Newsletter Date

SAFETY SIREN ALERT

18 June, 2012

OPERATIONAL WARNING

SAFETY SIREN ALERT

UFUQ MEMBERS

"PHOTOVOLTAIC"

[PV] ARRAY SAFETY

GUIDELINES AND

CONSIDERATIONS FOR

DAMAGED

PHOTOVOLTAIC

ARRAYS

AT

STRUCTURAL FIRES

United Firefighters Union of Australia, Union of Employees Queensland

"OPERATIONAL WARNING"

PHOTOVOLTAIC [PV] ARRAY SAFETY GUIDELINES AND SAFETY CONSIDERATIONS FOR DAMAGED PHOTOVOLTAIC ARRAYS

UNITED FIREFIGHTERS UNION - QLD MEMBERS

This SAFETY SIREN ALERT is for UFUQ MEMBERS who attend structural fires having "Alternative Power Systems" (APS) known as Photovoltaic (PV)Array Solar Power Systems.

There is potential exposure to live electrical current (electrocution) from and to these systems after isolation of electrical supply at the main electrical panel of the structure.

UFUQ HEALTH AND SAFETY CONCERNS AND RISKS

The potential exposure to "Live Power" to UFUQ members is a "Health and Safety" hazard and requires immediate attention for the following staff:

- ALL FRONTLINE MANAGERS (Station Officers and Leading Firefighters) in their "Dynamic Risk Assessment" and;
- FIREFIGHTERS "Situational Awareness" especially in their assessment of the structural fires.

OVERVIEW OF PHOTOVOLTAIC (PV) ARRAY SYSTEMS

A number of PV Panels may be connected in a series to achieve the desired voltage and current output.

Whilst these PV arrays only generate electrical current when exposed to sunlight (photons), they do present a risk to fire fighters.

GC systems generally take the solar generated electricity and feed it directly into the house and distribution network (grid). GC PV arrays can generate 200-400volts DC.

OPERATIONAL

WARNING

SAFETY SIREN ALERT

UFUQ MEMBERS

OPERATIONAL GUIDELINES AND PROCEDURES

REFER TO GUIDELINES

REFER TO DIRECTIONS

REFER TO PROCEDURES

- ✓ **DYNAMIC RISK ASSESSMENT**
- ✓ **SITUATIONAL AWARENESS**
- ✓ **LOOK AFTER YOUR MATE**

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Another type of PV system is the Stand Alone Power system or (Remote Area Power system).

In these systems the PV array charges batteries which provide electricity to an inverter allowing the premises to utilize 240volt electricity supplies outside daylight hours.

These PV arrays produce DC voltages typically in the range of 12, 24 or 48 volts DC. PV arrays generate Direct Current electricity which cannot be detected by 'voltage detectors' such as TAC stick and Volt Stick.

The voltage and current produced depends on the number of panels in the array. Individual solar panels vary in weight, output voltage and current depending on their type and manufacturer.

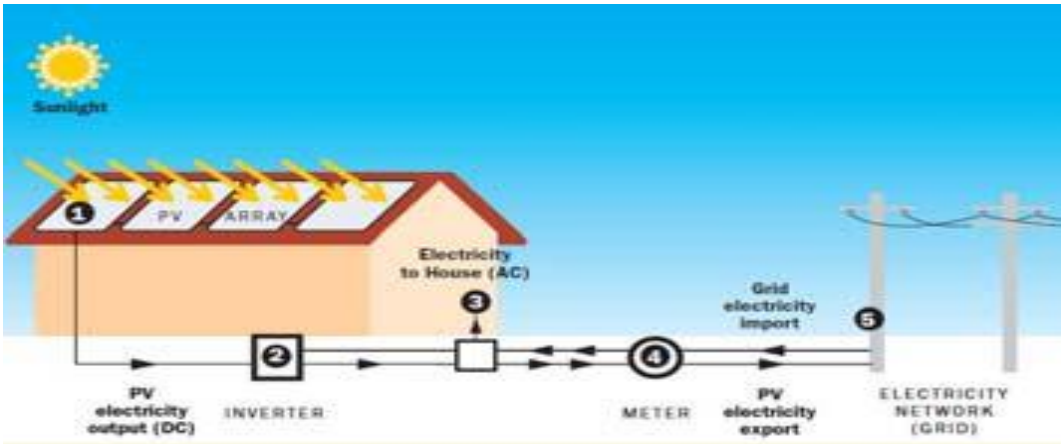
Smaller systems may have 6-8 panels and larger systems could have up to 20 panels in an array. Groups of panels may form the array, not necessarily in a single line or on the same section of roof.

