GUIDE | PETROLEUM LEGISLATION

Onshore petroleum reporting and data submission

A guide to geoscientific reporting and data submission of onshore petroleum exploration and production in New South Wales
Foreword

Comprehensive geoscientific records of onshore petroleum exploration and production provides a major competitive advantage to Australia. Access to reports and data on past exploration and production ensures that petroleum exploration investment does not duplicate past effort and can build on accumulated knowledge. Accordingly, the accurate recording of petroleum exploration and production is mandatory.

The Division of Resources and Energy (the division) within NSW Department of Industry is responsible for acquiring, assessing, storing and distributing this information. The department uses this geoscientific data to inform the government, resource industry and community about the state’s resources, and to facilitate safe and sustainable development of NSW mineral and energy resources for the benefit of all NSW citizens.

This guideline has been prepared according to the Petroleum (Onshore) Act 1991 (Act) and the Petroleum (Onshore) Regulation 2007 (Regulation). The Act legislates onshore petroleum exploration and production activities and as well as safety, environmental protection, royalties and compensation. The purpose of this guideline is to specify the format, contents and standards required to prepare and submit petroleum geoscientific reports and data.

Holders of the following petroleum titles are required to submit reports and data:

- Petroleum Exploration Licence (PEL)
- Petroleum Assessment Lease (PAL)
- Petroleum Production Lease (PPL)
- Petroleum Special Prospecting Authority (PSPA)

Note: this guideline does not apply to safety, environmental management and rehabilitation, or community consultation reporting.

More information on reporting, submission and archiving of petroleum geoscientific reports and data is available on the websites listed below.

Website links for further information

<table>
<thead>
<tr>
<th>Subject</th>
<th>Division of Resources and Energy website link</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DIGS® (Digital Imaging Geological System) is a digital reporting and archiving system provided by the DRE to store data and information in digital format. This allows reports and data to be searched for, viewed and printed.</td>
</tr>
<tr>
<td></td>
<td>Exploration and Environmental Online Lodgement (EROL) allows title holders to lodge reports and data online. All reports and data lodged are assessed by department geoscientists to ensure compliance with this guideline.</td>
</tr>
</tbody>
</table>
## Contacts

NSW Department of Industry  
Division of Resources and Energy  
Geological Survey of NSW  
516 High St Maitland NSW 2320  
PO Box 344 HRMC NSW 2310  

For further information on this guideline or geoscientific reporting contact:

**Geological Survey of NSW**  
Strategic Resource Assessment and Advice  
516 High St Maitland NSW 2320  
PO Box 344 HRMC NSW 2310  
**Phone:** 02 4931 6689  
**Email:** geoscience.petroleum@industry.nsw.gov.au

<table>
<thead>
<tr>
<th>Reporting/service</th>
<th>Unit/company</th>
<th>Contact details</th>
</tr>
</thead>
</table>
| Petroleum geoscientific reporting  | Strategic Resource Assessment and Advice - Geological Survey of NSW | Phone: (02) 4931 6689  
Email: geoscience.petroleum@industry.nsw.gov.au |
| Geoscience products and regional geophysical surveys | Geoscience Information – Geological Survey of NSW | Phone: (02) 4931 6717  
Email: geoscience.products@industry.nsw.gov.au |
| DIGS and EROL administration       | Geoscience Information – Geological Survey of NSW | Phone: (02) 4931 6556  
Email: digs.info@industry.nsw.gov.au |
| Londonderry Core Library           | Geoscience Information – Geological Survey of NSW | WB Clarke Geoscience Centre  
947-953 Londonderry Rd  
Londonderry NSW 2753  
Phone: (02) 4777 0322  
Email: corelibrary.admin@industry.nsw.gov.au |
| Broken Hill Core Library           | Geoscience Information – Geological Survey of NSW | E C Andrews Drillcore Facility  
42-56 Pinnacle PI  
Broken Hill NSW 2880  
Phone: (08) 8087 5143 |
| Seismic field tape/data archiving  | KDM SpectrumData                                  | KDM SpectrumData Pty Ltd  
357 Oxford St, Mount Hawthorn WA 6016  
Phone: (08) 6161 5354, Fax: (08) 9444 7570  
Email: perth.datamanagement@katalystdm.com |
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Part A: General requirements

1. Introduction

This guideline will assist the holders of petroleum titles in NSW prepare geoscientific reports and data required by the Petroleum (Onshore) Act 1991 (Act) and the Petroleum (Onshore) Regulation 2007 (Regulation).

Each report must comply with this guideline and contain all diagrams, plans, and data necessary to satisfactorily interpret and evaluate the report. Reports supplied to the department that provide incorrect or misleading information and/or do not meet all the reporting requirements will be considered unsatisfactory and returned to the author for revision. Data that is incomplete or outstanding can be submitted once received. You must indicate in your submission that there is additional data to come and when it will likely be submitted. The department takes a reasonable approach to incomplete and outstanding data.

2. Submitting reports and statistics

Table 1 provides a summary of all report types required, their due dates, mode of submission and the period of confidentiality. All reports, statistics and data must be submitted in digital form via the relevant mode of submission and in the specified structure outlined in Part B of this guideline. Accompanying data must also be submitted in the format listed under Part D of this guideline.

<table>
<thead>
<tr>
<th>Report type</th>
<th>Type of title required for</th>
<th>Reporting format</th>
<th>Due date</th>
<th>Mode of submission</th>
<th>Confidentiality period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual report – PELs and PALs (and data)</td>
<td>All PELs and PALs</td>
<td>As specified in Part B, Section 1 of guideline</td>
<td>1 calendar month after the grant anniversary date of title</td>
<td>EROL</td>
<td>Annual report remains confidential while the title is in force.</td>
</tr>
<tr>
<td>Annual report – PPLs (and data)</td>
<td>All PPLs</td>
<td>As specified in Part B, Section 2 of guideline</td>
<td>1 calendar month after the grant anniversary date of title</td>
<td>EROL</td>
<td>Any basic data submitted with the report - two years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Any interpretative data submitted with the report - five years</td>
</tr>
<tr>
<td>Annual financial year statistics</td>
<td>All petroleum titles</td>
<td>As specified in Part B, Section 3 of guideline</td>
<td>31 August each year</td>
<td>Email</td>
<td>Always confidential</td>
</tr>
<tr>
<td>Partial relinquishment report (and data)</td>
<td>All petroleum titles</td>
<td>As specified in Part B, Section 4 of guideline</td>
<td>One calendar month after notice of the part renewal or cancellation</td>
<td>EROL</td>
<td>None - Open File immediately on relinquishment or cancellation</td>
</tr>
<tr>
<td>Report type</td>
<td>Type of title required for</td>
<td>Reporting format</td>
<td>Due date</td>
<td>Mode of submission</td>
<td>Confidentiality period</td>
</tr>
<tr>
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<td>-----------------------</td>
</tr>
<tr>
<td>Final report (and data)</td>
<td>All petroleum titles</td>
<td>As specified in Part B, Section 5 of guideline</td>
<td>One calendar month after the expiry or cancellation of the title</td>
<td>EROL</td>
<td>None - Open File immediately on expiry or cancellation</td>
</tr>
<tr>
<td>Well completion report (and data) for all wells drilled including redrills</td>
<td>All petroleum titles</td>
<td>As specified in Part B, Section 6 of guideline</td>
<td>Six months after rig release date</td>
<td>EROL</td>
<td>Two years</td>
</tr>
<tr>
<td>Seismic survey report (and data)</td>
<td>All petroleum titles</td>
<td>As specified in Part B, Section 7 of guideline</td>
<td>Six months after data acquisition date</td>
<td>EROL</td>
<td>Two years</td>
</tr>
<tr>
<td>Well assessment: gas production and gas testing results</td>
<td>PALs and PPLs where they have this requirement in their licence condition and are producing</td>
<td>As specified in Part B, Section 8 of guideline</td>
<td>Within seven days after the end of each month of production</td>
<td>Email</td>
<td>While the title remains in force</td>
</tr>
<tr>
<td>Well status notification</td>
<td>All petroleum titles</td>
<td>As specified in Part B, Section 9 of guideline</td>
<td>Within seven days of any change in well status</td>
<td>Email</td>
<td>Open file immediately</td>
</tr>
<tr>
<td>Notification of discovery</td>
<td>All petroleum titles</td>
<td>As specified in Part B, Section 10 of guideline</td>
<td>Within three days of any new discovery of hydrocarbons</td>
<td>Email</td>
<td>While the title remains in force</td>
</tr>
</tbody>
</table>
3. Transitional reporting arrangements


PELs and PALs granted or renewed after the 1 July 2015 are called IMER titles and are subject to IMER licence conditions. Those titles that have not been renewed under IMER are called non-IMER titles and will continue with their current licence conditions until their next renewal.

Petroleum Production Leases (PPLs) are not covered under IMER and therefore are non-IMER titles.

IMER titles

For PELs and PALs granted or renewed after 1 July 2015, Annual Activity Reports must be submitted as per the Exploration guideline: Annual Activity reporting for prospecting titles.

