510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY

A. 510(k) Number:
k060110

B. Purpose for Submission:
Software architecture in *CellTracks®* Analyzer II operating system was changed. The operating system MS Windows XP has been changed to Mandrake Linux. This new operating system (Linux) is not compatible with the current Graphical User Interface (GUI) and a new GUI program was also developed.

C. Manufacturer and Instrument Name:
Immunicon Corporation's CellTracks Analyzer II

D. Type of Test or Tests Performed:
A semi-automated, qualitative immunomagnetic-capture immunofluorescent detection image analysis fluorescence microscope used to aid a CLIA-compliant, *CellTracks®* trained testing personnel in the enumeration of circulating tumor cells (CTC) (cells appearing like tumor cells with epithelial cell markers and no lymphocyte marker on their surfaces).

E. System Descriptions:

1. Device Description:
   The *CellTracks®* Analyzer II is a semi-automated fluorescence microscope. The product consists of the *CellTracks®* Analyzer II, a dedicated computer loaded with *CellTracks®* software, monitor, keyboard and mouse.
   The *CellTracks®* Analyzer II is for analysis of rare cells that are isolated from biological fluids including whole blood. It is used in conjunction with *CellTracks®* AutoPrep System, which automates, standardizes and optimizes the sample preparation with specific reagent kits.

2. Principles of Operation:
   The *CellTracks®* Analyzer II is used in conjunction with the *CellTracks®* AutoPrep System and reagent kits that contain a ferro-fluid-based capture reagent and immunofluorescent reagents for detection and characterization of the captured cells. The ferrofluid reagent consists of nano-particles with a magnetic core surrounded by a polymeric layer coated with antibodies targeting the cells of interest. After immunomagnetic capture and enrichment, fluorescent reagents are added for identification and enumeration of the target cells.
   The processed reagent/sample mixture is dispensed by the *CellTracks®* AutoPrep System into a cartridge that is inserted into a MagNest® cell presentation device. The strong magnetic field of the MagNest® device causes the magnetically-labeled target cells to move to the surface of the cartridge. The cartridge is then placed on the *CellTracks®* Analyzer II for data acquisition and analysis. The *CellTracks®* Analyzer II scans the entire surface of the cartridge with a series of fluorescence filters that are defined for the assay. Cell images from the filter are compiled and presented in a gallery format for final cell classification by the user.

3. Modes of Operation:
   Semi-automated, one-at-a-time MagNest® analysis.

4. Specimen Identification:
   Identification information entered individually for each patient sample.
5. Specimen Sampling and Handling:
   The processed reagent/sample mixture is dispensed by the CellTracks AutoPrep system into a cartridge that is inserted into a MagNest® cell presentation device. The MagNest® is not mixed or pierced, but put into place manually and then the surface is automatically scanned. The CLIA-compliant, *CellTracks*® trained testing personnel then manually interprets the results.
6. Calibration:
   The analyzer is calibrated using the *CellTracks*® System Verification Cartridge which contains a strip of material impregnated with dyes. System verification checks the optical performance and chamber "skew" which ensures proper scanning. There is no recognized reference material or method.
7. Quality Control:
   For the circulating tumor cell assay the *CellSearch*® Circulating Tumor Cell Control Kit (available from Veridex, LLC, a Johnson and Johnson company) should be run once per day of patient testing as a patient sample following each user's quality assurance program.
8. Software:
   FDA has reviewed applicant's Hazard Analysis and Software Development processes for this line of product types:
   Yes_____X_____ or No_____
   Frederick Prevo, PhD, (OSEL/DESE) has reviewed the software submission and found it to be acceptable for a moderate hazard level.
   Software validation and traceability of the requirements related to RUO and Administration were completed on the IVD aspects of the application only. Requirements related to other functionality were to be tested and traced prior to launch. Immunicon Corporation will submit to FDA the validation, traceability documentation and software report upon completion.

F. **Regulatory Information**:
   1. Regulation section:
      21 CFR 866.6020-Immunomagnetic Circulating Cancer Cell Selection and Enumeration System
   2. Classification:
      Class II
   3 Product code:
      NQI, System, Immunomagnetic, Circulating Cancer Cell, Enumeration
   4. Panel:
      Immunology (82)

G. **Intended Use:**
   1. Indication(s) for Use:
      The Immunicon *CellTracks*® Analyzer II is a semi-automated fluorescence microscope used to enumerate fluorescently labeled cells that are immunomagnetically selected and aligned. The product is for *in vitro* diagnostic use when used in tandem with specimen preparation equipment and reagents that

are legally marketed for *in vitro* diagnostic use with this device.
2. Special Conditions for Use Statement(s):
   For prescription use only
H. Substantial Equivalence Information:
1. Predicate Device Name(s) and 510(k) numbers:
   CellTracks® Analyzer II (k050145)
2. Comparison with Predicate Device:

Similarities		
Item	New Device	Predicate
Name	*CellTracks*® Analyzer II	*CellTracks*® Analyzer II
Sample	Processed via MagNest® fixture	Same
Available channels for analysis	4	Same
Sample Holder	MagNest	Same
Power	100-240 Vac 50-60 Hz.	Same
Differences		
Item	New Device	Predicate
Computer Operating system[1]	Mandrake Linux	MS Windows XP
Graphical User Interface[2]	Developed to be Linux compatible	MS Windows XP

[1]The Operating system (OS) performs basic tasks such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.
All the algorithms associated with image acquisition, analysis, cell selection, review, reporting and archiving; the logic and interface to the PC remain the same with the replacement of the OS.

