

15th ARRTC Meeting

28 February & 1 March 2005

Summary Record

Members Present

Prof Barry Hart (Chair)
Mr Ray Evans – Independent Member
Mrs Jill Fitch – Independent Member
Mr Mark Foy – Northern Land Council
Dr Carl Grant – Independent Member
Dr Terry Hillman – Independent Member
Dr Arthur Johnston – Supervising Scientist
Dr Tony Milnes – Energy Resources of Australia Ltd.
Prof Gerald Nanson – Independent Member
Dr Jenny Stauber - Independent Member

Apologies

Mr Shane Maraldo – Hanson Australia

Observers & Advisors Present (for all or part of the meeting)

Mr Julian Barry – Parks Australia
Dr Peter Bayliss - Environmental Research Institute of the Supervising Scientist
Dr Andreas Bollhofer - Environmental Research Institute of the Supervising Scientist
Ms Suzanne Davis-Hall - Office of the Supervising Scientist
Mr Don Elphick - Environmental Research Institute of the Supervising Scientist
Dr Ken Evans - Office of the Supervising Scientist
Mr Ian Hollingsworth - Earth Water Life Sciences Pty Ltd
Mr Alan Hughes - Office of the Supervising Scientist
Dr Chris Humphrey - Environmental Research Institute of the Supervising Scientist
Ms Michelle Iles - Office of the Supervising Scientist
Dr David Jones - Earth Water Life Sciences Pty Ltd.
Dr David Klessa - Earth Water Life Sciences Pty Ltd.
Mr Brendan Lewis – Northern Land Council
Mr Ian Loftus – Office of the Supervising Scientist
Mr Ian Marshman – Energy Resources of Australia Ltd (via video conferencing)
Mr Dene Moliere - Environmental Research Institute of the Supervising Scientist
Mr Bruce Ryan - Environmental Research Institute of the Supervising Scientist

Dr Claudia Sauerland - Environmental Research Institute of the Supervising Scientist
Mr Mike Saynor - Environmental Research Institute of the Supervising Scientist
Mr Keith Tayler - Department of Business, Industry and Resource Development
Dr Rick van Dam - Environmental Research Institute of the Supervising Scientist
Mr Peter Wellings – Parks Australia North
Mr Alex Zapantis – Energy Resources of Australia Ltd (via video conferencing)

1 Introductory Session

1.1 Welcome and Overview

1.1.1 The meeting opened at 9.00am on Monday 13 September 2004 with Barry Hart welcoming members, observers and advisors. Barry Hart then asked members, observers and advisors present to introduce themselves.

1.1.3 Barry Hart then noted the tabling of an additional three meeting papers; two from ERA and one from ERISS.

1.1.4 Barry Hart then talked about the meeting structure, noting the way that ERA and ERISS research programs would be reported. He advised that ERA reports on a calendar year basis and ERISS on a financial year basis, and that this would change the focus of ARRTC meetings. He expected that the March meetings would look at the ERISS program in detail (with a progress report on the ERA program) and that this arrangement would be reversed at the September ARRTC meetings.

1.1.5 Barry Hart then noted that the reconstituted ARRTC was now nearly four years old, and that he would like to do a very brief internal review discussion on the workings of ARRTC. He suggested that this should occur under Agenda Item 7.

1.2 Apologies and Observers

1.2.1 Apologies from Shane Maraldo of Hanson Australia were noted.

1.2.2 Barry Hart then noted that observers from a variety of organisations would be present for all or part of the meeting.

1.3 Declarations of any conflicts of interest with Agenda items

1.3.1 No conflicts of interest with any agenda items were declared by members.

2 Draft Summary Record of 14th Meeting - March 2004

2.1 Discussion of the Draft Summary Record of the 14th Meeting

2.1.1 Jill Fitch noted that a change should be made to paragraph 3.2.11, with “interest in being involved” being replaced with “interest in being kept informed”.

2.1.2 Jenny Stauber then noted that there was a typographical error in paragraph 3.2.45 and that “bioaccumulation” should be spelt correctly.

Action/Outcome No 2A:

ARRTC endorsed the draft summary record of the 14th Meeting of ARRTC, held in September 2004, subject to the changes described in paragraphs 2.1.1 and 2.1.2 of this summary record.

2.2 Business Arising

2.2.1 Barry Hart then went through the Actions/Outcomes list appended to the Summary Record of the 14th ARRTC meeting.

Action/Outcome 3B

2.2.2 Barry Hart noted the last dot point under **3B**, "... include reference to the application of human resources(in person weeks) for past, current and future projects...", and advised that he would raise this issue later in the meeting.

Action/Outcome 3F

2.2.3 Under **3F** Barry Hart noted that the progress report on bioaccumulation and trophic transfer was not being presented. Rick Van Dam responded, advising that, given the agreement that the February meeting address planning issues for *eriss*, a report on project progress was not necessary.

Action/Outcome 3G

2.2.4 Under **3G** it was noted that the sediment delivery work was awaiting additional statistical analysis by Dr David Fox. Ken Evans advised that a paper had been received from Dr Fox and that Peter Bayliss is still looking at that paper. Peter Bayliss advised that David Fox's consultancy contract was not finished. Whilst he developed a statistical method to examine power analysis of two slopes and two intercepts simultaneously in a regression model, he has yet to provide a method to estimate power analysis for the addition of other variables (for example, multiple regressions). Peter Bayliss offered to provide the completed consultancy report after it arrives.

Action/Outcome 3I

2.2.5 Under **3I** Barry Hart noted that ARRTC members are getting copies of Mnesite Technical Committee agendas and that they are satisfied with this arrangement.

Action/Outcome 3J

2.2.6 Barry Hart noted that David Klessa would be providing an update paper and presentation on his Magela Creek work at the meeting.

Action/Outcome 4A

2.2.7 Barry Hart noted that he was pleased to see the inclusion of a paper and Agenda Item for the ERA Radiological Monitoring issue that has been deferred from previous meetings.

Action/Outcome 6C

2.2.8 Barry Hart then noted that the ERISS indigenous knowledge paper had not been done. Peter Bayliss explained that this was due to several reasons, most importantly Max Finlayson's departure from ERISS which has increased Peter Bayliss' administrative load. Peter Bayliss noted that Elaine Glen resigned from the Northern Land Council in November 2004. She had agreed to provide the first draft, which was to be sent around for comment by other key stakeholders. Once that process was completed, Peter Bayliss and Elaine Glen had planned that the discussion paper be published, possibly as an SSR. However, although Elaine Glenn resigned before writing the first draft, she managed to write one prior to travelling to East Timor. This was sent to Peter Bayliss when he was on leave, and there had not been time to complete the work prior to ARRTC meeting. Peter Bayliss offered to follow up on this topic with Brendan Lewis of the the Northern Land Council and with Elaine Glen via e-mail. Terry Hillman then noted some work being undertaken by Tony McLeod of the Murray-Darling Basin Commission in the area of traditional/indigenous knowledge.

Other Issues

2.2.9 Ray Evans then raised paragraph 2.2.9 on page 3 of the Summary Record of the 13th Meeting of ARRTC. He advised that this issue should be put back on the agenda as it appeared to be slipping. Tony Milnes then responded, and advised that this is a landform (rather than a rehabilitation) issue.

2.2.10 Ray Evans then advised that he would like to see ARRTC agendas recast in line with the structure of the Key Knowledge Needs, with standard reporting against the Key Knowledge Needs being a key feature of each ARRTC meeting. Barry Hart asked Ray Evans about the level of reporting that should be provided, and Ray Evans noted that it could be provided down to the third level. Ray Evans added that this would require prioritisation of the items.

2.2.11 Arthur Johnston noted that, in relation to operational mining issues, ARRTC wanted to be advised of the science used in the approvals assessment process. He noted that this information is provided to ARRTC meetings using a standard template to capture relevant information. These issues are picked up at Agenda Item 5. Arthur Johnston noted that issues raised at Agenda Item 5 are in the past (post-assessment), rather than being a scientific view of the future.

2.2.12 Carl Grant noted that ARRTC's agendas appear to be driven by each previous meeting's actions, and that more out-of-session work is required. He noted that the papers provided by David Klessa were very good, but contained too much detail for full meeting consideration. He agreed that the agenda should be realigned to give a Key Knowledge Needs focus.

2.2.13 Arthur Johnston then commented on the level of detail being provided in ARRTC meeting papers. He noted that the papers are not detailed enough to provide the meeting with any more than a cursory overview of the science in the context of each meeting. He added that smaller groups could be used to deal with issues in detail.

2.2.14 Barry Hart noted the need to keep ARRTC meetings at the strategic level to provide a high-level macro view, rather than micro-level detail.

2.2.15 Terry Hillman then advised that he supported Carl Grant's model, adding that he is somewhat sceptical of one-to-one contact as it gives ERISS staff the impression that ARRTC is functioning as a board of control. Barry Hart agreed, noting that ARRTC looks to provide strategic level oversight, not management, for ERISS and ERA.