Annual Activity Reports contain four components, one of which is the annual (geoscientific) report:

- Annual summary activity and expenditure table
- Annual exploration (geoscientific) report
- Annual environmental management and rehabilitation report
- Annual community consultation report.

IMER titles are also subject to a condition relating to work programs which must be prepared in accordance with the Exploration guideline: work programs for prospecting titles. This requires the submission of the updated work program annually at the same time as an Annual Activity Report, regardless of whether the work program is changing.

Reporting under an Annual Activity Report condition meets requirements of Clause 16B of the Regulation.

Non-IMER titles

PELs and PALs granted or renewed before 1 July 2015 are known as non-IMER titles.

PELs and PALs that do not have a condition relating to Annual Activity reporting must continue to report in accordance with the regulation and this guideline. Environmental management and rehabilitation reports and community consultation reports may be required in accordance with existing licence conditions.

Non-IMER titles do not have to comply with the Exploration guideline: work programs for prospecting titles and do not have to submit work programs annually.

4. Tables to accompany reports

Most reports require tables to be submitted which provide information in standard formats as described in Part C of this guideline. The most up-to-date versions of table templates are available at: www.resourcesandenergy.nsw.gov.au/miners-and-explorers/enforcement/exploration-reporting/petroleum
5. Assessment of reports and data

You can lodge your reports and data online at the Exploration and Environmental Online Lodgement (EROL) website. All reports and data lodged are assessed by department geoscientists to ensure they comply with this guideline. Reports are also assessed to monitor exploration progress, inform decisions on applications for a new title or the renewal of a title, and to ensure that the results of exploration are fully and clearly recorded for the benefit of future explorers and researchers.

Satisfactory reports are accepted and an email notification advising that the report has been assessed and accepted is sent to the email address of the EROL account through which the report was lodged. Satisfactory reports are accepted and archived to DIGS®.

Reports and data that do not meet the requirements of this guideline are deemed unsatisfactory and sent back to the person who lodged the report for amendment and resubmission. In this case, an email notification is sent to the EROL account through which the report was lodged. The notification will include details of why the report was assessed as unsatisfactory and what action is required. Reports or data that require resubmission must be resubmitted within two weeks after the notification date.

6. Technical manager

All titles must have a nominated technical manager who is responsible for supervising prospecting operations and (geoscientific) exploration reporting. The person may hold tertiary qualifications in geoscience or mining engineering, or have other qualifications or other relevant and appropriate exploration experience for the commodities sought under the title.

Reports must be verified by the technical manager that the report accurately discloses the nature, extent, timing, results and geological interpretation, and that the activity summary accurately discloses expenditure (if relevant), of the exploration conducted during the reporting period, either by a signature or by making this statement. The name and contact details of the nominated technical manager must be provided in any report.

Approval of the technical manager is given on grant or renewal. The department must be notified of any change in the technical manager within 7 working days and approval sought.

7. Extensions and exemptions from reporting

Clause 16H of the Regulation allows for authority holders to apply for an extension of the period within which a report must be lodged, or for an exemption from reporting requirements. However, extensions and exemptions are not generally granted except in cases of extreme hardship.

Applications for extensions or exemptions must be lodged 30 days before the date the report is due using the form Application for extension or exemption from reporting (ER01). Exemption from reporting requirements does not exempt the authority holder from their obligation to fulfil other conditions of authority, especially the requirements to effectively explore, assess or mine the authority area.
8. Group reporting (PPLs only)

Group geoscientific reporting is only available for contiguous PPLs where they are operated as a single project. Group geoscientific reporting of PELs, PALs or PSPAs is not accepted.

Applications for group reporting must be lodged with and approved by the department in letter format via email to geoscience.petroleum@industry.nsw.gov.au.

Group reports must provide information on what activities were conducted on each title within the group and contain a separate expenditure table for each title. If a single activity occurs across more than one title a pro-rata distribution of expenditure across those titles is acceptable.

9. Confidentiality and the release of information

Part 13 of the Act specifies the timing for release of information for reports and data. The following reports remain confidential while a title is in force:

- annual reports
- annual financial year statistics
- well assessment: gas production and gas testing results
- notification of discovery.

The release of other reports and data, relating to specific activities, depends on the type of the report and data. Basic reports and data may be made open file after two (2) years from completion of acquisition. Interpretative reports and data may be made open file after five (5) years from completion of interpretive activity.

You may choose to submit all data (basic and interpretative) in a single report. Such reporting will be subject to two year confidentiality period.

Core, cuttings and samples are considered basic data, and are subject to two (2) year confidentiality periods.

When any petroleum title is no longer in force, all reports and data related to that title will immediately become publically available, regardless of any confidentiality periods.

a) Basic reports and data

Basic data is data that is obtained at the time of an acquisition activity. Basic reports are reports on the acquisition of basic data. All contractor and/or acquisition contractor derived data and results are defined as basic data.

All basic data should be included in the relevant completion reports on activities (such as a well completion report or seismic survey report), or as appendices to the relevant annual exploration report for the title period in which the acquisition took place.

Some examples of basic data acquisition activities for which basic report and data submission is required include, but are not limited to (Table 2):
Table 2: Basic data acquisition activities

<table>
<thead>
<tr>
<th>Geoscientific (geological, geochemical and geophysical) surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geophysical surveys (airborne and ground based)</td>
</tr>
<tr>
<td>Geochemical surveys</td>
</tr>
<tr>
<td>Geological surveys</td>
</tr>
<tr>
<td>Remote sensing</td>
</tr>
<tr>
<td>Any other scientific or technical survey data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis and studies undertaken on any rock, liquid or gas samples (whether the sample was obtained by the title holder directly or indirectly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedimentological and petrological analysis</td>
</tr>
<tr>
<td>Geomechanical analysis</td>
</tr>
<tr>
<td>Palaeontology</td>
</tr>
<tr>
<td>Source rock analysis</td>
</tr>
<tr>
<td>Routine core analysis</td>
</tr>
<tr>
<td>Special core analysis</td>
</tr>
<tr>
<td>Liquid or gas analysis</td>
</tr>
<tr>
<td>Drilling, workover or testing of, or production from, an exploration, stratigraphic, appraisal, production or monitoring well</td>
</tr>
<tr>
<td>Drilling of an exploration, stratigraphic, appraisal, production or monitoring well (including re-drills)</td>
</tr>
<tr>
<td>Workover of a well (includes re-entry, repair, recompletion or stimulation of an existing well)</td>
</tr>
<tr>
<td>Well testing (includes pilot testing, pressure tests, fluid sampling, build-up tests, drawdown tests)</td>
</tr>
<tr>
<td>Production</td>
</tr>
<tr>
<td>Processing or reprocessing of any geoscientific data</td>
</tr>
<tr>
<td>Seismic processing</td>
</tr>
<tr>
<td>Seismic reprocessing</td>
</tr>
<tr>
<td>Geophysical data processing</td>
</tr>
<tr>
<td>Reprocessed data from any other scientific or technical survey</td>
</tr>
</tbody>
</table>

b) Interpretive reports and data

Interpretive reports and data include any data and conclusions drawn from that data that are considered an interpretation of acquired data.

All interpretative reports and data should be lodged separately to basic data to maintain a confidentiality period of five years, however, a company may elect to submit all data (basic and interpretative) in a single report which will be subject to two-year confidentiality period.

Interpretative reports and data should be submitted as appendices to the relevant annual exploration report for the title period in which the interpretation took place.

Examples of activities which constitute interpretation of acquired data include, but are not limited to (Table 3).

Table 3: Interpretive activities

<table>
<thead>
<tr>
<th>Interpretation of any basic data (whether obtained by the title holder directly or indirectly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well interpretation</td>
</tr>
<tr>
<td>Seismic horizon interpretation</td>
</tr>
<tr>
<td>Seismic time/depth contour maps</td>
</tr>
<tr>
<td>Potential field geophysical data interpretation</td>
</tr>
<tr>
<td>Wireline log interpretation and composite logs</td>
</tr>
<tr>
<td>Liquid or gas analysis interpretation</td>
</tr>
<tr>
<td>Any other interpretation based on basic data</td>
</tr>
</tbody>
</table>
### Conclusions drawn from any basic data (whether obtained by the title holder directly or indirectly)
- Palaeontological analysis interpretation (eg: biostratigraphic zones, and conclusions drawn from species lists and range charts)
- Source rock analysis interpretation/conclusions

### Analyses made by companies considered to be commercial-in-confidence
- Core analysis studies carried out by titleholder research units utilising proprietary techniques
- Water flood test results derived by titleholder research units utilising proprietary techniques

### Interpretive reservoir and reservoir engineering data
- Interpretation of analytical results from tests data such as formation permeability, drawdown tests and build-up tests
- Resource/reserve estimates, structure/isopach maps of reservoir units
- Results of a re-evaluation of the commercial viability of the recovery of petroleum from a petroleum lease area

### Studies which contribute to the geoscientific knowledge of an area or reservoir
- Desktop studies
- Liquid or gas studies
- Reservoir engineering studies
- In-house study results
- Regional geology studies
- Sedimentological and petrological studies
- Other studies

## 10. Cores and samples

All petroleum title holders must collect, label and preserve all cores, characteristic samples and samples of any petroleum or water discovered in any well for the life of the title (Clause 16I of the Regulation). Cores and samples must be made available for examination and/or sampling by department officers on request.

