Integration Group for the Safety Case (IGSC)

STABILITY AND BUFFERING CAPACITY OF THE GEOSPHERE FOR LONG TERM ISOLATION OF RADIOACTIVE WASTE: APPLICATION TO ARGILLACEOUS MEDIA

An IGSC “Geosphere Stability” Workshop under the auspices of the NEA Clay Club

BRAUNSCHWEIG, GERMANY
9-11 DECEMBER 2003
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APPLICATION TO ARGILLACEOUS MEDIA

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A workshop organised by the OECD Nuclear Energy Agency and hosted by GRS–Braunschweig

FINAL PROGRAMME
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1. RATIONALE

A safety case for a geological repository for high-level and/or long-lived radioactive waste aims at conveying reasoned and complementary arguments to illustrate and instill confidence in the performances of the disposal system.

Potential geological host formations (and their surroundings) are chosen in particular for their long-term stability, their ability to accommodate the waste disposal facility, their ability to prevent or attenuate potential release of radioactivity (e.g. through retention capacities), and their buffering capacity vis-à-vis external and internal perturbations. Siting of potential disposal facilities is also carried out with an awareness of natural hazards. Honest recognition is required that no natural system is in equilibrium; the concept of “geosphere stability” does not therefore imply that steady state conditions are prevailing in the geosphere over (very) long period of time. However changes occur in many systems to an extent and at a rate such that their effects would not compromise deep disposal safety.

In building a safety case, it is therefore important to assess:

- the features, events and processes that could impact the evolution of the geosphere;
- the long-term stability of the favourable conditions displayed by the host formation;
- the buffering capacity of the formation vis-à-vis perturbations.

The key issue is to evaluate the resilience of the main safety functions of the geosphere (including flow and transport properties) to natural perturbations. Thus phenomenological evidence of persistence of those functions in past episodes of e.g. climatic changes, seismic activity, diagenetic evolution, burial/uplift should enhance confidence in geosphere stability.

The relevance of various naturally occurring processes and events will depend upon the timeframe to be considered. Following the conclusions of a previous NEA initiative\(^1\), the main focus is on features, events and processes over a period of about one million years – the order of magnitude of the time needed for HLW radioactivity to decay to levels comparable to uranium ores is indeed about a few hundred thousand years.

The sections hereafter present the aim, the operational structure, the practicalities and the final programme of the Workshop. Last changes on the timing and presentations are always possible.

2. **SCOPE AND OBJECTIVE OF THE WORKSHOP**

This workshop will be the first one of a series of workshops dealing with geosphere stability for various host rocks types (i.e. crystalline rocks, argillaceous media and evaporites). The overall “geosphere stability” initiative lies under the NEA IGSC (Integration Group for the Safety Case). The specific application to argillaceous settings of the IGSC initiative is being organised under the auspices of the NEA IGSC Working Group on the Characterisation, the Understanding and the Performance of Argillaceous Rocks as Repository Host Formations usually named Clay Club. The IGSC wishes to build upon the involvement in Clay Club activities of Earth scientists from academic institutions. An important objective is to ensure the views of the broader scientific community inform the understanding of geosphere stability in radioactive waste management.

Among the favourable properties often quoted to support the choice of argillaceous media as host formation for disposing of long-lived radioactive waste are:

- Ability to self-heal fractures and discontinuities;
- Diffusion-controlled transport of solute;
- High sorption capacity;
- Geochemical conditions that favour low radionuclide solubilities, radionuclide sorption and low degradation of Engineered Barrier Systems;
- High geochemical and mechanical buffering capacity (which is often considered as a means to maintain favourable properties over a long period of time).

The workshop will focus on clay specific issues and in particular on:

- The multiple lines of evidences to support the stability/buffering/robustness of the clays over long timescales;
- The resilience of the favourable properties of clays to natural perturbations; indeed, argillaceous rocks experience significant changes/alteration during diagenesis and geological history (tectonic, thermal loading, water expulsion, organic matter degradation, etc.), and may be quite reactive to external and internal perturbations (oxidation, thermal load…).

A further important objective is to evaluate the extent to which we may be confident about the required level of stability whether we know what we are looking for, and if we have the necessary tools to carry out the investigations (predictability).

