Integration Group for the Safety Case (IGSC)

Summary Record of the 18th Meeting of the Clay Club

Held on 19 September 2008
London, United Kingdom
Summary Record
of the
18th Meeting of the Clay Club
Held on 19 September 2008
Burlington House, London, UK
Hosted by the Nuclear Decommissioning Agency (NDA)

The list of participants is presented in Annex A.

All slides and supporting materials are posted on the restricted NEA Clay Club web page.

1. Opening of Meeting

Patrick Landais (Andra), Chair of the Clay Club, opened the meeting by thanking the NDA for serving as hosts. He welcomed the meeting participants and noted apologies (see Annex A).

Adoption of CC76 record, CC18 agenda

Summary Record of CC 17: NEA/RWM/CLAYCLUB(2007)1
Agenda for CC18: NEA/RWM/CLAYCLUB/A(2008)1

The summary record for the 17th Meeting of the Clay Club had been previously distributed for review. No comments were received either in advance or at the meeting; the outcomes were approved without objection or comment.

For the agenda of the 18th Meeting of the Clay Club, no additional topics were identified to be added and no adjustments to the existing items or timeframes were needed. The agenda was approved.

2. Current Developments, Ongoing and Future IGSC Projects

Updated IGSC PoW: NEA/RWM/IGSC(2007)16/REV1
RWMC Meetings List: NEA/RWM(2008)7

The Secretariat provided an update on relevant activities under the auspices of the NEA Integration Group for the Safety Case (IGSC). In particular, the Secretariat noted that the IGSC updated its programme of work during 2007. The main themes of the updated programme of work reflect the evolving needs and challenges for national repository development programmes. There is renewed interest in the technical and methodological issues at the heart of the IGSC’s mission. Planned activities will aim to systematically survey methodological advances and consolidate knowledge concerning, for example, safety assessment. At the same time, there is demand for highly integrated and very practical information—e.g., lessons learned from real-life experience as programmes approach or enter licensing review processes. An updated modus operandi of the IGSC emphasizes knowledge transfer and increased coordination with other working parties as well as with the main RWMC committee.
Several proposed IGSC activities have potential synergy with topics previously identified as priorities for the Clay Club, and should be considered in planning future Clay Club activities. These are, in particular, an IGSC workshop—planned for autumn 2009—on cementitious materials (envisioned as part of a new series of ad-hoc workshops on cross-cutting issues relevant to both engineered barrier systems and the geosphere) and a proposed IGSC workshop on gas migration in the 2010 timeframe.

Items highlighted as being of particular interest included the 2007 Geosphere Stability Workshop on Crystalline Rock (November 2007)—the follow-on to the Clay Club workshop on the same theme for clays, held in Braunschweig, Germany in 2003—and the AMIGO-3 workshop of April 2008 on the topic of integration of geoscience information in safety assessment. Updates were also provided on the INTESC project, a synthesis report for the EBS workshop series and the third phase of the Sorption Project, which aims to develop a guidance document for the application of thermodynamic sorption models in safety assessment.

3. Faulting and Fracturing at Depth in Clay


Martin Mazurek provided some observations and impressions of the international meeting on “Fault Zones: Structure, Mechanics and Fluid Flow,” which took place 16-18 September 2008 and with which was coordinated the scheduling of the 18th Clay Club meeting. The Clay Club co-sponsored the meeting along with the Geological Society of London, the Geological Society of America, and a number of other scientific organizations. Co-sponsorship and participation in the Fault Zones Conference provided an important (and long-sought) entry for the Clay Club into the broader geological community, including relevant industries, especially related to petroleum.

There was good attendance and representation of the Clay Club at the meeting. The number of presentations was somewhat limited in view of the many notices distributed even well in advance. Taken in combination, the level of participation and number of presentations demonstrate that the topic of faulting is still of interest to Clay Club members but is not as high a priority as in the past. In this regard, it was efficient to use an existing meeting as a platform rather than having a separate, independent Clay Club workshop.