2.2.16 Ray Evans then raised paragraph 2.2.20 on page 4 of the Summary Record of the 13th meeting of ARRTC. He noted that he would like to see the status of close-out reports in relation to the Jabiluka Land Application Area issues. He noted that this is underway but not finalised and that he would like to see it included on the agenda for the 16th Meeting of ARRTC.

2.2.17 Ray Evans asked if there had been any tangible results from the break-out sessions held during the 14th ARRTC meeting, and whether members saw the sessions as worthwhile. He suggested that it might be useful to have a report back later at this meeting on the break-out sessions.

2.2.18 Ray Evans then noted his appreciation of e-mail correspondence from Michelle Iles of the Office of the Supervising Scientist on chemistry issues.

3 Research Activities and Key Knowledge Needs

3.1 Key Knowledge Needs

3.1.1 Barry Hart asked ARRTC members whether or not they had any views on what now needed to be done with the Key Knowledge Needs documents.

3.1.2 Jenny Stauber asked when the traditional knowledge issues would be incorporated into the Key Knowledge Needs, and queried whether or not this would be done at the next revision in 2006. Barry Hart responded, noting the two-yearly cycle for the Key Knowledge Needs. Arthur Johnston noted the need to consider traditional knowledge, and advised that his preference is to have traditional knowledge embedded along the way in each of the individual Key Knowledge Needs projects.

3.1.3 Jill Fitch noted the use of the term “reviewed” which appeared in track changes mode on page 5 of the Key Knowledge Needs under *Radiological characteristics of the final landform*. She advised that the original term “assessed” might be more appropriate than “reviewed” as she is not sure that they were “assessed” as well as should have been in the first place. Tony Milnes responded, and noted the change in methodologies over the 25 years. Both Arthur Johnston and Tony Milnes then indicated that they were both comfortable with using “reviewed”. Members agreed.

3.1.4 Jill Fitch then asked about the sentence, “a more robust examination of radon loss from dust particles”, that appears at the top of page 4 under *Radiation exposure of workers*. She asked what it actually meant, and Andreas Bollhofer noted that it was related to the dose conversion factors linked to the inhalation of dust.

3.1.5 Barry Hart noted the sentence “within a modelling conceptual and risk assessment framework” on the top of page 9 under *Re-assess and prioritise the landscape program*. He suggested that the word “conceptual” should be moved so that the sentence reads “within a conceptual modelling and risk assessment framework”.

3.1.6 Jill Fitch then asked about Key Knowledge Need 5.2 on page 9 in relation to the South Alligator Valley burial site for radiologically active residue. She asked whether or not there would be one or more sites, and Peter Wellings advised that there would be only one site.

3.1.7 Jill Fitch noted under Key Knowledge Need 5.3 the word “mining”, and suggested that it should be “mineral”. Members agreed with this change.

3.1.8 Arthur Johnston queried the sentence in Key Knowledge Need 6.1 under *Development of an integrated framework* which reads “assist with the communication where the scientific information is relevant, and how it informs on the various risks to the system”. He asked what the sentence actually meant, and suggested it be reworded to read “assist with the communication of the various risks to the system”. Members agreed to this change.

3.1.9 The meeting then asked Ian Loftus to circulate the definitive Key Knowledge Needs document, including the tabular prioritised version, as a PDF to ARRTC members.

Action/Outcome No 3A:

ARRTC:

- Noted several changes to the Key Knowledge Needs documents, as described in paragraphs 3.1.3 to 3.1.8 of this Summary Record; and
- Requested that Ian Loftus circulate the amended Key Knowledge Needs document, including the tabular prioritised version, as a PDF document to ARRTC members.

3.2 ERISS Research

ERISS Proposed Research Program 2005-06

3.2.1 Arthur Johnston talked about the role of the ERISS research program, and noted that ARRTC has two distinct roles. These are: firstly, assessment of the relevance of the science (through the development of the Key Knowledge Needs), and, secondly, assessment of the quality of the science (through in-progress and post-event scrutiny). He then asked ARRTC to comment on the way that the proposed ERISS research program for 2005-06 addressed the Key Knowledge Needs. He then discussed the structure of the paper, noting that it described how each of the projects fits with the Key Knowledge Needs, and how it notes the status of each topic/project.

3.2.2 Carl Grant commented that the document would be good for proposed projects, but that it needed an update field for in-progress/ongoing projects.

3.2.3 Barry Hart noted that only a paragraph would be required for the update field, and that the level of information required would not be the same as that proposed to be required for the September 2005 ARRTC meeting.

3.2.4 Arthur Johnston described earlier reporting/feedback processes used for ARRTC meetings in relation to ERISS research issues, and Peter Bayliss queried whether or not the ERISS quarterly business plan could be used as it reports on progress of current projects. Arthur Johnston responded that it provides too much detail and is not in the Key Knowledge Needs format.

3.2.5 Ray Evans then noted that the ERISS document focussed on the breadth, rather than the depth, of issues. Arthur Johnston responded, noting that the format of the report allowed gaps in the Key Knowledge Needs to be identified. Barry Hart noted that the document's structure focussed on the higher level, and allowed members to then drill down to further detail if required.

3.2.6 Ray Evans asked Arthur Johnston about an ANSTO groundwater project that was conducted at Koongarra several years ago, and Arthur Johnston described the project, noting that it was designed to look at groundwater movement within the context of radioactive waste disposal.

3.2.7 Barry Hart and Jill Fitch noted recent media reports in relation to Koongarra, and Arthur Johnston responded and gave a brief description of Koongarra issues. Mark Foy described the relevant provisions of the *Aboriginal Land Rights (Northern Territory) Act 1976* and *Mining Act* in relation to Koongarra. He added that the application for the new Koongarra area re-activates every 5 years; this will next occur in April 2005.

3.2.8 Tony Milnes then noted the Jabiluka Long Term Care and Maintenance Agreement media announcement of Friday 25 February 2005.

3.2.9 Arthur Johnston then gave a PowerPoint presentation on uranium mining and landscape analysis conceptual models (see Figures 1 and 2 below).

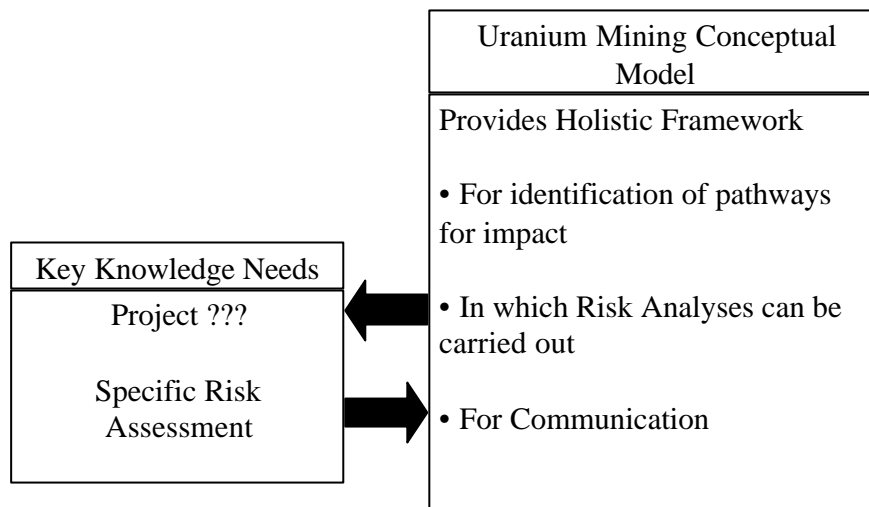


Figure 1 - Slide 1 – Uranium Mining

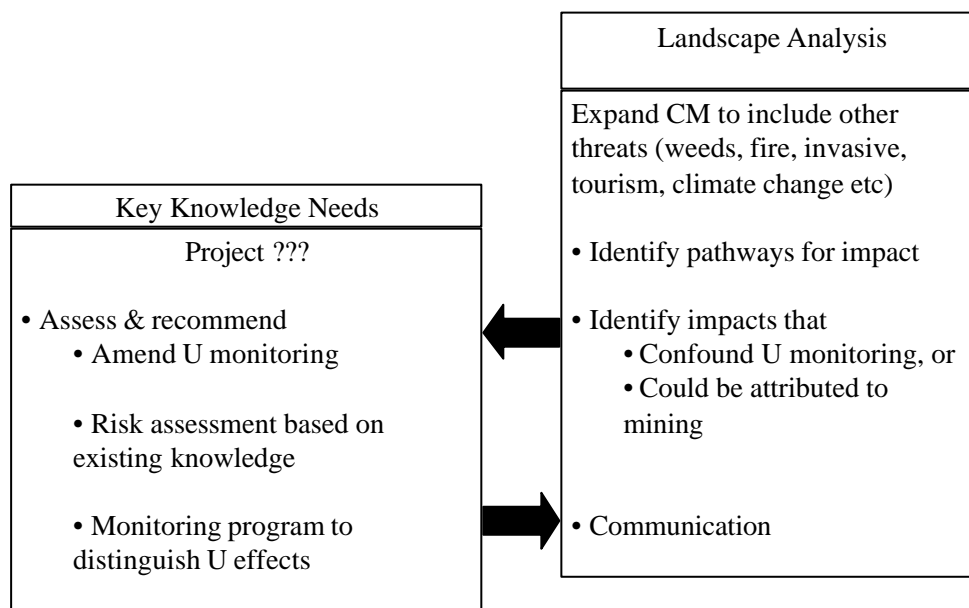


Figure 2 - Slide 2 - Landscape Analysis

3.2.10 Barry Hart then asked for discussion by ARRTC members on the issue, noting the particular place of “confounding” issues. Ray Evans agreed with the approach used in Arthur Johnston’s presentation. Jenny Stauber noted the tricky matter of identifying indirect issues, and the need to look at the highest level initially, and to then prioritise lower level issues. Arthur Johnston then noted the need to only do significant work where it fitted into the Key Knowledge Needs framework.

