

PRODUCT SAFETY DATA SHEET

HANWHA Q CELLS SOLAR PV MODULES ARE ARTICLES AS DEFINED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION HAZARD COMMUNICATION STANDARD (HCS), 29 C.F.R. § 1910.1200 AND ARE EXEMPT FROM THE LABELING AND SAFETY DATA SHEETS (SDS) REQUIREMENTS OF THE STANDARD.

Hanwha Q CELLS provides this product safety data sheet only for convenience of interested parties in the United States of America who are used to the format of safety data sheets in order to assess the product safety. This product safety data sheet does not replace any other documents provided by Hanwha Q CELLS such as Safety Information, Installation and Operation Manual, Packaging and Transport Information, Product Data Sheet as well as Warranty Terms of the respective product.

SECTION 1: IDENTIFICATION

Solar PV modules convert light into electricity. Light-sensitive cells are electrically interconnected in series and sealed between glass and plastic foils for this purpose. This product safety data sheet is applicable to the following solar PV modules of the Q CELLS brand made by Hanwha Q CELLS:

- Q.PLUS-G4.X, Q.PLUS BFR-G4.X, Q.PLUS L-G4.X, Q.PEAK-G4.X, Q.PEAK BLK-G4.X, Q.PEAK L-G4.X,
- Q.PLUS DUO-G5, Q.PLUS DUO BLK-G5, Q.PLUS DUO L-G5, Q.PLUS DUO-G5.X, Q.PLUS DUO BLK-G5.X, Q.PLUS DUO L-G5.X,
- Q.PEAK DUO-G5, Q.PEAK DUO BLK-G5, Q.PEAK DUO L-G5, Q.PEAK DUO-G5.X, Q.PEAK DUO BLK-G5.X, Q.PEAK DUO L-G5.X,
- Q.PEAK DUO-G6, Q.PEAK DUO BLK-G6, Q.PEAK DUO L-G6, Q.PEAK DUO-G6.X, Q.PEAK DUO BLK-G6.X, Q.PEAK DUO L-G6.X

Minor variations within the product families listed above can be identified by a versioning system which replaces character “X” with numerals of either “1”, “2” or “3” to form G4.1, G4.2, G4.3, G5.1, G5.2, G5.3, G6.1, G6.2 and G6.3, respectively. All of these variants as well as the ones with additional suffix “/TAA” are covered by this product safety data sheet. This is also true for B-grade modules which have minor optical imperfections. Product names of these replace “Q.” with “B.LINE”. B-grade modules of Q.PEAK-G4.1 are named B.LINE PEAK-G4.1 for example.

Responsible Party as Importer:

Name: Hanwha Q CELLS America

Address: 300 Spectrum Center Drive, Suite 1250, Irvine, CA 92618

Phone: 1-949-748-5996

SECTION 2: IDENTIFICATION OF SAFETY RISKS (HAZARDS IDENTIFICATION)

Hanwha Q CELLS solar PV modules do not pose any risk of hazardous chemicals. Hazard symbols and precautionary hazard statements for hazardous chemicals are not applicable. No symptoms or effects – neither acute nor delayed – have to be expected when Hanwha Q CELLS solar PV modules are handled as stipulated in the Installation and Operation Manual. Hanwha Q CELLS provides a Safety Information sheet with all modules shipments. This document contains detailed risk statements and recommendations for installation and operation. Before installing the module, read the Installation and Operation Manual for Q CELLS modules carefully. You can obtain the complete Installation and Operation Manual from your retailer.

Attention: Only qualified and authorized specialists may install modules and put them into operation. Keep children and unauthorized persons away from the modules.

Risks:

- Risk of death from electrocution! Solar modules generate electricity and are energized as soon as they are exposed to light.
- In rare cases, solar PV modules – as any other electrical device – can cause fire due to worn electrical contacts which result in electrical arching.
- Solar PV modules can reach high temperatures which can cause skin burns.
- Sharp edges, corners and broken glass can cause injuries.
- Solar PV modules can cause Injuries due to their weight.
 - Falling solar PV modules can cause injuries.
 - Lifting solar PV modules can cause injuries.

