

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Geomagnetic Disturbance Data System

Data Reporting Instructions

July 2020

RELIABILITY | RESILIENCE | SECURITY



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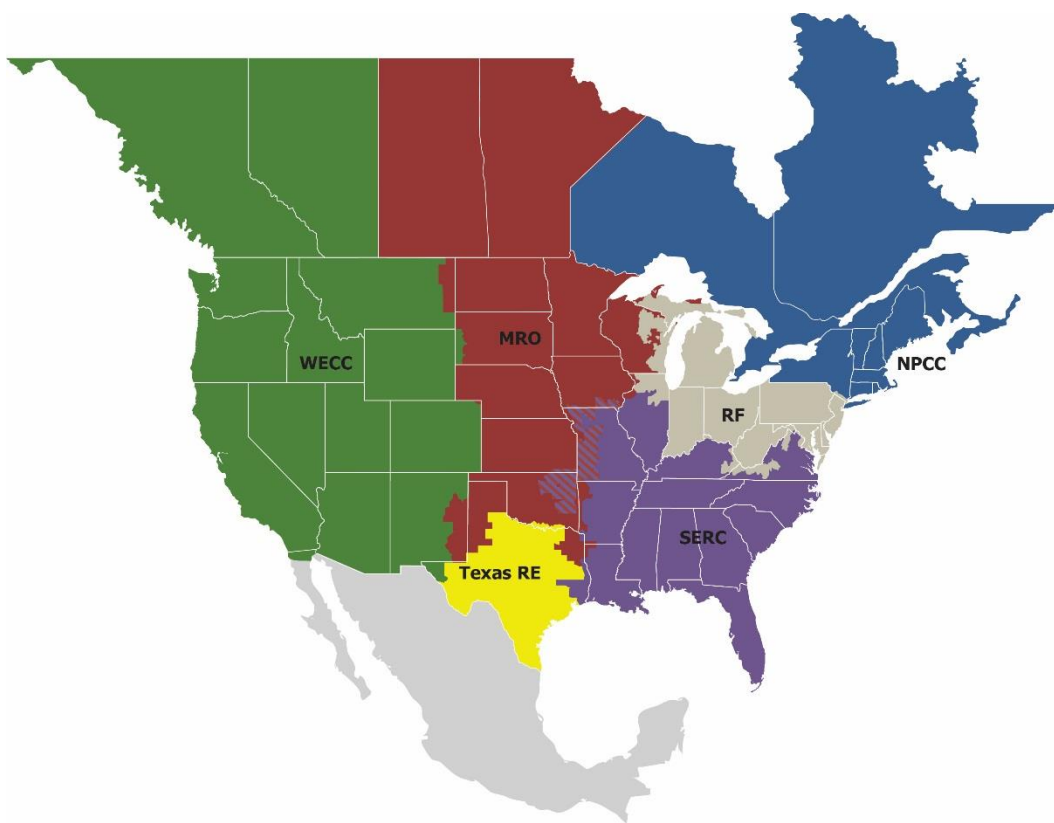
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Preface

Electricity is a key component of the fabric of modern society and the Electric Reliability Organization (ERO) Enterprise serves to strengthen that fabric. The vision for the ERO Enterprise, which is comprised of the North American Electric Reliability Corporation (NERC) and the six Regional Entities (REs), is a highly reliable and secure North American bulk power system (BPS). Our mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid.

Reliability | Resilience | Security
Because nearly 400 million citizens in North America are counting on us

The North American BPS is divided into six RE boundaries as shown in the map and corresponding table below. The multicolored area denotes overlap as some load-serving entities participate in one RE while associated Transmission Owners (TOs)/Operators (TOPs) participate in another.



MRO	Midwest Reliability Organization
NPCC	Northeast Power Coordinating Council
RF	ReliabilityFirst
SERC	SERC Reliability Corporation
Texas RE	Texas Reliability Entity
WECC	WECC

Introduction

The *Geomagnetic Disturbance Data System - Data Reporting Instructions* were developed to assist industry personnel in reporting information to NERC's GMD Data Portal application. The instructions detail the procedures, schedule, and format to follow when reporting data.

Background

In August 2018, the NERC Board of Trustees (Board) approved a Request for Data or Information under Section 1600 of the NERC Rules of Procedure to obtain geomagnetic disturbance (GMD) data that is collected by NERC entities ("GMD Data Request").¹ The GMD Data Request was developed to meet Federal Energy Regulatory Commission (FERC) directives in Order No. 830 for collecting geomagnetically induced current (GIC) and magnetometer data from registered entities for the period beginning May 2013, including both data existing as of the date of the order and new data for GMD events going forward.² Furthermore, FERC directed that NERC should make the collected GIC and magnetometer data available to support ongoing research and analysis of GMD risk.³

NERC's GMD data collection program is designed to obtain relevant measurement data that will aid stakeholders in understanding and reducing GMD risk to the BPS. GMD events are caused by the ejection of charged material from the sun and the interaction of this material with space around the earth (atmosphere and magnetosphere). The resulting disturbances in the earth's magnetic field have the potential to disrupt operations or cause damage to critical infrastructure, including power systems. Extremely strong GMD events, though rare, can induce strong quasi-dc currents in the electric power grid that could affect system voltages, relay and protection system performance, and the operation and health of some large power transformers. Through the GMD data collection program, NERC is collecting GIC and magnetometer data from reporting entities for designated strong GMD events ($K_p = 7$ and greater).⁴

In accordance with Section 1600 of the NERC Rules of Procedure, NERC may request data or information that is deemed necessary to meet its obligations under Section 215 of the Federal Power Act, as authorized by Section 39.2(d) of FERC regulations.⁵

The data reporting instructions (DRI) contain guidance for reporting entities to use in providing specified data. The DRI Manual does not address processes for requesting, accessing, or using the GMD data collected by NERC. Instructions for obtaining collected GIC and magnetometer data from NERC will be provided separately.

NERC encourages suggestions for improving this DRI by email to GMD@nerc.net

¹ The approved NERC Rules of Procedure Section 1600 Data Request for GMD Data can be found here:

https://www.nerc.com/comm/PC/Geomagnetic%20Disturbance%20Task%20Force%20GMDTF%202013/GMD_data_request_June_5_2018.pdf

² *Reliability Standard for Transmission System Planned Performance for Geomagnetic Disturbance Events*, Order No. 830, 156 FERC ¶ 61,215 at P 89 (2016). The directive applies to only U.S. responsible entities (*See id.* n. 118). However, responsible entities in other NERC jurisdictions including Canada are encouraged to participate.