3.2.11 Barry Hart noted that he was pleased to see the uranium-mining context, noting the obvious uranium mining focus of the Key Knowledge Needs.

3.2.12 Arthur Johnston then talked about looking at surface water pathways that include Traditional Owners’ perception of risk issues. These would fall under Key Knowledge Needs

6.1 to 6.4. Ray Evans and Barry Hart agreed that these would also fit under Key Knowledge Need 6.2.

3.2.13 Gerald Nanson then asked the meeting about the future of uranium mining, and how changes in the political, environmental, and economic context might relate to the existing Key Knowledge Needs context. He noted the need to think about more than just a 510 year period. Terry Hillman responded, noting that ARRTC's work could be generalised, and that it could be applied to other sites beyond Ranger, Jabiluka and Nabarlek.

3.2.14 Barry Hart then sought the meeting's views as to the what level of detail and content should be appropriate. Terry Hillman made a general comment, suggesting that the level of detail is about right, but noting that the issue of project design was not picked up. Barry Hart added that further information would be useful, but should be dealt with out of session as it would consume significant time in session.

3.2.15 Arthur Johnston then advised the meeting that the ERISS document contained enough of a description of each project to allow a judgement to be made by ARRTC.

3.2.16 Barry Hart then asked about resource implications, noting that this information did not appear in the document. He advised that this information should be included in order for ARRTC to assess the level of commitment towards addressing each Key Knowledge Need. Arthur Johnston then responded, noted that reporting is against outcomes rather than details of process. He added that ARRTC has set the priorities and ERISS will determine measures of getting to the end point.

3.2.17 The meeting then discussed *Ranger Current Operations – Monitoring* projects which are listed under **1.3.1 Surface water, groundwater, chemical, biological, sediment, radiological monitoring.**

3.2.18 Ray Evans noted that the first two projects listed appear to be descriptions, and do not describe what will actually happen. He presumed that these projects relate to monitoring.

3.2.19 Ray Evans then noted that he could not see the strategic relevance of the project *Monitoring of radionuclides in groundwater at Ranger.* Arthur Johnston then explained that this is a low-level ongoing project, and that it needs to be integrated with a broader groundwater project. It also needs better integration with ERA's own groundwater activities.

3.2.20 Arthur Johnston talked about the review/assessment of the landscape project. He noted that the thrust was not to try to fit all ERISS projects into the Key Knowledge Needs – has been to assess projects in the Key Knowledge Needs context.

3.2.21 In relation to the project *Stream Monitoring Program in Magela Creek* listed under 1.3.1 on page 6, Terry Hillman suggested that a review should look at how bioaccumulation model links with pathways issue. Rick Van Dam and Chris Humphrey then advised that it is being done, and Barry Hart noted it appears on page 9 as *Review of the bioaccumulation monitoring program.* Barry Hart then noted that the project on page 9 does not link to the conceptual model, and it would be useful to include the reference to linkages.

3.2.22 Jill Fitch sought a clarification of the terminology used in the document. Arthur Johnston noted that projects will be either *new* or *continuing*. He advised that this terminology is only useful in identifying whether a particular project is new or ongoing and helps with guiding the assessment of priorities.

3.2.23 Carl Grant then noted the need to consider the broader context, and to allow individual projects to be considered alongside each other. Gerald Nanson noted his need to have some idea of time/resources issue to show how everything fits together.

3.2.24 Tony Milnes then sought to clarify Carl Grant's comments. He noted the Johnston and Milnes Alligator Rivers Region research summary document that brought together the research history, and added that the Key Knowledge Needs were derived from that document. He added that it might be useful to update that research summary every few years.

3.2.25 Carl Grant suggested that a timeline for each project should be provided, identifying which projects were new, which projects were ongoing, and which projects will end each year. He added that this timeline should then provide a graphical link between each of the projects and then a link with the Key Knowledge Needs.

3.2.26 Tony Milnes noted that bringing all this information together could be difficult. Barry Hart then drew a timeline Gantt chart on the whiteboard, and suggested that this type of format could project forward several years and would allow the temporal and relational representation of projects. Carl Grant supported Barry Hart's suggestion.

3.2.27 Ray Evans noted that he needed an extra level of information to match the Key Knowledge Needs with the ERISS work plan and other important documents.

3.2.28 Terry Hillman then noted his desire to have outcomes reported against, rather than the inputs (being the expenditure and human resources).

3.2.29 Arthur Johnston then asked the meeting about the types of information that should be provided. He advised that he can present information on projects to address the Key Knowledge Needs, and that his desire is for ARRTC to endorse (or otherwise make comment on) the project. Arthur Johnston then advised that he does not see ARRTC's role as assessing individual projects prior to the projects actually commencing, but rather to provide scrutiny whilst the project is underway and upon completion. Ray Evans then advised that he agreed with Arthur Johnston in relation to the process of assessing whether the Key Knowledge Needs are being met.

3.2.30 Arthur Johnston then reiterated that ARRTC's involvement occurred on two levels: firstly, the relevance of the science (through the development of the Key Knowledge Needs) and the quality of the science (through in-progress and post-event scrutiny). Ray Evans then noted that both Arthur Johnston and Tony Milnes are responsible for managing the financial and human resources of the respective organisations, and that it would be inappropriate for ARRTC to micromanage the operations of the two organisations.

3.2.31 The meeting discussed the project "*Chronic toxicity of uranium in Magela Creek water to the freshwater snail, *Amerianna cumingi**" described on page 2-3 of the document.

3.2.32 Jenny Stauber noted a lack of Quality Assurance data in relation to the snail, and queried whether it was included in the protocol. She noted that the work needs Quality Assurance to enable the external/refereed publishing of documents. Rick Van Dam noted that publication of the material would occur on two levels: internal and then, later, external, and that quality assurance information would be included when published externally.

3.2.33 Jenny Stauber then suggested that reference to the toxicity of ammonia is the wrong way around, and that earlier work was not ammonia specific but derived from whole effluent toxicity testing. She noted the need to look at the sensitivity of ammonia for species to get an idea of ammonia-only toxicity. Arthur Johnston explained the process, noting the whole-of-effluent testing that was undertaken for the pilot process water treatment plant. He added that this gave context in relation to the performance of the pilot plant as well as the protection of the offsite environment.

3.2.34 Rick van Dam suggested that following the results of the whole effluent toxicity testing, a decision would be made as to whether to proceed with ammonia-alone toxicity testing, or the desk-top review of ammonia toxicity as proposed in the project description.

3.2.35 Ray Evans then noted that this is not picked up in the Key Knowledge Needs. Jenny Stauber noted that this is an important issue that has arisen, and Tony Milnes reiterated that it was linked to the process water treatment plant.

3.2.36 Barry Hart noted the link to Key Knowledge Need 2.4 in document “water treatment” Arthur Johnston noted that water treatment is an important issue, and that it might sit under “water treatment”. Tony Milnes then noted that parts of this work also fit under Key Knowledge Need 1.2 ecological risk

3.2.37 Barry Hart then noted the issue of dilution ratios, and queried whether dilution was the intended outcome. Arthur Johnston responded, noting the focus on the safe discharge of water to the external environment.

3.2.38 Barry Hart and the committee expressed satisfaction with this project.

3.2.39 The meeting then discussed the project “*Development of a reference toxicity testing program for routine toxicity species testing*” as described on pages 4-5 of the document.

3.2.40 Jenny Stauber advised that she would like to see detail in relation to the reference toxicant being used, and that the project method needs to be changed to have a minimum of five tests rather than a total of five tests. Rick Van Dam noted that this is a continuing project.

3.2.41 Ray Evans asked where the project fitted in relation to the Key Knowledge Needs, and Jenny Stauber noted that Arthur Johnston’s document was not exclusively focussed on the Key Knowledge Needs.