For precautionary statements, please refer to the Installation and Operations Manual of the respective product.

MISUSE OR INCORRECT USE OF SOLAR MODULES VOIDS THE LIMITED WARRANTY AND MAY CREATE A SAFETY HAZARD AND RISK PROPERTY DAMAGE. THIS INCLUDES IMPROPER INSTALLATION OR CONFIGURATION, IMPROPER MAINTENANCE, UNINTENDED USE, AND UNAUTHORIZED MODIFICATION.

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SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Safety data sheets are only required for hazardous chemicals covered by the Hazard Communication Standard (HCS). Solar PV modules made by Hanwha Q CELLS are not covered by HCS. The following table provides an overview of materials solar PV modules by Hanwha Q CELLS are made of. The values given for the share of weight are targets and can vary for the products covered by this Product Safety Data Sheet.

| COMPONENT | MATERIAL | TOTAL SHARE | REMARK |
|-----------|----------------------------------|-------------|------------------------------|
| FRAME | Aluminum | 8% – 16% | not hazardous |
| | Silicone | <2% | not hazardous, see section 8 |
| LAMINATE | Glass | 60% – 80% | not hazardous |
| | Plastics (EVA, PET, PE, PPE, PC) | 8% – 16% | no hazards known |
| | Silicon | 2% – 4% | not hazardous |
| | Metals (Aluminum, Copper, Tin) | 1% – 3% | not hazardous |
| | Lead | <0,1% | hazardous |
| | Silver | <0,05% | not hazardous |

SECTION 4: FIRST-AID MEASURES

In case of electrocution:

- Always protect yourself by taking all necessary safety precautions before rescuing persons injured.
- Attention: Stay away from sources of high voltage and leave the rescue to qualified personnel with appropriate personal protection equipment!
- Call emergency rescue services.
- Do not touch live parts. Qualified personnel should shut down the PV system as far as possible – e.g. disconnect the modules at the inverter before uncovering any live electrical parts. Be sure to observe the specified time intervals after switching off the inverter. Highvoltage components need time to discharge. Follow OSHA requirements for control of hazardous energy at 29 C.F.R. § 1910.147.
- In the event a person is electrocuted or affected by electrical energy of the solar PV module, CALL 911. Before attempting rescue, SHUTDOWN THE POWER SOURCE.
- Remove the victim from the power source using only insulated tools ONLY IF CONTACT WITH LIVE ELECTRICAL COMPONENTS CAN B PREVENTED.
- Carefully move the injured from the zone of danger.
- After moving to a safe location, check heartbeat, respiration and consciousness of the injured person.
- Apply appropriate life-saving measures (CPR) accordingly before taking care of minor injuries.
- Consult a medical professional even if there are no visible injuries.
 - Flush thermal skin burns caused by touching hot surfaces of solar PV modules with cool water. Consult a medical professional.
 - Injuries due to sharp edges, corners and broken glass need to be appropriately treated. Consult a medical professional.
 - Other types of injuries need to be treated appropriately as well. Consult a medical professional.

SECTION 5: FIRE-FIGHTING MEASURES

- Hanwha Q CELLS solar PV modules are fire rated as Class C according to IEC and UL 1703 as well as Type 1 according to UL 1703.
- Hanwha Q CELLS solar PV modules are extensively tested at the factory to ensure electrical safety of the product before shipment.
- In rare cases, solar PV modules – as any other electrical device – can cause fire due to worn electrical contacts which result in electrical arcing.
- In case solar PV modules which are not part of an array are on fire, USE FIRE EXTINGUISHERS RATED FOR ELECTRICAL EQUIPMENT, Class C.
- IN CASE A SOLAR PV MODULE ARRAY IS PRESENT, ANY FIRE SHOULD ONLY BE FOUGHT BY PROFESSIONAL FIREFIGHTERS. FIREFIGHTERS NEED TO TAKE PRECAUTIONS FOR ELECTRICAL VOLTAGES UP TO 1,500 VOLTS (DC).
- Some components of the modules can burn. Potential combustion products include oxides of carbon, nitrogen and silicon.
- In case of prolonged fire, solar PV modules may lose their structural integrity.