**Repository-induced effects (e.g. thermal loading, radiolysis, and migration of alkaline plumes) are excluded from the remit of this workshop.**

The workshop will consider the whole spectrum of argillaceous media envisaged as host formations, i.e. from poorly indurated, soft clays to hard, potentially fractured clays.

As already mentioned, the main focus is on features, events and processes over a period of about one million years; although longer timescales could be considered if adequate
3. AGENDA
(TIMING AND TOPICS)

<table>
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<tr>
<th>DAY 1</th>
<th>9th December 2003</th>
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<tr>
<td>13:00 – 14:00</td>
<td>Registration + poster set up</td>
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| 14:00 | Welcome addresses  
GRS, NEA and Clay Club chairman |

SESSION I
GENERAL FRAMEWORK:
ARGILLACEOUS MEDIA AS HOST FORMATIONS
Chairperson: Ph. Lalieux (ONDRAF/NIRAS, Belgium)

Questions to be addressed

- What are the main functions/roles of the geosphere for disposal at different time scales (especially for argillaceous media)?
- What kind of assumptions relating to argillaceous geosphere are commonly made in safety cases (uncertainties, time scales, etc.)?
- What are the regulatory expectations concerning the confidence in geosphere stability?

Oral presentations (30 min each, including 5 min for discussion)

14:40
Functions of argillaceous media in deep geological disposal and their handling in a safety case.
J. Marivoet, CEN/SCK, Belgium, S. Voinis, OECD/NEA, France, Ph. Lalieux and P. de Preter, ONDRAF, Belgium

15:10
Regulatory expectations concerning the confidence in geosphere stability and its handling in safety case
G. Bruno, J.Y. Boisson and F. Besnus, IRSN, France

15:40
Coffee break
SESSION II: EXAMPLES OF KEY EXOGENIC AND ENDOGENIC PROCESSES AFFECTING THE GEOSPHERE

Chairperson: A.Gautschi, Nagra

The session will focus on the processes, their potential consequences on host formations and their predictability

Questions to be addressed

- What are the predominant processes for natural and anthropogenic evolutions?
- What kinds of predictions over long timescales (up to one million year) are recommended and what are the related uncertainties?
- What predominant predictions could be provided for Crustal movement and seismicity?
- Are the diagenetic processes in a subsiding basin continuous or not in particular regarding THMC (Thermal, Hydro, Mechanical, and Chemical) mechanisms? What are the potential consequences on the geosphere at repository depths of these processes e.g ice loading, saline water intrusion, oxygenated water intrusion, crustal movement, seismicity?

SESSION II-A: EXOGENIC PROCESSES

(40 min each, including 10 min for discussion)

16:00
An overview of climate change (natural variability, anthropogenic influence, predictability /limitations, etc.)
V Masson, Institut Simon de Laplace / LSCE (France)

16:50
Surface erosion in orogenic systems
F. Schlunegger Institute of Geological Sciences, Bern university, Switzerland

17:40
Discussion between waste organisations and academic body on predictability and potential effects of exogenic processes on argillaceous media at depth

18:00 -18:30
Poster introduction (2 min per poster)

END OF THE DAY
DAY 2
10th December 2003
09:00
Session II continued

SESSION II. B: ENDOGENIC PROCESSES
(35 min each including 5 min for discussion)

9:00
Faulting and Hazard in Low Seismicity Areas (to be confirmed)
R. M. W. Musson, BGS, UK

9:35
Research of fault activity in Japan
T. Nohara, N. Nakatsuka, S. Takeda; JNC, Japan

10:10
Coffee break

10:30
Geological evolution of clay sediments: The petroleum exploration vision
F Schneider, IFP, France

11:05
New experimental methods in studying the diagenetic evolution of clays
in argillite host rocks
L. N. Warr, N. Clauer & N. Liewig, UMR 7517, France

11:40
Discussion between waste organisations and academic body on potential
effects of endogenic processes on argillaceous media at depth

12:00
Lunch break

14:00
Session III: ARGUMENTS TO SUPPORT CONFIDENCE IN THE STABILITY OF CLAYS
CONSIDERED AS POTENTIAL HOST FORMATIONS

Chairperson: Dr Wernt Brewitz, GRS, Germany

Questions to be addressed:

Each presentation will be provided by waste management organisations and
will focus on the arguments in support of the confidence in geosphere
stability, such as:

• Large-scale geotectonic environment (plate tectonics, stress-field)
• Burial history (burial/uplift/erosion(rates)), temperature history:
• scientific basis (only a list of methods and arguments used
• relation to the large scale tectonic evolution
• Paleohydrogeological aspects (expulsion of water, …)
• Future geological evolution: predictability, effects analysis (prospective,
site specific evolution / host formation performances stability).
Oral presentations (30 min each, including 5 min for discussion)

14:10
Screening methodology for site selection of a nuclear waste repository in shale formations in Germany
P. Hoth, Federal Institute for Geosciences and Natural Resources, Germany

14:40
The geological evolution of the Opalinus Clay in the Zürcher Weinland area (NE Switzerland): Learning from the Past to Predict Future Evolution and Stability
A. Gautschi, Nagra, Switzerland; M. Mazurek, University of Bern, Switzerland

15:10
The Evolution of the Callovo-Oxfordian Argillite Site, Eastern France
J. Brulhet, Andra, France

15:40
Evaluation of long term geological and climate changes in the Spanish programme
T. de Torres, School of Mines, Madrid, Spain

16:10
Coffee break

16:30
Session IV: REACTION OF ARGILLACEOUS MEDIA VIS-A-VIS NATURAL PERTURBATIONS AND GEOSPHERE EVOLUTION (BUFFERING)

Chairperson: Paul Degnan, UK Nirex

Questions to be addressed:

- What is the stability of key transport processes and parameters (diffusion...)?
- What kind of analogues should be used to support confidence (e.g. other types of formations and coming from other industry, e.g. the oil industry)?
- What kind of arguments could support the THMC buffering or absence of buffering? (N.B. repository-induced effects are excluded)

Four main topics are considered:

- Hydro-mechanical (HM) aspects
- Long term efficiency of diffusion
- Chemical buffering/mineralogical processes
- Organic matter evolution
Oral presentations (30 min each, including 5 min for discussion)

16:40 Clay club initiative: Self-healing of fractures in Clay-rich host rocks
S. Horseman, R. J. Cuss, H.J. Reeves, BGS, UK

17:10 HM aspects: glacial loading /erosion – the Opalinus Clay study
P Marshall, Nagra, Switzerland

17:40 Geochemical Stability of Clay-rich Rock Formations: Evidence Based on Natural Tracer Profiles
M. Mazurek, T. Gimmi, H. Niklaus Waber, University of Bern, Switzerland;
A. Gautschi, Nagra, Switzerland

18:10 Poster Session (continued)

19:00 End of the day

19h30 Workshop dinner offered by GRS
**DAY 3**

**11th December 2003**

08:30  
Session IV continued

8:30  
**Chemical buffering capacity of clay rock**  
C. Beaucaire, IRSN, France, F.J Pearson, Groundwater geochemistry, USA and A. Gautschi, Nagra, Switzerland

9:10  
**Some elements of understanding of Argilaceous media stability**  
E. Gaucher, BRGM, France

9:40  
**Chemical Buffering/mineralogical aspects : mineralogical stability**  
Part 1: **Temperature effect on clay rock**  
JC Parneix, A. Meunier, U. Poitiers / A Boucher, ERM, France

Part 2  
**A new approach to assess the mineralogical organisation and stability in clay rocks**  
S. Sammartino, ERM Soc., France

10:10  
Coffee Break

10:40  
**Geochemical characterisation and buffering capacity of a Spanish Reference Clay (to be confirmed)**  
J. Samper, U. La Coruna, Spain

11:10  
**Nature and reactivity of organic matter in argillaceous formations: example of the Callovo-Oxfordian of Bure**  
R. Michels, M Elie, P Faure, CNRS UMR, G2R, CREGU, France

11:40  
**Early fracturation in argillaceous massifs and related carbonate transfer**  
B. Beaudoin et al. ENSMP, France

12:10  
Lunch break

14:00  
**Clays in Basic Solutions**  
A. Bauer, FZK-INE, Germany

**SESSION V : ROUND UP SESSION**

14:30  
Discussion

15:30  
**Key concluding messages**  
*Workshop Programme Committee*

Around 16:00  
**Closing of the workshop**
Optional excursion to the KONRAD mine

The number of visitors will be limited to 25 at maximum according to the post order of the registrations. Special clothes will be available.