3.2.42 Jill Fitch then noted the need to make an ongoing record of issues that need revision/updating in the 2006 revision of the Key Knowledge Needs.

3.2.43 The meeting then discussed the project “*Enhancing species sensitivity distribution models used in ecotoxicological risk assessments with biomass scaling relationships*” described on page 5 of the document.

3.2.44 Arthur Johnston noted the sensitivity of organisms to toxicants, and suggested that there is an inverse relationship with body mass. He referred to Peter Bayliss’ earlier regression model where uranium NOEC values for animals increased with increasing body mass. However Arthur pointed out that there were only four sample points for animals and two for plants. Nevertheless, Arthur noted that toxicants in general may affect bigger organisms to a lesser degree than smaller organisms. He noted that the sensitivity of animals of different sizes to zinc toxicity fits Peter Bayliss’ hypothesis and here the sample size was much larger. Arthur noted that we want to re-examine the hypothesis with respect to uranium toxicity for aquatic species in Magela by indirectly estimating species mass from body length and then NOEC values. Arthur Johnston then added that the use of smaller, more sensitive animals in ecotoxicological risk models may give inaccurate results of environmental protection due to the inverse relationship described earlier.

3.2.45 Jenny Stauber then noted satisfaction with the project and suggested that the indirect modelling approach has great potential in overcoming inherent small sample size limitations of most Species Sensitivity Distributions (SSD).

3.2.46 Ray Evans asked why this issue is more important than other Key Knowledge Needs issues, and Jenny Stauber agreed with Ray Evans. She asked whether there are other items

(dissolved uranium and sediment effects) being picked up in later years or dropped off the program. Arthur Johnston then noted the Jabiluka issue, and Rick Van Dam noted the pending Australian Research Council linkage application.

3.2.47 Barry Hart noted that the project seems satisfactory and that he is comfortable with it sitting in its current location.

3.2.48 Jenny Stauber asked Arthur Johnston about sediment issues. Arthur Johnston responded, noting earlier the work that Chris Humphrey had undertaken for Parks Australia North. He also referred to Jabiluka, noting the ecotoxicology issues were important to the closure criteria.

3.2.49 Ray Evans noted some concern in relation to the process. He feels that the project is innovative and should be undertaken. He also advised that each proposal needs to be treated evenly and assessed in line with the Key Knowledge Needs. Jenny Stauber agreed that this issue is difficult and that there are projects that do not address the Key Knowledge Needs, but she added that these projects do allow ARRTC to have confidence in ERISS projects.

3.2.450 Arthur Johnston suggested that an honours student could be used for this work so it is not a Key Knowledge Needs issue. Ray Evans agreed that it is not a significant Key Knowledge Needs issue but could be done by ERISS subject to resource considerations.

3.2.51 Jill Fitch noted some difficulty with the wording in the Key Knowledge Needs. Barry Hart noted that the Key Knowledge Needs would be revised in 2006, and that comments on them would be considered during the revision process.

3.2.52 The meeting then considered the issue of *monitoring*, with Chris Humphrey noting that two papers on the ARRTC agenda at Agenda Items 4.1.1 and 4.1.2 describe issues related to the Supervising Scientist's routine monitoring program.

3.2.53 Ray Evans stated that because it is monitoring it is a trivial science issue, but simply noted that protocols have to happen. He added that there did not appear to be a clear description of stream monitoring, with the document only containing a brief description of monitoring techniques.

3.2.54 Terry Hillman queried how much monitoring activity had been imposed by external organisations and how much had been imposed internally. Arthur Johnston described the outcomes of the 2000 tailings leak investigation, which led to the Supervising Scientist's routine monitoring program in the Alligator Rivers Region. He added that it was a Commonwealth Government decision that it should happen, with the fine details determined internally.

3.2.55 Jenny Stauber queried the respective level of environmental radiation monitoring being undertaken by ERA and ERISS, as ERA activity is not mentioned in ERA's paper at Agenda Item 4.2. Tony Milnes stated that he is not aware if ERA does environmental radiation monitoring. Arthur Johnston then advised that he felt that the environmental radiation issue should be removed from ERA's document.

3.2.56 Terry Hillman raised the issue of bush tucker as a pathway. Arthur Johnston talked about the work that was done in the 1980s. Mussels were the biggest factor, followed by fish and then lilies. Jill Fitch suggested that a reassessment of the bush tucker diet is needed for several reasons, such as the decline in buffalo since the 1980s. Arthur Johnston noted that the terrestrial pollution pathways after rehabilitation are also important, not just the current surface water pathways. Terry Hillman also noted the need for a broader consideration of pathways.

3.2.57 The meeting then discussed the project “*Assess Ranger rehabilitated landform geomorphic stability using landform evolution modelling and GIS technology*” described on page 11 of the paper.

3.2.58 Gerald Nanson asked about Siberia, and its current status, and whether it would be worth getting other opinions on the Siberia model.

3.2.59 Tony Milnes talked about the Siberia model, noting that Siberia has progressed. He advised that the model is now looking at predictive soil models, and then queried how far it could be validated. He added that it is the only model that has been partly validated for use in the Alligator Rivers Region landscape, and that it could ultimately be beneficial to use several different models for comparison. Arthur Johnston advised that he sees Siberia as a tool for optimisation rather than as a tool to give the final answer.

3.2.560 Ken Evans noted that work has now progressed. He advised that Guy Boggs of the Charles Darwin University has added catchment and sediment transfer data to the model, and that Greg Hancock has done further calibration work. Dene Moliere has been involved with temporal change parameters, and ERISS is now working with Guy Boggs to vary parameters in relation to hydrology.

3.2.61 Ray Evans asked whether ERISS had enough parameter estimates. Ken Evans advised that this is a software issue. The model needs the hydrology parameters to be made variable.

3.2.62 Tony Milnes then suggested that the internal aspects of the landforms are as important as the surface aspects. The issue was discussed by members.

3.2.63 Carl Grant then talked about an Alcoa project which involves a MSc student using Siberia to examine steep surface rehabilitation.

3.2.64 Ray Evans then noted that this would be a good opportunity to do a project on near sub-surface processes, but that this could be somewhat difficult.

3.2.65 Tony Milnes noted that he would like Gerald Nanson to comment in relation to the predictability of the landform, and in relation to what level of change would be acceptable in the longer term. Gerald Nanson noted that ERISS could look at comparative long term landscape evolution, but that there is very limited expertise out there. He noted, however, that knowledge base is expanding (for example, the Flinders Ranges, and the Grampians).

3.2.66 Terry Hillman then raised the issue of hybrid models, noting that hydrologist Dr Rory Nathan of Sinclair Knight Merz in Melbourne has models that look at the movement of water.

3.2.67 Barry Hart noted that the issue of subsurface longevity is a critical area, and needs consideration. He added that the committee needs to recognise that Siberia is sound and is being used (and improved), noting that other approaches are also available.

3.2.68 The meeting then discussed the project “*Assessment of the significance of extreme events in the Alligator Rivers Region*” described on pages 11-12 of the document.

3.2.69 Ray Evans queried the non-hydrological extreme events issues that do not appear to be covered by this issue. Jenny Stauber suggested a change from “extreme events” to “extreme rainfall and hydrological events”. Mike Saynor then talked briefly to the paper on extreme events at Agenda Item 3.2.1.

3.2.70 Terry Hillman then advised the meeting that he was impressed with this project.

3.2.71 Terry Hillman noted that models tend to work within “normal” ranges, but that they do not work so well with the “abnormal” extreme events. He added that he would like to link extreme events to other issues such as the conceptual models.

3.2.72 Gerald Nanson queried whether rainfall run-off modelling might be useful, and that it could be possible to look at the Gulungul Catchment historical record to see if any erosion pattern pointed to an earlier extreme event. Ray Evans noted that rainfall monitoring could be another (separate) project, rather than falling within the extreme events project. Mike Saynor advised that there had originally been two separate projects, but now Peter Bayliss and he were working on the same model.

3.2.73 Terry Hillman then added that the Ranger mine itself has not made the Alligator Rivers Region area more liable to extreme events, and noted that the conceptual model could come first.

3.2.74 Ray Evans asked about tailings and extreme events such as earthquakes. Tony Milnes responded, and referred to work done by the Queensland University Advanced Centre for Earthquake Studies. Arthur Johnston then noted some work done in previous years in relation to the probability of the tailings dam wall being breached and potential downstream impacts.

3.2.75 Barry Hart thanked Mike Saynor and ERISS for the paper and presentation and noted satisfaction with progress.

3.2.76 The meeting then discussed the project “*Use of Koongarra as a pre-mining radiological analogue for Ranger*” described on pages 12-13 of the document.