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General recommendations from the below-mentioned reports:

- Fire service personnel should follow their normal tactics and strategies at structure fires involving solar power systems, but do so with awareness and understanding of exposure to energized electrical equipment. Emergency response personnel should operate normally, and approach this subject area with awareness, caution, and understanding to assure that conditions are maintained as safely as possible.
- Care must be exercised during all operations, both interior and exterior.
- Responding personnel must stay back from the roofline in the event modules or sections of an array may slide off the roof.
- Contacting a local professional PV installation company should be considered to mitigate potential hazards.
- Turning off an array is not as simple as opening a disconnect switch. As long as the array is illuminated, parts of the system will remain energized.
- When illuminated by artificial light sources such as fire department light trucks or an exposure fire, PV systems are capable of producing electrical power sufficient to cause inability to let go from electricity as a result of stimulation of muscle tissue, also known as lock-on hazard.
- Firefighting foam should not be relied upon to block light.
- The electric shock hazard due to application of water is dependent on voltage, water conductivity, distance and spray pattern.
- It is recommendable to fight fire with water instead of foam if a PV system is present. Salt water should not be used.
- Firefighter's gloves and boots afford limited protection against electrical shock provided the insulating surface is intact and dry. They should not be considered equivalent to electrical personal protection equipment.

Readers interested in more details may refer to the following reports:

- National Fire Protection Association, Fire Protection Research Foundation report "Fire Fighter Safety and Emergency Response for Solar Power Systems" issued May 2010, revised October 2013
- Important recommendations from a report called "Firefighter Safety and Photovoltaic Installations Research Project" issued by Underwriters Laboratories on November 29, 2011

SECTION 6: FIRE-FIGHTING MEASURES

This section is not applicable.

SECTION 7: HANDLING AND STORAGE

Before installing the module, read the Installation and Operation Manual for Q CELLS modules carefully. Noncompliance with the instructions may result in damage and physical injury or death. Only qualified and authorized specialists may install modules and put them into operation. You can obtain the complete installation manual from your retailer.

Details about transport and storage of palletized Hanwha Q CELLS solar PV modules can be found in the Packaging and Transport Information of the respective module type.

Storage, transport and unpacking:

- Store the module dry, well-ventilated and properly secured. The original packaging is not weatherproof.
- Always transport the module in its original packaging.
- Do not stack the modules. This prevents damage of the junction box.
- The module is made of glass. Take great care when unpacking, storing and transporting it.
- Do not subject the module glass to any mechanical stress (e.g. through torsion or deflection). Do not step on the module or place any objects onto the module.
- Protect both sides of the module against scratching and other damage.
- Carry the module by holding the edges with both hands, or use a glass suction lifter.
- Never lift or carry the module using the module junction box or wiring. Avoid pulling on the wiring at all costs.

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SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Before installing the module, read the Installation and Operation Manual carefully. Noncompliance with the instructions may result in damage and physical injury. Only qualified and authorized specialists may install modules and put them into operation. You can obtain the complete installation manual from your retailer.

- Please follow the valid national regulations and safety guidelines for the installation of electrical devices and systems.
- Please make sure to take all necessary safety precautions.
- Ensure that all personnel are aware of and adhere to accident-prevention and safety regulations.
- For handling of modules wear suitable protective gloves.
- Do not install damaged modules. Ensure that all electrical components are in a proper, dry, and safe condition.
- Do not modify the module (e.g. do not drill any additional holes). Never open the junction box.
- Ensure that modules and tools are not subject to moisture or rain at any time during installation. Only use dry, insulated tools for electrical work.
- Only connect cables with plugs. Ensure for a tight connection between the plugs. Plugs click together audibly.
- Cover the modules with an opaque material during installation. Cover the modules to be disconnected.

