



<b>Section III – Physical Data</b>	
<p><b>Cadmium</b>  Melting point (°F): 610  Boiling point (°F): 1,407  % Volatile by Volume:  Vapor Pressure (mm Hg):  Evaporation Rate:  Vapor Density (Air =1):  Specific Gravity (H<sub>2</sub>O): 8.65 @77°F  Solubility in Water: Insoluble  Appearance and Odor: Silver-white, blue-tinged, lustrous metal  Electrolyte specific gravity : 1.29 g/cm<sup>3</sup>  Electrolyte viscosity : 2.4 mPas (* mPas : milli-pascal second)</p>	<p><b>Cadmium Hydroxide</b>  Melting Point (°F):  Boiling Point (°C):  % Volatile by Volume:  Vapor Pressure (mm Hg):  Evaporation Rate:  Vapor Density (Air =1):  Specific Gravity(H<sub>2</sub>O): 4.79  Solubility in Water: Practically insoluble  Appearance and Odor: Powder</p>
<p><b>Nickel Powder</b>  Melting point (°F): 2,831  Boiling point (°F): 5,134  % Volatile by Volume:  Vapor Pressure (mm Hg):  Evaporation Rate:  Vapor Density (Air =1):  Specific Gravity (H<sub>2</sub>O): 8.90  Solubility in Water: Insoluble  Appearance and Odor: Powder</p>	<p><b>Nickel Hydroxide</b>  Melting point (°F): *  Boiling Point (°F):  % Volatile by Volume:  Vapor Pressure (mm Hg):  Evaporation Rate:  Vapor Density (Air = 1):  Specific Gravity (H<sub>2</sub>O):  Solubility in Water: Insoluble  Appearance and Odor: Apple green powder</p> <p>* Note: decomposes above 392°F into NiO and H<sub>2</sub>O.</p>
<p><b>Potassium Hydroxide:</b>  Melting point (°F):*  Boiling Point (°F):  % Volatile by Volume:  Vapor Pressure (mm Hg):  Evaporation Rate:  Vapor Density (Air =1):  Specific Gravity (H<sub>2</sub>O):  Solubility in Water: Soluble in 0.9 part water, 0.6 part in boiling water  Appearance and Odor: White or slightly yellow</p> <p>* Note: Potassium hydroxide is present as a liquid or paste and acts as the electrolyte in the battery cell.</p>	
<b>Section IV – Fire and Explosion Hazard Data</b>	
<p>Flash Point: NA  Lower Explosive Limit: NA  Upper Explosive Limit: NA</p>	<p>Extinguishing Media: Any class of extinguishing medium may be used on the batteries or their packing material.</p>
<p>Special Fire Fighting Procedures: Special Fire Fighting Procedures: Exposure to temperatures of above 212°F can cause evaporation of the liquid content of the potassium hydroxide electrolyte resulting in the rupture of the cell. Potential for exposure to cadmium fumes during fire; use self-contained breathing apparatus.</p>	

## Section V – Health Hazard Data

Threshold Limit Values: See Section II

Effects of a Single (Acute) Overexposure:

**Inhalation:** During normal use inhalation is an unlikely route of exposure due to containment of hazardous materials within the battery case. However, should the batteries be exposed to extreme heat or pressures causing a breach in the battery cell case, exposure to the constituents may occur. Inhalation of cobalt dusts may result in pulmonary conditions.

**Ingestion:** If the battery case is breached in the digestive tract, the electrolyte may cause localized burns.

**Skin Absorption:** No evidence of adverse effects from available data.

**Skin Contact:** Exposure to the electrolyte contained inside the battery may result in chemical burns. Exposure to nickel may cause dermatitis in some sensitive individuals.

**Eye Contact:** Exposure to the electrolyte contained inside the battery may result in severe irritation and chemical burns.

**Carcinogenicity:** Nickel has been identified by the National Toxicology Program (NTP) as reasonably anticipated to be a carcinogen. Cobalt has been identified by IARC as a 2B carcinogen.

**Other Effects of Repeated (Chronic) Exposure:** Chronic overexposure to nickel may result in cancer; dermal contact may result in dermatitis in sensitive individuals.

**Medical Conditions Aggravated by Overexposure:** A knowledge of the available toxicology information and of the physical and chemical properties of the material suggests that overexposure is unlikely to aggravate existing medical conditions.

**Emergency and First Aid Procedures:** Swallowing: Do not induce vomiting. Seek medical attention immediately.

**Skin:** If the internal cell materials of an opened battery cell comes into contact with the skin, immediately flush with water for at least 15 minutes.

**Inhalation:** If potential for exposure to fumes or dusts occurs, remove immediately to fresh air and seek medical attention.

**Eyes:** If the contents from an opened battery comes into contact with the eyes, immediately flush eyes with water continuously for at least 15 minutes. Seek medical attention.

## Section VI – Reactivity Data

The batteries are stable under normal operating conditions.

