Alternative Light Source (ALS) Procedural Guideline with Sample Competency 2026

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Introduction

Alternative Light Sources (ALS) play a critical role in forensic nursing by enhancing the visualization of findings and other areas of interest that may be difficult or impossible to detect under normal lighting conditions. An ALS can aid in examining patients' bodies, hair, and clothing. ALS may fluoresce both biological (e.g., semen) and non-biological substances (e.g., lubricants, oils). Emerging research also provides evidence that ALS may be useful in detecting and documenting potential injury from trauma.[1] ALS can also be used to visualize patterned injuries, fibers, and trace materials. ALS assessment supports comprehensive and trauma-responsive patient evaluation. As forensic nursing practice continues to integrate advanced technology, standardized guidelines are essential to ensure safe, ethical, and consistent use of ALS across clinical settings.

According to the National Law Enforcement and Corrections Technology Center System (FTCoE), a program of the National Institute of Justice (NIJ), ALS are firmly established as essential tools in crime scene and sexual assault investigations. Recent advancements in portable ALS technology, combined with the expanding role of forensic nursing, have further enhanced their utility in the field. The NIJ has played a pivotal role in supporting the integration of ALS into forensic nursing practice, particularly by highlighting its effectiveness in detecting findings consistent with latent bruising associated with violent acts.[2]

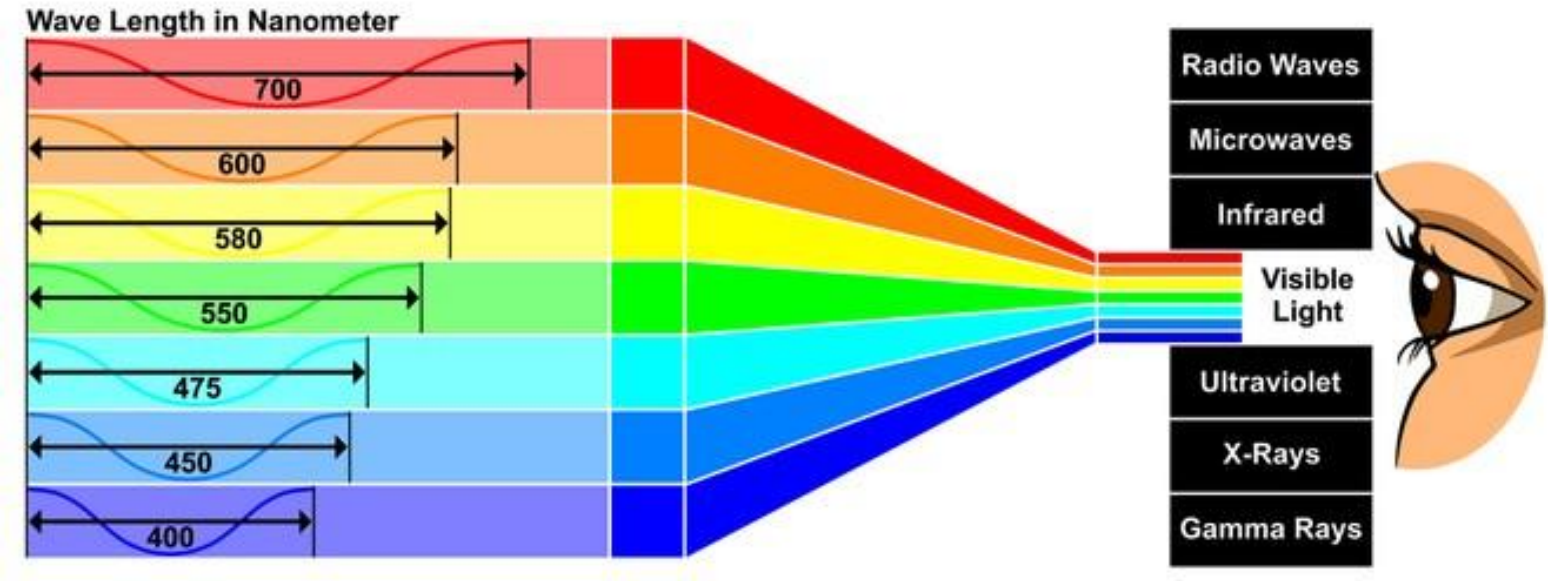
However, despite growing interest in the use of ALS to enhance injury detection and documentation in forensic medical examinations, the current state of practice lacks comprehensive, evidence-based guidelines tailored to forensic nursing. There are no universally accepted standards in existence for how and when ALS should be used, documented, or interpreted in clinical forensic settings. Existing recommendations, such as those from the U.S. Department of Justice and related practice directives, do not adequately address key clinical questions about ALS integration, documentation protocols, or forensic testimony implications for nurses. [3] Moreover, although some organizations provide broad practice and education guidelines, specific ALS implementation protocols remain absent or inconsistent across institutions, leading to variability in examiner training, equipment use, documentation terminology, and interpretation of findings. This inconsistency can create confusion for forensic nurse examiners and potentially impact the quality and equity of care and evidentiary documentation. Therefore, standardized, evidence-based ALS guidelines are essential to ensure safe, ethical, equitable, and consistent use of ALS among clinicians, improve clinical outcomes, and support reliable forensic documentation that withstands legal and clinical scrutiny.[3]