³ Order No. 830 at P 93. In the order, FERC stated: "The record in this proceeding supports the conclusion that access to GIC monitoring and magnetometer data will help facilitate GMD research, for example, by helping to validate GMD models." If GIC monitoring and magnetometer data is already publicly available (e.g., from a government entity or university), FERC stated that NERC need not duplicate those efforts (*see id.* n. 122).

⁴ The planetary K index, K_p , is an indicator used to characterize the magnitude of geomagnetic storms by quantifying disturbances in the horizontal component of the earth's magnetic field with an integer in the range of 0 to 9 [1=calm; 5 or more =geomagnetic storm].

⁵ 18 C.F.R. § 39.2(d).

Who Must Report

Pursuant to Section 1600 of the NERC Rules of Procedure and the approved GMD Data Request, Transmission Owners (TO) and Generator Owners (GO) registered in the NERC Compliance Registry must provide information and data as indicated in these instructions.⁶ NERC will request all TOs and GOs inform them annually as to whether they collect GIC data or magnetometer data. Those TOs and GOs that collect GIC data or magnetometer data are considered reporting entities for GMD events specified in the GMD Data Request and these instructions. TOs and GOs that have not installed GIC recorders and/or magnetometers and do not collect such data are not considered reporting entities. These instructions do not require TOs or GOs to install any GIC monitors or magnetometers.

A reporting entity may submit a consolidated report that covers the GIC data or magnetometer data of several NERC entities if the reporting entity desires to do so. Furthermore, NERC entities participating in data collection programs with other organizations (e.g., EPRI SUNBURST program) may arrange for data submissions to be made on their behalf. TOs and GOs that desire to have another reporting entity submit data on their behalf will designate their reporting entity in the GMD data portal application.

What will be reported

Reporting entities will provide the following types of data to NERC as specified in the GMD Data Request:

- GMD Monitoring Equipment (i.e., GIC monitor, magnetometer) information
- GIC measurement data for designated GMD events
- Geomagnetic field measurement data for designated GMD events

NERC will designate time periods during which GMD events $K_p = 7$ or greater have occurred and request reporting entities provide data to NERC annually. If desired by the reporting entity, the requested data may be provided to NERC prior to the annual deadline.

Reporting entities submit each data file that is appropriate for their collected data.

GMD Data Collection Events

NERC will designate specific time periods for which reporting entities are requested to provide their collected GIC and geomagnetic field data. NERC will identify these time periods in collaboration with U.S. government space weather monitors.⁷ Space weather forecasts, alerts, and warnings provide useful information for BPS operators and can serve as an indication of when GMD data collection will be required. However, specific GMD data collection periods will be based on the analysis of space weather experts using data from geomagnetic observatories. Consequently, NERC may communicate specific collection start and end periods after the onset of the GMD event.

Figure I.1 provides a notional depiction of notifications of a GMD data collection event.

⁶ The GMD Data Request applies to only U.S. responsible entities (See Order No. 830, n. 118). However, responsible entities in other NERC jurisdictions including Canada are encouraged to participate in order to obtain relevant GMD data for the North American BPS.

⁷ The U.S. National Oceanographic and Atmospheric Administration (NOAA) Space Weather Prediction Center (SWPC) operates 24x7 to continually monitor and forecast space weather. Forecasts, alerts, and warnings are available through the SWPC website. <https://www.swpc.noaa.gov/>

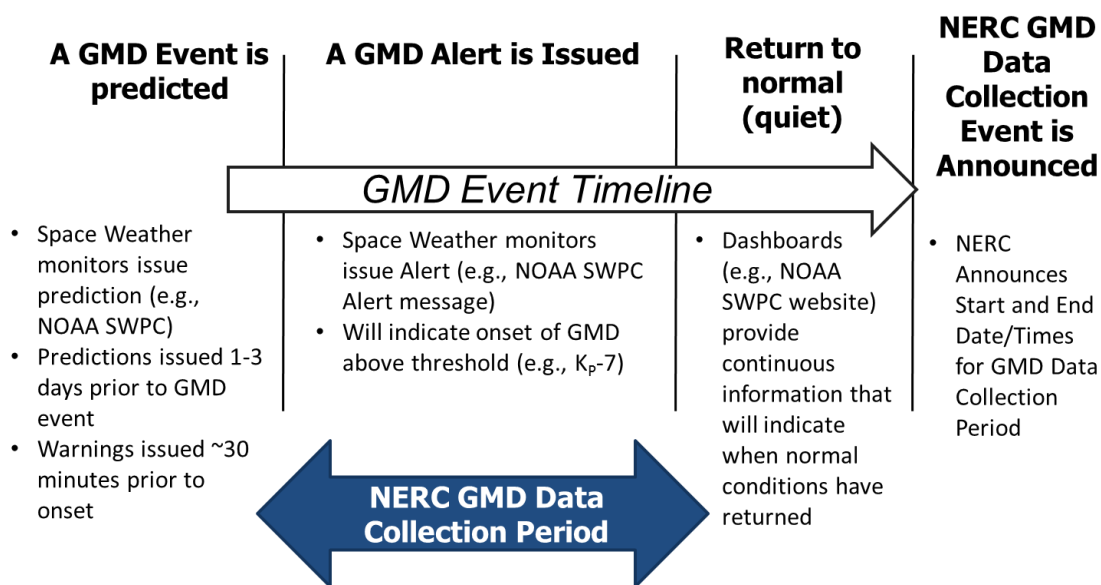


Figure I.1: GMD Data Collection Event Notional Timeline

Notification

NERC announces GMD data collection period start date/time and end date/time to reporting entities by email. Emails will be sent to contacts entered by reporting entities in the GMD Data System. Announcements will also be posted to the NERC website.

NERC will make notifications as GMD data collection events occur. NERC's notifications are for data collection purposes and are not operator alerts. NERC will also provide notifications to inform reporting entities of reporting deadlines as specified below, and other administrative matters.

One-time Collection of Data from Historical GMD Events

In addition to future GMD data collection, the GMD Data Request approved by the NERC Board authorizes NERC to collect GIC and magnetometer data for historical GMD events that occurred as far back as May 2013. [Appendix B](#) contains a listing of specific time periods for historical GMD events of magnitude $K_p = 7$ and greater.

When will Reporting Begin

Reporting begins October 1, 2020 as described in these instructions. Reporting Entities will be required to begin mandatory collection during designated GMD events beginning **October 1, 2020**. The first collection period will end on March 31, 2021. Collected data must be submitted by June 30, 2021, as described in these instructions. Additionally, TOs and GOs that have GIC data or magnetometer data for some or all of the historical GMD events listed in [Appendix B](#), or for portions thereof, are requested to provide data to NERC by June 30, 2021.