08:00 Arrival to Konrad
Welcoming and Introduction lecture

08:45 Visit

11:00 Return aboveground
Close discussion and snack (stew)

12:00 Shower / end of the visit

Return to Braunschweig main station (or Hanover airport) (to be detailed)
POSTERS

P1: Numerical investigations about the influence of glacial loading on the transport of radionuclides in the Opalinus clay
G. Kosakowski, PSI, Switzerland

P2: Burial History of Two Potential Clay Host Formations in Belgium
J. Mertens and L. Wouters, ONDRAF/NIRAS, Belgium, Ph. Van Marcke, Faninbel b.v.v.a, Belgium

P3: Presence and evolution of natural organic matter in the Boom clay
M. Van Geet, and al SCK-CEN, Belgium

P4: Uncertainty propagation in a deterministic seismic hazard assessment
C. Martin, R. Secanell, P Combes, GEO-TER, J Brulhet, Andra France

P5: Geological Disposal of SNF in clay formation in Slokavia
M. Pospisil, S. Provakova, VUJE TRWANA, Slovak Republic

P6: Characteristic properties and Cm (III) complexation of humic and future acids from Callovo-Oxfordian and Opalinus clay
F. Claret, FZK-INE

P7: Hungary – Awaiting Title of Paper

P8. Mineralogical Behaviour of Bentonites in Open and Closed Systems
H J Herbert, GRS, Germany, J. Kasbohm, University of Greifswald, Germany

P9: Experimental Study of the Hydromechanical Behaviour of the Callovo-Oxfordian Argillites"
C.L. Zhang and T. Rothfuchs, GRS, Germany

P10: Changes in x-ray patterns, rehydration ability, cation exchange capacity and specific surface area of bentonites from Rokle due to the experimental heating
I Kolarikova, Charles University, Czech Republic
4. OPERATIONAL STRUCTURE

4.1 Workshop Structure

The workshop will be organised into four main sessions, plus a poster session:

- The first and second plenary session will concern mainly the fundamental requirements and basis for the deep disposal regarding the stability and buffering capacity of the geosphere;
- The third and fourth plenary sessions will consist of more detailed presentations focusing on the argillaceous media;
- A poster session is organised during the whole workshop duration.

The workshop is structured to ensure open discussion between participants and in particular between the waste management organisations and the scientific community. A concluding session should help define the key outcomes and messages of the workshop.

4.2 Participation

The workshop organisers have already identified and invited several speakers from the waste management organisations, the regulatory bodies and the academic community.

In order to ensure a workable size, no more than 80 participants are allowed. The workshop is open to the scientific community (university, research centres), the industry, waste management organisations and regulatory bodies in order to provide a practical forum for fruitful exchanges.

4.3 Poster Session

The posters can address any of the workshop topics.

The normal poster sizes of about 100 x 140 cm.

The posters’ authors will be given one minute each to introduce their posters just at the end of the first day of the workshop.

4.4 Oral Presentations

For the plenary session, a portable computer projector (for presentations using PowerPoint) will be available as well as an overhead projector.

4.5 Preliminary Work before the Workshop

Speakers and authors of posters are asked to provide extended abstracts (at least four pages including figures and references) of their presentations prior to the workshop (electronic versions). Longer abstracts will be accepted, but it should be clear that four pages are adequate to meet the requirements of the workshop.
The extended abstracts will be submitted to the NEA. The NEA, together with the workshop Programme Committee, will review the proposed abstracts. The reviewers will provide feedback if necessary to the authors on the adequacy of their consideration of the questions they are to address.

The compilation of abstracts will be distributed as an “NEA General Distribution Report” at least one week prior to the workshop.

4.6 Proceedings

The OECD Nuclear Energy Agency will publish full proceedings of the Workshop.

The proceedings will include a synthesis (about 10 pages) of the workshop outcomes (presentations and sessions’ discussions), the compilation of the extended abstracts an the list of participants. The synthesis should aim at answering the key questions listed for the workshop (or state why a definite answer was not achievable). The proceedings will be prepared by Emmanuel Mouche, CEA, France and be reviewed by the programme committee.

Authors are requested to fill in and sign the attached grants for publication rights, which authorises the OECD to publish their papers in the proceedings (see Annex B). This form should be returned together with the master copy and electronic version of the paper. The text should be typed on a word processor, using preferably Microsoft and according to the recommendations of ANNEX C.