[2] The Graphical User Interface (GUI) is a program interface that uses a computer's graphic capabilities to make the program easier to use. Graphical interfaces use a pointing device to select objects, including icons, menus, text boxes, etc. A GUI includes standard formats for representing text and graphics. This allows users to compile defined data in a manner more usable to the operator. It does not allow them to alter the basic cell definition, count or image quality.
I. Special Control/Guidance Document Referenced (if applicable):
The CellTracks was developed in conformance to the following standards.

ISO 14971 Medical Devices- Application of Risk Management to Medical Devices

FDA Guidance: General Principles of Software Validation

EP5-A NCCLS document: Evaluation of Precision Performance of Clinical Chemistry

Devices

EP9-A NCCLS document: Method comparison and Bias Estimation Using Patient Samples

All requirements for these standards were met. EP9-A testing was performed using donor spiked samples rather than actual cancer patient samples.

In addition, the CellTracks Analyzer II will conform to the following two standards prior to marketing.

IEC 61010-1 IEC: Safety requirements for Electrical Equipment for Measurement, Control and Laboratory Use Part 1

BS EN61326 Electrical Equipment for Measurement, Control and Laboratory Use - EMC requirements.

J. Performance Characteristics:

1. Analytical Performance:
    a. *Accuracy*
       Accuracy was demonstrated by a recovery study. 7.5 mL of pooled donor blood was pipetted into 12 AutoPrep sample tubes. Six of the 12 tubes were spiked with 50 SKBR-3 cells/50µL and the other 6 were spiked with the 300 SKBR-3 cells/100 µL. The Veridex LLC CellSearch™ Epithelial Cell kit/Cell Spotter Analyzer, (k031588) was used to assay the samples. Three of the 50 cell count samples were scanned first with the new OS version Linux 1. The same samples were rescanned with the predicate OS version 1.2 (XP). The other three 50 cell count samples were first scanned with the predicate OS version 1.2 (XP) and rescanned with new OS version Linux 1. The same process was performed with the 300 cell count samples. Equivalent recovery was obtained with both operating systems (see table below).

	New device		Predicate	
Cell counts	50	300	50	300
Mean	53	304	53	304
SD	9.2	12.5	8.5	13.7
% CV	17.3	4.1	16.0	4.5

       Substantial equivalence was also demonstrated by comparing bead counts of high and low controls between the two devices. Six high control samples and 6 low control samples were pipetted into 12 AutoPrep sample tubes. Each control sample cartridge was scanned twice. Half of the low control samples were first scanned with the predicate version 1.2 (XP) and rescanned with the new device version Linux 1. The other half of the low control samples were first scanned with the new version Linux 1 and rescanned with predicate version 1.2(XP). The same process was done with the high control samples. According to the control product labels, the control cell ranges were:
          High control 632-922 beads
          Low control 15-65 beads

The following results were obtained:
Low control comparison
    (Linux) = 1.0588 (1.2 XP) – 1.4118
    R^2 = 0.9608
High control comparison
    (Linux) = 1.0748 (1.2 XP) – 45.652
    R^2 = 0.9939

b. *Precision/Reproducibility*:
Precision was measured using a single bead cartridge (approximately 100 beads) scanned 10 times with version 1.2 (XP) software and 10 times with version 1 Linux software on two different *CellTracks*® II Analyzers. The fluorescent beads do not photo-bleach and can be used to compare multiple scans. Results showed precisions seen with both operating systems are substantially equivalent.

Summary of Precision Analyses

	New device	Predicate
Mean	98	98
SD	0.49	0.48
% CV	0.49	0.49

c. *Linearity*
Linear regression analysis was performed using five cartridges each containing the following number of fluorescent beads: 0, 5, 99, 559 and 950 into 320 µL of 60% glycerol as diluent. 1000-2000 glacial blue beads were added to each cartridge to provide enough UV events for focusing. Only glacial blue beads were added to the 0 cartridge. Fluorescent bead count for each cartridge was verified using the CellSpotter system (Veridex LLC CellSearch™ Epithelial Cell kit/Cell Spotter Analyzer, k031588).
Each cartridge were scanned with OS version 1.2 (XP) and rescanned with OS version1 (Linux).
The following results were obtained:
    y = 1.0009x + 0.0958
    R^2 = 1.0
Conclusion: The new device version is substantially equivalent to the predicate device and linear to 950 fluorescent beads in 320uL diluent.

c. *Carryover*:
Refer to predicate device k050145 for carryover studies.
The changes made to the instrument were OS related. This should have no effect on carryover.
d. *Interfering Substances*:
Refer to predicate device k050145 for interference studies. The changes made to the instrument were OS related and there should be no effect on interference. Thus, no new interfering substances studies were needed.

K. Proposed Labeling:
The data indicate substantial equivalence between the new and the old operating systems. Thus, no changes need to be made to the labeling.
The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

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