Importantly, the conference opened lines of communication and highlighted that there are a number of issues which are well-known and studied for geological disposal but very little known in other applications and, in fact, were shown in the nature of "new discoveries" by experts from related fields. The issues include, for example, permeability along strike and the existence of an excavation disturbed zone. There is a need for the radioactive waste management community to educate colleagues in broader academic circles to build awareness of these issues and of the level of understanding already developed and reflected in safety cases; if not, there is the danger of “outside” geologists raising warnings on the safety or understanding of geological disposal based on issues that have already been addressed in detail or found not to be significant to performance. The conference also underscored that a much higher degree of inter-disciplinary work has been achieved within the radioactive waste community than in some other arenas of work, given that the conference still showed significant lack of interactions between, for example, structural geologists and hydrogeologists. However, progress in the field of fault growth modeling, shown in the meeting, may be of real interest to our community.

The conference results will be published in a special issue of the Journal of Structural Geology. Clay Club members (or organizations) that presented were strongly encouraged to submit articles for the journal to ensure that the Clay Club work is well represented. An indication, along with a title for the
In conclusion, members agreed that it was efficient and worthwhile for both sides to have the Clay Club join the larger fault zones meeting. The work of Martin Mazurek and Simon Norris in serving on the convening committee was appreciated. There was agreement that the Clay Club should consider in the future joining its activities to existing meetings if there are areas of mutual interest; the major advantages include the opportunity for communication with broader scientific and industrial experts and audiences and the fact that the logistical details and planning can be simplified. There is a desire, if the group co-sponsors another meeting, to have the Clay Club more clearly recognized rather than the Nuclear Energy Agency per se, whose interests are significantly broader and the links not as readily apparent. This could be done, for example, by developing a separate logo that might be used instead of, or beside, the NEA logo. This will be considered in planning future activities.

4. CLAYTRAC Update

Martin Mazurek provided an update on progress for the CLAYTRAC project. The CLAYTRAC project examines natural tracers in geological formations, through detailed re-evaluation and integration of existing measurements (from a variety of argillaceous formations) and evidence documented in literature, in order to improve understanding of transport mechanisms.

To begin, he reviewed the history of the project as an outgrowth of issues identified in the FEPCAT project. As a first step, a feasibility study was conducted (with financial support by Nagra) and the results were presented at the Clay Club meeting in October 2003. Following this initial study, the Clay Club agreed to undertake a larger project, which was planned and launched in late 2004/early 2005. The project was originally envisioned to last two years. Conceptual approaches and data clearance procedures were established in 2005. An update was provided in 2006 and a decision made at that time to expand the project team (with additional financial support pledged by Nagra) in order to overcome time constraints.

At the 2007 meeting, the Clay Club was presented the preliminary findings along with an incomplete draft of the report. The presentation ultimately led to the inclusion of additional data from Mount Russelin and Essen case studies. The preliminary results were also featured as a keynote presentation at the 3rd International Meeting on Clays in Natural and Engineered Barriers for Radioactive Waste Disposal (Lille, September 2007). Presentations on the project were also given at the NEA AMIGO-2 workshop in September 2005 and at the Water-Rock Interaction meeting in August 2007.

In accordance with the schedule agreed at the 17th Meeting of the Clay Club, a complete draft of the CLAYTRAC report was provided in February 2008 for review by the Clay Club as well as by an outside reviewer, Jim Hendry (whose involvement was supported by OPG). Clay Club organizations had identified, in advance, selected experts in their organizations to review the report and had agreed to a strict one-month review period.

Overall the comments on the draft report were extremely positive. The comments were numerous (not surprising given the length of the report) but none “shook the foundations” of the report. A revised report that took account of the comments was delivered to the Clay Club in September 2008.