This guideline provides clinicians with evidence-based recommendations for the selection, operation, and interpretation of ALS-assisted observations. It outlines appropriate indications, safety considerations, documentation requirements, and patient-centered communication strategies. By establishing clear expectations and best practices, this guideline aims to strengthen the quality of forensic healthcare, support accurate evidence collection, and enhance outcomes within the healthcare and criminal justice systems.

What is an ALS?

An Alternative Light Source (ALS) is a forensic tool that enhances the visualization of skin injury, matter, stains and debris by using specific wavelengths of light outside the range of standard white illumination. While white light contains all visible wavelengths (approximately 400-700 nanometers or nm), an ALS allows the examiner to isolate

narrow bands of light—such as ultraviolet (UV ~ 365-395 nm), visible (violet, blue or green), or infrared (IR ~700-1,000 nm)—to create optical effects that reveal details not seen with the naked eye under commercial white light (CWL). ALS technology relies on two primary scientific concepts: **absorption and fluorescence**. ALS devices operate on precise photophysical principles and leverage selective wavelength emission, optical filtration (i.e. barrier filters such as yellow, orange, or red goggles), and tissue–material interaction properties to create contrast that reveals features otherwise invisible or indistinct. Understanding the technical mechanisms of ALS operation is essential for forensic nurses to apply the technology safely, interpret findings accurately, and contribute to sound evidentiary practices.



Reflection occurs when light bounces off a surface; it is the return of light from a surface without a change in the wavelength. Generally, what we see in CWL is reflected light.

Absorption occurs when a substance exposed to a specific wavelength of light absorbs rather than reflects that light. Because different materials (such as deeper structures of the skin/tissue) absorb light differently, the examiner can enhance contrast between the target material (i.e. contused tissue) and the surrounding skin or surface (uninjured tissue). For example, contusions may absorb certain wavelengths more effectively than healthy tissue, making the contusion appear darker and more defined under ALS. This principle allows clinicians to detect patterned, faint, or even aged bruising (up to 4 weeks post induction) [4] that is difficult to visualize in CWL, and even have particular benefit on individuals with darker skin tones.[5] Other situations where ALS may enhance visual assessment may be in cases where edema, swelling, induration, or subtle discoloration complicates the assessment. Absorption-based visualization is especially useful for assessing skin injuries, bite marks, and patterned impressions. To optimize absorption, the examiner uses barrier filters (often yellow and/or orange filter goggles). This enhances contrast, reduces glare, and improves visualization of the darker areas created by the absorption.

Fluorescence occurs when a substance absorbs light at one wavelength and emits it at another, typically longer, wavelength. Many biological and trace materials—such as semen, saliva, urine, fibers, certain dyes, cosmetics, and

detergents—naturally fluoresce when exposed to ultraviolet or blue light. When these materials fluoresce, they appear bright or glowing against a darker background, significantly improving detectability. To optimize fluorescence, the examiner uses barrier filters (often orange filter goggles) that block the original excitation light while allowing only the emitted fluorescent light to pass through, making evidence easier to see.

📌 **Quick Summary:**

- **Reflection** = *light bounces back*
- **Absorption** = *light is taken in (darker)*
- **Fluorescence** = *light goes in → different color comes out (glow)*

ALS History

The development of ALS has its roots in early forensic science innovations of the mid-20th century, when investigators began experimenting with ultraviolet (UV) and infrared (IR) wavelengths to visualize evidence that was not visible to the naked eye. Initially, these techniques were primarily used in crime laboratories for document examination, latent fingerprint detection, and analysis of trace materials. Early UV lamps—often referred to as "Wood's lamps"—were among the first tools used to identify altered documents and various biological substances based on their natural fluorescence.[6]

By the 1970s and 1980s, forensic scientists began expanding ALS applications as technology improved. The introduction of more precise, portable light sources—such as xenon arc lamps and tunable lasers—allowed practitioners to illuminate evidence using specific wavelengths. These advances made it possible to distinguish bodily fluids, fibers, bruising, and residues through absorption, reflection, and fluorescence. The 1990s then marked a major turning point with the development of light-emitting diode (LED) technology and compact forensic light sources that were durable, portable, and cost-effective. These tools allowed forensic examiners to bring ALS capabilities directly to crime scenes. The ability to customize wavelengths with colored filters—rather than relying on bulky machines—greatly expanded operational flexibility.