The title holder must not dispose of cores and samples without approval from the department and without first offering them to the department for archival storage. The department will make a decision whether they wish to keep the cores/samples or not. The department’s core libraries contain a selection of representative cores and samples for the benefit of explorers and other researchers.

If directed, the title holder must lodge selected cores and samples with one of the core libraries, in formats as specified in Table 5. Offers of core must be directed in writing to:

**Geological Survey of NSW**

**Strategic Resource Assessment and Advice**
516 High St, Maitland  NSW  2320
PO Box 344, HRMC  NSW  2310
Phone: 4931 6689
Email: geoscience.petroleum@industry.nsw.gov.au
Part B: Structure of reports

1. Annual reports - PELs and PALs

Annual reports for PELs and PALs should present the technical results and interpretation of exploration and assessment activities conducted during the reporting period.

Annual reports for PELs and PALs must contain:

- **Title page (1 page)**
  - report type
  - title number
  - title holder
  - project operator (if applicable)
  - project name and location (if applicable)
  - the reporting period
  - date of report
  - author(s) including contact details
  - name, contact details and verification signature of the nominated technical manager.

- **Executive summary or abstract (maximum 1 page)**
  - a summary of all exploration activities conducted during the reporting period.

- **Background (recommended maximum 2 pages of text)**
  - location and access
  - geology
  - literature review (if applicable)
  - exploration rationale (the petroleum targets, prospectivity and reasons for considering the area prospective).

- **Exploration completed in reporting period**
  - a detailed description of exploration activities carried out within the reporting period only, including full details and results of all studies, surveys, sampling or drilling programs, or other operations conducted
  - a scaled diagram/map showing the locations of exploration activities undertaken during the reporting period. The scaled diagram/map should also include the title boundary, towns and major infrastructure (e.g. railways, highways, roads)
  - a results/discussion section which should include plans, sections and data generated to illustrate the exploration results, any interpretation of results and significance of results, geological models, conclusion reached and recommendations.
  - Where there have been external studies, such as university thesis, or where research papers have been prepared for publication, the main conclusions of those works should be briefly summarised and a reference to the full work provided.

- **Tables to accompany report**
  - a completed Reserve and Resources Table (if applicable)
  - a completed Gas testing and Gas Production Table (if applicable)
  - a completed Gas Compositions Table (if applicable).

- **Data**
  - a summary of data being submitted with this report
  - a summary of any data which is not being submitted, reasons why, and when and how the data will be submitted i.e. LaFiX.
  - completed tables should be submitted as XLS files in a zipped folder as well as in the PDF report.
Proposed exploration in next reporting period (non-IMER titles only)
- a description of the proposed exploration activities within the next reporting period only
- a standard scaled diagram/map showing the locations of proposed exploration activities. The scaled diagram/map should also include the title boundary, towns and major infrastructure (e.g. railways, highways, roads).

G. Other operations and activities (if applicable)
Reports and data must also be included in the annual report for any activities undertaken during the reporting period which constitute the acquisition, interpretation or assessment of geoscientific data. Examples of types of activities are included in Part A Section 9 (Table 2 and Table 3). Data requirements are specified in Table 5 to Table 9.

Specific reporting requirements for the completion of certain activities are detailed below.

i. Geophysical survey (excluding seismic) (if applicable)
In addition to required data (as specified in Table 9), reports on geophysical surveys undertaken within the reporting period should include the following as a minimum:
- regional geology
- methodology - parameters details
- interpretation - brief summary on interpretation such as whether the data is of a quality to allow interpretation of stratigraphy and or structures of interest, etc
- appendices - general information - contractor, survey coverage and duration
- operations - positioning, equipment, calibrations, testing, permitting
- processing sequence
- statistics and personnel
- enclosures - location, data display, interpretation maps, etc
- data.

ii. Seismic survey reprocessing (if applicable)
In addition to required data (as specified in Table 8), reports on seismic reprocessing undertaken within the reporting period should include the following as a minimum:
- summary of processed lines
- acquisition parameters
- scaled diagram/map showing location of reprocessed lines
- data quality
- processing sequence
- images of processed seismic lines.

iii. Seismic interpretation (if applicable)
Reports on seismic interpretation undertaken within the reporting period should include the following as a minimum:
- results of seismic section interpretation and mapping based on such interpretation
- all other information that falls into interpretative data category
- seismic horizons/projects
- project submissions of horizons and faults as ASCII files (XYZ).

iv. Geophysical data interpretation (excluding seismic) (if applicable)
Reports on the interpretation of acquired or reprocessed geophysical data (other than seismic survey) should include the following as a minimum:
- results of geophysical data interpretation
- any mapping based on such interpretation
- all other information that falls into the interpretative data category.

v. Workover of a well (if applicable)
Reports on the workover of any well should include the following as a minimum:

- details of the well(s) involved (well name/s and location/s as a minimum)
- details of the work or tests undertaken
- formation(s) (geological unit/s) in which the activity took place (if applicable)
- justification/rationale for activity
- results/discussion
- current well status at completion of activity
- any data collected.

* Note – A workover that results in the deepening of a well should be treated as the drilling of a well, and a well completion report is required.

vi. Production from or testing of a well

Reports on the production from or testing of any well should include the following as a minimum:

- details of the well(s) involved (well name/s and location/s as a minimum)
- date of production or pilot production testing period
- formation(s) (geological unit/s) in which the activity took place (if applicable)
- justification/rationale for activity
- volumes, or estimates of the volumes, of gas, oil and water produced from the testing
- density of any oil produced from testing, measured using the American Petroleum Institute’s (API) scale of measuring the specific gravity of oil, commonly known as the ‘API gravity’ of the oil
- pressure in the well, measured during the period, at which petroleum cannot escape from the wellhead for the well, commonly known as the ‘shut-in pressure’ of the well
- detail any workover or stimulation of wells undertaken for pilot production testing
- type of perforations in the well (if applicable)
- depth in metres of the top and bottom of perforated intervals (if applicable)
- choke size used for the well
- methodology of data recording and any corrections applied to the data
- brief summary of data quality such as whether the data is of a quality to allow resource estimation, production estimates, reservoir engineering for production etc.
- detail any workover, shut-in or completion activities on wells after the completion of pilot production testing program
- status of each well tested post pilot production testing program
- detailed summary of pilot production results, including conclusions reached regarding the geology of the area and the resource potential or lack of potential. Where resource potential is considered to be low, reasons for determining this must be included. In addition, where further work may increase the resource potential recommendations for future work should be included
- any data collected.
2. Annual reports - PPLs

Annual reports - PPLs should present the technical results and interpretation of production, exploration and associated activities during the reporting period.

Annual reports - PPLs must contain:

Title page (1 page)
- report type
- title number
- title holder
- project operator (if applicable)
- project name and location (if applicable)
- the reporting period
- date of report
- author(s) including contact details
- name, contact details and verification signature of the nominated technical manager.

Executive summary or abstract (maximum 1 page)
- a summary of all exploration and/or production activities conducted during the reporting period.

Background (recommended maximum 2 pages of text)
- location and access
- geology
- literature review (if applicable)
- extraction or exploration rationale (the petroleum targets, prospectivity and reasons for considering the area prospective).

Production/exploration/activities completed in the reporting period
- a description of production/exploration/activities undertaken during the reporting period
- a scaled diagram/map showing the location of activities undertaken during the reporting period
- a description of any assessment activities carried out during the reporting period
- a summary of geological findings - should include the main results of activities conducted (if any), such as geological and structural mapping and petrological and mineralogical studies
- where there have been external studies, such as university thesis, or where research papers have been prepared for publication, the main conclusions of those works should be briefly summarised and a reference to the full work provided.

Tables to accompany report
- a completed Expenditure and Statistics Table (expenditure is still required for PPLs)
- a completed Reserve and Resources Table
- a completed Gas Testing and Gas Production Table
- a completed Gas Compositions Table.

Data
- a summary of data being submitted with this report
- a summary of any data which is not being submitted, reasons why, and when and how the data will be submitted i.e. LaFiX
- completed tables should be submitted as XLS files in a zipped folder as well as in the PDF report.

Proposed production/exploration/activities in next reporting period
- a brief description of proposed production/exploration/activities in the next reporting period
• a standard scaled diagram/map showing the locations of proposed activities.

Other operations and activities (if applicable)
Reports and data must also be included in the annual report for any activities undertaken during the reporting period which constitute the acquisition, interpretation or assessment of geoscientific data. Examples of types of activities are included in Part A Section 9 (Table 2 and Table 3). Data requirements are specified in Table 5 to Table 9.

