

# GEORGINA

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## Lumicyano: A Validation Summary to Incorporate a one-step Fluorescent Cyanoacrylate Process in the GBI LP Processing Protocol

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[Background](#)

[Current Methods](#)

The current method used for non-porous and semi-porous items is a two-step Cyanoacrylate/Dye stain process. Cyanoacrylate fuming is conducted in either the Foster+Freeman MVC 5000 fuming cabinet or the Misonix CA-6000 chamber under specific conditions. The process begins with a humidity cycle, where the chamber will reach the 80% relative humidity needed in order to initiate the glue cycle. During the glue cycle the cyanoacrylate material is heated to 120OC to vaporize the liquid glue. The fumes, consisting of cyanoacrylate ester monomers, fill the chamber, coming in contact with the latent prints. The monomers quickly bond with the initiators in the latent print residue. Once the monomer is bonded with the residue, the monomer will react with another monomer. This reaction continues and forms a polymer. The last step of the cyanoacrylate fuming is to terminate the polymer chain reaction. This is done by initiating the “Purge” cycle. Once the “Purge” cycle is started, the hotplate is turned off and the remaining superglue fumes are purged from the chamber. A visual examination is conducted following this series of cycles. The fuming process can be repeated.

Per GBI DOFS policy manual, cyanoacrylate fuming can be followed by one of the three fluorescent dye stains, Basic Yellow 40 (BY), Rhodamine 6G methanol based (R6G-methanol), or Rhodamine 6G water based (R6G-H2O). It is recommended that the cyanoacrylate be allowed to cure on the item for at least 1 hour before applying a dye stain. The dye stain selection is based on two factors: the type of substrate, and the optical properties of that substrate. The dye stains only react to the cyanoacrylate deposits on the item. The dye stain is usually applied to an item by spraying the item to ensure even coverage on the entire surface. The item is then rinsed with water to remove the excess dye and to prevent any background staining; although background staining may still occur. The item is left to dry before a visual examination is conducted. This would conclude the processing for most nonporous and semi-porous items.

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The current method of cyanoacrylate and liquid dye stain application can be detrimental to other services such as DNA and Firearms. While DNA services are typically completed prior to Latent Print processing, there are instances where due to the nature of the case it may prove more advantageous to the preservation of evidence to complete latent print processing first. The physical application of a liquid dye stain followed by a water rinse creates the possibility of washing away genetic material. Consideration for firearms evidence is to prevent the formation of rust on the firearm after the liquid dye stain application, which can interfere with Firearms comparisons.

### Lumicyano

Lumicyano is a one-step Cyanoacrylate/Dye stain process; it is cyanoacrylate with a fluorescent additive that does not require a separate liquid dye stain application. Lumicyano can be purchased as a kit that contains the Lumicyano powder (fluorescent dye) and the Lumicyano liquid solution (cyanoacrylate), or the Lumicyano powder and Lumicyano liquid solution can be purchased separately. Lumicyano does not require any modifications to the fuming chamber like similar products (i.e., Polycyano UV). It is also reported that Lumicyano can produce adequate results without changing the settings of the fuming chamber (80% relative humidity and 120oC fuming temperature) from traditional cyanoacrylate products (per product information from EVIDENT, Inc.). The physical application of Lumicyano would be the same as with traditional cyanoacrylate. The process would begin with a humidity cycle, followed by a glue cycle, and finally a purge cycle. A visual examination, using both ambient and fluorescent lighting conditions, following the series of cycles would conclude the processing protocol.

### Validation

#### Phase 1 – Processing with Lumicyano

To begin, I needed to determine if Lumicyano would develop latent prints on nonporous, semi-porous, and adhesive surfaces. In order to validate the method, a variety of samples consisting of nonporous (such as glass slides, plastic bags, and aluminum), semi-porous (such as glossy magazine pages and examination gloves), and adhesive items (such as duct tape and packaging tape) were collected and fingerprints were placed on each item.

- One group contained “fresh” fingerprints that were deposited the same day as processing.
- The second group of items contained fingerprints that were deposited and aged two weeks prior to processing.
- The third group of items contained fingerprints that were deposited and aged one month prior to processing.
- The fourth group of items contained fingerprints that were deposited and aged two months prior to processing.

By aging the prints, I was able to determine if the method was still effective on older prints. The fingerprints for each group were placed in a depletion series to evaluate the sensitivity of the

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Lumicyano reagent. The items were visually examined once processing was completed and then again at various intervals (length to be determined through research) to help determine the robustness of the fluorescence of the Lumicyano reagent (i.e. for how long after application does the product continue to produce fluorescence).

The fingerprints were applied to each item using the Lightning Powder Part #1-2791 Latent Print Reference Pads that are available in the GBI DOFS lab and two volunteer donors. The Misonix CA-6000 and Foster + Freeman MVC 5000 cyanoacrylate fuming chambers were used during this phase to determine which chamber produces the best results (at the time this project was started the CAPture-BT had not yet been put into service for casework; this instrument was not used during the initial phase of the validation). The results were recorded with photography under optimal conditions for each development technique.

