IV. 510(K) SUMMARY: CARESIDE™ CK SAFETY AND EFFECTIVENESS

I. Applicant Information

A.	Applicant Name	**CARESIDE, Inc.**
B.	Applicant/Manufacturer Address	6100 Bristol Parkway Culver City, CA 90230
C.	Telephone Number	310-338-6767
D.	Contact Person	Kenneth B. Asarch, Pharm.D., Ph.D.
E.	FAX Number	310-338-6789
F.	e-Mail Address	AsarchK@CARESIDE.com
G.	Date 510(k) Summary prepared	January 29, 1999

II. Device Information

A.	Device Name (Trade)	**CARESIDE™ CK**
B.	Device Name (Classification)	Creatine phosphokinase/creatine kinase or isoenzymes test system
C.	Device Classification	Clinical chemistry panel CK test system Regulation Number: 21 CFR 862.1215 Regulatory Class II Classification Number: 75JFX
D.	Special controls and performance standards	None applicable

III. Substantial Equivalence Claim

A. General equivalency claim

The ability to monitor analyte-specific biochemical reactions in dry film and other formats is widely recognized and has gained widespread acceptance for use in chemistry assays.

CK *in vitro* diagnostic products, in both dry film and other formats, are already on the U.S. market, including CK products that utilize enzymatic coupling to convert the reaction product, ATP, to a colored dye.

B. Specific equivalency claim

This CARESIDE™ CK test is substantially equivalent in principle, intended use, and clinical performance to the currently marketed Vitros slides for the quantitative measurement of CK for use on the Vitros DTSC module of the Vitros DT II system.

Name of Predicate Device:	Johnson and Johnson's (formerly Eastman Kodak, Inc.) **Vitros CK DT Slides** for use on the **Vitros DTSC module of the Virtos DT II** system (formerly Eastman Kodak's DT 60 II).
Predicate Device 510K number:	**K912844/A**
Product Code:	75JFX

IV. Device Description

CARESIDE™ CK cartridges are used with the CARESIDE, Inc. CARESIDE *Analyzer*™ to measure CK activity in whole blood, serum or plasma specimens. The CARESIDE™ CK cartridge, a single use disposable *in vitro* diagnostic test cartridge, delivers a measured volume of serum or plasma to a dry film to initiate the measurement of CK activity. The film cartridge (patent pending) contains all reagents necessary to measure CK activity.

A. Explanation of Device Function

Each CARESIDE™ CK cartridge consists of a CK-specific multi-layer reagent film mounted in a plastic base with a hinged lid. The user introduces the specimen into the cartridge sample deposition well, closes the lid and inserts the cartridge into the CARESIDE *Analyzer*™.

Once loaded, the CARESIDE *Analyzer*™ scans the cartridge barcode, brings the cartridge and the contained specimen to 37°C, and spins the cartridge to move the sample from the sample deposition well into the cartridge channels and chambers. 8.5 µL microliters of sample remains in the metering passage. Any excess sample flows into an overflow well.

The sample is automatically dispensed onto the multi-layer reagent film. The spreading and substrate layer distributes the specimen which in turn catalyzes the reaction of creatine phosphate with ADP to form creatine and ATP. In the reagent layer, glucose-6-phosphate (G-6-P) is formed by the hexokinase catalyzed reaction of glucose with ATP. G-6-P then reduces NAD+ to NADH in a glucose 6-phosphate dehydrogenase (G6PDH) catalyzed reaction. NADH then reduces NTB to diformazan dye in a diaphorase catalyzed reaction. The color intensity of the resulting reddish dye, as measured by the amount of reflected light at 570 nanometers directly relates to the CK activity of the specimen.

Test Reaction Sequence:

$$\text{Creatine phosphate} + \text{ADP} \xrightarrow{\text{CPK}} \text{Creatine} + \text{ATP}$$

$$\text{ATP} + \text{Glucose} \xrightarrow[Mg^{+2}]{\text{Hexokinase}} \text{ADP} + \text{G-6-P}$$

$$\text{G-6-P} + \text{NAD}^{+} \xrightarrow{\text{G6PDH}} \text{6-phosphogluconic acid} + \text{NADH} + \text{H}^{+}$$

$$\text{NTB} + \text{NADH} \xrightarrow{\text{Diaphorase}} \text{Diformazan dye} + \text{NAD}^{+}$$

As the cartridges spin, a photodiode measures reflectance of light emitted by a wavelength-specific light emitting diode (LED) over a fixed time period. The analyzer uses the reflectance measurements and the lot-specific standard curve to calculate CK activity.

