

# Geomagnetic Disturbance Data

## Rules of Procedure Section 1600 Data Request in Response to FERC Order No. 830

### Background

On September 22, 2016, the Federal Energy Regulatory Commission (FERC) issued [Order No. 830](#) approving Reliability Standard TPL-007-1 – Transmission System Planned Performance for Geomagnetic Disturbance Events. In the Order, FERC also directed NERC, pursuant to Section 1600 of the NERC Rules of Procedure, to collect geomagnetically-induced current (GIC) monitoring 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 going forward.<sup>1</sup> Furthermore, FERC directed that NERC should make the collected GIC and magnetometer data available to support ongoing research and analysis of GMD risk.<sup>2</sup>

FERC also directed NERC to develop certain revisions to Reliability Standard TPL-007-1, including development of one or more requirements for responsible entities to obtain GIC monitoring and magnetometer data to enable model validation and situational awareness. NERC standards Project 2013-03 – Geomagnetic Disturbance Mitigation is addressing revisions to TPL-007-1 in accordance with the NERC Standard Processes Manual.<sup>3</sup>

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 (“data request”). This is a proposal for such a request.

### Authority

Under Section 215 of the Federal Power Act (16 U.S.C. § 824o), Congress entrusted FERC with the duties of approving and enforcing rules to ensure the reliability of the nation’s Bulk-Power System, and with the duties of certifying an Electric Reliability Organization (“ERO”) that would be charged with developing and enforcing mandatory Reliability Standards, subject to FERC approval. NERC was certified as the ERO on July 20, 2006. NERC’s authority for issuing this data request is derived from Section 215 of the Federal Power Act and from the following sources discussed below.

NERC is requesting information in accordance with its authority provided in 18 C.F.R. §39.2(d), which provides:

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<sup>1</sup> Order No. 830, P 89. The directive applies to only U.S. responsible entities (*See 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 Bulk-Power System.

<sup>2</sup> Order No. 830, 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 (n. 122).

<sup>3</sup> NERC filed proposed Reliability Standard TPL-007-2 with FERC on January 22, 2018. The proposed standard was developed to address the directives for revisions to TPL-007-1 contained in FERC Order No. 830.

- Each user, owner or operator of the Bulk-Power System within the United States (other than Alaska and Hawaii) shall provide the Commission, the Electric Reliability Organization and the applicable Regional Entity such information as is necessary to implement section 215 of the Federal Power Act as determined by the Commission and set out in the Rules of the Electric Reliability Organization and each applicable Regional Entity. The Electric Reliability Organization and each Regional Entity shall provide the Commission such information as is necessary to implement section 215 of the Federal Power Act.

NERC Rules of Procedure Section 1600 provides:

- **1601. Scope of a NERC or Regional Entity Request for Data or Information**
  1. Within the United States, NERC and Regional Entities may request data or information that is necessary to meet their obligations under Section 215 of the Federal Power Act, as authorized by Section 39.2(d) of the Commission's regulations, 18 C.F.R. § 39.2(d). In other jurisdictions NERC and Regional Entities may request comparable data or information, using such authority as may exist pursuant to these Rules of Procedure and as may be granted by Applicable Governmental Authorities in those other jurisdictions. The provisions of Section 1600 shall not apply to Requirements contained in any Reliability Standard to provide data or information; the Requirements in the Reliability Standards govern. The provisions of Section 1600 shall also not apply to data or information requested in connection with a compliance or enforcement action under Section 215 of the Federal Power Act, Section 400 of these Rules of Procedure, or any procedures adopted pursuant to those authorities, in which case the Rules of Procedure applicable to the production of data or information for compliance and enforcement actions shall apply.
- **1602. Procedure for Authorizing a NERC Request for Data or Information**
  2. NERC shall provide a proposed request for data or information or a proposed modification to a previously-authorized request, including the information specified in Section 1602.2.1 or 1602.2.2 as applicable, to the Commission's Office of Electric Reliability at least twenty-one (21) days prior to initially posting the request or modification for public comment. Submission of the proposed request or modification to the Office of Electric Reliability is for the information of the Commission. NERC is not required to receive any approval from the Commission prior to posting the proposed request or modification for public comment in accordance with Section 1602.2 or issuing the request or modification to Reporting Entities following approval by the Board of Trustees.
  3. NERC shall post a proposed request for data or information or a proposed modification to a previously authorized request for data or information for a forty-five (45) day public comment period.
    - 2.1. A proposed request for data or information shall contain, at a minimum, the following information: (i) a description of the data or information to be requested, how the data or information will be used, and how the availability of the data or information is necessary for NERC to meet its obligations under applicable laws and agreements; (ii) a

description of how the data or information will be collected and validated; (iii) a description of the entities (by functional class and jurisdiction) that will be required to provide the data or information (“Reporting Entities”); (iv) the schedule or due date for the data or information; (v) a description of any restrictions on disseminating the data or information (e.g., “Confidential Information,” “Critical Energy Infrastructure Information,” “aggregating” or “identity masking”); and (vi) an estimate of the relative burden imposed on the Reporting Entities to accommodate the data or information request.