The formal integration of ALS into forensic nursing practice began in the late 1990s and early 2000s, as Sexual Assault Nurse Examiners (SANEs) and forensic nurses recognized its value in visualizing patterned injuries, bite marks, and subdermal bruising that were difficult to detect under white light. Early studies [7-8] demonstrated that ALS could increase the detection of patterned injuries and contusions highlighting its importance in trauma documentation and injury interpretation.

Does ALS assist with observations in diverse skin tones?

Melanocytes are specialized skin cells located in the epidermis that produce melanin, the pigment primarily responsible for skin color. Melanin is a broad-spectrum light-absorbing chromophore — especially in the UV and shorter visible wavelengths — and serves to protect deeper skin layers by absorbing and dissipating light energy, particularly UV radiation. In the context of forensic nursing and injury detection, melanin's optical properties are important because melanin absorbs light, including visible wavelengths used in ALS examinations. Melanin absorption influences how light interacts with skin and underlying tissues, and this can affect how bruises and other injuries appear under ALS compared to under CWL. Although melanin's absorption is stronger at shorter wavelengths, light at specific visible wavelengths (such as 415 nm and 450 nm) viewed with yellow filters has been shown to increase the probability of detecting bruising across a wide range of skin pigmentation categories — even in individuals with higher melanin content — compared to CWL alone.[5]

Importantly, this does not mean that melanin itself is a marker of injury; rather, because melanin competes with hemoglobin and other chromophores for light absorption, understanding its role helps clinicians select optimal ALS wavelengths and filters that improve visualization of sub-surface findings in persons regardless of skin tone. This enhanced detection is particularly valuable because individuals with more melanin are historically less likely to have subtle bruises identified by healthcare providers under CWL, which can contribute to disparities in clinical documentation and legal outcomes.[5] The fact that ALS can enhance bruise visibility across diverse skin tones highlights the potential for ALS to support more equitable forensic assessment when used as part of a comprehensive physical exam and documented appropriately.[2]

Is ALS safe?

Yes. ALS examination is considered safe when used correctly, and it is widely used in forensic nursing, medicine, and forensic science. The primary safety concern is eye exposure. ALS can be bright, and some wavelengths—especially UV and blue light—can cause eye strain or discomfort if viewed directly. Most ALS units with violet or blue light are Risk Group 2 (moderate risk), which does not generally pose a danger to the eyes.[9] This is why goggles are always required. While they serve to filter wavelengths to enhance visualization, goggles also protect the examiner and patient from UV or near UV light. With goggles and standard practices, eye risk is effectively eliminated.

Does ALS increase identification of contusions (bruises)?

Multiple studies [4, 5, 10-12] have investigated the clinical application of an ALS for the purposes of contusion detection and visibility with promising results, although all studies have limitations. Contusions result in extravasated blood from blunt force trauma. The hemoglobin from this blood is broken down into bilirubin and other byproducts, through an enzymatic process. Light absorption properties of hemoglobin (around 415 nm) and bilirubin (460 nm) fall within wavelength ranges that are better visualized with the use of ALS and barrier filters. Specifically, ALS wavelengths of 415 and 450 nm viewed with a yellow filter provided five times greater odds of detecting contusions

than CWL and provided greater probability of detection in groups with darker skin. However, ALS is not diagnostic, and absorption of alternate light is not pathognomonic for contusions or other injuries. A comprehensive clinical assessment including a history of blunt force trauma to the area, pain or tenderness on palpation, swelling, or induration, should be considered and documented, in conjunction with observations using ALS.

Can ALS fluoresce other matter or tissues besides injuries or biological matter?
Yes, certain things may appear significant (positive fluorescence or absorption) but are not actually an injury or biological material once clinically or contextually evaluated (i.e. false positive).

Many substances fluoresce, [6] including common topical substances (i.e. make-up, ointments, hair products) and most body fluids (i.e. semen, sweat, urine). Positive ALS fluorescence does not mean that semen or other significant biological material is present on the skin. Likewise, absence of fluorescence does not indicate an absence of bodily fluids.[6] An area that fluoresces should be swabbed so that the lab can complete further testing.