B. Test Summary

Creatine kinase (CK), also known as creatine phosphokinase, is an enzyme consisting of two sub-units (termed B and M) that catalyzes the reversible phosphorylation of creatine by adenosine-triphosphate (ATP) to creatine phosphate and adenosine-diphosphate (ADP). Only the CK dimer has enzymatic activity. Thus, total active CK is the combination of CKBB, CKMB and CKMM isoenzymes. These are also referred to as CK-1, CK-2 and CK-3 respectively, according to their differential mobility on an electrophoretic gel. CK is distributed in various organs; the highest activities are found in skeletal muscle, heart, and brain. Considerably lower activities are present in the urinary bladder, stomach, ileum, colon, and uterus. The CK content of liver, erythrocytes, and kidney is less that 1% of the amount found in skeletal muscle.

Measurement of total CK activity is important in the diagnosis of cardiac and skeletomuscular disorders, and is increased after muscle trauma, intramuscular injections, exercise, and in other conditions. CK level is also increased after acute alcohol intoxication, surgery-induced muscle injury, drug overdoses and poisoning, trauma to muscle or brain, hypothermia, hyperthermia, Reye's syndrome, infectious diseases, and hypothyroidism. Abnormal CK activities have been described in all forms of muscular dystrophy as well as polymyositis, dermatomyositis, and other myopathies. Many non-affected carriers of muscular dystrophy have abnormal CK activity in the blood, which provides a method for identifying such carriers.

V. Intended Use

A. Intended Use

The CARESIDE™ CK cartridge is intended for *in vitro* diagnostic use in conjunction with the CARESIDE *Analyzer*™ to quantitatively measure CK activity in whole blood, serum or plasma.

B. Indications for Use

For in vitro diagnostic use with the CARESIDE *Analyzer*™ to quantitatively measure CK activity from anti-coagulated whole blood, plasma, or serum specimens to aid in the diagnosis and treatment of patients with myocardial infarction and muscle diseases such as progressive, Duchenne-type muscular dystrophy. It is intended professional laboratory use: not for point of care or physician office laboratory use.

VI. Technological Characteristics

A. Similarities

	CARESIDE™ CK	Vitros CK DT Slides
Intended Use	Primarily to aid in the diagnosis and treatment of patients with with myocardial infarction and muscle diseases such as progressive, Duchenne-type muscular dystrophy.	Diagnosis of skeletal muscle disease, myocardial infarction, and cerebrovascular accidents.
Indications	For *in vitro* diagnostic use. For professional laboratory: not for point of care or physician office laboratory use.	For *in vitro* diagnostic use
Measurement	Quantitative	Same
Method Principle	Reflectometry of enzymatically coupled production of dye from CK reaction product.	Same
Specimen dilution	Not required	Same
Materials	Creatine phosphate, nitrotetrazorium blue, ADP, glucose, hexokinase, glucose-6-phosphate dehydrogenase (G6PDH), NAD^+, diaphorase	Glycerophosphate oxidase, peroxidase, gycerol kinase, creatine phosphate, N-acetylsysteine, magnesium acetate, glycerol, ADP.
Detector	Reflectance (570 nm)	Reflectance (680 nm)
Test time	Approximately 4-minute warm-up (on-board) plus 4 minute test time.	15 minutes slide warm-up (off-line) plus 5 minutes test time.
Sample Type	Anti-coagulated whole blood, plasma, or serum	Plasma or serum
Specimen volume	8.5 µl test volume (85 ± 15 µl applied volume)	10 µl
Calibration	Calibration information bar-coded on each cartridge. Calibration information may change with each lot.	Run Vitros DT II calibrators whenever a new slide lot is used or when necessary.
Quality Control	2 levels	Same
Reporting Units	U/L	Same
Reaction Temp.	37°C	Same

B. Differences

	CARESIDE™ CK	Vitros CK DT Slides
Accurate pipetting	Not required	Required
Reagent pre-warming	Not required	Required

