DEPARTMENT OF THE ARMY
UNITED STATES ARMY EVALUATION CENTER
2202 ABERDEEN BOULEVARD – SECOND FLOOR
ABERDEEN PROVING GROUND, MD 21005-5001

TEAE-SE 13 February 2012

MEMORANDUM FOR Project Manager-Rapid Equipping Force (Mr. Jed Deplitch), 10236 Burbeck Road, Building 361-T, Fort Belvoir, VA 22060

SUBJECT: Safety Confirmation for the Forward Operating Renewable Generator (FORGE) in Support of Rapid Equipping and Associated Continental United States (CONUS) Pre-deployment Training

1. References.

a. MIL-STD-882D, Standard Practice for System Safety, 10 Feb 00.

b. Memorandum, Assistant Secretary of the Army (Acquisition Logistics and Technology (ASA(ALT)), SAAL-PE, 10 Dec 10, subject: Environment, Safety and Occupational Health (ESOH) Risk Assessment and Risk Acceptance Guidance.

c. US Army Developmental Test Command (DTC) Policy Bulletin No. 11-10, Software Safety Verification Policy and Guidelines, 27 Sep 10.

d. Report, US Army Aberdeen Test Center (ATC), TEDT-AT-WFE, undated, subject: DRAFT Final Report Engineering Design Test (EDT) Zerobase Forge and ReGenerator 2012, ADSS Project Number 2012-DT-ATC-F2375.

e. Operator's Manual, ReGenerator Forward Operating Renewable Generator (FORGE), 01 Dec 11.

f. E-mail, US Army Rapid Equipping Force (REF), Mr. Jed Deplitch, 20 Jan 12, subject: Zerobase Regenerator and Forge.

g. MIL-STD-1472G, Human Engineering, 11 Jan 12.

h. Email, Communications Electronics Command (CECOM) (AMSEL-SF-SI), Mr. Larry Valencourt, 6 Feb 12, subject: Forge and H-Series Batteries.

i. Report, Communications-Electronics Research Development and Engineering center (CERDEC), subject: Safety Assessment Report (SAR) for Zerobase RGenerator H-Series and Forward Operating Renewable Generator (FORGE), 8 Feb 12.

2. Purpose. This US Army Evaluation Center (AEC) Safety Confirmation for the Forward Operating Renewable Generator (FORGE) is provided in support of rapid equipping and associated Continental United States (CONUS) pre-deployment training. A safety assessment in accordance with (IAW) MIL-STD-882D (reference 1a) has been conducted. The overall risk for the use of the FORGE is considered LOW. The warnings, cautions, procedures, mitigations identified in this document and reference 1e should be implemented in order to minimize risk.

3. System Description.

a. The ReGenerator FORGE is a self-contained portable solar power system manufactured by ZeroBase Energy (figure 1). The FORGE system consists of six solar panels, up to two OES3 Li-Ion Batteries or four lead acid absorbent glass mat (AGM) batteries, and all the electronics required to charge the batteries. The system is capable of outputting 120 Volts Alternating Current (VAC) power at 2.5 kW continuous or 8.4 kW peak. The Forge cases are all man portable and can be carried on a variety of prime movers.

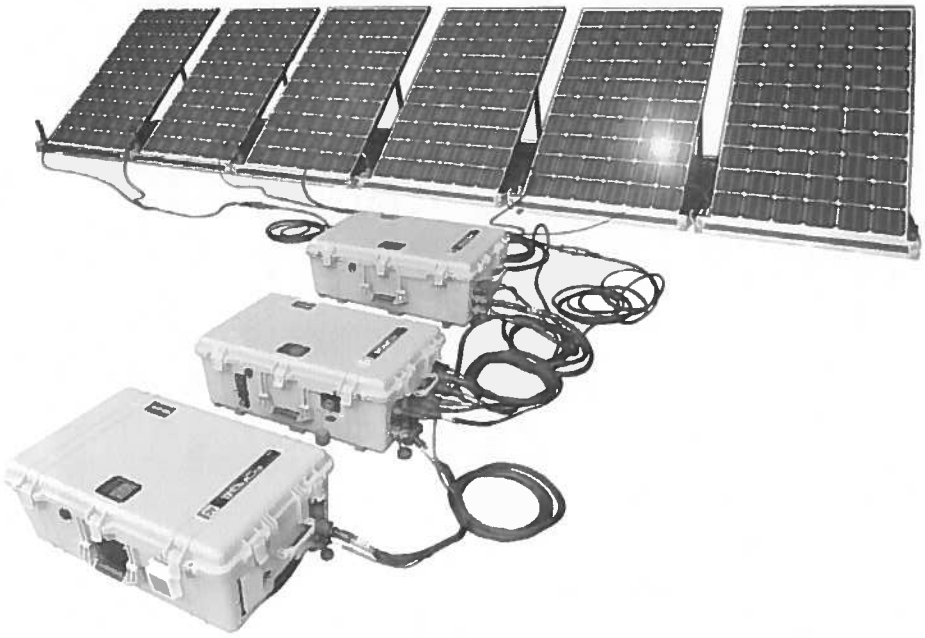

Figure 1. FORGE System.

b. The ReGenerator FORGE is a ruggedized mobile and transportable hybrid power system that manages solar and battery power to provide uninterrupted power to replace or augment fossil fuel generators. It can be transported into position as loose cargo and ready for use in minutes. It is expandable using add-on solar or fossil fuel resources. Units can be plugged together to create a nanogrid or microgrid. The units can be monitored automatically to provide real-time information on their performance.