Specific reporting requirements for the completion of certain activities are detailed below.

i. Geophysical survey (excluding seismic) (if applicable)
In addition to required data (as specified in Table 9), reports on geophysical surveys undertaken within the reporting period should include the following as a minimum:
• regional geology
• methodology - parameters details
• interpretation - brief summary on interpretation such as whether the data is of a quality to allow interpretation of stratigraphy and or structures of interest etc.
• appendices - general information - contractor, survey coverage and duration
• operations - positioning, equipment, calibrations, testing, permitting
• processing sequence
• statistics and personnel
• enclosures - location, data display, interpretation maps etc.
• data.

ii. Seismic survey reprocessing (if applicable)
In addition to required data (as specified in Table 8), reports on seismic reprocessing undertaken within the reporting period should include the following as a minimum:
• summary of processed lines
• acquisition parameters
• scaled diagram/map showing location of reprocessed lines
• data quality
• processing sequence
• images of processed seismic lines.

iii. Seismic interpretation (if applicable)
Reports on seismic interpretation undertaken within the reporting period should include the following as a minimum:
• results of seismic section interpretation and mapping based on such interpretation
• all other information that falls into interpretative data category
• seismic horizons/projects
• project submissions of horizons and faults as ASCII files (XYZ).

iv. Geophysical data interpretation (excluding seismic) (if applicable)
Reports on the interpretation of acquired or reprocessed geophysical data (other than seismic survey) should include the following as a minimum:
• results of geophysical data interpretation
• any mapping based on such interpretation
• all other information that falls into the interpretative data category.

v. Workover of a well (if applicable)
Reports on the workover of any well should include the following as a minimum:
• details of the well/s involved (well name/s and location/s as a minimum)
• details of the work or tests undertaken
• formation/s (geological unit/s) in which the activity took place (if applicable)
• justification/rationale for activity
• results/discussion
• current well status at completion of activity
• any data collected.
* Note: A workover that results in the deepening of a well should be treated as the drilling of a well, and a well completion report is required.

vi. Production from or testing of a well
Reports on the production from or testing of any well should include the following as a minimum:
• details of the well/s involved (well name/s and location/s as a minimum)
• date of production or pilot production testing period
• formation/s (geological unit/s) in which the activity took place (if applicable)
• justification/rationale for activity
• volumes, or estimates of the volumes, of gas, oil and water produced from the testing
• density of any oil produced from testing, measured using the American Petroleum Institute’s (API) scale of measuring the specific gravity of oil, commonly known as the ‘API gravity’ of the oil
• pressure in the well, measured during the period, at which petroleum cannot escape from the wellhead for the well, commonly known as the ‘shut-in pressure’ of the well.
• detail any workover or stimulation of wells undertaken for pilot production testing
• type of perforations in the well (if applicable)
• depth in metres of the top and bottom of perforated intervals (if applicable)
• choke size used for the well
• methodology of data recording and any corrections applied to the data
• brief summary of data quality such as whether the data is of a quality to allow resource estimation, production estimates, reservoir engineering for production etc.
• detail any workover, shut-in or completion activities on wells after the completion of pilot production testing program
• status of each well tested post pilot production testing program
• detailed summary of pilot production results, including conclusions reached regarding the geology of the area and the resource potential or lack of potential. Where resource potential is considered to be low, reasons for determining this must be included. In addition, where further work may increase the resource potential recommendations for future work should be included
• any data collected.
3. Annual financial year statistics

Annual financial year statistics must be submitted by 31 August each year. The annual collection of this petroleum exploration and production data in NSW enables accurate reporting by the department about the level of exploration investment and petroleum production occurring in the state.

Statistics are to be submitted using the Expenditure and statistics table template.

Where activities and expenditure apply to more than one title, please apportion amounts to each title (using a separate form for each title). Where exploration in a title covers both conventional and unconventional targets, separate submissions are requested for each target.

Completed statistics will be treated as confidential.

Templates and forms for petroleum title holders are available on the department’s website:

4. Partial relinquishment reports

Partial relinquishment reports are required when a title is reduced in area. These reports describe all of the exploration work conducted on the part of the title being relinquished.

Partial relinquishment reports are made open file immediately and therefore must contain all the relevant information that was previously contained in annual reports in addition to a discussion about the results and their significance.

Partial relinquishment reports must contain:

- **Title page (1 page)**
  - report type
  - title type and number
  - title holder
  - grant date
  - partial relinquishment date
  - area relinquished (blocks and % of title)
  - project operator (if applicable)
  - project name and location (if applicable)
  - date of report
  - author(s) including contact details
  - name, contact details and verification signature of the nominated technical manager.

- **Executive summary or abstract (maximum 1 page)**
  - a summary of all exploration, assessment and production activities carried out during the full term (since grant) of the area being relinquished
  - the reason(s) for relinquishment.

- **Background (recommended maximum 2 pages of text)**
  - location and access
  - geology
  - title history and previous exploration
  - exploration rationale (the petroleum targets, prospectivity and reasons for considering the area prospective).

- **Exploration/assessment completed**
  - a description of all exploration activities carried out on the area being relinquished since the grant of the title
  - a scaled diagram/map showing the locations of all activities carried out in the relinquished area

- **Results and discussion**
  - plans, maps, diagrams and sections that illustrate the geology including shows, occurrences, resources and reserves where applicable
  - a discussion of the exploration results and their significance in the relinquished area, including potential petroleum plays, identified shows or occurrences, recommendations for further exploration or development, reasons for considering the area prospective/un-prospective, and reasons for relinquishment of the area
  - details of hydrogeological studies and water monitoring bores
  - where there have been external studies, such as university thesis or where research papers have been prepared for publication, the main conclusions of those works should be briefly summarised and a reference to the full work provided.

- **Tables to accompany report**
Onshore petroleum reporting and data submission

- a completed Reserve and Resources Table (if applicable)
- a completed Gas Testing and Gas Production Table (if applicable)
- a completed Gas Compositions Table (if applicable).

**Additional requirements for partial relinquishment of PALs, PSPAs and PPLs (if applicable)**
- details of economic modelling and feasibility studies carried out
- details of marketing studies carried out
- details of any other assessment activities carried out
- production statistics for the area being relinquished
- a statement of any reserves/resources remaining in place
- an assessment of any future production potential
- a description of completed production activities.

**Conclusions and recommendations**
This section must provide conclusions reached regarding the geology of the area and any identified resources, shows or occurrences and implications for future exploration.
5. Final reports

Final reports are the last reports for a title and are submitted after the title is no longer in force. They must provide a summary of all exploration undertaken, a synthesis of the results and a discussion about the results and their significance.

Final reports must contain:

   **Title page (1 page)**
   - report type
   - title number
   - title grant data
   - title holder
   - project operator (if applicable)
   - project name and location (if applicable)
   - date of the report
   - author(s) including contact details
   - name, contact details and verification signature of the nominated technical manager.

   **Executive summary or abstract (maximum 1 page)**
   - a summary of all exploration, assessment and mining activities conducted during the full term (since the grant) of the title
   - the significance of the results.

   **Background (recommended maximum 2 pages of text)**
   - location and access
   - geology
   - title history
   - exploration rationale (the petroleum targets, prospectivity and reasons for considering the area prospective).

   **Exploration completed**
   - a summary of all exploration completed from the grant of the title
   - a detailed description of any exploration activities carried out during the last year of the title
   - a scaled diagram/map showing the locations of all exploration activities undertaken from the grant of the title. The scaled diagram/map should also include the title boundary, towns and major infrastructure (e.g. railways, highways, roads).
   - an inventory of all core and samples collected and their storage locations.

   **Results and discussion**
   - plans, maps, diagrams and sections that illustrate the geology including shows, occurrences, resources and reserves where applicable
   - a discussion of the exploration results and their significance, including potential petroleum plays, identified shows or occurrences, recommendations for further exploration or development, reasons for considering the area prospective/un-prospective, and reasons for relinquishment of the title
   - details of hydrogeological studies and water monitoring bores
   - where there have been external studies, such as University thesis or where research papers have been prepared for publication, the main conclusions of those works should be briefly summarised and a reference to the full work provided.

   **Tables to accompany report**
   - a completed Reserve and Resources Table (if applicable)
   - a completed Gas Testing and Gas Production Table (if applicable)
Onshore petroleum reporting and data submission

• a completed Expenditure and Statistics Table – This expenditure data will be for the final annual reporting year only.
• a completed Gas Compositions Table (if applicable).

Additional requirements for PALs (if applicable)
• details of economic modelling and feasibility studies carried out
• details of marketing studies carried out
• details of any other assessment activities carried out.

Additional requirements for PPLs (if applicable)
• a statement of any unmined reserves/resources
• an assessment of any future production potential
• a description of completed production activities.

Conclusion
This section must provide conclusions reached regarding the geology of the area and any identified resources, shows or occurrences and implications for future exploration.
6. Well completion reports

The body of the well completion report is a summary and/or compilation of the data, and the actual raw data is included as appendices. Well data must be submitted in the formats as specified in Table 5.

Analyses that require longer periods of time to finalise (more than 6 months after the completion of the well) must be submitted immediately after relevant reports and data are available via EROL.

Well completion reports must contain:

**Title page (1 page)**
- report type
- title number
- title holder
- project operator (if applicable)
- project name and location
- date of well completion and rig release
- date of report
- author(s) including contact details
- name, contact details and verification signature of the nominated technical manager.

**Table of contents**
- including tables, figures and/or plates, appendices, enclosures, attachments, additional volumes, digital data etc.

