CHOL Colorimetric
Incubation time and temperature	No Change	Approximately 5 minutes 37°C (98.6° F)
Sample type	No Change	Serum and plasma
Amount of Slide Reactive Ingredients per slide (test)	The composition of the analytical element of each test within the VITROS XT Slide will remain the same as that used in each predicate devices	TRIG Lipase (*Pseudomonas* sp.) 0.08 U; peroxidase (horseradish root) 0.52 U; glycerol kinase (*Cellulomonas* sp.) 0.35 U; L-α-glycerophosphate oxidase (*Pediococcu*s sp.) 0.19 U; Triton X-100 0.62 mg; 2-(3,5-dimethoxy-4-hydroxyphenyl)-4,5-bis(4-dimethylaminophenyl) imidazole (leuco dye) 0.04 mg; and adenosine triphosphate 0.14 mg.

Summary of the technological characteristics of the device compared to the predicate device		
Device Characteristic	**New Device** **VITROS XT TRIG-CHOL Slide (New)**	**Predicate Devices** **VITROS TRIG Slide [K130332]** **VITROS CHOL Slide [K820263]** **(Current)**
		CHOL Triton X-100 0.81 mg; cholesterol oxidase (*Cellulomonas* sp.) 0.4 U; cholesterol ester hydrolase (*Pseudomonas* sp.) 2.0 U; peroxidase (horseradish root) 5.3 U; and 2-(3,5-dimethoxy- 4-hydroxyphenyl)-4,5-bis-(4-dimethylaminophenyl) imidazole (leuco dye) 0.17 mg.
Assay Range	No Change	TRIG 10.0–525.0 mg/dL CHOL 50–325 mg/dL
Calibrators	Same	VITROS Chemistry Products Calibrator Kit 2
Controls	Same	VITROS Chemistry Products Performance Verifier I and II
Differences		
Instrumentation	VITROS XT 7600 Integrated System	VITROS 250/350, 5,1 FS and 4600 Chemistry Systems VITROS 5600 and XT 7600 Integrated Systems
Sample volume	TRIG 2.9 µL CHOL 3.9 µL	TRIG 5.5 µL CHOL 5.5 µL

Non-Clinical Testing Analytical Performance

Method Comparison

Method Comparison testing followed CLSI Protocol EP09c, *Measurement Procedure Comparison and Bias Estimation Using Patient Samples. S*erum samples were evaluated on the VITROS XT Chemistry Products TRIG-CHOL Slides using the VITROS XT 7600 Integrated System and on VITROS Chemistry Products TRIG Slides and VITROS Chemistry Products CHOL Slides using the VITROS 5600 Integrated System. The correlation between the predicate and the new tests within the VITROS XT TRIG-CHOL Slides on the VITROS XT 7600 Integrated System is summarized below.

Summary of Method Comparison Weighted Deming Regression Analysis Data
Units mg/dL

Test	N	Slope	Intercept	Corr. Coeff.	Test Range	Measuring range
TRIG Serum	148	0.99	1.49	1.000	17 - 519	10 - 525
CHOL Serum	148	0.97	0.09	0.999	72 - 315	50 - 325

Precision

Precision was evaluated with patient pools and quality control materials following CLSI Protocol EP05-A3, *Evaluation of Precision Performance of Quantitative Methods; Approved Guideline—Third Edition*, using the VITROS XT Chemistry Products TRIG-CHOL Slides on the VITROS XT 7600 Integrated System. The test included 80 observations (2 replicates per run, 2 runs per day over 20 days) for serum. The long term precision analysis is summarized below.

The data presented are a representation of test performance and are provided as a guideline. Variables such as sample handling and storage, reagent handling and storage, laboratory environment, and system maintenance can affect reproducibility of test results.