In a GC system the PV arrays generate electricity, then the DC current is passed through an inverter, meters and then fed into the mains electricity supply.
Inverters could be located anywhere within the building and are manufactured in a wide range of sizes, shapes and colours.

There is currently no requirement to indicate the location of the inverter on the property.

Switching off the Inverter will isolate the AC output from the inverter, but will not isolate the DC supply from the PV array.

Disconnection of the mains supply (switch off the main switch or remove the service fuse) will automatically shut down the 240v output from the inverter.



OPERATIONAL

WARNING

SAFETY SIREN ALERT

UFUQ MEMBERS

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ARRAYS

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STRUCTURAL FIRES

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AS/NZ 5033:2005 requires installations where the PV arrays have a rated power output greater than 500W, or 50V DC to have a sign installed next to the meter box and main switchboard. This sign is to be legible from at least. 1.5m, and indicate the voltage and

OPERATIONAL

WARNING

SAFETY SIREN ALERT

UFUQ MEMBERS

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GUIDELINES AND

CONSIDERATIONS FOR

DAMAGED

PHOTOVOLTAIC

ARRAYS

AT

STRUCTURAL FIRES

United Firefighters Union of Australia, Union of Employees Queensland

location of the PV array.

The DC cable between the PV array and inverter should be marked at a minimum of 3m intervals with 'Solar DC' or similar. A conduit containing the cable may not be labeled.

Warning in meter panel

Warning in main

Point of attachment warning

Installations before this 2005 standard or solar systems not installed by a registered electrical contractor **may not contain the same information.**

In a GC system the DC cables between the PV array and the inverter poses significant risk to fire fighters.

Safe access to the isolating switch can be difficult and in some cases will be impossible. This DC isolator is not required under the current AS/NZ4777, however Energy Safe Victoria have made it a requirement.

For Fire Services who attend fires/incidents outside Victoria, this isolator may not exist.

QFRS SAFETY BULLETIN – ALTERNATE POWER SYSTEMS / SOLAR POWER

(issued 7 May 2010 – removal date 6 August 2010)
Extract: QFRS Safety Bulletin – Action Required as per QFRS

OPERATIONAL

WARNING

SAFETY SIREN ALERT

UFUQ MEMBERS

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⇒ On arrival at an incident, the Officer-in Charge (OIC) must identify if an APS is installed when establishing their Incident Action Plan (IAP). The type of system in use and any direct risks should be conveyed to all fire ground personnel.

⇒ Power will be isolated at the service fuse or switchboard and the OIC will inform all personnel to treat as "live" until confirmed by the electrical authority.

⇒ All personnel must be aware that electricity produced by the APS back to the inverter during operational (daylight) hours will remain "live" regardless of any isolation of the fuse box or power pole fuse.

UFUQ HEALTH AND WELFARE DIRECTIVE TO UFUQ MEMBERS

Scope

This Guideline applies only to situations where PV arrays that have been installed at a structure where an emergency incident is taking place have been damaged. It does not cover the general safety implications of PV or other distributed generation systems.

Guidelines

1. PV arrays can continue to generate lethal voltages despite being damaged by physical impact (e.g. fallen tree) or fire.

2. Operating isolation switch(es) so as to isolate PV arrays from the power system at the premises should de-energise DC circuits downstream (on the premises side) of the isolation switch, but will not de-energise the PV array and associated wiring upstream (on the array side of) the isolation switch.

3. Physical damage to a PV array and its associated wiring, causing contact between the array or wiring and conductive components of the structure on which it is mounted, can mean that metal components of the roof or structure are energised with potentially lethal current.

OPERATIONAL WARNING SAFETY SIREN ALERT

UFUQ MEMBERS

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4. Accordingly, during daylight hours, a damaged PV array must be treated as though lethal voltages remain present in the array itself, and in nearby metal components, regardless of the fact that isolation switches have been operated.