Subsequent to the first collection period, the annual collection period for GMD data will be from April 1 – March 31. During the annual collection period, NERC will designate time periods when GMD events $K_p = 7$ or greater have occurred. Reporting entities shall submit collected data on or before June 30 of each reporting year. If desired by the reporting entity, the requested data may be provided to NERC prior to the annual (June 30) deadline.

[Figure I.2](#) describes the first collection period and reporting deadline for GMD events of interest.

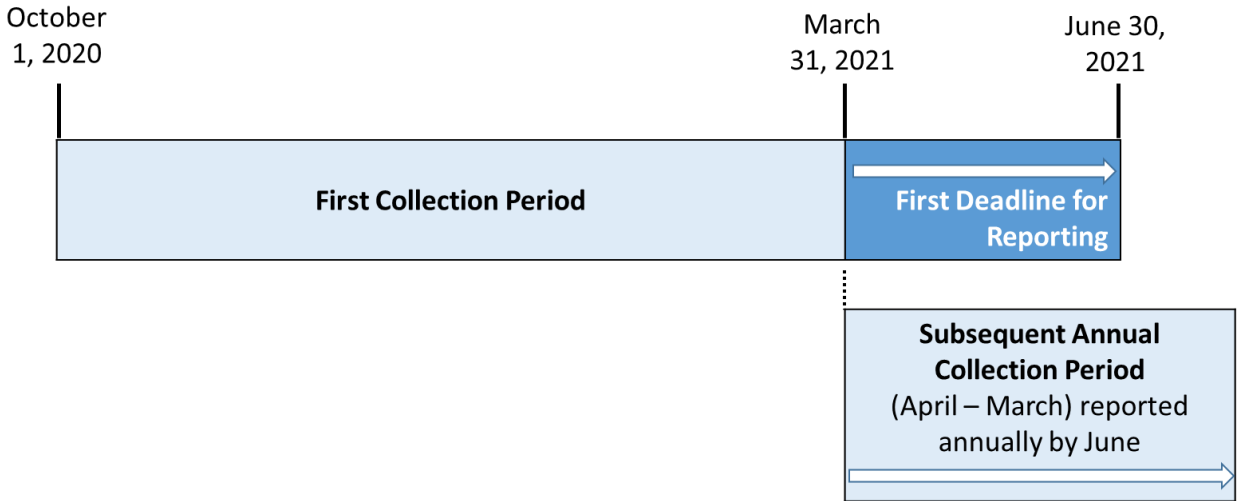


Figure I.2: First GMD Data Collection Period and Reporting Deadline

Chapter 1: Data Transmittal and Format

There are three types of information reported in the GMD Data System:

- GMD Monitoring Equipment (i.e., GIC monitor, magnetometer) information
- GIC measurement Data
- Magnetometer Data

The *GMD Data Reporting Instructions* describe each type of data in the chapters that follow. The GMD Monitoring Equipment information must be submitted before reporting GIC data or magnetometer data for a GMD event. Entities submit each data file that is appropriate for their collected data.

Format

Data should be submitted to NERC through the GMD Data System by the annual reporting deadline.

Reporting Deadlines

The annual collection period for GMD data will be from April 1 – March 31.⁸ During the annual collection period, NERC will designate time periods when GMD events $K_p = 7$ or greater have occurred. Reporting entities shall submit collected data on or before June 30 of each reporting year, as shown in **Figure 1.1**. If desired by the reporting entity, the requested data may be provided to NERC prior to the annual (June 30) deadline.

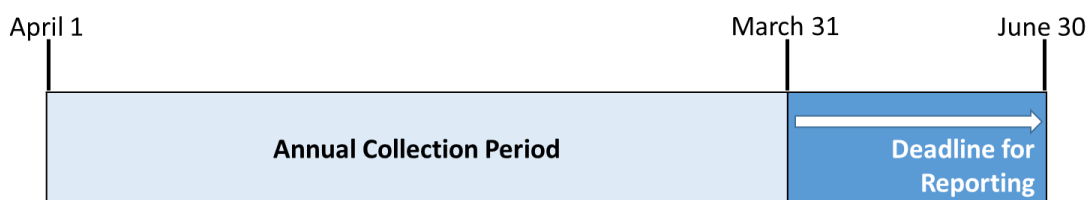


Figure 1.1: Collection and Reporting Timeline

Questions and Comments

All questions regarding GMD data reporting procedures and transmittals should be directed to NERC at GMD@nerc.net.

Restrictions on Disseminating Data

In Order No. 830, FERC stated, based on the record in the proceeding, that “GIC and magnetometer data typically should not be designated as Confidential Information under the NERC Rules of Procedure.”⁹ Accordingly, NERC does not anticipate that the requested information will contain Confidential Information as that term is defined by Section 1501 of the NERC Rules of Procedure. Consistent with Section 1501, NERC will not grant confidential treatment to any information that is publicly available.

Reporting entities provide GMD monitor location information in latitude and longitude to the nearest tenth of a degree as specified in the approved GMD Data Request (see **Chapter 2**). Users of GMD data may need general location

⁸ Reporting begins October 1, 2020 as described in these instructions. Reporting entities will be required to begin mandatory collection during designated GMD events beginning **October 1, 2020**. The first collection period will end on March 31, 2021. Collected data must be submitted by June 30, 2021, as described in these instructions.

⁹ See Order No. 830 at PP 4.

information for GMD validation and research. Location information is not considered Confidential Information in the definitions contained in NERC Rules of Procedure Section 1501.

If a reporting entity reasonably believes that any information required to be submitted under these instructions is Confidential Information, the reporting entity shall submit a request for Confidential Information treatment in accordance with FERC's guidance in Order No. 830.¹⁰ Appendix E provides information on the process for requesting confidential treatment. Consistent with section 1502 of the NERC Rules of Procedure, this request shall:

1. identify the information that the Reporting Entity reasonably believes contains Confidential Information;
2. identify the category or categories defined in Section 1501 of the NERC Rules of Procedure in which the information falls, including specific reasons why the information is believed to be Confidential Information;
3. if the information is subject to a prohibition on public disclosure in the FERC-approved rules of a regional transmission organization or independent system operator or a similar prohibition in applicable federal, state, or provincial laws, provide supporting references and details; and
4. if applicable, identify the time period after which the Reporting Entity would no longer consider the information to qualify for Confidential Information treatment (e.g., six months).