4. Evaluation Limiting Factors. Soldier safety during maintenance was not assessed since all maintenance was performed by Field Service Representatives (FSRs) (reference 1f).

5. Evaluation Results.

a. This AEC Safety Confirmation is derived through Test Manager analysis of the results of testing conducted by the US Army Aberdeen Test Center (ATC) and review of the referenced documentation. The definitions from MIL-STD-882D were used to assign hazard severity and probability of occurrence of identified hazards. Risk Assessment Codes (RAC's) were assigned IAW the guidelines given in the Assistant Secretary of the Army (Acquisition Logistics and Technology (ASA(ALT)) Risk Acceptance Memorandum (reference 1b). The FORGE system does contain safety critical software as defined by reference 1c; however, related potential hazards are only present during troubleshooting and/or maintenance tasks which are to be performed by FSRs (reference 1f). Identified safety hazards are summarized below.

b. Testing at ATC consisted of physical characteristics measurements and safety testing, to include overload device and short circuit device testing. Several safety issues were identified and communicated to the vendor early in the program. All issues, with exception to those noted below were eliminated or mitigated to an acceptable level.

c. CECOM has reviewed the OES3 Li-Ion battery and AGM battery specification sheets and has concluded that there are no uncontrolled hazards associated with using these batteries (reference 1h).

d. During setup of the solar panels, the latches on the solar panel cases were difficult to operate and were identified as a potential pinch point. The hinges and latches on the solar panels themselves were also identified as potential pinch points. Additionally, the corners of the solar panels are sharp. The possibility of Soldier injury during setup due to numerous pinch points and sharp corners is assessed a Negligible-Occasional hazard (RAC 4-C, LOW Risk), provided Soldiers wear heavy duty work gloves.

6. Conclusions and Recommendations. This AEC Safety Confirmation is issued for the FORGE in support of rapid equipping and associated CONUS pre-deployment training. A safety assessment IAW MIL-STD-882D was conducted. The overall risk for the use of the FORGE system is considered LOW. The warnings, cautions, procedures, and mitigations identified in this document and reference 1e should be implemented in order to minimize risk.

a. Hazards identified in paragraph 5 should be eliminated or controlled to an acceptable level. If the hazards are not eliminated, the residual hazard(s) must be accepted by the appropriate decision authority IAW ASA(ALT) Risk Acceptance Memorandum, dated 10 Dec 10 (reference 1b). The technical or operational limitations or precautions identified herein, needed to prevent injury and property damage during operation, are the responsibility of the Materiel Developer. To permit revision of this Safety Confirmation, all design changes effected by the Materiel Developer to reduce or eliminate hazards identified above will be verified and validated as acceptable through analysis or testing.

b. This AEC Safety Confirmation does not negate the need for other safety activities or documents required for materiel release IAW AR 700-142.

7. The AEC point of contact is Mr. Gary Smith, TEAE-SE, gary.d.smith2.civ@mail.mil, DSN 298-2397, and commercial (410) 278-2397.

FOR THE DIRECTOR:

ADDISON.CHRISTOPHER.J.1044991140

CHRISTOPHER J. ADDISON
Chief, Test Division
Sustainment Evaluation Directorate

CF:
ATEC G2/3/7, (dal.m.nett.civ@mail.mil; jorge.a.hernandez46.civ@mail.mil)
TRADOC (ATCS-S), (gustave.r.steenborg.civ@mail.mil; sean.bonney@us.army.mil)
AMC (AMCSF-E), (AMCSF-HQAMC@conus.army.mil)
AEC ILS, (douglas.s.savick.civ@mail.mil)
OTC OPS, (HOOD.OTC.TEOT.OP@conus.army.mil)
ATEC G9, (christine.a.foster.civ@mail.mil; dawn.k.kowalewski.civ@mail.mil)
PHC (MCHB-IP-OHH), (timothy.kluchinsky@us.army.mil)
USA Combat Readiness Center, (usarmy.rucker.hqda-secarmy.list.safe-systemsafety@mail.mil)
MaterielRelease.ATEC@conus.army.mil
CERDEC, (jonathan.cristiani@us.army.mil
PM REF, (john.e.deplitch2.ctr@mail.mil)
REF, (westford.d.warner.ctr@mail.mil; stephen.b.miller41.ctr@mail.mil)