C. Comparative Performance Characteristics

	CARESIDE™ CK	Vitros CK DT Slides
Detection limit	20 U/L	20 U/L
Reportable range	20 to 1600 U/L	20 to 1600 U/L
Accuracy	Mean recovery 101%	Not provided
Precision	Total CV, 168 U/L, 10%	Total CV, 175 U/L, 3%
Reference Method	Kinetic determination with enzymatically coupled spectrophotometric detection of creatine.	Not provided
Method comparison	CARESIDE™ CK = 1.03 (Trace) – 22.4 U/L, r = 0.98	
Linearity	Linearity yielded slope and correlation coefficient within acceptable limits.	Not provided
Interference	No significant interference observed at tested concentration of interferent: Ascorbic Acid, 10 mg/dL Bilirubin, 20 mg/dL Triglycerides 2000 mg/dL	Elevated carbon dioxide (> 40mmol/L) may decrease CK results.

D. Conclusion

The nonclinical and clinical data provided demonstrate that the CARESIDE™ CK product is as safe, effective, and performs as well as or better than the legally marketed predicate device.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Food and Drug Administration
9200 Corporate Boulevard
Rockville MD 20850

APR 19 1999

Kenneth B. Asarch, Pharm. D., Ph.D.
Vice President, Quality Systems/
Regulatory Affairs
Careside Inc.
6100 Bristol Parkway
Culver City, California 90230

Re: K990439
Trade Name: CARESIDE™ CK
Regulatory Class: II
Product Code: JHS
Dated: January 29, 1999
Received: February 11, 1999

Dear Dr. Asarch:

We have reviewed your Section 510(k) notification of intent to market the device referenced above and we 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). 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.

If your device is classified (see above) into either class II (Special Controls) or class III (Premarket Approval), it may be subject to such additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 895. A substantially equivalent determination assumes compliance with the Current Good Manufacturing Practice requirements, as set forth in the Quality System Regulation (QS) for Medical Devices: General regulation (21 CFR Part 820) and that, through periodic QS inspections, the Food and Drug Administration (FDA) will verify such assumptions. Failure to comply with the GMP regulation may result in regulatory action. In addition, FDA may publish further announcements concerning your device in the Federal Register. Please note: this response to your premarket notification submission does not affect any obligation you might have under sections 531 through 542 of the Act for devices under the Electronic Product Radiation Control provisions, or other Federal laws or regulations.

Under the Clinical Laboratory Improvement Amendments of 1988 (CLIA-88), this device may require a CLIA complexity categorization. To determine if it does, you should contact the Centers for Disease Control and Prevention (CDC) at (770) 488-7655.

This letter will allow you to begin marketing your device as described in your 510(k) premarket notification. The FDA finding of substantial equivalence of your device to a legally marketed predicate device results in a classification for your device and thus, permits your device to proceed to the market.

If you desire specific advice for your device on our labeling regulation (21 CFR Part 801 and additionally 809.10 for in vitro diagnostic devices), please contact the Office of Compliance at (301) 594-4588. Additionally, for questions on the promotion and advertising of your device, please contact the Office of Compliance at (301) 594-4639. Also, please note the regulation entitled, "Misbranding by reference to premarket notification"(21 CFR 807.97). Other general information on your responsibilities under the Act may be obtained from the Division of Small Manufacturers Assistance at its toll-free number (800) 638-2041 or (301) 443-6597, or at its internet address "http://www.fda.gov/cdrh/dsma/dsmamain.html".

Sincerely yours,

Steven Gutman

Steven I. Gutman, M.D, M.B.A.
Director
Division of Clinical
Laboratory Devices
Office of Device Evaluation
Center for Devices and
Radiological Health

Enclosure

VI. INDICATIONS FOR USE

510(k) Number: K990439

Device Name: CARESIDE™ CK

Indications for use: For *in vitro* diagnostic use with the CARESIDE *Analyzer*™ to quantitatively measure CK from anti-coagulated whole blood, plasma, or serum specimens to aid in the diagnosis and treatment of patients with myocardial infarction and muscle diseases such as progressive, Duchenne-type muscular dystrophy.

Sean Cooper
(Division Sign-Off)
Division of Clinical Laboratory Devices
510(k) Number K990439

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

Concurrence of CDRH, Office of Device Evaluation (ODE)

Prescription Use
(Per 21 CFR 801.109)

OR

Over-The-Counter Use ___
(Optional Format 1-2-96)