If the request for Confidential Information treatment is granted, NERC shall mark the information as Confidential Information or Critical Energy Infrastructure Information (CEII) as instructed in Section 1502.1 of the NERC Rules of Procedure prior to submission. NERC will handle the information in accordance with Sections 1500 and 1605 of the NERC Rules of Procedure for as long as the information is considered Confidential Information.

¹⁰ See Order No. 830 at P 95 (internal citations omitted):

[G]iven both the lack of substantiated concerns regarding the disclosure of GIC and magnetometer data, and the compelling demonstration that access to these data will support ongoing research and analysis of GMD threats, the Commission expects NERC to make GIC and magnetometer data available. Notwithstanding our findings here, to the extent any entity seeks confidential treatment of the data it provides to NERC, the burden rests on that entity to justify the confidential treatment.¹¹ Exceptions are possible if the providing entity obtains from NERC, at the time it submits data to NERC, a determination that GIC or magnetometer data qualify as Confidential Information.¹² Entities denied access to GIC and magnetometer data by NERC or providers denied Confidential Information treatment of GIC and magnetometer data may appeal NERC's decision to the Commission.

Chapter 2: GMD Monitoring Equipment Reporting

In the approved GMD Data Request, TOs and GOs must submit certain information related to GMD monitoring equipment (i.e., GIC monitors or magnetometers). This required information must be reported in the GMD Data System before submitting measurement data for a GMD event. Entities provide the information in this chapter when a GMD monitoring device is initially reported into the system, and then update information when changes occur. Furthermore, if a GMD monitoring device is replaced, information for the new device must be provided prior to submitting measurement data from the new device.

GIC Monitor Information

The information in [Table 2.1](#) provides NERC with the location and characteristics of the GIC monitors in use by NERC entities that are collecting GIC data. This information can be used, along with GIC data collected during GMD events and other power system information, in performing analysis of GMD impacts to the BPS. Some of this information can also be used by NERC in administering the GMD data collection program. The information in [Table 2.1](#) should be submitted to NERC through the GMD Data System.

Table 2.1: GIC Monitor Information		
Field	Description	Data Type
NERC Compliance Registry (NCR) Number (NCRID)	Code assigned to the Reporting Entity in the NCR	Alpha-numeric
GIC Device ID (GICDeviceID)	5-digit code assigned by NERC via the GMD Data Reporting System	5-digit integer
Device Manufacturer (DeviceManufacturer)	Name of GIC monitor manufacturer	Text (List) <ul style="list-style-type: none"> • AAC – American Aerospace Controls • APT – Advanced Power Technologies • CTH – CTH Controls, Inc. • EPRI – Electric Power Research Institute • FLEX – FLEX-CORE, Inc. • OS-Ohio Semitronics • WET – Weidmann Electrical Technologies • OTH - Other
Device Model No (DeviceModel)	From current transformer device nameplate	Alpha-numeric
Device Serial No (DeviceSerial)	From current transformer device nameplate	Alpha-numeric
Geographic Latitude (Latitude)	Latitude (North Hemisphere) where installed, to nearest tenth degree	3-digits, including tenths
Geographic Longitude (Longitude)	Longitude (West Hemisphere) where installed, to nearest tenth degree	4-digits, including tenths

Table 2.1: GIC Monitor Information

Field	Description	Data Type
Initial Operating Date (InitialOperatingDate)	Date after installation when the monitor began measuring GIC for data collection	date (mm/dd/yyyy)
Installation Type (InstallationType)	Separate or Combined monitor (CT and data relay)	Select 1-Separate 2-Combined
Connection (Connection)	Common neutral of 3-phase transformer, Common neutral of three (3) single-phase transformers, Neutral of single-phase transformer, Phase conductor, or N/A.	Select 1-Common neutral of a 3-phase transformer 2-Common neutral of three (3) single-phase transformers 3-Neutral of single-phase transformer 4-phase conductor 5-OTH - other
Fastest Data Sampling Rate Capable (SamplingRateCapable)	samples per second	4-digits, to the hundredths
Peak Value in Measurement Range (PeakValueRange)	Maximum GIC in amperes that the device can measure	Integer up to 4 digits
Minimum Value in Measurement Range (MinValueRange)	Minimum GIC in amperes that the device can measure (i.e., the lowest detectable limit of dc current that the device can measure flowing into or out of the equipment.)	Up to 3 digits including hundredths
Device Status (DeviceStatus)	Toggle to indicate device status. An active device is installed and can provide measurements during GMD events of interest. An inactive device is not in a status for providing measurements (e.g., has been removed or deactivated, or is no longer attached to power system equipment.) Inactive status is intended to indicate long-term conditions (i.e., routine maintenance or intermittent operability issues are not considered inactive status).	Select ID Request, Active, Inactive ID-ID Request AV-Active IV-Inactive
Status Effective Date (StatusEffectiveDate)	Date that the current status for this device became effective.	date (mm/dd/yyyy)
Confidentiality Flag (Confidential)	Indicator if any data or information in this record is determined by NERC to be Confidential. Confidentiality data fields are filled in by NERC.	Yes/No
Confidentiality Effective Date (ConfEffectiveDate)	Date on which NERC determined that data from this was determined	date (mm/dd/yyyy)

Table 2.1: GIC Monitor Information

Field	Description	Data Type
	to be confidential. Confidentiality data fields are filled in by NERC.	
Confidentiality Expiration Date (ConfExpireDate)	Date on which the data from this device will no longer be treated as confidential. Confidentiality data fields are filled in by NERC.	date (mm/dd/yyyy)

Changes to GIC Monitor Information

When information for a GIC monitor is initially entered by the reporting entity, the GMD Data System will assign a GIC Device ID (GICDeviceID field). Certain fields associated with the GIC monitor cannot be updated in the GMD Data System (i.e., changes to these certain fields require the reporting entity to change the device status field to 'Inactive' and enter a new device). When a reporting entity relocates or replaces a GIC monitor, a new GIC monitor should be entered into the system, and the previous GIC monitor device should be changed to device status of 'Inactive'.

- Geographic Latitude (Latitude)
- Geographic Longitude (Longitude)
- Serial Number

If any other data correction is needed to the above fields, contact NERC at GMD@nerc.net.

Magnetometer Information

The information in [Table 2.2](#) provides NERC with the location and characteristics of the magnetometers in use by NERC entities that are collecting geomagnetic field data. This information can be used, along with other GMD data and power system information, in performing analysis of GMD impacts to the BPS. Some of this information can also be used by NERC in administering the GMD data collection program. The information in [Table 2.2](#) should be submitted to NERC through the GMD Data System.