3.2.77 Jill Fitch advised that she is happy with the description “reviewed” rather than “assessed”.

3.2.78 Arthur Johnston talked about the history and discovery of the Alligator Rivers Region ore bodies in the 1960s-1970s. Andreas Bollhofer noted that survey data dating back to 1976 is available. He added that ERISS is also doing on-ground surveys at Koongarra and extrapolating the results of that work to the Ranger site. He is also aware of earlier studies, but noted that they tended to focus on the ore body rather than the whole site. Ray Evans noted that geochemical issues were also a gap

3.2.79 The meeting then discussed the project “*Radio- and lead-isotopes in sediment of the Alligator Rivers Region*” described on page 13 of the document.

3.2.80 Andreas Bollhofer noted the need for more work on monitoring techniques, and added that this cuts across several Key Knowledge Needs. He advised that project work includes looking at pre-mining sediment cores for different catchments, as well as looking at using lead isotopes. He noted an ARC linkage grant for a PhD student to do work in several catchments. Arthur Johnston noted that this has the potential to produce a useful mechanism for monitoring, and will be a good project for a PhD student.

3.2.81 Ray Evans asked if there are any other anomalies on the Ranger Project Area that could be used as an analogue for Ranger pits #1 and #3. Tony Milnes responded, noting that known anomalies at Ranger have little value as analogues. Brendan Lewis then noted that anomaly #2 is located close to Mount Brockman and has sensitivities for Traditional Owners.

3.2.82 Barry Hart expressed satisfaction with this project.

3.2.83 The meeting then discussed the project “*Development of broad scale closure criteria for the Ranger mine site*” described on page 14 of the document.

3.2.84 Arthur Johnston noted that this project had yet to be worked up, and that it needs lots of effort and collaboration between the various organisations. Carl Grant noted that this is a very important project, and that a project timeline would be useful to prevent duplication between different activities and organisations.

3.2.85 Arthur Johnston then outlined the existing goals/objectives (dating from 1990) in the Ranger *Environmental Requirements* which had some degree of input from the Traditional Owners. He added that the Traditional Owners' expectations may have changed since the *Environmental Requirements* were developed.

3.2.86 Tony Milnes advised that EWLS is working on the development of a closure plan for Ranger, and that ERA and Rio Tinto require that it be finalised by June 2005. Under current assumptions, ERA expects to rehabilitate all of the infrastructure. A draft plan is likely to become available in March 2005. Carl Grant noted that he would like to see the document presented to the next ARRTC meeting.

3.2.87 The meeting then discussed the project "***Development of predictive habitat suitability models of biological communities in aquatic and terrestrial ecosystems***" as described on pages 14-15 of the document.

3.2.88 Chris Humphrey noted that this project adds to existing EWLS work. Arthur Johnston then noted that the wording will change as a result of the joint ERISS/EWLS workshop that was held in February 2005 prior to the ARRTC meeting. Carl Grant then noted that this area is an ongoing concern and that it requires a quantitative assessment.

3.2.89 The meeting then discussed the project "***Key aspects of native seed biology that supports Ranger mine rehabilitation goals***" as described on pages 15-16 of the document.

3.2.90 It was noted that this project involved collaboration between ERA, Traditional Owners, ERISS and the Charles Darwin University. This project was strongly supported by Carl Grant. He advised the meeting that he had met with Sean Bellairs (of the Charles Darwin University) and ERISS in 2004.

3.2.91 Peter Wellings expressed concern about the use of the term "Traditional Owners", and suggested that it has been used too loosely. He noted that the plant suppliers are not Traditional Owners but that Mirarr may get involved in the future.

3.2.92 The meeting then discussed the project "***Bioaccumulation of radionuclides in terrestrial plants on rehabilitated landforms***" described on pages 16-17 of the document.

3.2.93 Terry Hillman advised that he was glad that this work is going ahead. He noted that mussels are a significant aquatic pathway, and that the focus could be on food chain transmission. Andreas Bollhofer noted that ERISS is looking at updating the Aboriginal diet that was used in earlier bush tucker studies. Bruce Ryan then noted that ERISS has started research work on wallabies, and is also looking at buffalo and pig.

3.2.94 Terry Hillman then asked about frog eating snakes (for example, olive pythons) as well as geese. Peter Wellings added that the goanna is another important food source for local Aboriginal people.

3.2.95 Ray Evans noted early Bureau of Mineral Resources data which was undertaken as part of a uranium exploration program. Arthur Johnston added that this issue is complicated by soil constituents and nutrients. Arthur Johnston then noted that metals tend to *bioaccumulate* rather than *biomagnify*.

3.2.96 Barry Hart then asked what the outcome of this project would be, and Arthur Johnston advised that the timeframe is longer than a year, and there may be a need for ERA to grow its own plants, as happened with Nabarlek.

3.2.97 The meeting then discussed the projects *“Incorporation of disturbance effects in the development of vegetation succession models”* and *“Development of key indicators and indices of ecosystem “health” to monitor and assess rehabilitation success”* described on pages 17-18 of the document.

3.2.98 Carl Grant noted that both projects looked good, and are a good start. Carl Grant also noted that the second project (*“Development of key indicators and indices of ecosystem “health” to monitor and assess rehabilitation success”*) was good, and that the focus should be how to do the research – noted improvements in satellite monitoring technology. Carl Grant also noted the need to have closure criteria in place prior to having indicators put in place.

3.2.99 Barry Hart noted that this work has to be done, and that it should start. He added that it is progressive and can not be progressed too quickly.

3.2.100 The meeting then discussed the project *“Quantitative comparison of remotely sensed data for minesite assessment”* described on page 19 of the document. Carl Grant noted that the use of remote sensing methods to assess the early stages of revegetation at Ranger may not be effective, and that ground survey methods may be more appropriate.

3.2.101 Peter Bayliss talked about the remote sensing work being done on vegetation assessment and monitoring at Nabarlek, noting that it is taking place ten years after the initial rehabilitation of the site and so is about the right timing for the use of this technology there. Peter Bayliss noted also that the combined use of ground survey and remote sensing methods may be more effective in the long-term, as the limitations in both methods can be overcome. Peter Bayliss then noted that whilst you would never get away from ground surveys, you could hopefully reduce the costs of monitoring the whole minesite using cost-effective remote sensing, especially the closer revegetated sites get to analogue sites. Peter Bayliss finally noted that ERISS has purchased a hand-held reflectance spectrometer, and will obtain spectral libraries of key ground cover features at both Nabarlek and Ranger. He noted that these libraries would allow use of more powerful hyperspectral captures to monitor and assess rehabilitation success, but it could take a few years to get the full matrix combination for each key species of plant and mineral or chemical assemblage, which like Nabarlek would then be about the right timing.

3.2.102 The meeting then discussed the project *“Monitoring sediment movement in the Magela Creek System”* described on page 20 of the document.

3.2.103 Ray Evans advised that he saw no problems with this project as applied to Magela and Gulungul, but suggested that Narradj appears to be contrary to advice given by ARRTC at the last meeting. Arthur Johnston explained the methodology in relation to measuring turbidity; ie some suspended sediment samples were required to check the calibration of turbidity probes.

3.2.104 Barry Hart advised that he was satisfied with this project.

3.2.105 Arthur Johnston then raised the issue of Jabiluka monitoring, noting that there would be no biological monitoring at Jabiluka, and that the existing chemical monitoring program would be reduced. He added that ERA and DBIRD will continue some monitoring activity. He added that the project being discussed is being finalised and that it consists of the analysis

of previously collected data, rather than active data collection. The project will end later in 2005.

3.2.106 Ray Evans then noted that the residual questions about the use of the sediment flux relationship developed by ERISS as a performance measure for minesite rehabilitation had not yet been answered.

3.2.107 Barry Hart noted the need to resolve what happens, and suggested that things could be resolved out-of-session by telephone. He noted that Ray Evans had been overseas when much of the out-of-session discussion had occurred.

3.2.108 Ray Evans advised that the major issue relates to statistical analysis, and that he is not the best person for the job. Ray Evans noted that he would talk to Gerald Nanson, Arthur Johnston and Ken Evans to progress and resolve these issues

3.2.109 Arthur Johnston then asked about the statistical issue, and who might do the statistical work. Ray Evans advised that he did not feel comfortable with the statistical issues, and Barry Hart advised that he would look at this matter.

3.2.110 Barry Hart noted that a phone link up to consider this issue would be desirable, and added that some of the issues are yet to be resolved.

3.2.111 The meeting then discussed the project ***“Develop revegetation management options for Nabarlek encompassing new agreed closure criteria”*** described on page 22 of the document.

3.2.112 Arthur Johnston talked about the issue of revegetation research at Nabarlek, and noted that the Minesite Technical Committee is looking at developing a new revegetation plan at Nabarlek, which will progress matters substantially.

3.2.113 Terry Hillman asked about the status of proposed work at the radiologically anomalous area at Nabarlek. Arthur Johnston responded, noted that the project is to be managed by the Office of the Supervising Scientist with ERISS providing technical advice.