- 2.2. A proposed modification to a previously authorized request for data or information shall explain (i) the nature of the modifications; (ii) an estimate of the burden imposed on the Reporting Entities to accommodate the modified data or information request, and (iii) any other items from Section 1602.2.1 that require updating as a result of the modifications.
  4. After the close of the comment period, NERC shall make such revisions to the proposed request for data or information as are appropriate in light of the comments. NERC shall submit the proposed request for data or information, as revised, along with the comments received, NERC’s evaluation of the comments and recommendations, to the Board of Trustees.
  5. In acting on the proposed request for data or information, the Board of Trustees may authorize NERC to issue it, modify it, or remand it for further consideration.
  6. NERC may make minor changes to an authorized request for data or information without Board approval. However, if a Reporting Entity objects to NERC in writing to such changes within 21 days of issuance of the modified request, such changes shall require Board approval before they are implemented.
  7. Authorization of a request for data or information shall be final unless, within thirty (30) days of the decision by the Board of Trustees, an affected party appeals the authorization under this Section 1600 to the Applicable Governmental Authority.
- **1603. Owners, Operators, and Users to Comply**

Owners, operators, and users of the Bulk Power System registered on the NERC Compliance Registry shall comply with authorized requests for data and information. In the event a Reporting Entity within the United States fails to comply with an authorized request for data or information under Section 1600, NERC may request the Commission to exercise its enforcement authority to require the Reporting Entity to comply with the request for data or information and for other appropriate enforcement action by the Commission. NERC will make any request for the Commission to enforce a request for data or information through a non-public submission to the Commission’s enforcement staff.

## Rules of Procedure Section 1600 Required Information

The following information is provided to support the data request, as required by NERC Rules of Procedure Section 1602.

### **Description of the data requested, how the data will be used, and how the availability of the data is necessary for NERC to meet its obligations under applicable laws and agreements**

NERC, pursuant to Section 1600 of the NERC Rules of Procedure, will request geomagnetically-induced current (GIC) monitor data and magnetometer data for specific time period(s) from registered entities that possess such data.<sup>4</sup> Attachment 1 contains details of the data and information requested. Data that is publicly available (e.g., from a government entity or a university) will not be collected by NERC pursuant to Section 1600 of the NERC Rules of Procedure.

The data is intended to promote greater understanding of GMD events and their potential impacts to the reliable operation of the Bulk-Power System. For example, measured GIC and magnetometer data can help validate various models used in calculating GICs and assessing their impacts in power systems. As specified in Order No. 830, NERC will make non-confidential collected GIC and magnetometer data available.

### **Description of how the data will be collected and validated**

Data will be collected by electronic submission for specific time period(s) designated by NERC. NERC entities participating in data collection programs with other organizations (e.g., EPRI SUNBURST program) could arrange for data submissions to be made on their behalf.

The request covers measured (raw) data. NERC will verify completeness of received data for the collection periods described in Attachment 1.

### **Description of entities that are requested to provide data (Reporting Entities)**

Transmission Owners and Generator Owners will be requested to indicate whether or not they have GIC data or magnetometer data for the period beginning May 1, 2013. Reporting Entities with GIC data or magnetometer data from May 1, 2013, or later will be requested to provide data for specific periods as described in Attachment 1. 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. NERC entities outside the United States may provide data specified in Attachment 1, but are not required to do so.

### **Schedule for providing data**

Data reporting is anticipated to begin in 2020. NERC will designate time periods during which historical GMD events  $K_p7$  or greater occurred between May 1, 2013 to March 31, 2020, and request reporting entities provide data contained in Attachment 1. Thereafter, NERC will designate time periods during which GMD events  $K_p7$  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  $K_p7$  or greater occurring in the 12-month period of April 1 to March 31 prior to the June 30 report

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<sup>4</sup> The data request applies to U.S. responsible entities. Responsible entities in other NERC jurisdictions, including Canada, are encouraged to participate in order to obtain relevant GMD data for the North American Bulk-Power System.

date. If desired by the Reporting Entity, the requested data may be provided to NERC prior to the annual (June 30) deadline.