**Executive summary or abstract (maximum 1 page)**
- a summary of the activity conducted including reason for activity conducted and new geological concepts and plays discovered.

**Background (recommended maximum 2 pages of text)**
- location and access
- a standard scaled diagram/map showing the location of the activity. The scaled diagram/map should also include the title boundary, towns and major infrastructure (e.g. railways, highways, roads)
- title history and previous exploration
- literature review (if applicable)
- exploration rationale (the petroleum targets, prospectivity and reasons for considering the area prospective).

**Expenditure table for activity**
- refer to summary template available on website for the activity being conducted. This should be inserted in the PDF report as well as attached separately as XLS (zipped) file.

**Well data summary table**
- refer to Well Data Summary Table template available on website.

**Well history**
- an ASCII Format file of Well Path for input into ARCGIS should be supplied for all drilling (a shape file if available). It should include XYZ coordinates, azimuth and dip. For horizontal/deviated wells coordinates of azimuth and dip changes and end point coordinates must be included (XYZ coordinates)
- well location plotted on a satellite image in a scale allowing visual verification of the location in relation to features visible on image such as buildings, fence line, water bodies
- drilling plan (drilling contractor; drilling rig details; blow out preventers etc)
- drilling data (hole size and depth; casing details; drilling fluids; fishing operations, etc)
- mud data (chemicals, additives used, ASCII file)
Onshore petroleum reporting and data submission

- formation sampling (cuttings, coring and sidewall cores; drill stem tests; gas detector; etc)
- logging and surveys (geological logging, mud logging, coring, wireline logging; velocity surveys, temperature surveys etc)
- testing (other tests)
- cementing - full details including plugs and depths
- plug and abandonment or suspension.

Geology
- regional geology/geological setting
- stratigraphy (regional and penetrated) submitted as an ASCII file
- structure
- palaeontological results
- source rock data
- porosity, permeability and formation testing data
- temperature data (including temperature, depth, time since circulation and circulation time)
- hydrocarbon shows.

Data
- a summary of data being submitted with this report
- a summary of any data which is not being submitted, reasons why, and when and how the data will be submitted i.e. LaFiX.

Results and conclusions
- a section including plans, sections and data generated to illustrate the exploration results, significance of results, geological models, resource/reserve estimates and anything else that may be relevant
- detailed summary of exploration and/or production results, including conclusions reached regarding the geology of the area and the resource potential or lack of potential. Where resource potential is considered to be low reasons for determining this must be included. In addition, where further exploration work may increase the resource potential recommendations for future exploration should be included.

References

Appendices
- location plan and surveyors notes – must contain a figure at an appropriate scale
- composite well log
- drillers logs
- lithology log
- graphic log (strip log)
- core, sidewall core and cutting descriptions
- core/cuttings photos
- core analysis data
- palaeontology and palynology reports
- petrological reports
- perforation logs
- fracture stimulation report and data (must include details of chemical additives and monitoring plan on possible aquifer contamination)
- borehole deviation plots, verticality Logs
- wireline geophysical data (LAS) and borehole scanning data, including digital data and images of wireline logs
- velocity survey
- vertical seismic profiling (VSP)
- DST, RFT, FIT – includes ASCII data, recorded charts and pressure recording
- gas desorption results and gas analysis
• mud log
• detailed well schematic (including completion details).
7. Seismic survey reports

The body of the seismic survey report is a summary and/or compilation of the data and the actual raw data is included as appendices. Seismic data must be submitted in the formats as specified in Table 6 and Table 7.

Seismic survey reports must contain:

**Title page (1 page)**
- report type
- title number
- title holder
- project operator (if applicable)
- project name and location (if applicable)
- dates of seismic survey
- date of report
- author(s) including contact details
- name, contact details and verification signature of the nominated technical manager.

**Table of contents**
- including tables, figures and/or plates, appendices, enclosures, attachments, additional volumes, digital data etc.

**Executive summary or abstract (maximum 1 page)**

**Introduction**
- summary of location, operator, parameters, line listing and length, etc.

**Geology**
- brief history of exploration including previous seismic, gravity, magnetic and radiometric surveys, wells drilled or any information that was considered before start of the survey.

**Objectives of the survey**

**Acquisition and processing**
- brief summary of the acquisition and processing. Details to be provided in appendices.

**Data quality**
- brief summary of data quality such as whether the data is of a quality to allow interpretation of stratigraphy and or structures of interest etc. Actual interpretation of the seismic data should be reported separately, not within this report.

**Results and conclusions**
- a section including plans, sections and data generated to illustrate the results, significance of results, geological models, resource/reserve estimates and anything else that may be relevant.
- detailed summary of exploration and/or production results, including conclusions reached regarding the geology of the area and the resource potential or lack of potential. Where resource potential is considered to be low reasons for determining this must be included. In addition, where further exploration work may increase the resource potential recommendations for future exploration should be included.

**References**
Appendices

- contractor - report coverage, location and duration of survey
- acquisition:
  - positioning (survey report, system, equipment, mapping)
  - data acquisition report (recording system, equipment, layout, energy source, instrument and noise tests, recording parameters, up hole tests, other surveys undertaken)
  - observer’s log
  - surveyor’s report
  - navigation data
  - QC field operations report
- processing report
- data quality report
- list of key personnel and list of field tapes and shotpoint numbers
- enclosures
  - shotpoint location maps
  - energy source array and spread arrangement figures
  - processing flow charts
  - images of processed seismic.

At the completion of the seismic work, a complete LEGIBLE set of observers logs, uphole records, surveyors notes, ASCII file of shot point location data, must be supplied together with a complete set of field tapes, stacked tapes, final stacks and migrated stacked sections in SEGY format. Field data should be submitted directly to SpectrumData (see seismic field and stack tapes).
8. Well assessment: gas production and gas testing results

Some petroleum titles have a licence condition regarding Well Assessment which requires the submission of gas flow rates for each well connected to a gas gathering system and the total gas flow into the treatment facility.

This data must be submitted within seven days after the end of each month using the Gas Testing and Gas Production Table template available at:


The table must be submitted via email to geoscience.petroleum@industry.nsw.gov.au

Well status notification

If there is any change in the status of a well, the department must be notified within seven days.

You must submit this notification via email to geoscience.petroleum@industry.nsw.gov.au using only the approved definitions provided in Table 4 below.

Table 4: Well status definitions

<table>
<thead>
<tr>
<th>Well status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under construction</td>
<td>Yet to be completed well</td>
</tr>
<tr>
<td>Active</td>
<td>Constructed well with activity taking place (e.g. Work over, pumping, production etc). Please specify the activity taking place within the notification</td>
</tr>
<tr>
<td>Shut in</td>
<td>A constructed well with surface valves closed to stop it flowing. The well may be under pressure and may flow gas and/or fluids if valves were opened</td>
</tr>
<tr>
<td>Suspended</td>
<td>A constructed well that is not capable of flowing gas and/or fluids to the surface through the installation of at least 2 barriers (e.g. a pressure tested mechanical device and a full column of fluid) or a well that has temporarily discontinued operations</td>
</tr>
<tr>
<td>Plugged and decommissioned</td>
<td>A well that is fitted with cement and/or mechanical plugs that effectively seal the well from open petroleum bearing formations, potential leak points, freshwater aquifers and the surface, and decommissioned (removed from service) after cessation of function. The well is closed permanently</td>
</tr>
</tbody>
</table>
9. Notification of discovery

Section 27 of the Act requires that if there is any new discovery of hydrocarbons within a petroleum title, the department must be notified within 3 days.

This notification must be submitted in letter or report format via email to geoscience.petrolem@industry.nsw.gov.au.

The notification should include the following as a minimum:

- title type and number
- title holder
- project operator (if applicable)
- project name and location (if applicable)
- date of discovery
- date of notification
- author(s) including contact details
- details of the discovery, including but not limited to:
  - location of the discovery (eg: well name and coordinates)
  - formation (geological unit) in which the discovery was made (if known)
  - measurement of quantity or rate of production of hydrocarbon and water from the well (if known)
  - physical and chemical properties of the hydrocarbon (if assessed)
  - preliminary estimation of quantities of hydrocarbon discovered (if assessed)
  - plans for the analysis and measurement of the hydrocarbon
  - plans for the well in which the discovery was made
  - plans for further testing of the region/geological unit in which the discovery was made.
Part C: Tables to accompany reports

Most reports require tables which provide information in standard formats that can be easily extracted for use by the department.

All tables must be in PDF format and inserted into the report, as well as XLS format and zipped as an attachment to the report in EROL.

Tables required are:

- Expenditure and Statistics Table
- Gas Compositions Table
- Gas Testing and Gas Production Table
- Reserves and Resources Table
- Well Data Summary Table

Templates can be found at:
Part D: Submitting digital data

1. Online lodgement

a) Digital Imaging Geological System – DIGS®

DIGS® is an online archive that holds reports, publications and other important documentary material held by the department.

The department requires the submission of data in digital format. This allows the department to provide useful non-confidential data to industry, either via data packages or directly from DIGS®.