TRIG Serum Units (mg/dL)									
Fluid Id	Mean Conc.	Repeatability		Within Day		Within Lab		No. of Obs.	No. of Days
		SD	CV%	SD	CV%	SD	CV%		
Pool 1	29	0.2	0.6	0.3	1.0	0.4	1.3	80	20
Native Pool	90	0.3	0.3	0.9	1.0	1.4	1.5	80	20
Control 1	115	0.4	0.3	0.6	0.5	0.8	0.7	80	20
Control 2	255	1.1	0.4	1.5	0.6	2.1	0.8	80	20
Pool 2	379	1.4	0.4	2.3	0.6	3.4	0.9	80	20
Pool 3	513	1.7	0.3	3.1	0.6	4.5	0.9	80	20

CHOL Serum Units (mg/dL)									
Fluid Id	Mean Conc.	Repeatability		Within Day		Within Lab		No. of Obs.	No. of Days
		SD	CV%	SD	CV%	SD	CV%		
Pool 1	74	0.6	0.8	0.6	0.8	1.6	2.1	80	20
Control 1	149	1.5	1.0	1.5	1.0	2.9	1.9	80	20
Native Pool	159	1.2	0.8	1.4	0.9	2.1	1.3	80	20
Pool 2	208	1.5	0.7	2.1	1.0	3.1	1.5	80	20
Control 2	261	1.5	0.6	2.5	1.0	4.2	1.6	80	20
Pool 3	312	2.1	0.7	3.3	1.1	4.7	1.5	80	20

Detection Capability

Detection capability studies for the TRIG and CHOL tests within the VITROS XT TRIG-CHOL Slides were evaluated according to CLSI EP17-A2: Evaluation of Detection Capability for Clinical Laboratory Measurement Procedures.

The Limit of Quantitation (LoQ) for the TRIG test within the VITROS XT TRIG-CHOL Slides is 10 mg/dL. The total number of LoQ determinations was 180. The criteria used to accept the LoQ was %CV < 20%.

The Limit of Quantitation (LoQ) for the CHOL test within the VITROS XT TRIG-CHOL Slides is 50 mg/dL. The total number of LoQ determinations was 180. The criteria used to accept the LoQ was %CV < 9%.

The results of this analysis are summarized below:

	TRIG (mg/dL)	CHOL (mg/dL)
	Serum	Serum
LOB	3.8	1.8
LOD	4.1	2.1
LOQ	6.5	17.6
Claimed LOQ	10	50

Linearity

Linearity studies were performed according to CLSI EP06-A, *Evaluation of the Linearity of Quantitative Measurement Procedures: A Statistical Approach Approved Guideline (2003).* VITROS XT TRIG-CHOL Slides were tested on the VITROS XT 7600 Integrated System. A series of eighteen proportionally related admixtures of low and high test fluids were tested to verify linearity of the TRIG and CHOL serum tests; each sample was tested in quadruplicate. The linearity studies support the claimed measuring ranges for the individual tests within the VITROS XT TRIG-CHOL Slides.

Assay	Fluid	Measuring Range (mg/dL)	Linear Range (mg/dL)	Claimed Linearity (mg/dL)
TRIG	Serum/plasma	10 - 525	8.0 – 542.8	10 - 525
CHOL	Serum/plasma	50 - 325	27 – 358	50 - 325

Serum and plasma samples with values greater than the measuring range should be diluted with 1 part sample with 2 parts diluent for the TRIG test and with1 part sample with 1 part diluent for the CHOL test. A 7% BSA solution was found to be an acceptable diluent for serum and plasma specimens assayed using VITROS XT Chemistry Products TRIG-CHOL Slides.

Expected Values

The National Cholesterol Education Program (NCEP)[1] sets the guidelines for TRIG and CHOL and uses a classification scheme in place of a reference interval for the expected values. The expected values of the TRIG and CHOL tests within the VITROS XT TRIG-CHOL Slides are the not changed from those of the predicate assays.

Each laboratory should confirm the validity of these intervals for the population it serves.

TRIG Classification

Triglyceride levels are categorized according to the classification scheme in the ATP III guidelines recommended by NCEP for samples collected from fasting patients.

Classification	Conventional Units (mg/dL)	SI Units (mmol/L)	Alternate Units (g/L)
Normal	< 150	< 1.69	< 1.50
Borderline High	150–199	1.69–2.25	1.50–1.99
High	200–499	2.26–5.64	2.00–4.99
Very High	≥ 500	≥ 5.65	≥ 5.00

CHOL Classification

Cholesterol levels are categorized according to the classification scheme in the ATP III guidelines recommended by NCEP for samples collected from fasting patients.