The project shows that tracers can provide convincing evidence of diffusion as the transport-controlling process at the sites studied. Important conclusions of the report are:
• Tracer profiles yield safety-case relevant information on transport processes and spatial heterogeneity in argillaceous rocks on the spatial and temporal scales of interest (“self analogues”).

• Diffusion is recognised as the dominant transport mechanism for the sites studied (although some ambiguity remains at sites with limited data sets).

• The bounding values of vertical advection velocities in shale units were found to be: 5E-13 to 5E-12 m/s (and these bounds could possibly be lowered if more complete data sets were available).

• The conclusiveness of model results and interpretations is limited by incomplete data sets.

• The boundaries of the low-permeability sequence are not known a priori and often the sequence extends beyond the clay-rich unit.

• Tracer profiles document the most recent stage of a possibly complex evolution and can be used to constrain non-uniqueness of past site evolution. The evolution times in question for the sites studied were in the range of tens of thousands to several million years (Ma).

• Multi-tracer studies provide more complete conclusions than single tracers; nevertheless, it is important to note that no contradictions among the tracers were identified.

• The strengths and weaknesses of different tracers were noted, insofar as their application to inform understanding of site evolution and transport. For example, $\delta^{37}$Cl may be of limited usefulness, whereas $^{36}$Cl or $^{14}$C could be considered in the future for some specific cases.

• Pore-water studies should be a component of each site-characterisation programme targeted at clays and shales.

The members of the Clay Club commended the high scientific standard of the report and the value of the conclusions. The report was approved for publication. The Secretariat confirmed that the report will be printed in color (high quality, by a print shop outside the OECD) and that final formatting will be accomplished in cooperation with Martin Mazurek to ensure accuracy of the full report, quality of figures, etc. The final report is expected to be published in late 2008.

The Clay Club also endorsed the idea to publish the results of the report in the open scientific literature. Options such as developing a textbook or special issue of a journal were rejected as too time-consuming or ineffective for reaching a larger audience. Instead, it was agreed to aim for publication of a “review” article (up to ~30 pages) in a relevant scientific journal. Such articles are often of interest to journals because they tend to be widely cited and it was agreed that this goal is achievable especially if members draw on their connections; negotiations with journal editors might allow even a longer paper to be submitted. Such a review article could possibly be supplemented with a companion case study (or two) examining in more detail the data for specific sites. Mont Terri or Essen would be good candidates in this regard.

Martin Mazurek agreed to evaluate the feasibility of condensing the report results in such an article as well as to identify and approach relevant journals to establish their interest. In order to advertise the report and reach a broader audience, it was also suggested that the Clay Club could consider separate overview articles (normally much shorter and less detailed) in professional journals such as the European Geologist journal. Results of the feasibility assessment and next steps for journal publication will be reported to the Clay Club in late 2008. It was emphasized that, if the report will be shared with a broader audience, it will be especially important to ensure that it is available electronically and preferably without charge through the NEA web site.
There were some important lessons learned from the operation of the project. The timeframe for the project was much longer than originally envisioned: by the time of completion, it will have taken six years from the first idea to the printed project report. This highlights that the Clay Club need time for setting up sensible and generally agreed guidelines for a given project, and that the time resources of the expert team for successfully completing the project are finite and must be realistically assessed.

Outside the elongation of the time frame, the project proceeded well, achieving the original scope and deliverables. The financial resources provided by the Clay Club were adequate, taking account that some additional support provided by Nagra. There was an efficient use of resources, with little overhead (in terms of time or money) devoted to administrative work. The consultant work team operated very efficiently, and the flexibility for the project leader to engage an inter-disciplinary team of experts was an important factor in this regard. There was excellent technical co-operation with organisations supplying data, ideas and comments. The feedback from the Clay Club during the review stage was important; in particular, the review and comments of the independent expert (i.e., Jim Hendry) were extremely valuable and similar input should be considered for future Clay Club projects.