Silicones used in manufacturing release methanol during curing. Once cured, no additional methanol is released during use. Small amounts of these chemicals may be present in shipping cartons. Upon receipt, open container in a well ventilated location and allow to stand for 5 minutes before removing units from cartons. Exposures above recommended limits for methanol of 200 ppm eight-hour time-weighted-average (TWA) will not occur.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

- Physical state: solid
- Voltage: refer to data sheet (below 50 volts for a single module)

Attention: Voltage of single modules add up when modules are electrically connected in series. Hanwha Q CELLS solar PV modules are designed and certified for voltages up to 1,000 volts or even up to 1,500 volts. Connection of modules in series is only permitted up to the maximum system voltage as listed in the applicable data sheet.

- Weight: refer to data sheet
- Solubility in water: insoluble in water

SECTION 10: STABILITY AND REACTIVITY

Under normal operating conditions as specified in the Product Data Sheet, Hanwha Q CELLS solar PV modules are chemically stable.

- Hanwha Q CELLS solar PV modules are tested for salt spray and ammonia resistance according to IEC 61701 and IEC 62716, respectively.
- Hanwha Q CELLS solar PV modules support ambient operating temperatures from -40°C to $+85^{\circ}\text{C}$ (-40°F to $+185^{\circ}\text{F}$).
- Do not install modules above 13.120 ft (4000m) altitude above sea level.
- Some components of the modules can burn. Potential combustion products include oxides of carbon, nitrogen and silicon.
- Do not scratch off dirt. Use a soft cellulose cloth or sponge to carefully wipe off stubborn dirt. Do not use micro fleece wool or cotton cloths.
- Rinse dirt off with lukewarm water (dust, leaves, etc.)
- Use an alcohol based glass cleaner. Do not use abrasive detergents or tensides.
- Isopropyl alcohol (IPA) can be used selectively to remove stubborn dirt and stains within one hour after it appeared.
- Follow the safety guidelines provided by the IPA manufacturer.
- Do not let IPA run down between the module and the frame or into the module edges.

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SECTION 11: TOXICOLOGICAL INFORMATION

Small amounts of methanol may be present inside shipping cartons. Open cartons and allow to vent before removing units. No exposure to hazardous chemicals will occur when the units are in use.

SECTION 12: ECOLOGICAL INFORMATION

Hanwha Q CELLS solar PV modules are designed to withstand outdoor operating conditions for 25 years. Biodegradation is not expected due to high chemical stability of the components.

SECTION 13: DISPOSAL CONSIDERATIONS

Hanwha Q CELLS solar PV modules should be recycled rather than dumped in a landfill. Raw materials of the product can be recovered by recycling companies. Disposal must be in accordance with national and local laws and regulations for electric/electronic waste.

SECTION 14: TRANSPORT INFORMATION

Hanwha Q CELLS solar PV modules can be shipped via standardized container freight. Regulations for hazardous goods do not apply. For further details, please refer to the Packaging and Transport Information which can be provided as a separate document by Hanwha Q CELLS.

SECTION 15: REGULATORY INFORMATION

- Hanwha Q CELLS solar PV modules are tested according to international standards IEC 61215, IEC 61730 as well as US standards UL 1703.
- Please refer to the Installation and Operation Manual and Product Data Sheet of the respective Hanwha Q CELLS solar PV module.

SECTION 16: OTHER INFORMATION

- Date of initial creation of this product safety data sheet: July 1, 2016
- Date of last revision: August 14, 2018

Toxicity Characteristic Leaching Procedure (TCLP) Regulatory Levels

| METALS | TCLP Regulatory Level, mg/L | EPA Hazardous Waste Number | Recommended Test Method |
|---------------|------------------------------------|-----------------------------------|--------------------------------|
| Arsenic | 5.0 | D004 | 7061 |
| Barium | 100.0 | D005 | 7080 |
| Cadmium | 1.0 | D006 | 7130 |
| Chromium | 5.0 | D007 | 7190 |
| Lead | 5.0 | D008 | 7420 |
| Mercury | 0.2 | D009 | 7471 |
| Selenium | 1.0 | D010 | 7741 |
| Silver | 5.0 | D011 | 7760 |

