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March 13, 2008
[HPWLI 10684-01A]

Law Office of [redacted]
[redacted] Street
[redacted]

Attention: [redacted]

Dear Mr. [redacted]:

Your letter of December 12, 2007 requested examination and evaluation of a replica Brown Bess muzzle loading flintlock rifle hand carried on November 27, 2007 by [redacted].

The rifle was severely damaged. The buttstock and a portion of the forearm still retain the entire lock mechanism. The barrel, ramrod and a large portion of the forearm are separate. The barrel has stampings to indicate it was fabricated in India. The barrel is split at the rear to about 50 cm forward of the breech end. The area in which the fracture originated appears to be bulged slightly. A bulge is usually the result of an obstruction in the barrel. There is also a deposit of unknown grayish residue in the barrel not at all typical black powder residue.

The rifle was submitted to Dr. William Bruchey, a metallurgist familiar with firearms, for an analysis of the steel used in the barrel. He found no metallurgical defects and he confirmed the bulge in the barrel. His report is attached.

Mr. [redacted] indicated that he was the shooter at the time of the incident; that he was involved in a battle re-enactment; and that, in keeping with re-enactment protocols, he simply poured black powder into the muzzle and fired. He also indicated that re-enactment protocols prohibit any kind of projectile or wadding on the field, and that even ramrods are prohibited.

It is my opinion that the rifle was not defective. If all firing was as Mr. [redacted] described, I cannot identify a specific cause of the incident. It is very likely that some sort of significant constriction or obstruction was present, but I cannot identify what that was.

Thank you for the opportunity to conduct this examination. The rifle will be held pending your disposition instructions. If you have any questions, please feel free to call.

Very truly yours,

H.P White Laboratory, Inc.

Lester W. Roane

LWR/mw
[Enclosure]

Dr. William J. Bruchey
5[redacted]
P[redacted]
Ph: (W) [redacted]; Fax: [redacted]
E-Mail: [redacted]

REPORT OF ANALYSIS

9 March 2008

No.	HPW-08-02
Sample of	Black Powder Muzzle Loader
Client	[redacted]
Source of Sample	Les Roane, H.P. White Laboratory
Marks or Other Data	Damaged black powder muzzle loader, split barrel separate from breech, split stock with lock mechanism attached

[redacted]

Mr. [redacted]

First, my apologies for taking so long. I set this muzzle loader off in a corner after receiving it just before Christmas and after the holidays and completely forgot it until you contacted H.P. White. It should not have taken all this time.

A damaged Brown Bess Pattern Musket was received from H.P. White. The rifle as received in shown in figure 1. There are three main pieces: the buttstock with lock mechanism attached with a portion of the forearm still attached, the rifle barrel with a portion of the split forearm attached and a small splinter of the forearm (not shown).

Figure 1 As received Brown Bess Musket

Figure 2 Barrel showing split extending from the breech to a length of approximately 18.5 inches

The lock mechanism has no visible serial number. It is marked by a vertical "TOWER" stamped on the rear of the lockplate. Between the hammer and flash pan is the stamp of a crown over the letters GR. The barrel is stamped: "A.H.U. UDR INDIA" over "G/9100 25/9/79". No other makings were present.

The pins holding the remaining forearm splinter to the barrel were removed to release the forearm. The barrel with forearm removed is shown in figure 2. The barrel contains a split running from the breech for a length of approximately 18.5 inches. Diameter measurements were taken along the length of the barrel to determine the position of maximum bulge diameter. All rifles of this type have tapered barrels. Maximum thickness occurs at the breech and minimum thickness occurs at the muzzle. As the thickness of the barrel decreases the pressure that section can handle also decreases. Under normal conditions, maximum pressures occur in the thickest section of the barrel. A bulge as seen here is an indication that the pressure at the breech end was not exceeded at the time of failure but was sufficiently high that the thinner forward area of the barrel could not sustain the pressure.