The schedule for data reporting will be finalized when the data collection technology application and data reporting instructions are completed. Voluntary data collection prior to data request implementation may be used for technology application prototyping, testing, and evaluation.

### **Restrictions on disseminating data**

Consistent with FERC's determination in Order No. 830,<sup>5</sup> 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.

If a Reporting Entity reasonably believes that any information required to be submitted under this request is Confidential Information, the entity shall mark the information as Confidential Information or Critical Energy Infrastructure Information as instructed in Section 1502.1 of the NERC Rules of Procedure. In accordance with FERC's guidance in Order No. 830,<sup>6</sup> the Reporting Entity shall submit a request for Confidential Information treatment concurrent with its data submission. 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 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.

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<sup>5</sup> See Order No. 830 at PP 93-95.

<sup>6</sup> See Order No. 830 at P 95 (internal citations omitted): Given 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.<sup>¶</sup> 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.<sup>¶</sup> 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."

### **Burden to Reporting Entities**

The burden of responding to this data request will vary depending on several factors, including the number of monitoring devices, system capabilities for data retrieval, and the specific data requested (based on GMD activity during the reporting period). The selected threshold for reporting ( $K_p$ -7 GMD events or stronger) is intended to meet the objective of obtaining relevant data on GMD events with the potential to impact reliable operation of the Bulk Electric System (BES) with minimal reporting burden on Reporting Entities. GMD Events meeting the reporting threshold are expected to occur, on average, 130 days during an 11-year solar cycle.<sup>7</sup>

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<sup>7</sup> See National Oceanographic and Atmospheric Administration Space Weather Prediction Center (NOAA SWPC) Space Weather Scales, Category G3 - Strong.

## Attachment 1

NERC, pursuant to Section 1600 of the NERC Rules of Procedure, requests geomagnetically-induced current (GIC) monitor data and magnetometer data from registered entities that possess such data for the period beginning May 2013, including both data existing as of the date of the approved data request and new data going forward.

### Entity Information

The following information is requested for each NERC Registered Entity that is a Transmission Owner or Generator Owner on March 31, 2020. Entities that register as a Transmission Owner or Generator Owner after March 31, 2020 are requested to provide the following information within 90 days of registering. Reporting Entities will report changes to the information below, if any, within 90 days of completing any change. A Reporting Entity may submit a consolidated report that covers the requested information of several NERC entities if the Reporting Entity desires to do so.

- Entity Name and NERC ID
- Entity Point of Contact(s): Name, email address, and phone number
- Number of GIC monitoring devices connected to the Reporting Entity's BES Facility(ies) providing data to the Reporting Entity, if any
  - Date that the GIC monitoring devices were installed
  - If any existing GIC monitoring devices were rendered inoperable, date the functionality was lost, and date the functionality was returned to service
- For each GIC monitoring device connected to the Reporting Entity's BES Facility(ies), provide:
  - **Geographic Latitude**, in nearest whole degree and tenth of degree
  - **Geographic Longitude**, in nearest whole degree and tenth of degree
  - **A device identification number (Device ID) assigned by NERC.**
  - The **measurement range** for the GIC Monitor in Amperes (e.g., -500 A through + 500 A)
  - Sampling rate in use
  - The type of transformer associated with the GIC monitoring device (e.g., three-phase, single-phase, auto)
  - The type of **neutral connection** ("3" to indicate three-phase, "1" to indicate single-phase, or "N/A" to indicate the information is not applicable)
- Number of magnetometers owned or operated by the Reporting Entity, if any
  - Date that the magnetometer(s) were installed
  - If any existing magnetometer(s) were rendered inoperable, date the functionality was lost, and date the functionality was returned to service

- For each magnetometer, provide:
  - **Geographic Latitude**, in nearest whole degree and tenth of degree
  - **Geographic Longitude**, in nearest whole degree and tenth of degree
  - A **device ID assigned by NERC**. The identifier will permit distinguishing the magnetometer from a GIC monitor owned by the entity, if applicable.
  - Orientation of the magnetometer (i.e., sensors aligned for geographic or geomagnetic coordinates)
    - For geomagnetic orientation, provide date of alignment
  - Sampling rate in use
  - Type of instrument and manufacturer

## GIC Monitoring Device Data

Provide all GIC monitoring device data collected within the time period defined for each GMD event of interest. Data sampling rates during GMD events of interest should be at a continuous rate of between one sample per 10 seconds to one 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), provide GIC monitoring device data of one sample per 10 seconds, or at the best data sampling rate available to the reporting entity. If data is not available for whole or portions of the requested time period, identify those periods and report '**No data available**'.