| VOLATILE ORGANICS | TCLP Regulatory Level, mg/L | EPA Hazardous Waste Number | Recommended Test Method |
|--------------------------|------------------------------------|-----------------------------------|--------------------------------|
| Benzene | 0.5 | D018 | 8260B |
| Carbon Tetrachloride | 0.5 | D019 | 8260B |
| Chlorobenzene | 100.0 | D021 | 8260B |
| Chloroform | 6.0 | D022 | 8260B |
| 1,4-Dichlorobenzene | 7.5 | D027 | 8260B |
| 1,2-Dichloroethane | 0.5 | D028 | 8260B |
| 1,1-Dichloroethylene | 0.7 | D029 | 8260B |
| Methyl Ethyl Ketone | 200.0 | D035 | 8260B |
| Tetrachloroethylene | 0.7 | D039 | 8260B |
| Trichloroethylene | 0.5 | D040 | 8260B |
| Vinyl Chloride | 0.2 | D043 | 8260B |

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| SEMIVOLATILE ORGANICS | TCLP Regulatory Level, mg/L | EPA Hazardous Waste Number | Recommended Test Method |
|------------------------------|------------------------------------|-----------------------------------|--------------------------------|
| o-Cresol | ¹ 200 | D023 | 8270C |
| m-Cresol | ¹ 200 | D024 | 8270C |
| p-Cresol | ¹ 200 | D025 | 8270C |
| Cresol | ¹ 200 | D026 | 8270C |
| 2,4-Dinitrotoluene | 0.13 | D030 | 8270C |
| Hexachlorobenzene | 0.13 | D032 | 8270C |
| Hexachlorobutadiene | 0.5 | D033 | 8270C |
| Hexachloroethane | 3.0 | D034 | 8270C |
| Nitrobenzene | 2.0 | D036 | 8270C |
| Pentachlorophenol | 100.0 | D037 | 8270C |
| Pyridine | 2 5.0 | D038 | 8270C |
| 2,4,5-Trichlorophenol | 400.0 | D041 | 8270C |
| 2,4,6-Trichlorophenol | 2.0 | D042 | 8270C |

¹If Cresols cannot be differentiated, total cresol may be used.

| ORGANOCHLORINE PESTICIDES | TCLP Regulatory Level, mg/L | EPA Hazardous Waste Number | Recommended Test Method |
|----------------------------------|------------------------------------|-----------------------------------|--------------------------------|
| Chlordane | 0.03 | D020 | 8081A |
| Endrin | 0.02 | D012 | 8081A |
| Heptachlor (and its Epoxide) | 0.008 | D031 | 8081A |
| Lindane | 0.4 | D013 | 8081A |
| Methoxychlor | 10.0 | D014 | 8081A |
| Toxaphene | 0.5 | D015 | 8081A |

| CHLOROPHENOXY ACID HERBICIDES | TCLP Regulatory Level, mg/L | EPA Hazardous Waste Number | Recommended Test Method |
|--------------------------------------|------------------------------------|-----------------------------------|--------------------------------|
| 2,4-D | 10.0 | D016 | 8150 |
| 2,4,5-TP (Silvex) | 1.0 | D017 | 8150 |

Reference: 40 CFR 261, Appendix II, 1993 ed., as amended by 58 FR 46040, August 31, 1993.

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**JONES ENVIRONMENTAL
LABORATORY RESULTS**

Client: Hanwha Q CELLS America Inc.
Client Address: 400 Spectrum Center Dr., Suite 1400
Irvine, CA 92618

Report date: 4/4/2019
JEL Ref. No.: ST-13602

Attn: Ralph Alvarado

Date Sampled: 4/1/2019
Date Received: 4/1/2019
Date Analyzed: 4/3-4/2019
Physical State: Solar Panel
Q.PEAK DUO
L-G5.2 XXX

ANALYSES REQUESTED

1. TCLP Metals by ICP-OES

Approval:

Angela Haar, Ph. D.
Mobile Lab Manager



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JONES ENVIRONMENTAL LABORATORY RESULTS

Client: Hanwha Q CELLS America Inc. **Report date:** 4/4/2019
Client Address: 400 Spectrum Center Dr., Suite 1400 **Jones Ref. No.:** ST-13602
 Irvine, CA 92618
Attn: Ralph Alvarado **Date Sampled:** 4/1/2019
Date Received: 4/1/2019
Date Analyzed: 4/3-4/2019
Physical State: Solar Panel -
 Q.PEAK DUO L-G5.2 XXX