It was noted that the process for formatting and printing of reports can still be improved. Despite the fact that these issues were raised early in the planning and drafting of the report, they were not fully resolved and clear guidance was not made available. The Secretariat noted that some requirements have been clarified in the course of this project and that this information will be used to improve the process for future reports by, for example, providing a clear template and formatting guidelines.

Finally, Martin Mazurek observed that report also raised some issues for which the understanding can still be further developed and which might merit further work. These are:

- Understanding of porosity and ion mobility (“geochemical porosity”); effects of salinity; flow porosity; implementation in geochemical and transport codes
- Microscopic pore structure
- Validity of Darcy’s law
- Understanding chemical osmosis
- Tracer versus salt-diffusion coefficients; species-specific data
- Spatial heterogeneity of diffusion coefficients
- Anion reservoirs in shales
- Explicit linkage of the science-based CLAYTRAC approach to safety relevance.

5. Country Reports

Clay Club members made short presentations of their country reports by highlighting significant advances and changes. Presentations were made by: Belgium (ONDRAF/NIRAS, SCK-CEN), France (Andra, IRSN), Germany (BGR, FZK, GRS), Hungary (PURAM), Japan (JAEA, NUMO), Switzerland (HSK, NAGRA), and the UK (UK-NDA). Presentation materials and supporting written reports, when provided, are available on the Clay Club web page.
6. Self-Sealing Report

Review of Funding Situation and Contract Status

Room Document: Review of Funding Situation and Contract Status

Betsy Forinash (NEA Secretariat) reviewed briefly the history, funding situation and contract status for the Self-Sealing Project. The objective of the self-sealing report is to investigate self-sealing properties of natural and induced fractures in clays at typical repository depths. Of interest is the possibility to reduce or eliminate potential flow pathways. A key aspect is to link empirical evidence and synthesize existing information specifically in the context of geological disposal. An initial draft report (from 2005) failed to achieve the project goals, and the original contract was terminated.

At the 16th Meeting of the Clay Club, members reinforced the importance of the topic of self-sealing and set a path forward to obtain updated information, with an emphasis on site-specific and empirical data, and considering its relevance in the context of geological disposal. [NEA/RWM/IGSC/CLAYCLUB(2006)4]

Subsequently, Dr. Helmut Bock (Q+S Consult, Germany) was engaged to conduct initial scoping work, funded by Nagra, with the 2005 draft as the starting point. The outcome of the scoping phase, a proposed work plan, was provided to the Clay Club in January 2007 for review, along with a funding request. Response to the work plan and funding request was very favorable. Voluntary contributions of nearly 40 000 euro were provided by Clay Club organizations (HSK, Mecsekerc, NDA, NUMO, SCK•CEN). Additional funds in the amount of approximately EUR 50 000 euro were recovered from the previous contract (with BGS), which had been terminated. In-kind contributions totaling up to 80 man days of work were pledged by four organisations (Andra, ONDRAF/NIRAS, OPG, Nagra).

The proposed work plan was also endorsed in principle as supporting an appropriate emphasis, bringing to bear the necessary expertise, and outlining a realistic time frame. For practical and project management/oversight reasons, it was decided to pursue further work in phases. This approach allowed the project to begin more quickly, in that an initial contract could be put in place with only partial funding. Importantly, this also approach provided the opportunity for the Clay Club to confirm, at an interim stage of work, that the work team was operating effectively and that the new information gathered was sufficient to justify the investment in producing a full updated report on self-sealing.

In accordance with this approach, an initial contract was put in place with Dr. Bock, beginning in May 2007. This contract, in the amount of EUR 48 500, covered the following tasks:

- Literature review, interviews, and data-gathering (with a focus on Clay Club organizations) regarding the potential for self-sealing properties of clays in the context of geological disposal for radioactive waste, and
- Preliminary report on the results of
  - Relevant laboratory experiments and
  - Relevant field tests and observations.