3.2.114 Jenny Stauber asked about the project’s goals, and whether these would involve closure criteria. Arthur Johnston noted that the earlier closure criteria could not be met, and that the Northern Land Council and Hanson have been in discussions in relation to a revised set of objectives, and that this process is being assisted by the Supervising Scientist Division. He added that the outcomes must also satisfy the Minesite Technical Committee, and that there are links to the rehabilitation bond issue that was raised at an earlier ARRTC meeting.

3.2.115 The meeting then discussed the project ***“Radiological impact assessment of the rehabilitated Nabarlek site”*** described on page 23 of the document.

3.2.116 Arthur Johnston talked about the issues related to the exposure pathways of the rehabilitated landform, and Ray Evans asked how long the groundwater system would be sampled. Arthur Johnston responded that he was not sure. Ray Evans then noted the desirability of an in-house ERISS groundwater capability to be able to review and assess the data collected at Nabarlek. He added that ERISS was fortunate to have some thirty years of data available.

3.2.117 Alan Hughes noted that the Minesite Technical Committee is looking at a revised program, with the possibility of less frequent monitoring but at more sites.

3.2.118 Barry Hart then asked if ERISS felt that this Nabarlek project is under control and that it meets the Key Knowledge Needs. Arthur Johnston responded that it did.

3.2.119 Ray Evans then queried the possible use of the Siberia model in relation to Nabarlek, and Arthur Johnston suggested that with Ken Evans would circulate IR480 (Lowry JBC, Moliere DR, Boggs GS & Evans KG 2004. *Application of landform evolution modelling to the Nabarlek minesite*. Internal Report 480, July, Supervising Scientist, Darwin. Unpublished paper).

3.2.120 Terry Hillman noted two key tasks; firstly, to tidy up the site; and secondly, to learn from the mistakes.

3.2.121 Barry Hart then expressed general satisfaction with the project.

3.2.122 Barry Hart noted that work on **Key Knowledge Need 5.1.1 - Re-assess and prioritise the landscape program** had now been completed. Arthur Johnston noted that he undertook a further reassessment and reduced the scope of the program considerably.

3.2.123 The meeting then discussed the project “**A conceptual model of contaminant pathways for Ranger uranium mine**” described on page 24 of the document.

3.2.124 Jenny Stauber asked if this project had been externally reviewed, and Arthur Johnston noted that it had been considered by ARRTC in September 2004, but not by any other stakeholders as yet.

3.2.125 Terry Hillman noted that it would be better to consult earlier rather than later, and that this could be done relatively easily. Arthur Johnston agreed, noting that ERISS would be consulting with the Traditional Owners and other stakeholders as soon as possible.

3.2.126 Barry Hart and the committee noted strong support for this project.

3.2.127 The meeting then discussed the project “**Landscape-scale ecological risk assessment of Magela floodplain to differentiate the potential impacts of mining from broader non-mining stressors**” described on page 24 of the document.

3.2.128 Arthur Johnston suggested that this project is too broad, and will need to be refocussed on uranium mining aspects

3.2.129 Arthur Johnston then noted that the endemic species project (IUCN/WHC identified) would be finished this year.

3.2.130 The meeting discussed the project “**Communicating risks associated with the surface water pathway from Ranger**” described on page 26 of the document.

3.2.131 Arthur Johnston noted that ERISS is seeking Traditional Owner views on their concerns in relation to events and activities in the Alligator Rivers Region.

3.2.132 Barry Hart suggested that this issue covers a bit of Key Knowledge Needs 6.1 and 6.4, and Arthur Johnston advised that it also links to other projects.

3.2.133 Barry Hart noted the recent ERA/EWLS workshop, and suggested that it could slot in under 6.2. He asked Alan Hughes to talk about the workshop. Alan Hughes advised that it had been raised previously, and that it highlighted the need for more collaboration between ERISS and ERA.

3.2.134 Alan Hughes advised that Key Knowledge Need 2.2 was selected for first consideration at the first workshop, with later workshops to follow. He noted that 6-7 participants from each organisation attended. Participants were able to learn each others' capabilities and identify skill sets and gaps. There were no hard outcomes but it was a good bridge building and goodwill exercise. The participants identified the need for acceptable closure criteria to be developed early, and the need for early meetings with all stakeholders.

3.2.135 Jill Fitch asked whether or not the Charles Darwin University had been involved. Peter Bayliss advised that a continuing Honours program on revegetation had been developed and implemented at Charles Darwin University with Dr Sean Bellairs, and that we have recently submitted an ARC-Linkage grant application to undertake research on critical aspects of seed biology. This project will involve all key Alligator Rivers Region stakeholders. Peter Bayliss added that he will continue to co-supervise Honours and post-graduate students.

3.2.136 Barry Hart and other members expressed strong support for the project.

Action/Outcome No 3B:

ARRTC:

- Thanked ERISS for its paper and overview on the proposed 2005-06 research program; and
- Noted broad satisfaction with the overall direction and content of the program, subject to specific comments on projects as noted in paragraphs 3.2.1 to 3.2.135 of this Summary Record.

3.3 ERA Research

3.3.1 Tony Milnes noted the two tabled documents, which contained lists of ERA Research and Development projects for 2004 and 2005. He added that some key projects would be discussed at the meeting.

3.3.2 Tony Milnes then explained ERA/EWLS project approval process, describing the budget development process used for gaining ERA approval. He explained that projects are approved on an annual budget cycle. He noted the timing/costing process, and explained that ERA and EWLS function on a strict financial costing basis which is different to the ERISS processes.

3.3.3 Ray Evans then queried the 2005 projects list. Tony Milnes responded, and went through the list and advised which projects are underway.

3.3.4 Terry Hillman then asked about ERA processes, and Tony Milnes noted that “one line” projects had been approved for 2005. He added that the fully costed proposals had not yet been done for many of the projects. Tony Milnes then went through the list and described the status of each project. He added that most will get up but could get displaced if ERA’s priorities change.

3.3.5 Ray Evans then suggested that this meeting should note the progress at the March meetings of ARRTC and use the opportunity to identify any possible gaps, as well as identifying which projects do not get done.

3.3.6 Barry Hart then advised that ARRTC is interested in looking at priorities list, and Barry Hart asked Tony Milnes to provide appropriate documents addressing the Key Knowledge Needs documents to the September ARRTC meeting.

Action/Outcome No 3C:

ARRTC:

- Thanked ERA for its papers and overview of its research and development program; and
- Requested Tony Milnes to provide a paper and report for the 16th ARRTC meeting, consistent with the issues raised in paragraphs 3.3.3 to 3.3.6 of the Summary Record.

Framework for Surface Water Quality Closure Criteria for the Ranger Lease

3.3.7 David Jones gave the presentation *Framework for Surface Water Quality Closure Criteria for the Ranger Lease*, noting the assumptions in the study that mining at Ranger will cease in 2008, and that milling will then continue until 2012.

3.3.8 Ray Evans then asked where the “environment” actually started, and that onsite versus offsite issues exist. He noted the links to the locations of the statutory compliance points.

3.3.9 David Jones noted the Traditional Owners’ view of what should be done to protect the Georgetown Billabong, and their views on the type of protection that should be afforded. David Jones then raised the new approach being used by ERA, and Arthur Johnston advised that he feels comfortable with ERA’s approach.

3.3.10 Brendan Lewis noted some concerns with the approach being used, and queried whether it minimised contaminant movements. He suggested that “the bar” might be set “too low”.

3.3.11 Ray Evans asked if this is a “change” versus “impact” issue. He noted that the NLC and Traditional Owners wanted “no change” whilst ERA is focussing on “no impact”. David Jones advised that ERA wants to set the bar, by boking for absolute numbers and then working with those levels.

3.3.12 Carl Grant then asked about data for analogue billabongs. Chris Humphrey responded, noting sporadic data since 1978. Carl Grant noted that it could be better to use a number of analogue sites as a way of obtaining a more useful range of levels.

3.3.13 Terry Hillman then noted historical EC levels resulting from approximately 20 years of work in the Region, and advised that the levels have been generally very low, even at maximum levels. There was then some discussion in relation to turbidity issues, with the meeting noting that the levels were influenced by a range of factors including rainfall and fauna such as birds and buffalo.

3.3.14 Jenny Stauber then queried the use of a 95th percentile, and asked whether closure criteria would be exceeded 5% of the time. David Jones responded, advising that this would be the case, but the matter was still being worked on.

3.3.15 Ray Evans advised that he would like to see a time-series analysis of the data so that any difference in response over the peiod of data collection could be identified, rather than using the whole record as indicative of baseline conditions. Further, he reiterated an earlier point about Traditional Owner view of “change” versus the regulator/miner view of “impact”, and suggested that this is a tension point.

3.3.16 Tony Milnes then advised that the MTC is the appropriate forum for discussions with the NLC on these issues, adding that the NLC consults with the Traditional Owners on the issues. Arthur Johnston added that major efforts were made to listen to Traditional Owners as much as possible.