Table 2.2: Magnetometer Information

Field	Description	Data Type
NERC Compliance Registry (NCR) Number (NCRID)	Code assigned to the Reporting Entity in the NCR	Alpha-numeric
Magnetometer Device ID (MagnetometerDeviceID)	Five-digit code assigned by NERC via the GMD Data Reporting System	5-digit integer
Device Manufacturer (DeviceManufacturer)	Name of Magnetometer manufacturer	Text (List) <ul style="list-style-type: none"> • BI – Bartington Instruments • CPI – Computational Physics, Inc. • EPRI – Electric Power Research Institute • NASA – National Aeronautics and Space Administration • OTH - Other
Geographic Latitude (Latitude)	Latitude (North Hemisphere) where installed, to nearest tenth degree	3-digits, including tenths

Table 2.2: Magnetometer Information

Field	Description	Data Type
Geographic Longitude (Longitude)	Longitude (West Hemisphere) where installed, to nearest tenth degree	4-digits, including tenths
Initial Operating Date (InitialOperatingDate)	Date after installation when the magnetometer began B-field measurements for data collection	date (mm/dd/yyyy)
Fastest Data Sampling Rate Capable (SamplingRateCapable)	samples per second	4-digits, to the hundredths
Magnetometer Orientation (MagnetometerOrientation)	Magnetometer data is provided in either geographic or geomagnetic coordinates. Geographic orientation (i.e., referenced to geographic North and geographic East) is preferred. Refer to Figure 2.1 .	Select option for geographic or geomagnetic. 1-geographic 2-geomagnetic
Device Status (DeviceStatus)	Toggle to indicate device status. An active device is installed and can provide measurements during GMD events of interest. An inactive device is not in a status for providing measurements (e.g., has been removed or deactivated, or is no longer attached to power system equipment.) Inactive status is intended to indicate long-term conditions (i.e., routine maintenance or intermittent operability issues are not considered inactive status).	Select ID Request, Active, Inactive. ID-ID Request AV-Active IV-Inactive
Status Effective Date (StatusEffectiveDate)	Date that the current status for this device became effective.	date (mm/dd/yyyy)
Confidentiality Flag (Confidential)	Indicator if any data or information in this record is determined by NERC to be Confidential. Confidentiality data fields are filled in by NERC	Yes/No
Confidentiality Effective Date (ConfEffectiveDate)	Date on which NERC determined that data from this was determined to be confidential. Confidentiality data fields are filled in by NERC.	date (mm/dd/yyyy)
Confidentiality Expiration Date (ConfExpireDate)	Date on which the data from this device will no longer be treated as confidential. Confidentiality data fields filled are in by NERC.	date (mm/dd/yyyy)

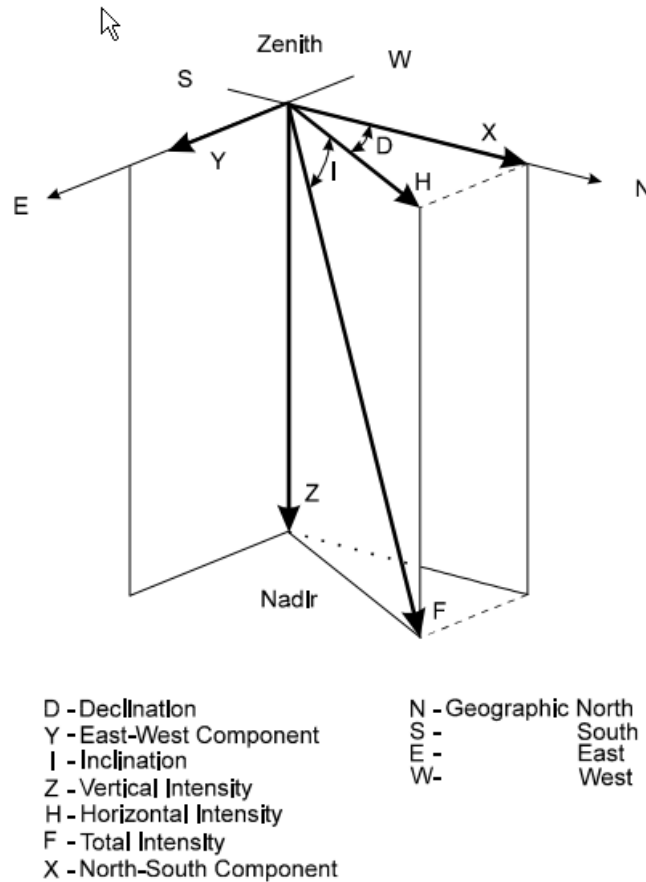


Figure 2.1: Vector Diagram of Geomagnetic Field Components

Changes to Magnetometer Information

When information for a magnetometer is initially entered by the reporting entity, the GMD Data System will assign a Magnetometer Device ID (MagnetometerDeviceID field). Certain fields associated with the magnetometer cannot be updated in the GMD data system (i.e., changes to these certain fields require the reporting entity to change the device status field to 'Inactive' and enter a new device). When a reporting entity relocates or replaces a GIC monitor, a new magnetometer should be entered into the system, and the previous magnetometer device information should be changed to status of 'Inactive'.

- Geographic Latitude (Latitude)
- Geographic Longitude (Longitude)

If any other data correction is needed to the above fields, contact NERC at GMD@nerc.net.

Chapter 3: GIC Data Reporting

NERC will collect GIC data for designated GMD events annually. NERC will designate time periods during which GMD events $K_p = 7$ or greater have occurred and request reporting entities provide data to NERC by **June 30** of each reporting year. The reporting period covers the GMD events $K_p = 7$ or greater occurring in the 12-month period [i.e., of April 1 to March 31] prior to the annual reporting date. If desired by the reporting entity, the requested data may be provided to NERC prior to the annual (June 30) deadline.

GIC Data Report

Table 3.1 describes the data fields that are collected for each GIC monitor during each designated GMD Event. Provide all GIC monitor data collected within the time period defined for each GMD event of interest. This information can be used in performing analysis of GMD impacts to the BPS. Data should be submitted to NERC in American Standard Code for Information Interchange (ASCII) text comma-separated value (CSV) files as specified throughout this chapter.

Sample Rate

Data sampling rates during GMD events of interest should be at a continuous rate between 1 sample per 10 seconds to 1 sample per second. Sample rates up to 1 sample per minute are acceptable if required by equipment limitations. For historical GMD events of interest (back to May 2013), the desired sample rate is 1 sample per 10 seconds. If this sample rate is not available to the reporting entity, provide the best data sampling rate available (resampling measurements to obtain 1 sample per 10 seconds is not desired).