Sample ID: Sample 1 **Jones ID:** ST-13602-01

TCLP Metals by ICP-OES

| | <u>Result</u> | <u>Dilution</u> | <u>Batch</u> | <u>Prepared</u> | <u>Analyzed</u> | <u>Reporting Limit</u> | <u>Units</u> |
|------------------|---------------|-----------------|----------------|-----------------|-----------------|------------------------|--------------|
| Analytes: | | | | | | | |
| Silver, Ag | 0.01 | 1 | TCLP_040219-01 | 4/2/2019 | 4/3/2019 | 0.01 | mg/L |
| Arsenic, As | ND | 1 | " | " | " | 0.01 | mg/L |
| Barium, Ba | 0.10 | 1 | " | " | " | 0.01 | mg/L |
| Cadmium, Cd | ND | 1 | " | " | " | 0.01 | mg/L |
| Chromium, Cr | ND | 1 | " | " | " | 0.01 | mg/L |
| Selenium, Se | ND | 1 | " | " | " | 0.01 | mg/L |
| Lead, Pb | 1.48 | 1 | " | " | " | 0.01 | mg/L |

EPA 7471A - Mercury by Cold Vapor Atomic Absorption

| | <u>Result</u> | <u>Dilution</u> | <u>Batch</u> | <u>Prepared</u> | <u>Analyzed</u> | <u>Reporting Limit</u> | <u>Units</u> |
|-------------|---------------|-----------------|----------------|-----------------|-----------------|------------------------|--------------|
| Mercury, Hg | ND | 1 | TCLP_040219-01 | 4/2/2019 | 4/4/2019 | 100 | mg/L |

ND= Not Detected



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JONES ENVIRONMENTAL LABORATORY RESULTS

Client: Hanwha Q CELLS America Inc. **Report date:** 4/4/2019
Client Address: 400 Spectrum Center Dr., Suite 1400 **Jones Ref. No.:** ST-13602
Irvine, CA 92618
Attn: Ralph Alvarado **Date Sampled:** 4/1/2019
Date Received: 4/1/2019
Date Analyzed: 4/3-4/2019
Physical State: Solar Cell

Sample ID: Sample 2 **Jones ID:** ST-13602-02

TCLP Metals by ICP-OES

| | <u>Result</u> | <u>Dilution</u> | <u>Batch</u> | <u>Prepared</u> | <u>Analyzed</u> | <u>Reporting Limit</u> | <u>Units</u> |
|------------------|---------------|-----------------|----------------|-----------------|-----------------|------------------------|--------------|
| Analytes: | | | | | | | |
| Silver, Ag | ND | 1 | TCLP_040219-01 | 4/2/2019 | 4/3/2019 | 0.01 | mg/L |
| Arsenic, As | ND | 1 | " | " | " | 0.01 | mg/L |
| Barium, Ba | 0.07 | 1 | " | " | " | 0.01 | mg/L |
| Cadmium, Cd | ND | 1 | " | " | " | 0.01 | mg/L |
| Chromium, Cr | ND | 1 | " | " | " | 0.01 | mg/L |
| Selenium, Se | ND | 1 | " | " | " | 0.01 | mg/L |
| Lead, Pb | 1.36 | 1 | " | " | " | 0.01 | mg/L |

EPA 7471A - Mercury by Cold Vapor Atomic Absorption

| | <u>Result</u> | <u>Dilution</u> | <u>Batch</u> | <u>Prepared</u> | <u>Analyzed</u> | <u>Reporting Limit</u> | <u>Units</u> |
|-------------|---------------|-----------------|----------------|-----------------|-----------------|------------------------|--------------|
| Mercury, Hg | ND | 1 | TCLP_040219-01 | 4/2/2019 | 4/4/2019 | 100 | mg/L |

ND= Not Detected



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JONES ENVIRONMENTAL LABORATORY RESULTS

Client: Hanwha Q CELLS America Inc.
Client Address: 400 Spectrum Center Dr., Suite 1400
 Irvine, CA 92618