The results were presented and discussed at the 17th Meeting of the Clay Club. [NEA/RWM/CLAYCLUB(2007)1] At that time, the Clay Club acknowledged the value and relevance of new information that had been gathered and concluded that it was worthwhile to proceed with developing a fully updated report. The following points were agreed in terms of the path forward for drafting the report:
• The report should follow along the structure proposed by Dr. Bock based on the scoping work funded by Nagra.
• The existing work team, with Dr. Bock as the coordinator, should be retained for drafting the report.
• In terms of financial and in-kind contributions:
  o Commitments were received from Andra, NAGRA, ONDRAF/NIRAS, and OPG to extend in-kind contributions at the level deemed necessary to support continued participation of work team members in drafting the report.
  o Additional contributions of approximately 5 000 euro would be needed to fully fund the expected cost of a new contract covering completion of the report; this amount was later provided by GRS.
• A full draft report would be expected for review by the Clay Club in September 2008.

In accordance with these points, the NEA Secretariat established a contract with Dr. Bock beginning in February 2008 for drafting a full updated report on self-sealing. The contract, in the amount of EUR 45 500, covers the following tasks and timeframes:
• Continued data collection, with a cut-off date of 15 March 2008 for new information.
• A full draft of the report by September 2008.
• Revision of the report, taking into account comments from Clay Club members.
• A final report in March 2009.

The collective costs of the contracts and work to date—and through the projected completion of the report—are fully covered by available funds and in-kind contributions.

**Current Status, Discussion and Path Forward**

Room document: Draft report

Helmut Bock reported the work accomplished and the results to date. Since February 2008, data collection has been finalized. There has been a stream of new data available and significant new information was collected even since the Clay Club meeting last year. A cut-off date in mid-March 2008 was established (in consultation with various sponsoring organisations) in order to be able to move ahead with drafting the report. However, the flow of information continues and it is difficult to enforce the cut-off without exception.

A draft of the report was provided to Clay Club ahead of the meeting. The report addresses motivation, presentation of the issue, identification of relevant processes, discussion of data, and conclusions. The main report, as it stands, is about 50 pages, supported by extensive appendices totally about 250 pages. However, some sections were incomplete, notably the chapters on sealing mechanisms (Ch. 4) and conclusions (Ch. 5)—two chapters that are of major importance for the consistency of the report. The incompleteness is due mainly to some delays in the original schedule that were incurred due to late contributions (i.e., draft sections of the report) from members of the expert team. It was emphasized (and agreed by Dr. Bock) that additional work on Chapters 4 and 5 is essential to provide a view that is as exhaustive and coherent as possible regarding the mechanisms involved in the self-sealing phenomena occurring in clay formations. Nevertheless, progress is encouraging and the main directions of the report are logical and follow the plan set out by the Clay Club.
Further discussion of the draft report addressed particularly the balance on information between the main report and appendices. There is a lot of useful and quite important information in the appendices. On the one hand, it is preferable to have a report that is reader-friendly and to concentrate the theoretical aspects mainly in the appendices. On the other hand, the main body of the report must be scientifically solid as a stand-alone document. Significant re-writing is not deemed necessary; however, it was suggested that further clay-specific information and examples should be moved into the main body of the report whereas some of the background information on the project could be placed in relevant appendices. Helmut Bock agreed that this could be undertaken along with completing the remaining chapters to develop a full draft of the report.

Taking into account the original project schedule along with the work remaining to be done, the following points were agreed for the path forward:

- A complete draft will be provided to the Clay Club in mid-Nov (or at latest in mid-Jan 2009).
- A period of approximately 3 months will be allotted for Clay Club review, ending in March 2009.
  - The full membership of the Clay Club will receive the report.
  - Particular commitments were received from Andra, ONDRAF, Nagra and NDA to review thoroughly the full report and appendices.
- In view of the value of an additional technical review for the CLAYTRAC report, a similar review should be sought for the self-sealing project.
  - Derek Martin will be asked to provide such an “external” review. In fact, he was already identified as a member of the consultant team and his time on the project already financially supported by OPG, but since he has not directly contributed to the report so far, he has a good measure of independence.
  - He will be requested to provide a constructive review that not only identifies issues but also suggests the means to resolve them.
  - This internal” external review should be completed in the same timeframe as the review by Clay Club members.
- Following the review period, and based on the volume and nature of comments, a decision will be taken regarding:
  - The deadline for the final report
  - Any further review by additional external experts and, if so, the priorities for this review.