### Phase 2 – Comparing Current Methods to Lumicyano

The processing of items in Phase 2 were completed in the same manner as Phase 1. The substrates having the best results from Phase 1 were used in Phase 2. The Misonix fuming chamber was primarily used since it completed a fuming cycle faster than the MVC fuming chamber. As the CAPture-BT fuming chamber was approved for casework during the completion of Phase 2 of this validation, a cycle was run utilizing the Lumicyano program to determine if the program worked properly and produced the expected results.

I determined during this phase that the Lumicyano performed just as well as current methods. The Lumicyano program in the CAPture-BT worked properly and produced the expected results. All results were recorded using photography under optimal conditions for each development technique.

Since it is known that the fluorescence of the Lumicyano will fade over time, a sample fumed in September 2017 was refumed with the Lumicyano powder and solution in January 2018. The fluorescence was refreshed without any over-fuming. Additionally, processing with a liquid dye stain can follow the Lumicyano processing to increase the fluorescence.

### Phase 3 – Cost Analysis

Throughout the project, calculations were done to compare the costs of Lumicyano to the current method used to determine if Lumicyano is more cost effective than the current method. Processing was also timed to determine which method is least time consuming.

Below are summary tables of the cost analysis:

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FOR IDENTIFICATION



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Please complete and return to:  
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P. O. Box 1949, Carrollton, GA. 30112  
ANNUAL FEE: \$30

I hereby make application for membership in the Georgia State Division, International Association for Identification in accordance with its Bylaws and Constitution and agree to be bound by them.

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 Employed by: \_\_\_\_\_ How long? \_\_\_\_\_  
 In what capacity? \_\_\_\_\_ How long? \_\_\_\_\_  
 Business Address: \_\_\_\_\_  
 Home Address: \_\_\_\_\_  
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- Have you ever been convicted of a crime?  
 NO  
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- All applications MUST be accompanied by payment of fees, which will be refunded if the application is rejected. *Incomplete applications will be returned.*
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### Comparison of CA with Dye Stain costs to Lumicyano Costs

Since the Basic Yellow and R6G Methanol based dye stains are similar in the price per application, I combined the two together and took the average (\$2.48).

Product	Price/Application (based on 200 mL of Dye Stain per application)
CA + Basic Yellow/R6G Methanol Based	\$2.82
CA + R6G Water Based	\$1.45
Lumicyano	\$2.56

### Time Cost Comparisons

The processing of items was timed to determine how long it took to complete processing using the current methods vs. using the Lumicyano. It was determined to take, on average, 2.5 hours to complete processing and photography on small items that dry quickly, using the current method. It was determined to take, on average, 45 minutes to complete processing and photography (using all fluorescence options) on comparable items using Lumicyano.

### Total Cost Comparisons

Based on the information in the table above and the salaries of GBI Latent Print Technicians and Latent Print Examiners, the table below demonstrates the approximate total cost to complete processing.

Method	Total Cost for Application by a Technician	Total Cost for Application by a Scientist
Cyanoacrylate with BY/R6G (m)	\$36.22	\$77.35
Cyanoacrylate with R6G (w)	\$34.85	\$75.98
Lumicyano	\$12.58	\$24.71

### Summary

Since this validation was completed, the GBI Impressions Section has implemented the use of Lumicyano into the LP Processing Protocol.

Based on the results of this study, supplemental testing is underway with the help of the GBI Firearms section. It has been noted that by using the current methods, CA followed by a liquid dye stain, the firearms evidence begins to rust, specifically inside the barrel of the gun. By processing firearms evidence with the Lumicyano, the item will never be wetted and, therefore, should not rust before

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being examined in the Firearms section. Testing is underway to determine if Lumicyano has any negative effect on firearms examinations. Results of this testing will be available at a later date.

#### References

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- Basic Latent Print Workshop- *Jesse Worley, GBI*
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- Introduction to NIBIN- *Brian Moore, ATF*
- ULW Basic Workshop- *Patricia Mason, FBI*
- ULW Advanced Workshop- *Patricia Mason, FBI*
- Cybercrime in Georgia and the Law Enforcement Response - *Steve Foster, GBI*
- Alternative Light Source Photography- *Ted McDonald, FLETC*
- Forensic Video Enhancement- *Thomas Edwards PhD*
- Cadaver dogs and how to use them on your crime scene- *Heidy Drawdy*
- Forensic Science: Two Steps Forward, One Step Back- *Jessica Gabel, Cino*
- AFIX Tracker Users Workshop
- Georgia's NGI-ULW's User's Dialouge and Network- *Fredrick Wells Dougherty County Sheriff's Office*
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