Report date: 4/4/2019
Jones Ref. No.: ST-13602

Attn: Ralph Alvarado

Date Sampled: 4/1/2019
Date Received: 4/1/2019
Date Analyzed: 4/3-4/2019
Physical State: Solar Panel -
 Q.PEAK DUO L-G5.2 XXX

Sample ID: Sample 3 **Jones ID:** ST-13602-03

TCLP Metals by ICP-OES

| | <u>Result</u> | <u>Dilution</u> | <u>Batch</u> | <u>Prepared</u> | <u>Analyzed</u> | <u>Reporting Limit</u> | <u>Units</u> |
|------------------|---------------|-----------------|----------------|-----------------|-----------------|------------------------|--------------|
| Analytes: | | | | | | | |
| Silver, Ag | ND | 1 | TCLP_040219-01 | 4/2/2019 | 4/3/2019 | 0.01 | mg/L |
| Arsenic, As | ND | 1 | " | " | " | 0.01 | mg/L |
| Barium, Ba | 0.12 | 1 | " | " | " | 0.01 | mg/L |
| Cadmium, Cd | ND | 1 | " | " | " | 0.01 | mg/L |
| Chromium, Cr | ND | 1 | " | " | " | 0.01 | mg/L |
| Selenium, Se | ND | 1 | " | " | " | 0.01 | mg/L |
| Lead, Pb | 1.07 | 1 | " | " | " | 0.01 | mg/L |

EPA 7471A - Mercury by Cold Vapor Atomic Absorption

| | <u>Result</u> | <u>Dilution</u> | <u>Batch</u> | <u>Prepared</u> | <u>Analyzed</u> | <u>Reporting Limit</u> | <u>Units</u> |
|-------------|---------------|-----------------|----------------|-----------------|-----------------|------------------------|--------------|
| Mercury, Hg | ND | 1 | TCLP_040219-01 | 4/2/2019 | 4/4/2019 | 100 | mg/L |

ND= Not Detected



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JONES ENVIRONMENTAL LABORATORY RESULTS

Client: Hanwha Q CELLS America Inc. **Report date:** 4/4/2019
Client Address: 400 Spectrum Center Dr., Suite 1400 **Jones Ref. No.:** ST-13602
 Irvine, CA 92618
Attn: Ralph Alvarado **Date Sampled:** 4/1/2019
Date Received: 4/1/2019
Date Analyzed: 4/3-4/2019
Physical State: Solar Cell

Sample ID: Sample 4 **Jones ID:** ST-13602-04

TCLP Metals by ICP-OES

| | <u>Result</u> | <u>Dilution</u> | <u>Batch</u> | <u>Prepared</u> | <u>Analyzed</u> | <u>Reporting Limit</u> | <u>Units</u> |
|------------------|---------------|-----------------|----------------|-----------------|-----------------|------------------------|--------------|
| Analytes: | | | | | | | |
| Silver, Ag | ND | 1 | TCLP_040219-01 | 4/2/2019 | 4/3/2019 | 0.01 | mg/L |
| Arsenic, As | ND | 1 | " | " | " | 0.01 | mg/L |
| Barium, Ba | 0.11 | 1 | " | " | " | 0.01 | mg/L |
| Cadmium, Cd | ND | 1 | " | " | " | 0.01 | mg/L |
| Chromium, Cr | ND | 1 | " | " | " | 0.01 | mg/L |
| Selenium, Se | ND | 1 | " | " | " | 0.01 | mg/L |
| Lead, Pb | 1.04 | 1 | " | " | " | 0.01 | mg/L |

EPA 7471A - Mercury by Cold Vapor Atomic Absorption

| | <u>Result</u> | <u>Dilution</u> | <u>Batch</u> | <u>Prepared</u> | <u>Analyzed</u> | <u>Reporting Limit</u> | <u>Units</u> |
|-------------|---------------|-----------------|----------------|-----------------|-----------------|------------------------|--------------|
| Mercury, Hg | ND | 1 | TCLP_040219-01 | 4/2/2019 | 4/4/2019 | 100 | mg/L |

ND= Not Detected