Publication of the final report might be achieved as early as the end of 2009. On a final practical matter for publication, it was noted that case needs to be taken to ensure the quality of the final figures for printing and also to verify the appropriate copyright permission. The Secretariat also mentioned that formatting guidelines had been provided and these will be taken into account in developing the full draft of the report.
7. **Next Steps for Future Clay Club Work**

Patrick Landais reviewed the priorities and proposed actions that had been agreed at the 17th Meeting of the Clay Club. Taking into account those proposals and other international activities that have developed in the meantime, the following activities and steps forward were agreed:

- **Gas Migration:** This is still a topic of importance to many programmes. For a Clay Club activity, the focus should be on understanding gas migration in natural clays: where are the knowledge gaps and how can they be filled? It was agreed to pursue an informal seminar (modeled, for example, on the Penrose Conference hosted by the Geological Society of America) in 2009. This format is intended to encourage the participation of industry and foster very open discussions. For similar reasons, it would not be planned to issue proceedings of the meeting or to otherwise formally document the outcomes. Nevertheless, the timing of the workshop is such that the conclusions and key information can serve informally as input to a potential IGSC gas generation/migration workshop being considered for 2010. A further priority for planning is to ensure coordination with the new EC project FORGE, which also relates to this issue.

It was emphasized again that it is a high priority to involve experts from outside the radioactive waste community. Given the success and benefits of the Clay Club participation in the Fault Zones meeting, members agreed that it could be similarly efficient to pursue a gas migration seminar in conjunction with an existing meeting. The top option identified for this purpose is an international meeting on Fault and Top Seals being planned in 2009 (21-24 September 2009, Montpellier, France; see www.eage.org). Andreas Gautschi (Nagra) has some involvement with the convenors and agreed to investigate the possibility to have a joint activity linked with the meeting or, if not, to hold a coordinated but separate Clay Club seminar. A preliminary indication will be provided to the Clay Club as soon as possible.¹

To encourage participation of Clay Club members and to minimize travel obligations, it was agreed that the annual meeting should be held at the same time; thus, the timing and logistics of the 19th Meeting of the Clay Club will be decided based on the planning for the gas migration seminar. In view of the time that would already be devoted possibly to the conference as well as a seminar, an abbreviated meeting without a topical session is again proposed.

- **Alkaline Plume:** This topic was addressed in detail at the Lille 2007 conference on clays. For this reason, it is not a high priority to pursue a Clay Club activity at this time. However, there is still interest in the interaction of alkaline plume in the excavation disturbed zone (EDZ) and demand in some national programmes (by regulators, for example) for more phenomenological treatment of this issue; in addition, safety assessment often treat this with simplifying assumptions and for this reason limited investment may be merited. It was agreed that the Clay Club interests could be effectively addressed by the IGSC workshop being planned on cementitious materials for autumn 2009; conversely, the Clay Club knowledge and experience can contribute to a broader discussion of the topic. The most efficient mechanism for involvement is to have a Clay Club member participate in the programme committee for

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¹. Organisers for the EAGE Fault and Top Seals meeting have indicated, based on preliminary inquiries, their receptiveness to have either a joint or coordinated activity and this will therefore be pursued.
the workshop, which initiated planning in September 2008 under the sponsorship of ONDRAF/NIRAS. This option was subsequently agreed by the IGSC and workshop programme committee and Simon Norris, NDA, agreed to serve in this role.