3.3.17 Carl Grant then noted stability and resilience as major themes related to the identification of impacts. He raised the issue of impact versus stability.

3.3.18 Gerald Nanson then asked about differences between the examples presented and analogue billabongs. He was advised that there is no definitive answer. Chris Humphrey

advised that there is a variety of analogue billabongs in a range of catchments in the Region. There was then some discussion on a range of chemical constituents in water.

3.3.19 Gerald Nanson noted that this work looks impressive.

3.3.20 Barry Hart thanked David Jones for his presentation, and noted some concerns by ARRTC over the robustness of the work and of the dynamics of Georgetown Billabong.

Outcome/Action No 3D:

ARRTC:

- Thanked David Jones for his paper and presentation; and
- Noted satisfaction with the project, subject to comments by members in paragraphs 3.3.11 to 3.3.19.

Hydrological and mining influences in creeks within the Ranger lease: Concentration variations and solute flux in Magela Creek

3.3.20 David Klessa gave the presentation “Hydrological and mining influences in creeks within the Ranger lease: Concentration variations and solute flux in Magela Creek”, which is an update of the project he described at the 14th ARRTC meeting in September 2004.

3.3.21 Ray Evans commented on the diffuse source of inputs to Magela Creek, noting the possible problems with sulfate load estimates.

3.3.22 Gerald Nanson commented that it might be worth drilling into the creek bed of Magela Creek to examine groundwater movement.

3.3.23 Arthur Johnston raised the issue of the rainfall record. He noted that David Klessa’s work is based on Jabiru Airport’s rainfall record which is relatively short. He suggested that the Oenpelli record might be a better long-term record.

3.3.24 Arthur Johnston then noted that the contribution of shallow aquifer flows is relatively small (up to 10%) and that the overall amount is trivial. He advised that he does not believe that Land Application Area flows could be scaled up to represent broader Magela catchment. David Klessa accepted Arthur Johnston’s point. Arthur Johnston then added that surface flow is more important as base flow than subsurface flow.

3.3.25 Ray Evans then noted that it is hard to demonstrate a groundwater signature, adding that the Table 2.3 baseline index of 46% is confusing. David Klessa responded, noting that he felt that 46% is an average at peak flow and that some 10-15% is groundwater.

3.3.26 Gerald Nanson added that the Magela creek bed is an arbitrary boundary, as the flow disappears beneath the surface in the Dry season.

3.3.28 David Klessa answered, and accepted that members were right to accept Sulfate load inaccuracies. He noted that the SO₄ loads were the most problematic for balancing, and that his model was somewhat crude. He noted the range of different variables, and suggested that a mixing model, incorporating a broader range of factors, could be more useful.

3.3.29 Tony Milnes noted that the original aim of the study had come from ARRTC. Ray Evans noted the intended strategic outcomes, which were to provide some conceptual bound that is a crude mass balance for sulfate heightened the need/area for further work

3.3.30 Barry Hart asked members if they felt that the presentation and paper gives enough information. Ray Evans then suggested that the project lets us know that we can not close a

balance, and that the other models are also inaccurate. Gerald Nanson then advised that he would like to see the slow (base) flow gaps filled.

3.3.31 Barry Hart thanked David Klessa for his paper and presentation.

Outcome/Action No 3E:

ARRTC:

- Thanked David Klessa for his paper and presentation; and
- Noted satisfaction with the project, subject to comments by members in paragraphs 3.3.20 to 3.3.30

State of the Irrigation Areas and Fate of Contaminants

3.3.31 Ian Hollingsworth gave the presentation “State of the Irrigation Areas and Fate of Contaminants” and this was followed by a general discussion on groundwater issues such as the aquifer, the composition of the regolith, and the movement of contaminants through groundwater.

3.3.32 Ian Hollingsworth noted that the decommissioning of the Land Application Areas is a problem, and that agreement between stakeholders is required.

3.3.33 Ray Evans asked about the issue of sulfates fixed in soil, and the types of problems that might be encountered. Ian Hollingsworth then outlined several possible explanations, but noted that there is still the need to examine the mobility of sulfates in the sub-soil. He speculated that there is less sulfate in soil than had been applied, and that a loss to the surrounding environment of up to 75% may have taken place. Gerald Nanson then commented on the possible concentration of sulfate downstream.

3.3.34 Arthur Johnston then noted the Key Knowledge Need linkage, and that ERISS will have an interest in radiation doses from the final landform. Andreas Bollhofer noted that Cameron Lawrence did some work in this area for his PhD thesis.

Outcome/Action No 3F:

ARRTC:

- Thanked Ian Hollingsworth for his paper and presentation; and
- Noted satisfaction with the project, subject to comments by members in paragraphs 3.3.31 to 3.3.34.

Ranger Final Landform Design

3.3.35 Ian Hollingsworth gave a paper and presentation on the Ranger final landform design issue, noting the relationship between the land and the plant community on the land.

3.3.36 Gerald Nanson thanked Ian Hollingsworth and commented on the impressive nature of the work being undertaken.

3.3.37 Ian Hollingsworth noted the potential for other factors to arise, and advised that ERA is looking at strategies to get a return of biodiversity. He advised that the properties of the biota, together with the links to hydrology and geology/geomorphology, are being considered.

3.3.38 Terry Hillman advised that the work looks sensible, and suggested that an analogue could become a theoretical link for the new Ranger landform. Ian Hollingsworth then noted that the fire environment is missing.

3.3.39 Barry Hart asked how the work was situated relative to world's best practice. Ian Hollingsworth answered that he was not sure. He added that the work is based on soil survey conceptual approaches using a range of factors, and that it uses Nabarlek experiences and other factors.

3.3.40 Ray Evans then referred to David Klessa's sulfate balance, and suggested that the missing sulfate exited the Land Application Areas. He added that both David Klessa and Ian Hollingsworth have missing sulfate, and that there could be an error in their mass balances.

3.3.41 Barry Hart thanked Ian Hollingsworth for his paper and presentation and noted that ARRTC is impressed.

Outcome/Action No 3G:

ARRTC:

- Thanked Ian Hollingsworth for his paper and presentation; and
- Noted satisfaction with the project, subject to comments by members in paragraphs 3.3.35 to 3.3.41.

Status of Pond and Process Water Treatment at Ranger

3.3.42 David Jones gave the presentation "Status of Pond and Process Water Treatment at Ranger" and then talked to the a tabled paper on the status of this project. He added that he was providing some of the information on behalf of David Borries who was in South Africa and, therefore, unable to attend the meeting and present the information.

3.3.43 Terry Hillman asked whether Retention Pond 1 or the Retention Pond 1 wetland filter would be receiving water, and whether the water would be of good quality after treatment. David Jones responded, noting that the water would be suitable for discharge.

3.3.44 Brendan Lewis then asked about what would be happening in Corridor Creek, and what would be going down the creek. David Jones responded, noting that treated process water would be discharged into the Corridor Creek wetlands in the Dry season and that it would be flushed in the Wet season.

3.3.45 Arthur Johnston raised the issue of Georgetown Billabong criteria, noting that ammonia will be stored in the tailings mass. He asked if this will be an additional constituent to worry about. David Jones answered, noting that the ammonia is already present.

3.3.46 Barry Hart thanked David Jones for his paper and presentation.

3.4 Summary of Research

3.4.1 Barry Hart then summed-up the meeting's response to the papers and presentations made by ERA and ERISS.

3.4.2 Barry Hart then asked Arthur Johnston and Tony Milnes to put together an overview matrix and timeline linking ERA and ERISS research with the Key Knowledge Needs. He added that that this matrix and timeline will also provide a broad assessment of human resources being applied to each project in a single snapshot document, and contact information for each project leader.

3.4.3 Ray Evans noted that the new document would be very similar to the existing ERISS document, but with the ERA program added.

3.4.4 The meeting also decided that agendas and papers should be prepared and provided to members as far as possible in advance of each meeting, with papers being made available to members no later than two weeks prior to each meeting.

4 Monitoring

4.1 Supervising Scientist's Monitoring Program

4.1.1 Chris Humphrey advised the meeting that six out of the eight monitoring protocols had now been prepared, and that the final two have been deferred but would be completed later in 2005.

4.1.2 Chris Humphrey then talked about the process of the development of the protocols, noting that the remainder are to be completed later this year. He commented on the need for additional data analysis, advising that the Charles Darwin University had assisted with this. He then noted that, in relation to the QA/QC aspects, the status of Jabiluka requires further work, and that it would be useful for Jenny Stauber, Barry Hart, and Terry Hillman to look at the protocols and get back to ERISS.

4.1.3 Chris Humphrey then noted that the QA/QC issue had been raised previously with ARRTC, and he advised the meeting that he has prepared a detailed risk analysis of the monitoring protocols. He noted that the ultimate intention is to have QA/QC content in all of the protocols. Arthur Johnston then talked about the actual ARRTC request for QA/QC information on the monitoring work, and asking whether this was what ARRTC had sought.