Digital data provided to the department will be held in the DIGS® system in its native format. Native formats as defined by DIGS® are: PDF, ASCII (TXT, DAT, LAS, CSV), JPG, TIFF and ZIP.

b) Exploration and Environmental Reports Online Lodgement – EROL

Exploration and Environmental Reports Online Lodgement (EROL) allows titleholders to lodge reports online for verification by the department. A satisfactory report lodged in EROL is submitted electronically to DIGS®.

For more information on how to submit petroleum reports (including instructions for applying for a user account) using EROL, refer to the department website:


The maximum limit of a single digital file attached to a report is 32 MB. Each report can have up to 200 digital files of up to 32 MB each attached.

For help with using EROL call (02) 4931 6556 or email digs.info@industry.nsw.gov.au.

c) Large File Exchange Service - LaFix

the department’s Large File Exchange Service (LaFix) is used where data needs to be submitted that exceeds 32 MB (for a single file) or where there are more than 200 files to attach to a report.


This data is to be submitted in addition to a report submitted via EROL. Data to be added to an existing report can be submitted via LaFix.

2. File formats for digital data submission

The primary format for the submission of digital reports is Adobe Acrobat PDF format. All textural documents, most figures, plans etc and small amounts of tabular data should be supplied in PDF format. Documents that cannot be supplied (or it would be inappropriate to be supplied) in PDF format should be supplied in the formats set out in sections (a) to (k) below.

All files must be virus free and not have any form of password or other security protection.
a) **Reports**

Reports must be provided as PDF documents. This includes the title page, summary, list of contents, references, and any figures and tables that are interleaved with the text, appendices and plans. Reports must contain the sections headings outlined in Part B of this Guideline.

When using PDF format, the report text (including tables of contents, abstract etc) and any figures, plans etc that form part of the body of the report should be compiled as a single PDF file. Each appendix to the report should be a single separate PDF file where possible. However, if creating one PDF file would create an excessively large PDF file (>32 MB), the report should be split into a small number of logically named PDF files.

b) **Images**

All graphics should be provided in PDF, JPEG or JPG or TIFF or TIF format. They must be readable, of good print quality, and the colour and spatial data of the original plan or image should be maintained. Resolution should be generally 300 dpi or better.

Most small to medium size graphics can be accommodated in PDF. These may be included in the main report PDF file, particularly if they are interleaved with the text.

For larger plans, or where PDF is not considered appropriate, JPEG and TIFF may be used. File names should be logical (e.g. Figure1.tif, Appendix1_Figure1a.jpg).

c) **Tables**

All tables must be included in the relevant report in PDF format, as well as provided as Microsoft Excel files in the ‘XLS’ format. ‘XLS’ format files must be zipped and submitted as an attachment to the report lodged via EROL (EROL will not allow the submission of ‘XLS’ format files unless they are within a zipped folder). Further details about the type of tables are provided in Part C.

d) **Tabular data**

Tabular data should be supplied in fixed width, space delimited ASCII format (if the data is a small table in the body of a report it may be provided as part of the relevant PDF file). Acceptable ASCII formats are: TXT, DAT, LAS, CSV.

Files should have names that indicate which part of the report they are and/or what they contain. The files should also include a header with column headings, units, and explanations of abbreviations etc (or a separate file containing such information).

Example of fixed width, space delimited ASCII format:

<table>
<thead>
<tr>
<th>Line</th>
<th>Shot</th>
<th>Elev.</th>
<th>Longitude</th>
<th>Latitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMR98-02</td>
<td>100</td>
<td>345.67</td>
<td>149.4523567</td>
<td>-30.4512634</td>
</tr>
<tr>
<td>DMR98-02</td>
<td>110</td>
<td>346.23</td>
<td>149.4654456</td>
<td>-30.4545675</td>
</tr>
<tr>
<td>DMR98-02</td>
<td>120</td>
<td>345.13</td>
<td>149.4724465</td>
<td>-30.4612459</td>
</tr>
<tr>
<td>DMR98-02</td>
<td>130</td>
<td>344.67</td>
<td>149.4756397</td>
<td>-30.4656346</td>
</tr>
</tbody>
</table>
e) Lithology logs (English logs)

Textural lithological descriptions should be supplied as PDF or ASCII (if in a table form they should be fixed width, space delimited) format. Acceptable ASCII formats are: TXT, DAT, LAS, CSV. Each well/borehole should be a separate file.

f) Geophysical logs (Wireline)

Digital logs files must be supplied in LAS version 2.0 format. In the case of imaged logs, data should be supplied as in LIS or TIF format. Log curves should be treated as images (see above), and provided preferably in PDF. File names should indicate the well name, the tool type and the run number where practical (e.g. Bohena2h_Gamma_r2.las).

g) Seismic sections

Final stack and migrated stack seismic sections should be supplied digitally as PDF, JPEG or TIFF format files. File names should include the line name (e.g. BohenaSS_98FSG_AAA.PDF, GunnedahSS_80-M3.PDF).

h) Seismic field and stack tapes

The raw seismic field data and stack tapes must be supplied on the latest industry standard storage media e.g. high quality DVD/CD, high density durable storage media (LTO or DLT) in SEG standard format. No other format or media will be accepted.

The field data should be sent directly to SpectrumData with clear instruction that data should be archived as CONFIDENTIAL in the department archives (NOT in petroleum company archives).

KDM SpectrumData address:

Library, Logistics and Vault Team Lead
KDM SpectrumData
357 Oxford St, Mount Hawthorn WA 6016
Phone: +61 (08) 6161 5354
Fax: +61 (08) 9444 7570

A transmittal acknowledging that SpectrumData received field data should be sent to:

Strategic Resource Assessment and Advice
Division of Resources and Energy
516 High St, Maitland NSW 2320
PO Box 344 HRMC NSW 2310
Email: geoscience.petroleum@industry.nsw.gov.au

Seismic data submission requirements have been outlined in Table 6 to Table 8.

i) Geophysical survey data (non-seismic)

Raw, processed and final located data files should comply with the ASEG-GDF2 standard for a wide range of located data, or the ASEG-ESF standard for electrical surveys. Should the ASEG-GDF2 or ASEG-ESF standards be inappropriate for a particular survey type, the digital data should be delivered in a format complying with those listed in Table 9.

Derived data such as grids, images or models created from data are to be submitted in the appropriate file format specified in Table 9.

All coordinate data must also include clearly stated datum, spheroid and projection, clearly stated transformation parameters if not in same coordinate system as was acquired in the field. All elevation values must be AHD.
j) Location co-ordinates and plans
All coordinates are to be for the GDA94 geocentric datum and GRS80 spheroid.
Wherever location grid co-ordinates (including grids on plans, figures etc) are used, complete spheroid, datum, grid system and projection details must be stated (e.g. GDA94 Lat/long, GDA94 MGA zone 55). The department requires locations to be supplied in Decimal degrees Latitude\Longitude to a minimum of 6 decimal places (ddd.dddddddd).

k) File compression
Files may be submitted in compressed form in ZIP format. Compressed files must be self-extracting or instructions for decompression must be included. Compressed files must decompress into a single directory with no subdirectories. Compressed files must not be recompressed into another compressed file. File names used in lists of contents etc. must be the decompressed file names not the compressed file names.
# Part E: Data formats

## Table 5: Well data formats

<table>
<thead>
<tr>
<th>Field and processed digital data</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edited field data and processed data for all wireline logs, MWD or LWD tools. Includes well test raw data.</td>
<td>LIS, DLIS, LAS</td>
<td>With verification listing of the data supplied. The data shall include full header information.</td>
</tr>
<tr>
<td>Edited field and processed data for borehole deviation surveys.</td>
<td>LIS, DLIS, ASCII, LAS, XLS</td>
<td>The data shall include full header information.</td>
</tr>
<tr>
<td>Mud logging data</td>
<td>ASCII, LAS</td>
<td>With a header giving field names, curve names and units of measure.</td>
</tr>
<tr>
<td>Downhole seismic and GPR</td>
<td>SEGY</td>
<td></td>
</tr>
<tr>
<td>Velocity surveys</td>
<td>DLIS, SEGY</td>
<td>To include verification header file.</td>
</tr>
<tr>
<td>Core, side wall core natural light photography – UV light to be done in fluorescent sections</td>
<td>JPEG, PNG or TIF</td>
<td>Provide minimum 300 DPI image in 24-bit colour. High-resolution images able to be magnified (zoom in) without pixilation.</td>
</tr>
</tbody>
</table>

## Reports and images (Digital format required for all lodgements)

<table>
<thead>
<tr>
<th>Data required</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well completion report</td>
<td>PDF</td>
<td>Image files and logs included in reports must be submitted as separate JPEG or TIF files.</td>
</tr>
<tr>
<td>Log displays</td>
<td>PDS/ META/ PDF</td>
<td>Software to be provided. Continuous page at a readable scale.</td>
</tr>
<tr>
<td>Mudlog</td>
<td>TIF/ PDF</td>
<td>Continuous page at a readable scale.</td>
</tr>
<tr>
<td>Well data summary table</td>
<td>PDF and XLS (zipped)</td>
<td>As per template provided on website.</td>
</tr>
<tr>
<td>Petrophysical, geochemical or other sample analyses</td>
<td>ASCII/ XLS</td>
<td>As a space or tab delimited ASCII file with metadata included.</td>
</tr>
<tr>
<td>Composite well log</td>
<td>TIF/JPEG/PDF</td>
<td></td>
</tr>
<tr>
<td>Velocity log displays</td>
<td>TIF/JPEG/PDF</td>
<td></td>
</tr>
</tbody>
</table>