Similarly, false positives can also be noted with absorption, as observed light absorption has been noted with certain topical substances, skin lesions (i.e. acne, pressure injuries, scars, hyperpigmentation, telangiectasia) as well as tattoos, birthmarks, and nevi.[6,9] This highlights the importance of always assessing, and photo documenting, the area first in CWL to evaluate for other conditions that could cause absorption. Then, after areas of interest are swabbed for specimen collection, the clinician should cleanse the skin with soap and water and reassess and photodocument.[9]

Documentation Considerations
Written documentation should include an objective description of the finding, location of the finding, presence/absence of tenderness or pain, presence/absence of swelling and/or induration, the type of light source, wavelength, filters used, presence/absence of fluorescence, presence/absence of absorption, skin cleanser used, and the patient's account of the area examined.[9]

> An example is as follows: "3cm circular area of absorption noted to right lateral upper arm. Area visualized with and without UltraFire 400nm ALS and yellow barrier filter. Pt endorses tenderness upon palpation. Induration noted when compared to L upper arm. Pt reports she was punched here by Alex, her significant other. After area swabbed and cleansed per hospital protocol, area reassessed with ALS and yellow barrier filter. No change in absorption finding appreciated."

Court Considerations
The use of ALS in forensic practice carries significant implications for courtroom testimony, evidence admissibility, and the perceived reliability of clinical findings. Courts expect forensic clinicians to demonstrate that ALS was used as an adjunct assessment tool—not a diagnostic device—and that its findings were interpreted within the limits of current scientific knowledge. Because ALS primarily highlights potential areas of interest through the concepts of absorption or fluorescence, again, clinicians must clearly articulate that ALS does not confirm injury, bodily fluids, or patterned evidence. Instead, it guides further assessment, documentation, photography, and possible laboratory testing.

Foundational competency is a key courtroom consideration. Clinicians must be able to discuss their ALS training, proficiency, and adherence to established protocols.

Another important aspect is avoiding overstated conclusions. ALS findings may be influenced by lotions, detergents, dyes, and normal skin variations, conditions, or lesions. Clinicians must be prepared to explain potential false positive results and the importance of correlating findings with patient history and physical examination. Regardless of the clinician's findings upon examination of the patient with a history of blunt force trauma, appreciable physical findings such as tenderness, pain, or induration, the clinician cannot determine the cause of the findings. The clinician can state that the findings are consistent with the history of events that the patient provided.

Ultimately, credibility in court depends on transparency, standardized procedures, and a clear understanding of the science of ALS, including ALS's capabilities and limitations. By emphasizing scientific integrity and objectivity, clinicians help ensure that ALS-supported evidence is presented soundly and with integrity in order to withstand legal scrutiny.

Other Considerations for using ALS

The clinician should first ensure patient preparation, informed explanations, and consent. The clinician should introduce ALS as a noninvasive tool that helps identify areas of interest such as developing bruises not yet visible in CWL, biological fluorescence, or trace matter. The patient should be informed of what to expect, offered the opportunity to ask questions, and positioned comfortably with privacy maintained. Contraindications include patient declination. In addition, ALS assessment is not intended for mucous membrane tissue.

Environmental preparation must also be considered. Some ALS devices require reducing ambient light to optimize visualization and ensure the examination space is safe and controlled. The light source should be at a consistent distance and angle to ensure clarity and reproducibility. Often, the further the ALS is from the subject, the more the light disperses, making it harder to evaluate. Defer to ALS manufacturer guidelines, but majority of ALS should be held 4-12 inches from the skin/clothing being evaluated. Any observed absorption or fluorescence is treated as a potential indicator, not a definitive finding. When an area of interest is noted, the clinician should correlate it with the patient's history and conduct a focused physical examination of that same area of interest under CWL. Medical forensic photography follows, capturing images both under ALS and CWL.

Any clinicians utilizing ALS must complete education and training. This training should include context for ALS, research evidence on ALS, procedure for ALS, skin assessment and photodocumentation skills, interpretation of ALS findings, documentation of ALS findings, and testimony pertaining to ALS. [9]

SAMPLE Alternative Light Source Evaluation Competency
Forensic Nurse Examiner Team
(Insert agency/organization here)

Forensic Examiner: _____

SKILL	YES	NO	COMMENTS
Properly gathers the correct supplies needed for the procedure and performs hand hygiene			
Verbalizes potential contraindications, as well as patient education provided			
Verbalizes the purpose and clinical indications for using ALS			
Ensures patient understands the process, including that lights may be dimmed during the procedure for optimal visualization. Confirms with patient that the procedures can stop immediately if the patient wishes			
Demonstrates knowledge of assessment of skin and/or clothing in commercial white light (CWL), as well as using ALS. Includes clinical significance of medical history to guide assessment			
Demonstrates application of barrier filters while using ALS (such as yellow/orange goggles or yellow/orange lens on camera)			
Demonstrates skin assessment using ALS to identify area of fluorescence and indications for specimen swabbing			
Demonstrates process for skin cleansing			
Demonstrates skin assessment using ALS and can describe and document absorption			
Describes how to interpret and document (written and photo documentation) of skin assessment using ALS. Describes examples of false positives.			
Describe how to share the examiner's observations with the patient and answer their questions			
Demonstrates how to clean and store equipment after use			

Employee Signature: _____

Preceptor/Evaluator Signature: _____ **Date:** _____

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