Figure 3 is a graph of the diameter of the barrel as a function of the distance from the breech. At a distance of roughly 12 inches from the muzzle, there is a significant hump or bulge in the plot. This is where the maximum pressure that the barrel could sustain was exceeded.

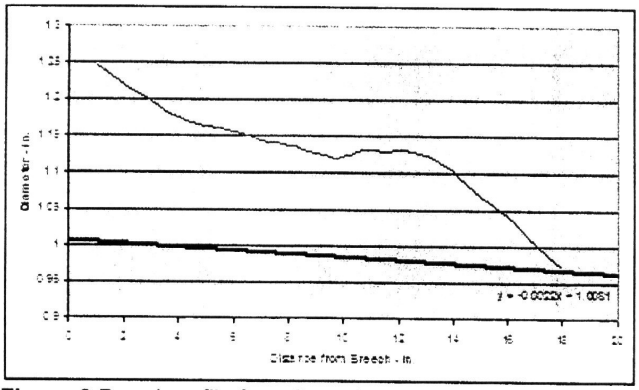

Figure 3 Barrel profile from Breech to muzzle

A microscopic exam of the fracture surface did not show any visible or obvious defects on the fracture surfaces which would have served as an imitation site for the crack. The barrel was sectioned at this general location to examine the material strength and micro structure for anomalies.

Sections were removed from the barrel which corresponded to a plane transverse to the barrel axis (Plane I), a plane horizontal to the barrel surface (Plane II) and a plane parallel to the plane of the fracture (Plane III). Figures 4,5,6 show sample of each plane. In all three cases, the micro structure appears to be a mixture of austenite and pearlite typical of 1100 series plain carbon steels seen in most black powder rifles. The micro structure is highly elongated due to the barrel forming process. The was no evidence of excess or large inclusions which might have weakened the barrel.

Each of the metallurgical sections was tested for hardness. Plane I had a hardness of Rockwell B 88.7; Plane II Rb 97.2; Plane III 99.3. These types of variations are normal for the worked micro structures seen in the metal specimens. Using accepted conversion charts, there hardness numbers convert into tensile strength of about 85,000 pounds per sq inch. Again, the is typical for material strengths used in muzzle loading weapons.

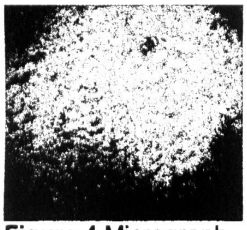

Figure 4 Micrograph Plane I

Figure 5 Micrograph Plane II

Figure 6 Micrograph Plane III

In summary, to a high degree of scientific certainty, no connection could be made to the material or micro structures contained in the rifle barrel aa the source of failure. The location of the failure, approximately 12 inches from the breech, suggests a barrel obstruction of some sort.

Some informal observations follow: Powder residue within the barrel appeared abnormal in my experience. Normally, black powder residue is just that black. The residue in this barrel was gray and rather hard. Past the failure location this residue appeared to be "undisturbed" suggesting that the barrel obstruction may not have been a projectile or a hard object that was expelled out the muzzle. The gray residue was relatively thick beyond the end of the crack for what one would expect a powder residue to be. Based on my understanding re-enactors are not allowed to insert even a ramrod rod during exercises. Since no projectile is used, users may not clean the firearms on as regular a basis and continued build up of a thick layer of combustion products may eventually result in a constriction in the barrel which allows powder to be poured in but results in increasing pressures as the constriction grows. This doesn't happen when using a patch and ball and ramrod which scour the barrel as it is loaded. As a matter of practice, the rifles should be cleaned as if they had been used as projectile loaded rifles. Again, these are suggestions/observations. It may be that the re-enactor community should re-visit its guidelines to insure that safety is not compromised. Whether there is anything to this hypothesis would require a series of test firing.

Sincerely,

William J. Bruchey

William J. Bruchey