- **Diffusion:** It was previously agreed that this is an important topic, but that there it may not be worthwhile to develop a state-of-the-art report at this point in time, given that some fundamental questions are yet to be addressed experimentally. At the 17th Meeting of the Clay Club, it was pointed out that several ongoing international projects are examining and will report on aspects of diffusion in the next several years, namely:
  - The EC project FUNMIG includes a review of current approaches on data regarding upscaling of diffusion (nanoscale to microscale).
  - The CLAYTRAC project will also highlight gaps in understanding.

While the CLAYTRAC report is finalized, important results from FUNMIG—including an identification of open issues—will not be available until 2009. In view of these considerations, it was agreed that the topic should be revisited in 2009 to assess what issues remain to be addressed and to determine if further work by the Clay Club is warranted. Key experts and FUNMIG participants (notably Scott Altmann, Andra) will be invited to participate at the meeting to help inform the Clay Club discussions.

- **Imaging and Observations of Clays at the Microscopic Scale:** Progress in observation of clay rocks at the microscopic level (to examine mineralogy or track porosity, for example) was previously agreed to be a topic of interest and had been suggested as topical session for the 18th Meeting of the Clay Club in 2008. The topical session was eventually not held in 2008 because the annual Clay Club meeting was abbreviated in order to be scheduled following the Fault Zones international conference. Members confirmed that the topic remains of interest; however, as the annual meeting in 2009 is again proposed to be held in coordination with an outside conference (i.e. in Montpellier during September 2009), a topical session cannot be held at the 19th Meeting. As an alternative, it was agreed to pursue a separate topical session in coordination with the next international clay conference, which will be held in Nantes, France during March 2010. Andra volunteered to take the lead in organizing a topical session at that time on the topic of “Imaging and Observation of Clays at the Microscopic Level: Approaches and Techniques.” FZK will provide support.

- **Other Topics of Interest:** An emerging issue is the interaction between clays and steel. Examples from several national programmes (Japan, for example) showed that the interaction could be significant, and there has been some work by Posiva\(^2\) on the topic. This is an issue that should be monitored as it evolves; the Clay Club will revisit it next year to assess whether any activity is warranted by the group on this topic.

Concerning the future work programme, Patrick Landais underscored that the value of the Clay Club lies especially in its ability to investigate the progress and information emerging from upstream academic research in the context of national disposal programmes and to evaluate its applicability to specific aspects of national programmes. Further involvement of the Clay Club at the interface with other communities (academic, scientific and industrial) should provide good additional opportunities to bring new ideas, generate cooperation and boost exchanges. The 2008 Fault Zones meeting and the potential partnership with the EAGE meeting in September 2009 are good examples of this role for the Clay Club and its potential contribution to broader NEA activities. Such positioning also reduces the

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2. A draft Posiva report was distributed as follow-on to the Clay Club meeting.
possibility of Clay Club activities duplicating related work of other international groups (e.g., research projects in the context of the European Community Euratom Framework).

8. Other Clay Club Business – Next Meeting

It was agreed that the next meeting should be planned in coordination with the gas migration seminar being pursued in 2009, which---as noted in Item 7 of the agenda---will likely be joined with the Fault and Top Seals Conference in September 2009 (Montpellier, France). The exact timing of the Clay Club meeting should be set to minimize travel and time demands on Clay Club members.

A separate topical session will on “Imaging and Observations of Clays at the Microscopic Level” will be planned in coordination with the next international conference on clays, which will take place in March 2010 in Nantes, France.

No additional items of Clay Club business were identified for discussion.

9. Summary of Meeting Outcomes and Conclusions

Patrick Landais provided a slide presentation summarizing the outcomes and conclusions of the meeting, which are reflected in detail in this summary record. He also thanked NDA for serving as a very efficient and gracious host of the meeting. At that, the meeting was closed.
Annex A

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19 September 2008, Lille, France

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