4.7 The Workshop Programme Committee

The Programme Committee is in charge of:

- defining the topics and the workshop agenda,
- identifying and inviting speakers and chairpersons,
- defining the lists of questions the sessions have to deal with,
- reviewing the abstracts
- reviewing the workshop synthesis and proceedings.

The workshop Programme Committee consists of representatives of IGSC and Clay Club members and of the host organisation. Members of the SPC are Philippe Lalieux [ONDRAF, Belgium, Clay Club Chair], Andreas Gautschi (Nagra, Switzerland), Alan Hooper [UK Nirex limited and IGSC representative], Jacques Brulhet (Andra, France), Hoerst-Juergen Herbert [GRS, Germany, representative of the host organisation], Jean Yves Boisson (IRSN, France) and Sylvie Voinis (NEA).
4.8 Dates and Location of the Workshop

The workshop will be held on 9-11 at a conference-hall of the chamber of commerce and industry of Braunschweig:

Industrie- und Handelskammer (IHK) Braunschweig
Brabandtstraße 11
38100 Braunschweig
Germany

4.9 Working Language

English will be the working language of the Workshop and of the proceedings.

4.10 Local Arrangements

GRS will offer coffee break during each morning and each afternoon, contribute to the general organisational costs and provide secretariat support as well as transportation and lunch for the Konrad mine technical visit.

Lunches, dinners and hotel will be at the charge of participants A workshop dinner will be offered by GRS and organised on 10th December 2003.

Questions related to local arrangements are to be directed to the conference secretary:
Claudia Filbir; GRS
Tel.: + 49 531 / 80 12-271
Fax: + 49 531 / 80 12 200
fil@grs.de

Accommodation

80 single-rooms have been pre-booked by GRS at the “Deutsches Haus”. Participants need to confirm their booking (dates of arrival and departure) within the attached registration form through the NEA secretariat.

Ringhotel Deutsches Haus
Rufäutchenplatz 1
DE-38100 Braunschweig
Phone: +49 531 12 00 - 0
Fax: +49 531 12 00 - 444
E-Mail: resi@ringhotel-braunschweig.de

Costs per accommodation incl. breakfast are 87 EUR.
**Travel to Braunschweig**

The easiest possibility of transportation to Braunschweig is to travel first by plane to Hanover and further by train to Braunschweig. You can drive from Hanover to Braunschweig in about one hour.

### 4.11 Registration and Participation

The workshop registration will be capped at 80 participants.

**Additional Extended abstracts for poster session will be due with registration, i.e. by end of November 2003**

Please take contact with the NEA secretariat by email if you are interested in proposing a paper (oral or poster) should inform ASAP the NEA Secretariat.

A participation fee (organisation costs, workshop rapporteur, etc.) is requested. It will amount to 200 €. The fee is to be paid **no later than 30th November 2003**, preferably by bank transfer in € to the following account:

For all participants except from France

- **Bank:** JP Morgan, AG, Frankfurt, Germany
- **Account:** 6161603441
- **BLZ:** 50110800
- **SWIFT/BIC:** CHASDEFX
- **IBAN:** DE95501108006161603441

For French participants:

- **Bank:** JP Morgan Chase Bank, Paris, France
- **Account:** 30628-00001-0060908330294
- **IBAN:** FR76306280000010060908330294
- **SWIFT/BIC:** CHASFRPP
- **Siret:** 775 687 957 00016

**Attention:** For the Bank Transfer, please inform your financial division and/or the bank to mention the following references: "AEN/WS-GEOSTAB”.

Or

By cheque made payable to “OECD” and sent to the attention of:

Sylvie Voinis

OECD/NEA

Waste Management Division

Le Seine Saint Germain Building

12, Boulevard des Iles

F-92130 Issy-les-Moulineaux

Unfortunately, payments by credit card are not accepted.
# ANNEX A

**GEOSPHERE STABILITY WORKSHOP** on

“STABILITY AND BUFFERING CAPACITY OF THE GEOSPHERE FOR LONG TERM ISOLATION OF RADIOACTIVE WASTE: APPLICATION TO ARGILLACEOUS MEDIA”

## REGISTRATION FORM (PLEASE FILL IN USING BLOCK CAPITALS)

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Will submit the following paper:  (oral presentation) (poster presentation)