Hazardous polymerization will not occur.

Hazardous decomposition products: oxides of nickel and cadmium.

Conditions to avoid: heat, open flames, sparks, and moisture.

Potential incompatibilities (i.e., materials to avoid contact with): The battery cells are encased in a non-reactive container; however, if the container is breached, avoid contact of internal battery components with acids, aldehydes, and carbamate compounds.

## Section VII – Spill and Leak Procedures

Spill and leaks are unlikely because cells are contained in a hermetically sealed case. If the battery case is breached, don protective clothing that is impervious to caustic materials and absorb or pack spill residues in inert material. Dispose of as a hazardous waste in accordance with applicable state and federal regulations. Resultant spill residues may be characterized as D002 (caustic) and D006 (cadmium) pursuant to the federal Resource Conservation and Recovery Act (RCRA). See Section IV for response to fires or explosions.

### Section VIII – Safe Handling and Use

**Ventilation Requirements:** Not required under normal use.

**Respiratory Protection:** Not required under normal use.

**Eye Protection:** Not required under normal use.

**Gloves:** Not required under normal use.

### Section IX – Precautions for Safe Handling and Use

**Storage:** Store in a cool place, but prevent condensation on cell or battery terminals. Elevated temperatures may result in reduced battery life. Optimum storage temperatures are between -31°F and 95°F.

**Mechanical Containment:** If there are special encapsulation or sealing requirements, consult your SANYO Energy Corp. representative about possible cell hazard precautions or limitations.

**Handling:** Accidental short circuit will bring high temperature elevation to the battery as well as shorten the battery life. Be sure to avoid prolonged short circuit since the heat can burn attendant skin and even rupture of the battery cell case. Batteries packaged in bulk containers should not be shaken. Metal covered tables or belts used for assembly of batteries into devices can be the source of short circuits; apply insulating material to assembly work surface. If soldering or welding to the case of the battery is required, consult your Sanyo Energy Corp. representative for proper precautions to prevent seal damage or external short circuit.

**Charging:** This battery is designed for recharging. A loss of voltage and capacity of batteries due to self-discharge during prolonged storage is unavoidable. Charge battery before use. Observe the specified charge rate since higher rates can cause a rise in internal gas pressure that may result in damaging heat generation or cell rupture and/or venting.

**Labeling:** If normal label warnings are not visible, it is important to provide a device label stating: CAUTION: Do not dispose in fire, mix with other battery types, charge above specified rate, connect improperly, or short circuit, which may result in overheating, explosion or leakage of cell contents.

**Soldering/welding:** If soldering or welding to the case of the battery is required, consult your Sanyo Energy Corp. representative for proper precautions to prevent seal damage or external short circuit.

### Section X – Recycling and Disposal

SANYO encourages battery recycling. Our nickel cadmium batteries are recyclable through the Rechargeable Battery Recycling Corporation's (RBRC) *Charge Up to Recycle! Program*. For information call 1-800-8-BATTERY or see their website at [www.rbrc.org](http://www.rbrc.org). Nickel cadmium batteries must be handled in accordance with all applicable state and federal laws and regulations.



DO NOT INCINERATE or subject battery cells to temperatures in excess of 212 F. Such treatment can vaporize the liquid electrolyte causing cell rupture. Incineration may result in cadmium emissions.

## Section XI – Transportation

SANYO sealed Nickel Cadmium batteries are considered to "dry cell" batteries and not subject to hazardous materials (dangerous goods) regulations for the purpose of transportation by the U.S. Department of Transportation (DOT), the International Civil Aviation Organization (ICAO), the International Air Transport Association (IATA) or the International Maritime Organization (IMO).

The only DOT requirement for shipping Nickel Cadmium batteries are contained in Special Provision 130 which states, "*Batteries, dry*" are not subject to the requirements of this subchapter when they are securely packaged and offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals) and protects against short circuits." A similar requirement is contained in 49 CFR 173.21(c) of the U.S. DOT hazardous materials regulations.

The IATA Dangerous Goods Regulations contain a similar requirement in Special Provision A123 that states, "*This entries applies to Batteries, electric storage, not otherwise listed in Subsection 4.2 – List of Dangerous Goods. Examples of such batteries are alkali-manganese, zinc-carbon, nickel-metal hydride, and nickel cadmium batteries. Any electrical battery or battery powered device having the potential of dangerous evolution of heat that is not prepared so as to prevent a short-circuit (e.g. in the case of batteries, by the effective insulation of exposed terminals; or, in the case of equipment, by disconnection of the battery and protection of exposed terminals) is forbidden from transport.*"

Failure to comply with these requirements may result in substantial civil penalties.

**The information and recommendations set forth are made in good faith and believed to be accurate as of the date of preparation. SANYO ENERGY CORP. makes no warranty, expressed or implied, with respect to this information and disclaims all liabilities from reliance on it.**