## Samples

<table>
<thead>
<tr>
<th>Data required</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ditch cuttings</td>
<td></td>
<td>One set of washed and dried cuttings stored in the standard soil sample/pulp envelope or vials/bottles (minimum of 100g) labelled with the well name and depth intervals.</td>
</tr>
<tr>
<td>Core and cuttings from any drilling activities</td>
<td></td>
<td>Selected core and cuttings must be lodged in standard modular core boxes/chip trays. Information on the hole and drilling depths must be clearly and permanently indicated on both the inside and the outside of each box.</td>
</tr>
<tr>
<td>Fluid hydrocarbon samples (in an API approved safety container)</td>
<td></td>
<td>Consultation with the department recommended (1ltr if available).</td>
</tr>
<tr>
<td>Sidewall core material (if recovered)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palynological slides and residues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palaeontological material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petrological slides</td>
<td></td>
<td>As prepared.</td>
</tr>
</tbody>
</table>
Table 6: Seismic data 2D formats

<table>
<thead>
<tr>
<th>Field data</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navigation data includes final processed navigation,</td>
<td>UKOOA</td>
<td>P1/90 or subsequent format with header information of navigation / shotpoint location data including elevations or bathymetry. Header data must include geodetic datum, spheroid, projection and clearly stated transformation parameters</td>
</tr>
<tr>
<td>elevation and bathymetry data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw navigation data</td>
<td>UKOOA</td>
<td>P2/94 or subsequent format</td>
</tr>
<tr>
<td>Seismic field data</td>
<td>SEG Standard</td>
<td></td>
</tr>
<tr>
<td>Seismic support data</td>
<td>PDF</td>
<td>Observers logs, surveyors notes, chaining diagrams, intersections</td>
</tr>
<tr>
<td>Uphole data</td>
<td>ASCII</td>
<td></td>
</tr>
<tr>
<td>Itemised field tape listing</td>
<td>Digital (ASCII)</td>
<td>Field data showing tape number, survey name, line number, shotpoint range</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processed data</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw and final stacked data, near/mid/far sub-stacks</td>
<td>SEG-Y</td>
<td>Includes fully annotated EBCDIC header</td>
</tr>
<tr>
<td>if generated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw and final migrated data including PSDM / PSTM,</td>
<td>SEG-Y</td>
<td>Includes fully annotated EBCDIC header</td>
</tr>
<tr>
<td>near/mid/far sub-stacks - if generated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully annotated image of final processed migrated data.</td>
<td>TIFF,</td>
<td>The image must have a vertical scale of not less than 5cm/sec, and a</td>
</tr>
<tr>
<td>(Onshore)</td>
<td>JPEG,</td>
<td>resolution of minimum 300dpi</td>
</tr>
<tr>
<td></td>
<td>PDF</td>
<td></td>
</tr>
<tr>
<td>Shotpoint to CDP relationship</td>
<td>ASCII</td>
<td>Sufficient SP/CDP data for workstation interpretation. At least SOL and EOL relationships for each line and a listing of equivalent CDP/SP pairs for each line</td>
</tr>
<tr>
<td>Itemised process tape listing</td>
<td>ASCII</td>
<td>Showing tape number, survey name, line number, shotpoint range, data type</td>
</tr>
<tr>
<td>Velocity data</td>
<td>ASCII</td>
<td>Including line number, shotpoint, time versus RMS pairs for both stacked and migrated velocities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final reports</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final report (operations and navigation)</td>
<td>PDF</td>
<td>Location map included. Onboard processing and any retained outputs to be documented in report</td>
</tr>
<tr>
<td>Final processing report</td>
<td>PDF</td>
<td>To include sample print out of SEGY EBCDIC header</td>
</tr>
<tr>
<td>Final interpretation report</td>
<td>PDF</td>
<td></td>
</tr>
<tr>
<td>Digital images of interpretation maps</td>
<td>TIF</td>
<td>These include TWT structure maps at key horizons and representative sections showing seismic horizon picks as Geo-referenced TIF images</td>
</tr>
<tr>
<td>Interpreted horizons and faults</td>
<td>ASCII</td>
<td>X, Y and Z values</td>
</tr>
</tbody>
</table>
### Table 6 Seismic data 3D formats

#### Field data

<table>
<thead>
<tr>
<th>Data required</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final processed navigation data includes elevation and bathymetry data</td>
<td>UKOOA</td>
<td>All associated data sufficient to re-process seismic data including shot and receiver coordinates</td>
</tr>
<tr>
<td>Raw navigation data</td>
<td>UKOOA</td>
<td>P2/94 or subsequent format</td>
</tr>
<tr>
<td>Seismic field data</td>
<td>SEG Standard</td>
<td>To be submitted on high density media</td>
</tr>
<tr>
<td>Seismic support data</td>
<td>PDF</td>
<td>Must include observer’s logs</td>
</tr>
<tr>
<td>Uphole data</td>
<td>ASCII</td>
<td>Includes line number, shotpoint and time depth pairs for each upheole</td>
</tr>
<tr>
<td>Itemised field tape listing</td>
<td>ASCII</td>
<td>Showing tape number, survey name, line number, shotpoint range, data type in ASCII format</td>
</tr>
</tbody>
</table>

#### Processed data

<table>
<thead>
<tr>
<th>Data required</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw stacked data, near/mid/far sub-stacks - if generated</td>
<td>SEG-Y</td>
<td>Includes fully annotated EBCDIC header</td>
</tr>
<tr>
<td>Raw and final migrated data including PSDM / PSTM, near/mid/far sub-stacks - if generated</td>
<td>SEG-Y</td>
<td>Includes fully annotated EBCDIC header</td>
</tr>
<tr>
<td>Final processed (grid) bin coordinates</td>
<td>UKOOA 3D binning grids</td>
<td></td>
</tr>
<tr>
<td>Polygonal position data (Full Fold Outline and Surface Outline)</td>
<td>ASCII space or tab delimited</td>
<td>Listing major inflection points of a polygon describing the location of the survey providing survey name, polygon point, inline/crossline nomenclature, latitude and longitude</td>
</tr>
<tr>
<td>Velocity data</td>
<td>ASCII (Western Format)</td>
<td>Including bin number and time versus RMS velocity pair for both stacked and migrated velocities</td>
</tr>
<tr>
<td>2D data subset (non-exclusive surveys)</td>
<td>SEG-Y</td>
<td>Final migrated data</td>
</tr>
<tr>
<td>Itemised process tape listing</td>
<td>ASCII</td>
<td>Showing tape number, survey name, in-lines and crosslines, cdps, data type</td>
</tr>
</tbody>
</table>

#### Final reports

<table>
<thead>
<tr>
<th>Data required</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final report (operations and navigation)</td>
<td>PDF</td>
<td>Location map included. Operations and Navigation Reports can be supplied as separate volumes. Onboard processing and any retained outputs to be documented in report</td>
</tr>
<tr>
<td>Final processing report including grid definition</td>
<td>PDF</td>
<td>To include sample print out of SEGY EBCDIC header, 3D grid definition details used for loading SEGY into interpretation work stations</td>
</tr>
<tr>
<td>Final interpretation report</td>
<td>PDF</td>
<td></td>
</tr>
<tr>
<td>Digital images of interpretation maps</td>
<td>TIF</td>
<td>These include TWT structure maps at key horizons and representative sections showing seismic horizon picks as Georeferenced TIF images.</td>
</tr>
<tr>
<td>Interpreted horizons and faults</td>
<td>ASCII</td>
<td>X, Y and Z values</td>
</tr>
</tbody>
</table>

---

Onshore petroleum reporting and data submission

NSW Department of Industry, Division of Resources and Energy 33
Table 7: Reprocessed seismic data formats

<table>
<thead>
<tr>
<th>Processed data</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw stacked data 2D and 3D, near/mid/far sub-stacks – if generated</td>
<td>SEG-Y</td>
<td>Includes fully annotated EBCDIC header</td>
</tr>
<tr>
<td>Raw and final migrated data including PSDM / PSTM (2D and 3D), near/mid/far sub-stacks - if generated</td>
<td>SEG-Y</td>
<td>Includes fully annotated EBCDIC header</td>
</tr>
<tr>
<td>Final processed (grid) bin coordinates</td>
<td>UKOOA 3D binning grids</td>
<td>To be completed using UKOOA</td>
</tr>
<tr>
<td>Polygonal positions for 3D data (Full Fold Outline for offshore; Full Fold Outline and Surface Outline for onshore)</td>
<td>ASCII tab or space delimited</td>
<td>Listing major inflection points of a polygon describing the location of the survey providing survey name, polygon point, inline/crossline nomenclature, latitude and longitude</td>
</tr>
<tr>
<td>Itemised tape listing</td>
<td>ASCII</td>
<td>Showing the tape number, survey name, line number, shotpoint, data-type and what original tapes are on the copy tapes</td>
</tr>
<tr>
<td>Fully annotated image of final reprocessed migrated data. (Onshore only)</td>
<td>TIFF, JPEG or CGM+</td>
<td>The image must have a vertical scale of not less than 5cm/sec</td>
</tr>
<tr>
<td>Velocity data</td>
<td>ASCII</td>
<td>Include line number, shotpoint, Time versus RMS pairs for both stacked and migrated velocities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final reports</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final report (Reprocessing)</td>
<td>PDF</td>
<td></td>
</tr>
<tr>
<td>Final report (Interpretive)</td>
<td>PDF</td>
<td></td>
</tr>
<tr>
<td>Digital images of interpretation maps</td>
<td>TIF</td>
<td>These include TWT structure maps at key horizons and representative sections showing seismic horizon picks as Georeferenced TIF images</td>
</tr>
</tbody>
</table>
## Table 8: Geophysical data formats