Column ID	Description	Data Type
GIC Monitor Device ID (GICDeviceID)	Five-digit code assigned by NERC to this GIC monitor in the GMD Data Reporting System	5-digits
Sample Date (SampleDateTime)	Calendar date and time that the data was sampled - Universal Time Coordinates (UTC)	yyyy/mm/dd HH:MM:SS (UTC)
GIC Measured Value (GICMeasured)	Measurement of GIC to the nearest tenth Amperes (A). Positive (+) and negative (-) signs indicate direction of GIC flow. Positive reference is flow from ground into transformer neutral	4-digits, including tenths and sign (+/-)

Missing Data

If data is not available from one or more GIC monitors for all or portions of a designated GMD Event, the reporting entity shall submit a missing data report. Refer to [Chapter 5](#) for details. Examples that may lead to missing data include GIC monitor or data recording system malfunction.

Chapter 4: Magnetometer Data Reporting

NERC will collect magnetometer data for designated GMD events annually. NERC will designate time periods during which GMD events $K_p = 7$ or greater have occurred and request reporting entities provide data to NERC by **June 30** of each reporting year. The reporting period covers the GMD events $K_p = 7$ or greater occurring in the 12-month period [i.e., of April 1 to March 31] prior to the annual reporting date. If desired by the reporting entity, the requested data may be provided to NERC prior to the annual (June 30) deadline.

Geomagnetic Field Data Report

Table 4.1 describes the data fields that are collected from each magnetometer during each designated GMD Event. Provide all geomagnetic field data collected within the time period defined for each GMD event of interest. This information can be used in performing analysis of GMD impacts to the BPS. Data should be submitted to NERC in ASCII CSV files as specified throughout this chapter.

Sample Rate

Data sampling rates during GMD events of interest should be at a continuous rate between 1 sample per 10 seconds to 1 sample per second. Sample rates up to 1 sample per minute are acceptable if required by equipment limitations. For historical GMD events of interest (back to May 2013), the desired sample rate is 1 sample per 10 seconds. If this sample rate is not available to the Reporting Entity, provide the best data sampling rate available (resampling measurements to obtain 1 sample per 10 seconds is not desired).

Table 4.1: Sampled Geomagnetic Field Data Provided for Each Magnetometer for GMD Event		
Column ID	Description	Data Type
Magnetometer Device ID (MagnetometerDeviceID)	Five-digit code assigned by NERC to this magnetometer in the GMD Data Reporting System	5-digits
Sample Date (SampleDateTime)	Calendar date and time that the data was sampled - Universal Time Coordinates (UTC)	YYYY-MM-DD HH:MM:SS (UTC)
Geomagnetic (B-field) measurement – North vector (GeoBfieldMeasureNorth)	Measurement of B-field (North Vector) to the nearest hundredths nano-Tesla (nT).	Up to 7-digits, including hundredths
Geomagnetic (B-field) measurement – East vector (GeoBfieldMeasureEast)	Measurement of B-field (East Vector) to the nearest tenth nT.	Up to 7-digits, including hundredths
Geomagnetic (B-field) measurement – Vertical vector (GeoBfieldMeasureVertical)	Measurement of B-field (Vertical Vector) to the nearest tenth nT.	Up to 7-digits, including hundredths

Missing Data

If data is not available from one or more magnetometers for all or portions of a designated GMD Event, the reporting entity shall submit a missing data report. Refer to [Chapter 5](#) for details. Examples that may lead to missing data include magnetometer or data recording system malfunction.

Chapter 5: Missing Data Reporting

If data is not available from one or more data sources (i.e., a GIC monitor or magnetometer) for all or portions of a designated GMD Event, the reporting entity shall submit a missing data report. Examples that may lead to missing data include data measuring device or data recording system malfunction. **Table 5.1** describes the fields that are collected for each data source with missing data during a designated GMD event.

Short gaps in GIC or magnetometer data (up to 10 consecutive minutes) during a GMD event of interest do not require a missing data report.

Table 5.1: Missing Data Report Fields

Field	Description	Data Type
Device ID (DeviceID)	Five-digit code assigned by NERC to this data source (i.e., GIC monitor or magnetometer) in the GMD Data Reporting System	5-digits
Start Date and Time for Missing Data (StartDateTimeMissing)	Calendar date and time at the beginning of the period for which data is not available - Universal Time Coordinates (UTC). Only report missing data periods that are within a designated GMD event.	YYYY-MM-DD HH:MM:SS (UTC)
End Date and Time for Missing Data (EndDateTimeMissing)	Calendar date and time at the end of the period for which data is not available - Universal Time Coordinates (UTC). Only report missing data periods that are within a designated GMD event.	YYYY-MM-DD HH:MM:SS (UTC)
Missing Data – Reason (Reason)	Reason (category) for missing data	Select from list: 1-GIC Monitor Malfunction 2-Magnetometer malfunction 3-Data Recording Device Malfunction 4-Operator Error 5-Other (narrative required)
Missing Data – Narrative (DataNarrative)	Describe the reason for missing data	Text Field (Optional, unless Missing Data Reason = 5)

Appendix A: Definitions

Table A.1: Definition of Terms Used In These Instructions

Term	Definition
Geomagnetically-Induced Current (GIC) Monitor	A device or set of devices installed in a Bulk Electric System (BES) Facility (e.g., power transformer neutral connection or transmission line) to sense, measure, and communicate dc current flow. For example, an installation consisting of a Hall-effect DC current transducer and a GIC relay can be a GIC monitor.
Facility	A set of electrical equipment that operates as a single Bulk Electric System Element (e.g., a line, a generator, a shunt compensator, transformer, etc.). This is the definition used in the Glossary of Terms Used in NERC Reliability Standards. ¹¹
Magnetometer	A device installed to measure and communicate the direction and strength of earth's magnetic field, or changes in the direction and strength of earth's magnetic field.
Planetary K Index, K_p	Indicator used to characterize the magnitude of geomagnetic storms by quantifying disturbances in the horizontal component of the earth's magnetic field with an integer in the range of 0 to 9 [1=calm; 5 or more =geomagnetic storm]. Note, the approved GMD Data Request specifies that NERC will collect data for GMD events that are K_p 7 and greater
Sample Rate	The number of measurements in a specified time interval (e.g., 1 sample per second). Data sampling rates during GMD events of interest should be at a continuous rate of between 1 sample per 10 seconds to 1 sample per second. Sample rates up to 1 sample per minute are acceptable if required by equipment limitations.