Classification	Conventional Units (mg/dL)	SI Units (mmol/L)	Alternate Units (g/L)
Desirable	< 200	< 5.2	< 2.0
Borderline High	200–239	5.2–6.2	2.0–2.4
High	≥ 240	≥ 6.2	≥ 2.4

Specificity

The TRIG and CHOL tests within the VITROS XT Chemistry Products TRIG-CHOL Slide were screened for interfering substances following CLSI EP07-03, Interference Testing in Clinical Chemistry. The supplemental tables in CLSI document EP37 were referenced for recommended testing concentrations for analytes and endogenous substances that may interfere in clinical chemistry measurement procedures.

Point estimates of the effects of potential interferents on VITROS XT TRIG-CHOL Slides were made using the paired difference method. Dose-response analysis was conducted to characterize the degree of interference for each substance, and expected bias was reported at the lowest test level which did not meet acceptance criteria for bias as shown in the product claims.

Serum

Known Interferences

Free glycerol in serum is measured along with the glycerol from the hydrolysis of triglycerides and diglycerides. Certain clinical conditions show high endogenous free glycerol levels.[2] Some drugs are also known to produce elevated glycerol levels in serum. Triglyceride results from samples of such patients will not reflect actual serum triglyceride content.

Grossly lipemic samples show a slower rate of color development than do clear serums, which results in a negative bias. These samples often contain triglyceride concentrations greater than the system's measuring (reportable or dynamic) range. Grossly lipemic samples should be diluted prior to testing.

The substances listed in the table, when tested at the concentrations indicated, caused the bias shown. The bias is an estimate of the maximum bias observed.

It is possible that other interfering substances may be encountered. These results are representative; however, your results may differ somewhat due to test-to-test variation. The degree of interference at concentrations other than those listed might not be predictable.

TRIG Test

For the TRIG test within VITROS XT TRIG-CHOL Slides, interference was observed for two (2) substances.

Interferent	Interferent Concentration	Triglycerides Concentration	Bias
Dextran 40	2 g/dL	140 mg/dL	29.6 mg/dL
		504 mg/dL	62.7 mg/dL
Total protein	12 g/dL	138 mg/dL	19.0 mg/dL
	15 g/dL	496 mg/dL	62.9 mg/dL

For the TRIG test within VITROS XT TRIG-CHOL Slides, no interference was observed for seventy-eight (78) substances when tested at the concentrations listed.

CHOL Test

For the CHOL test within VITROS XT TRIG-CHOL Slides, interference was observed for seven (7) substances.

Interferent	Interferent Concentration	Cholesterol Concentration	Bias
Ascorbic acid	5.2 mg/dL	145 mg/dL	-14 mg/dL
	30.1 mg/dL	249 mg/dL	-101 mg/dL
Cefazolin	120 mg/dL	153 mg/dL	-18 mg/dL
		249 mg/dL	-29 mg/dL
Dextran 40	4 g/dL	157 mg/dL	-24 mg/dL
		265 mg/dL	-49 mg/dL
Glutathione	69 mg/dL	147 mg/dL	-21 mg/dL
Hemoglobin	1000 mg/dL	166 mg/dL	-17 mg/dL
N-Acetylcysteine	15 mg/dL	147 mg/dL	-20 mg/dL
	42 mg/dL	246 mg/dL	-69 mg/dL
Total protein	10 g/dL	154 mg/dL	20 mg/dL
	12 g/dL	263 mg/dL	42 mg/dL

For the CHOL test within VITROS XT TRIG-CHOL Slides, no interference was observed for seventy-nine (79) substances when tested at the concentrations listed.

Other Limitations

Certain drugs and clinical conditions are known to alter triglyceride and cholesterol concentrations *in vivo*. For additional information, refer to one of the published summaries.

Conclusion

The conclusions drawn from the nonclinical tests (discussed above) demonstrate the VITROS XT Chemistry Products TRIG-CHOL Slides for use on the VITROS XT 7600 Integrated System are as safe, effective, and perform as well as the predicate devices. The information submitted in the premarket notification is complete and supports a substantial equivalence decision.

References

1. NCEP. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III), Final Report. NIH Publication No. 02–5215. National Institutes of Health. Bethesda, Maryland: September 2002.
2. Stein EA, et al. National Cholesterol Education Program Recommendations for Triglyceride Measurement: Executive Summary. Clin. Chem. 41:1421–1426; 1995.