### Field data

<table>
<thead>
<tr>
<th>Data required</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geophysical data (magnetic, radioelement, gravity)</td>
<td>ASEG-GDF2 ER Mapper Grid</td>
<td>Components must be submitted in a ZIP or RAR file. Gravity field data must include raw loop data, raw elevations plus measurement times and dates. Aeromagnetic data must include descriptive headers, flight number, line number, date and time, fiducial, raw magnetic reading, processed magnetic reading, radar and GPS or barometric altimeter, and base station reading</td>
</tr>
<tr>
<td>Located data and derived grids.</td>
<td>ER Mapper Grid</td>
<td>Located data and derived grids. Components must be submitted in a ZIP or RAR file</td>
</tr>
<tr>
<td>Located data and derived grids.</td>
<td>ASCII</td>
<td>Located data and derived grids. Components must be submitted in a ZIP or RAR file</td>
</tr>
<tr>
<td>Located data and derived grids.</td>
<td>ASEG-ESF ER Mapper Grid</td>
<td>Located data and derived grids. Components must be submitted in a ZIP or RAR file</td>
</tr>
<tr>
<td>Altimeter, storm monitor, etc. (aeromagnetic only)</td>
<td>ASCII</td>
<td>One copy of analog monitor records, diurnal records and altimeter records in an appropriate format</td>
</tr>
<tr>
<td>3D models</td>
<td>See national standard</td>
<td>DXF and ASCII preferred plus a 3D PDF</td>
</tr>
<tr>
<td>Ground Penetrating Radar (GPR)</td>
<td>All formats accepted with text header file</td>
<td>SEGY preferred</td>
</tr>
<tr>
<td>Other types of surveys</td>
<td></td>
<td>Submission and format details to be negotiated with the department</td>
</tr>
<tr>
<td>Digital images of interpretation maps</td>
<td>TIF</td>
<td>These include any maps included in the Interpretation report as separate Georeferenced TIF images</td>
</tr>
</tbody>
</table>

### Processed data

<table>
<thead>
<tr>
<th>Data required</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field and processed data</td>
<td>ASCII</td>
<td>ASCII data includes ASEG- GDF2 format</td>
</tr>
<tr>
<td>Geophysical data (magnetic, radioelement, gravity)</td>
<td>ASEG-GDF2 ER Mapper Grid</td>
<td>Aeromagnetic processed data must include pre and post microlevelling data. Gravity processed data must include descriptive headers, station, XY lat/lon coordinates, meter reading, observed gravity value, elevation value calculation errors, final processed gravity value</td>
</tr>
<tr>
<td>Electrical geophysical data (DC Resistivity, Time Domain EM, Frequency Domain EM, CSAMT, SP and MT)</td>
<td>ASEG-ESF ER Mapper Grid</td>
<td>Components must be submitted in a ZIP or RAR file</td>
</tr>
<tr>
<td>3D models</td>
<td>DXF, U3D PDF</td>
<td>See national standard; DXF / ASCII preferred plus a 3D PDF</td>
</tr>
<tr>
<td>GIS data</td>
<td>Any format acceptable.</td>
<td>ESRI formats preferred</td>
</tr>
<tr>
<td>Geophysical inversion and numerical modelling</td>
<td>See national standard</td>
<td>Models and pseudosections</td>
</tr>
<tr>
<td>Geophysical images</td>
<td>PDF</td>
<td></td>
</tr>
</tbody>
</table>
## Final reports

<table>
<thead>
<tr>
<th>Data required</th>
<th>Format</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final report (operations, navigation and processing)</td>
<td>PDF</td>
<td>Must include location map and flight line map. Aeromagnetic surveys: Including aircraft and survey equipment details and specifications, flight line directions and terrain clearance, line spacing, total line kilometres. Gravity surveys: Including meter type, scale factor for meter. Data must be tied to an Isogal station in the Australian Fundamental Gravity Network. Processing report must include company details and processing parameters</td>
</tr>
<tr>
<td>Digital images of interpretation maps</td>
<td>TIF</td>
<td>These include any maps included in the Interpretation report as separate Georeferenced TIF images</td>
</tr>
</tbody>
</table>
## Part F: Glossary

### Table 10 Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>department</td>
<td>NSW Department of Industry, Skills and Regional Development</td>
<td>NSW Department of Industry</td>
</tr>
<tr>
<td>the division</td>
<td>Division of Resources and Energy</td>
<td>NSW Department of Industry</td>
</tr>
<tr>
<td>GSNSW</td>
<td>Geological Survey of NSW</td>
<td>NSW Department of Industry</td>
</tr>
<tr>
<td>SRAA</td>
<td>Strategic Resource Assessment and Advice</td>
<td>NSW Department of Industry</td>
</tr>
<tr>
<td>DIGS</td>
<td>Digital Imaging Geological System</td>
<td>Digital Data Storage and Exchange</td>
</tr>
<tr>
<td>EROL</td>
<td>Exploration and Environmental Reports Online Lodgement</td>
<td>Digital Data Storage and Exchange</td>
</tr>
<tr>
<td>LaFix</td>
<td>Large File Exchange Service</td>
<td>Digital Data Storage and Exchange</td>
</tr>
<tr>
<td>Act</td>
<td>Petroleum (Onshore) Act 1991</td>
<td>Legislation</td>
</tr>
<tr>
<td>Regulation</td>
<td>Petroleum (Onshore) Regulation 2007</td>
<td>Legislation</td>
</tr>
<tr>
<td>PAL</td>
<td>Petroleum Assessment Lease</td>
<td>Title Type</td>
</tr>
<tr>
<td>PEL</td>
<td>Petroleum Exploration Lease</td>
<td>Title Type</td>
</tr>
<tr>
<td>PPL</td>
<td>Petroleum Production Lease</td>
<td>Title Type</td>
</tr>
<tr>
<td>PSPA</td>
<td>Petroleum Special Prospecting Authority</td>
<td>Title Type</td>
</tr>
<tr>
<td>Open File</td>
<td>A document/report and/or data that is able to be viewed by the public, no longer subject to confidentiality under the Petroleum (Onshore) Act 1991</td>
<td>Confidentiality /Release of Data</td>
</tr>
<tr>
<td>Confidential</td>
<td>A document/report and/or data that is not able to be viewed by the public, subject to confidentiality under the Petroleum (Onshore) Act 1991</td>
<td>Confidentiality /Release of Data</td>
</tr>
<tr>
<td>CSV</td>
<td>Comma Separated Values</td>
<td>File Extension</td>
</tr>
<tr>
<td>DAT</td>
<td>Data File</td>
<td>File Extension</td>
</tr>
<tr>
<td>DXF</td>
<td>Drawing eXchange Format</td>
<td>File Extension</td>
</tr>
<tr>
<td>ESF</td>
<td>External Source Format</td>
<td>File Extension</td>
</tr>
<tr>
<td>JPG/JPEG</td>
<td>Joint Photographic Experts Group</td>
<td>File Extension</td>
</tr>
<tr>
<td>PDF</td>
<td>Portable Document Format</td>
<td>File Extension</td>
</tr>
<tr>
<td>PNG</td>
<td>Portable Network Graphics</td>
<td>File Extension</td>
</tr>
<tr>
<td>RAR</td>
<td>Roshal Archive</td>
<td>File Extension</td>
</tr>
<tr>
<td>TIFF/TIF</td>
<td>Tag Image File Format</td>
<td>File Extension</td>
</tr>
<tr>
<td>TXT</td>
<td>Text File</td>
<td>File Extension</td>
</tr>
<tr>
<td>U3D</td>
<td>Universal 3D</td>
<td>File Extension</td>
</tr>
<tr>
<td>XLS/XLSX</td>
<td>eXcel Spreadsheet</td>
<td>File Extension</td>
</tr>
<tr>
<td>ZIP</td>
<td>Compressed File Format</td>
<td>File Extension</td>
</tr>
<tr>
<td>CSAMT</td>
<td>Controlled Source Audio-Frequency Magnetotellurics</td>
<td>Geophysics</td>
</tr>
<tr>
<td>DC Resistivity</td>
<td>Direct Current Resistivity</td>
<td>Geophysics</td>
</tr>
<tr>
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