5. Incident controllers at an incident where damaged PV arrays are present must undertake a dynamic risk assessment and must apply a risk management methodology such that any risk to personnel is outweighed by the potential reward.

6. Generally speaking, the risks to personnel of making access to a roof or other part of the structure where damaged PV arrays are present are not justified where the incident objective is loss prevention, for example securing leaks through the roof with tarpaulins or plastic sheet. It is not generally possible for an unqualified person safely to de-activate the damaged array.

7. Emergency personnel should generally speaking not access a roof or other part of the structure where there are damaged PV arrays for loss control, salvage or fire investigation purposes until an electrician qualified in solar installations has declared the scene safe.

8. Although it is possible to de-energise a damaged PV array by completely covering it with 100% opaque sheeting, only sheeting that has been tested and found suitable in advance should be used for this purpose. Using the wrong sheeting may result in lethal current remaining within the system. Tests have shown that some salvage tarpaulins commonly used for emergency service salvage work will not prevent lethal current being generated.

9. There are also risks to the personnel applying the sheeting resulting from the need to work at heights and the need to be in close proximity to an energised PV array, which if damaged, may be energising nearby metal components. Only trained personnel using agency-approved sheeting should attempt this activity and even then, only when the incident situation justifies the associated risk being accepted.

10. Carrying out operations at night to secure a PV array before daylight comes may be safer in that no current will be being generated from solar energy. However the incident controller will have to understand the potential for current to be generated from artificial lighting being used at the scene, and the other risks of working at heights still remain.

11. At incidents involving rescue of persons from a roof or other structure in the vicinity of a PV array, a dynamic risk assessment is required. The incident controller must take into account the possibility that the person(s) to be rescued have been, or are still, in contact with lethal current being generated by the PV array.

    This involves consideration of whether the person(s) may be in contact with a damaged or exposed DC cable, which is not readily visible from ground level.

Safety

1. PV arrays (including damaged PV arrays) are capable of generating lethal voltages, even during overcast days. If damaged, any contact between the metal components on the roof may be energised with potentially lethal currents.

OPERATIONAL WARNING

SAFETY SIREN ALERT

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FIREFIGHTER HEALTH & SAFETY = WELLNESS

2. Isolate the electricity supply at the Main Switch Board (MSB), and then the inverter.
3. Consideration should be given to PV arrays even when the emergency occurs at night. It is a matter of priority in making the installation safe before daylight.
4. Ensure non-conductive ladders (fibre glass) are used to access isolation switches and correct PPC is worn when isolating the electricity supply (electrical gloves, long sleeves, safety glasses).
5. Isolate the electricity supply at the PV array (where the PV array, wiring or structure supporting the array has been damaged, do not touch the frame or any conductive material such as downpipes, *gutters* and roofing iron.)
6. An aerial appliance may need to be utilised to safely access the isolating switch or cover the array.
7. Incident controllers should consider the additional weight these panels place on the roof structure. During a fire, structural collapse may occur earlier than anticipated due to the additional weight (weights vary depending on type and manufacturer of the panels. NOTE: Individual panels can be 20-30Kg).
8. When damaged PV arrays are present the Incident Controller should ensure a dynamic risk assessment is undertaken.
9. The electricity supply company should be requested where the electrical supply cannot be determined or is required to be disconnected Electricity distributors cannot work on electrical installations on the consumer's property and may not be able to assist in the disconnection or making safe of a PV Array. Where a PV array is involved, the electricity company must be advised to send a "DC" or "Solar" accredited technician.
10. There is likely to be some installations where the PV array cannot be made safe with the resources available.

UFUQ Final Word

For your safety on the fire ground:

Refer to the UFUQ Health and Welfare Directive to UFUQ Members and the priority of "Frontline Managers" to address "Dynamic Risk Assessment" and "Situational Awareness" at all structural fires involving Photovoltaic [PV] Array Solar power systems. It may be identified that some installations cannot be made safe with the resources you have on-scene.

Authorised by John Oliver State Secretary United Firefighters Union of Australia, Union of Employees Queensland