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☐ I am not interested in visiting the KONRAD site on 12th of December 2003
☐ I am interested

If you are interested please complete the table hereafter:

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**ACCOMMODATION/SOKOS HOTEL DEUSCHES HAUS**

Date of arrival: ________/_________2003 Date of departure: ________/_________2003

Number of nights: _______________________

This form must be returned to:

Sheila.O'Sullivan (sheila.osullivan@oecd.org), Fax number (+33 1 45 24 11 10)
ANNEX B

GRANT OF PUBLICATION RIGHTS

GEOSPHERE STABILITY WORKSHOP on

“STABILITY AND BUFFERING CAPACITY OF THE GEOSPHERE
FOR LONG TERM ISOLATION OF RADIOACTIVE WASTE: APPLICATION TO
ARGILLACEOUS MEDIA “

Title of the paper:

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The undersigned, acting on his/her own behalf as holder of the copyright, or as the authorised
representative of the person or entity holding the copyright, grants to the OECD the non-exclusive, royalty-
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The undersigned confirms that he/she has the authority to grant this permission.

Name: ...................................................................................................................................

Date: ......................................................................................................................................

Signature: ................................................................................................................................

Note: If the paper is published in a collection of papers under OECD copyright, the OECD
copyright will cover the collection but will in no way impede an author who is not an OECD consultant or
employee from publishing his/her individual paper elsewhere.

This form must be returned to the NEA Secretariat
with the master copy of the paper.
ANNEX C

INSTRUCTION FOR AUTHORS IN VIEW OF THE PROCEEDINGS

IMPORTANT REMARKS

Please be sure to use WORD 97 and TIMES as the font, even for equations.
No color reproduction is possible.
Please check the clarity of figures/pictures/equations once inserted in the text and printed in Black and white.
For figures, drawings, maps... encapsulated post-script files (.eps) or high-resolution (300 dpi) .tif files inserted as a PICTURE and (not as a FILE) in the text document are preferred.
If there is no electronic version of your figures/photos, leave the appropriate space in the text and provide a full-page, high-quality, original (with figure/photo number on the reverse side and indicating top and bottom). Do not tape or glue them to the paper.

DISPATCH

Please send to the address below: one original, one photocopy and one electronic copy of your paper along with the signed Grant of Publication Rights form (see attached). Material for publication cannot be accepted by fax.
Electronic copies may be provided on the following media formatted for PC: 3.5 inch high-density (1.44 MB) diskettes; floppy zip (100 MB); super disk (3.5”, 120 MB); CD-ROM. Please label your media clearly. FTP transfers and e-mail are also possible.

Sylvie Voinis
OECD/Nuclear Energy Agency
Le Seine Saint-Germain
12, Boulevards des Iles
F-92130 Issy-les-Moulineaux
Tel: +33 (0)1 45 24 10 49
Fax: +33 (0)1 45 24 11 45
E-mail: sylvie.voinis@oecd.org

Title [Bold, Centred, Times 14. First Letter in Each Word Should Be in Upper Case, except Prepositions and Articles]

Author [centred, Times 11, bold]
Affiliation, Country [Centred, Times 11]

Second author [centred, Times 11, bold]
Affiliation, Country [Centred, Times 11]

Body text [Times 11, with any numbers and units joined by a forced blank. Margins: Top - 3.45 cm, Bottom - 3.45 cm, Left - 2.8 cm and Right - 2.2 cm, Header 1.0 cm, Footer for pagination 2.5 cm. A4
paper size for the page set-up even if you are printing on another size paper. Alignment: Justified, Line spacing: Single]

1. **Subtitles** [Bold, Times 11, with first letter of first word capitalised only]
   to be numbered as 1, 1.1, 1.1.1, …..
   Body text [see above]

Caption Table 1. [Centered, Times 11, bold, and placed above the table]
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Caption Figure 1. [Centered, Times 11, bold, and placed under the figure]

Figures: encapsulated post-script files (.eps) or high-resolution (300 dpi) .tif files inserted as a PICTURE and (not as a FILE) in the WORD document.
[1 blank line, font 11 or 12 pt]

References

[A consistent referencing system should be used throughout the paper, e.g. consecutive numbers, authors’ names and date. All references should be collected together in a section headed “References” at the end of the paper. Please avoid using acronyms for designating publications.]