¹¹ The Glossary of Terms Used in NERC Reliability Standards is posted here:
https://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf

Appendix B: Historical GMD Event Collection Periods

In addition to future GMD data collection, the GMD Data Request approved by the NERC Board authorizes NERC to collect GIC and magnetometer data for historical GMD events that occurred beginning in May 2013. [Table B.1](#) provides a listing of time periods for historical recorded GMD events of magnitude $K_p = 7$ and greater. TOs and GOs that have GIC data or magnetometer data for some or all of these events, or for portions thereof, are requested to provide data to NERC by **[June 30, 2021]**.

Table B.1: Historical GMD Events From May 2013 to Present for One-time Reporting

Event ID Number	K_p	Start Date	Time (UTC)	End Date	Time (UTC)
2013E01	7	2013-05-31	15:00:00	2013-06-01	15:00:00
2013E02	8	2013-10-02	00:00:00	2013-10-03	03:00:00
2015E01	8	2015-03-17	03:00:00	2015-03-18	06:00:00
2015E02	8	2015-06-22	03:00:00	2015-06-23	15:00:00
2015E03	7	2015-09-11	03:00:00	2015-09-11	18:00:00
2015E04	7	2015-09-19	18:00:00	2015-09-20	18:00:00
2015E05	7	2015-10-06	18:00:00	2015-10-09	09:00:00
2015E06	7	2015-12-20	03:00:00	2015-12-21	09:00:00
2017E01	7	2017-05-27	15:00:00	2017-05-28	15:00:00
2017E02	8	2017-09-07	21:00:00	2017-09-09	03:00:00
2017E03	7	2017-09-27	15:00:00	2017-09-29	00:00:00
2018E01	7	2018-08-25	18:00:00	2018-08-27	00:00:00

Appendix C: Example Information - GMD Monitoring Equipment

Table C.1 contains sample GIC monitor information for entry in the GMD Data System. TOs and GOs that are collecting GIC data are required to report information for each GIC monitor prior to submitting GIC event data. Reporting requirements and a description of the fields are contained in [Chapter 2](#).

Table C.1: Example GIC Monitor Information	
Field	Example Information
NCRID	NCR21412
GICDeviceID ¹²	12311
DeviceManufacturer	OS
DeviceModel	Mk-1
DeviceSerial	92
Latitude	33.7
Longitude	84.4
InitialOperatingDate	10/03/2003
InstallationType	1
Connection	3
SamplingRateCapable	10.00
PeakValue Range	500
DeviceStatus	AV
StatusEffectiveDate	10/01/2020
Confidential ¹³	No
ConfEffective_Date ¹³	N/A
ConfExpireDate ¹³	N/A

¹² ID field is assigned by the GMD data application

¹³ Confidentiality data fields filled in by NERC.

Table C.2 contains sample magnetometer information in the GMD Data System. TOs and GOs that are collecting geomagnetic field data are required to report this information for each magnetometer prior to submitting event data. Reporting requirements and a description of the fields are contained in **Chapter 2**.

Table C.2: Example Magnetometer Information	
Field	Example Information
NCRID	NCR21412
MagnetometerDeviceID ¹⁴	01118
DeviceManufacturer	CPI
Latitude	35.7
Longitude	72.4
InitialOperatingDate	10/03/2003
SamplingRateCapable	01.00
MagnetometerOrientation	1
DeviceStatus	AV
StatusEffectiveDate	10/01/2020
Confidentiality ¹⁵	No
ConfEffectiveDate ¹⁵	N/A
ConfExpireDate ¹⁵	N/A

¹⁴ ID field is assigned by the GMD data application

¹⁵ Confidentiality data fields filled in by NERC.

Appendix D: Example Data Reports

Table D.1 contains example GIC monitor data to be submitted in the GMD Data System. The example shows seven data points to illustrate reporting format. Actual GMD events are known to span hours and days, resulting in significantly more data points. Reporting requirements and a description of the fields are contained in [Chapter 3](#).

Table D.1: Example GIC Data				
Field	GICDeviceID	SampleDateTime		GICMeasured
Example Data	12311	2015-09-10	00:00:20	+1.0
	12311	2015-09-10	00:00:30	+1.1
	12311	2015-09-10	00:00:40	+1.0
	12311	2015-09-10	00:00:50	+0.0
	12311	2015-09-10	00:01:00	-1.0
	12311	2015-09-10	00:01:10	+1.0
	12311	2015-09-10	00:01:20	+1.0

Table D.2 contains example magnetometer data to be submitted in the GMD Data System. The example shows four data points to illustrate reporting format. Actual GMD events are known to span hours and days, resulting in significantly more data points. Reporting requirements and a description of the fields are contained in [Chapter 4](#).

Table D.2: Example Geomagnetic Field Data						
Field	Magnetometer DeviceID	SampleDateTime		GeoBfield MeasuredNorth	GeoBfield MeasuredEast	GeoBfield MeasuredVertical
Example Data	01118	2001-03-13	00:00:00	10800.10	-6100.28	53381.51
	01118	2001-03-13	00:00:10	10800.32	-6100.27	53381.50
	01118	2001-03-13	00:00:20	10800.11	-6100.20	53381.50
	01118	2001-03-13	00:00:30	10800.18	-6100.20	53381.56

Table D.3 contains a sample Missing Data report. A Reporting Entity submits a Missing Data report when data is not available from one or more data sources (i.e., a GIC monitor or magnetometer) for all or portions of a designated GMD Event. Reporting requirements and a description of the fields are contained in [Chapter 5](#).

Table D.3: Example Missing Data Report	
Field	Example Information
DeviceID	12311
StartDateTimeMissing	2020-11-21 11:43:00
EndDateTimeMissing	2020-11-25 21:15:00
Reason	1
DataNarrative	GIC monitor failed to measure and transmit data for the entire GMD event period.

Appendix E: Process for Entities to Request Confidential Designation in the GMD Data System

If a reporting entity reasonably believes that any information required to be submitted under these instructions is Confidential Information, the reporting entity shall submit a request for Confidential Information designation in accordance with FERC’s guidance in Order No. 830.¹⁶ Figure E.1 provides an overview of the process for reporting entities to request NERC designate their data or information as confidential in the GMD Data System. Requests for marking data or information as confidential in the GMD data system are to be submitted by reporting entities no later than April 30 (60 days prior to the annual reporting deadline). The reporting entity shall not report GMD data for which they are requesting confidential designation until after the process shown in Figure E.1 is completed.