- **Data fields.**
  - **Device ID.** The unique identifier described above.
  - **Date/Time stamp.** The date and time to the whole second at which the data was sampled (versus system or SCADA time), recorded in Universal Time (UTC). (YYYY-MM-DD HH:MM:SS). If sample time is not recorded, indicate '**System Time**'
  - **GIC value.** The measurement of the GIC, reported to the nearest tenth of an Amperes (A). Positive (+) and negative (-) signs indicate direction of GIC flow (Positive reference is flow from ground into transformer neutral).

## Magnetic Field Data

Provide all magnetic field data collected from the Reporting Entity's magnetometers within the time period defined for each GMD event of interest. Data sampling rates during GMD events of interest should be at a continuous rate of between one sample per 10 seconds to one sample per second (preferred).

- **Data fields.**
  - **Device ID.** The unique identifier described above.
  - **Date/Time stamp.** The date and time to the whole second at which the data was sampled (versus system or SCADA time), recorded in Universal Time (UTC). (YYYY-MM-DD HH:MM:SS)



- **Measurement values.** The measured magnetic field vector (e.g., three magnetic field components, reported to nearest tenth of nano-Tesla (nT) or higher resolution.)

## **GMD Events of Interest**

### **GMD events of interest for the period starting May 1, 2013**

A listing of periods when geomagnetic activity met or exceeded  $K_p-7$  as determined by the U.S. National Oceanic and Atmospheric Association Space Weather Prediction Center will be specified in the Data Reporting Instruction by date and time ranges.

### **GMD events of interest for annual periods (between April 1 and March 31 of the subsequent year)**

NERC will designate time periods associated with GMD events  $K_p-7$  or greater for data collection. Data collection periods will be established on a case by case basis to capture the entire GMD event including significant pre-solar storm conditions. The data collection period continues for a duration that is sufficient to collect data for the entire GMD event (e.g., data collection periods may extend beyond the time after which geomagnetic activity recedes below  $K_p-7$  thresholds to obtain relevant post-solar storm magnetic field data.<sup>8</sup>)

## **Data Format and Submission**

To be defined separately as Data Reporting Instructions (DRI).

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<sup>8</sup> NOAA SWPC issues an alert when geomagnetic activity thresholds for  $K_p-7$  are reached. NOAA SWPC forecasts, warnings, and alerts are available to the public by subscription service and from the NOAA SWPC website.

## Example Data Formats

Date	Time	Station 1 (Amps)	Station 2 (Amps)	Station 3 (Amps)	Station 4 (Amps)
2015-09-11	00:00:00	1.1	-0.2	5.1	0.0
2015-09-11	00:00:10	1.1	-0.2	5.2	0.0
2015-09-11	00:00:20	1.0	-0.2	5.1	0.0
2015-09-11	00:00:30	1.1	-0.2	5.1	0.1
2015-09-11	00:00:40	1.0	-0.2	5.2	0.0
2015-09-11	00:00:50	1.0	-0.2	5.1	0.0
2015-09-11	00:01:00	1.0	-0.2	5.1	0.0
2015-09-11	00:01:10	1.0	-0.2	5.1	0.0
2015-09-11	00:01:20	1.0	-0.1	5.3	0.0
2015-09-11	00:01:30	1.0	-0.1	5.0	0.0
2015-09-11	00:01:40	0.9	-0.6	4.9	0.0
2015-09-11	00:01:50	0.8	-0.1	4.6	0.1
2015-09-11	00:02:00	0.8	-0.3	4.6	0.0
2015-09-11	00:02:10	0.8	-0.3	4.7	0.1
2015-09-11	00:02:20	0.8	-0.2	5.0	0.0
2015-09-11	00:02:30	0.5	-0.2	5.8	0.0
2015-09-11	00:02:40	0.3	0.0	6.3	0.0
2015-09-11	00:02:50	0.5	-0.2	5.5	0.1
2015-09-11	00:03:00	0.5	-0.2	4.3	0.1
2015-09-11	00:03:10	0.4	-0.2	4.0	0.0

Figure 1: Example of GIC data

Date	Time_utc	Station	N (NT)	E (NT)	Z (NT)
2001-03-13	00:00:00.000	BOU	10800.11	-6100.23	53381.51
2001-03-13	00:00:10.000	BOU	10800.31	-6100.20	53381.51
2001-03-13	00:00:20.000	BOU	10800.11	-6100.23	53381.51
2001-03-13	00:00:30.000	BOU	10800.12	-6100.23	53381.51

Figure 2: Example of Magnetic Field Data