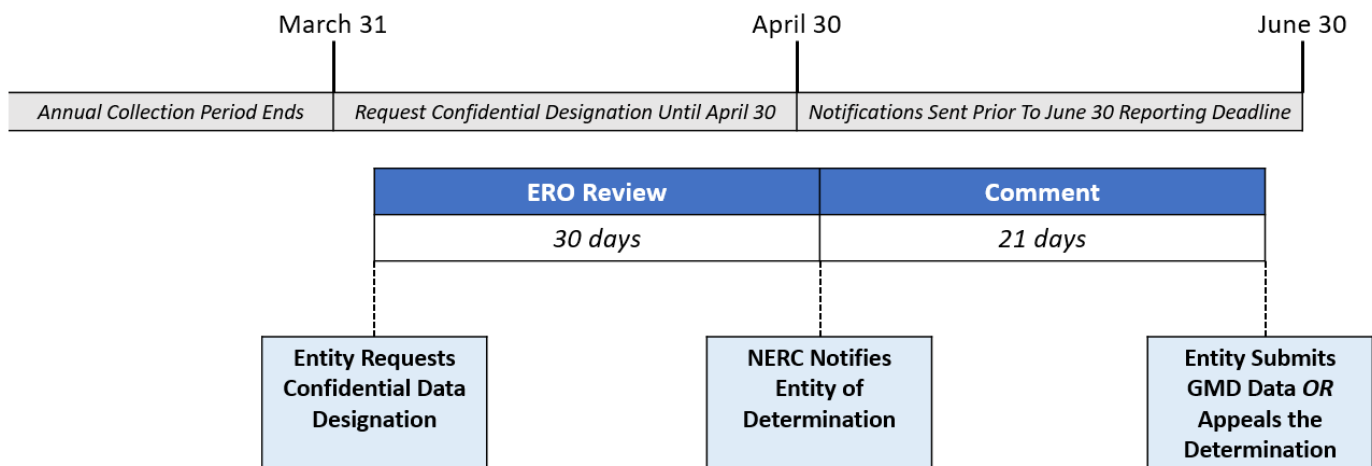


Figure E.1: Overview of Process for Reporting Entities to Request Confidential Designation for GMD Data

Format of Request

Reporting entities submit requests for designating their GMD data as Confidential Information by downloading the available form on the GMD Data System web page and emailing the completed form to gmdconfidentialrequest@nerc.net. Requests must include the following information:

1. Name of Reporting Entity
2. Reporting Entity NERC Compliance Registry ID
3. Name, title, phone number, and email address of Reporting Entity Point of Contact
4. Date of Request
5. Type of GMD Monitoring Equipment: (GIC monitor, magnetometer, or both)

¹⁶ See Order No. 830 at P 95 (internal citations omitted):

[G]iven both the lack of substantiated concerns regarding the disclosure of GIC and magnetometer data, and the compelling demonstration that access to these data will support ongoing research and analysis of GMD threats, the Commission expects NERC to make GIC and magnetometer data available. Notwithstanding our findings here, to the extent any entity seeks confidential treatment of the data it provides to NERC, the burden rests on that entity to justify the confidential treatment.¹ Exceptions are possible if the providing entity obtains from NERC, at the time it submits data to NERC, a determination that GIC or magnetometer data qualify as Confidential Information.² Entities denied access to GIC and magnetometer data by NERC or providers denied Confidential Information treatment of GIC and magnetometer data may appeal NERC’s decision to the Commission.

6. Device ID (if assigned): (List GMD Data System device ID(s), if assigned. Otherwise, N/A)
7. Narrative Justification for Confidential Designation: Provide written explanation for why the information should not be released to GMD data requestors. Include:
 - a. Data field(s) meeting Confidential Information definitions in NERC Rules of Procedure Section 1501 (See Tables 2.1, 2.2, 3.1, 4.1, and 5.1 for data fields)
 - b. Category or Categories of Confidential Information as defined in Section 1501 (e.g., Critical Energy Infrastructure Information, Confidential Business and Market Information)

Critical Energy Infrastructure Information (CEII)
 CEII means *specific engineering, vulnerability, or detailed design information about proposed or existing Critical Infrastructure that (i) relates details about the production, generation, transportation, transmission, or distribution of energy; (ii) could be useful to a person in planning an attack on Critical Infrastructure; and (iii) does not simply give the location of the Critical Infrastructure.* See NERC Rules of Procedure Section 1501.
 - c. Specific justification for why the reporting entity believes the information is Confidential Information. If the information is subject to a prohibition on public disclosure in the FERC-approved rules of a regional transmission organization or independent system operator or a similar prohibition in applicable federal, state, or provincial laws, provide supporting references and details.
8. Identify the date after which the reporting entity would no longer consider the information to qualify for Confidential Information treatment, if applicable (e.g., December 31, 2025)

NERC Determination and Response

NERC Staff will review each request to determine whether the information meets the criteria for Confidential Information specified in NERC Rules of Procedure Section 1501. NERC staff will provide a written response to the submitting entity within 30 days of receipt of the request. The written response will specify:

- Approval of the request for designating the information as ‘confidential’ along with the date that the confidential designation will expire if no further requests are received from the reporting entity;
- Rejection of the request; or
- Notification that NERC will require additional information or time to act on the request.

A reporting entity that receives a rejection of their request for confidential designation may appeal the determination to FERC or other applicable governmental authority (AGA). The reporting entity shall submit the appeal in writing within 21 days of NERC’s notification and provide a copy of the appeal to NERC.

NERC's determination regarding confidentiality shall be final within 21 days of the decision, unless the reporting entity appeals to the appropriate governmental authority. The reporting entity shall report GMD data after a final decision by NERC (or AGA) regarding the request for confidentiality.

Data Markings in GMD Data System

The GMD Data System is used to store all data; however, data that is designated as Confidential Information will be appropriately marked and can only be viewed by the submitting entity and ERO GMD Data System administrators. Other system users, including public data requestors, cannot view, download, or select data that NERC designates as Confidential Information.

Confidential Information and Data

NERC GMD Data System administrators will create an initial GMD monitoring equipment (i.e., GIC monitor or magnetometer) record in the GMD Data System, assign the device ID, and set confidentiality flag to 'Yes' indicating that the monitor and associated data are treated as confidential. NERC staff will notify the reporting entity that the confidential record is established so that data can be uploaded. Only the reporting entity and NERC Staff GMD Data System administrators can view, download, or select data for the designated device.

All Other Information and Data

Reporting entities should provide information and data for all other devices according to the instructions provided in Chapters 1-5 of this DRI.