4.1.4 Barry Hart noted the work done by ERISS exceeded the original ARRTC request, and that the work was good. He complimented ERISS for the QA/QC work, with Chris Humphrey then noting the role played by Claudia Sauerland in the development work.

4.1.5 Jenny Stauber then queried the criteria being used for test acceptability, noting that it could not be found in the QA/QC document. Chris Humphrey responded, and talked about the statistical issues.

4.1.6 Barry Hart then suggested that the ERISS work is exemplary and must be close to world's best practice. He noted a high level of satisfaction with the program and the processes.

4.1.7 Terry Hillman then advised that he found the fish protocols very interesting, noting that they had been tailored for the Alligator Rivers Region. He added that the protocols were well designed and substantiated, and are of a very high quality.

4.1.8 Rick Van Dam then asked Jenny Stauber if she was aware of any documented protocols for in-situ ecotoxicology, and Jenny Stauber responded that she was not aware of any.

4.2 ERA Radiological Monitoring

4.2.1 Alex Zapantis and Ian Marshman joined the meeting via videoconference from the Jabiru Field Station. They gave a PowerPoint presentation and then responded to questions from the meeting.

4.2.2 Jill Fitch asked about the involvement of Mark Sonter in ERA's work, and Ian Marshman advised that Mark Sonter had been involved until very recently and had now returned to Queensland.

4.2.3 Jill Fitch then asked whether or not a plan of the Ranger mine site could be useful to assist in assessing sites for monitoring. She also noted that mine sites do change, and that monitoring points need to be kept relevant. Ian Marshman undertook to provide a plan to members and to include one in ERA's radiation management documents. Andreas Bollhofer then advised the meeting that he had visited the Ranger site with DBIRD's Russell Robinson recently, and that he thinks it unlikely that the two proposed monitoring sites will vary.

4.2.4 Alex Zapantis then explained the rationale for selection of the sites, noting that the mine area site is close to the high grade ore stockpile and crusher and will, therefore, have higher levels. The second site is in the middle of the process plant, and has been chosen for a variety of purposes. Temporal variation of radon progeny concentration is far greater than spatial variances in the process plant area. Alex Zapantis then noted the role of weather as the dominant factor in radon variations.

4.2.5 Arthur Johnston then noted Figure 6 of the tabled report, and queried why the top diagram showed the mine office area to be consistently high. He asked why this is so, noting that it has a median significantly higher than the other two sites.

4.2.6 Alex Zapantis then talked about some of the factors influencing radon in the mine office area, noting that atmospheric, soil, ventilation, and background (ambient) radon factors are all present. He then noted that there are four separate buildings in the mine office area and there could be different radon levels in different buildings due to different ventilation arrangements.

4.2.7 Terry Hillman asked if there is any likelihood of extreme variations at any point on the mine site, and Ian Marshman responded, noting that significant changes could occur if there was a change to the current stockpiling arrangements.

4.2.8 Jill Fitch then asked if all Ranger workers are "designated employees". Ian Marshman responded, noting that some administrative employees were not "designated" and are, therefore, not monitored. Barry Hart then queried the issue of "designated" versus "non-designated" workers" and Jill Fitch explained how the monitoring process functioned with "designated" workers being individually monitored.

4.2.9 Jill Fitch then asked how ERA demonstrated adherence to the ALARA principle. She commented that the doses appeared to be below a limit, but could not see that ALARA had been applied. Ian Marshman and Alex Zapantis agreed that there is a need to convince regulators that this is the case.

4.2.10 Alex Zapantis then advised that the operational monitoring program is designed to be flexible, and includes features that allow it to be varied without seeking the approval of regulators and changing the authorisation on every occasion.

4.2.11 Jill Fitch then advised that she does not feel that the Ranger historical data demonstrates a need to change the radiological monitoring program

4.2.12 Arthur Johnston then noted MTC discussion, but would appreciate comments from Jill Fitch.

4.2.13 Jill Fitch then asked about redundancy issues, and how equipment breakdowns might be managed. She then queried the reliability of the monitoring equipment. Ian Marshman responded, noting that several instruments were located at each point. He added that ERA has

purchased additional monitoring equipment for five locations, and that further funding has been sought for additional equipment.

4.2.14 Alex Zapantis then described the “seven consecutive day” requirements, noting that equipment could be rotated between sites on a weekly basis if required.

4.2.15 Jill Fitch then asked how the tabled document fitted into the full range of radiation management documents, and what documents comprise the full radiation management plan. Ian Marshman noted that the development of the revised radiation management plan is currently underway, and is linked to ERA’s AS4801 certification of the Ranger site.

4.2.16 Barry Hart then asked about the status of the management plan, and Ian Marshman advised that the radiation management plan forms part of the Ranger Mining Management Plan which is nearly complete.

4.2.17 Jill Fitch then suggested that a range of other documents, such as dose assessment reports, would help fill in the gaps in the ERA paper and presentation. Alex Zapantis then noted that this information is in the quarterly ERA reports, but that it could be appended to the document.

4.2.18 Jill Fitch then asked about monitoring for special tasks (however described), where employees were required to do certain tasks in out-of-the-ordinary situations. Ian Marshman responded, noting that ERA is looking at a permit-to-work system. Alex Zapantis then added that a pre-task risk assessment was done for every task and radiation monitoring would be undertaken if a radiation risk was identified during this assessment.

4.2.19 Jill Fitch then noted that the document did not mention respiratory protection factors, and she queried the status of this issue. Ian Marshman advised that airstream helmets are used in the product packing area, and that they are factored into dose assessments. Jill Fitch queried whether this was included in the document, and Alex Zapantis advised that only raw data had been included in the document.

4.2.20 Jill Fitch added that she felt that the use of the terms “random” and “on demand” in relation to operational monitoring are too flexible. She noted that this leaves too much in the hands of operators, noting the link to the recent history of poor housekeeping at Ranger. Ian Marshman noted that the use of “on demand” refers to clearances to take equipment from the site.

4.2.21 Alex Zapantis then asked Jill Fitch if she was looking for minimum frequencies for contamination surveys, and Jill Fitch advised, again, that housekeeping issues were important. Alex Zapantis then advised that ERA can look at minimum levels.

4.2.22 Arthur Johnston then noted the difficulty to monitoring/assessing the ingestion pathways from surface contamination, and Alex Zapantis agreed, noting that priority areas for monitoring were areas such as lunchrooms and crib rooms.

4.2.23 Jill Fitch then advised that she is not familiar with the processes involved in presenting documents to regulators in the Northern Territory. She noted that some parts of the documents appeared to be background information, and do not form part of the program. She queried whether all the information in the document was included in the application.

4.2.24 Alex Zapantis then advised that the tabled paper is for the ARRTC meeting, and is not the application. Arthur Johnston noted the introductory paragraph of the document which says “this is an application”.

4.2.25 Alex Zapantis then added that ERA is looking at including temporal control charts to track any changes to levels, noting that this will make it easier to pick up any changes in a user-friendly format rather than simply dumping raw data on the regulators.

4.2.26 Arthur Johnston then suggested that the words “protection of the environment” on page 3 of the document should be removed if not specifically referred to in the document itself. Alex Zapantis agreed. Arthur Johnston also suggested that wording in relation to the remaining life-time of the mine could be changed to “for mine in its current operations”.

4.2.27 Arthur Johnston then noted the graphs on page 7 of the documents which describe doses over a ten-year period. He noted that mean doses had been reduced by a factor of five, and queried what actions/events had resulted in that period to result in the improvements. Alex Zapantis then responded, noting that improvements had been made in the area of radon but that gamma radiation has remained stable and is difficult to control.

4.2.28 Arthur Johnston then noted that he feels generally comfortable with the overall approach being used by ERA. Jill Fitch also advised that she is generally comfortable, but noted that the document does require some tidying-up, which Alex Zapantis and Ian Marshman undertook to do. Jill Fitch then noted that the title of the paper should refer to “Ranger” rather than “ERA”.

4.2.29 Barry Hart noted clear support from ARRTC for the overall approach used in radiation monitoring and protection. He suggested that the document should be amended in line with the discussion held at this meeting.

Action/Outcome No 4A:

ARRTC:

- thanked Alex Zapantis and Ian Marshman for the presentation and document; and
- noted that ERA’s document could be improved through the incorporation of changes suggested in paragraphs 4.2.1 to 4.2.29 of the Summary Record.

5 Operational Mining Issues

5.1 Applications

5.1.1 Alan Hughes provided the meeting with a regulators’ view of ERA applications.

5.1.2 He noted that the application to discharge water has been around a long time and that lots of discussion has already taken place. He then noted that the application to actually build the process water treatment plant had come in fairly late, and that the associated tender for plant construction had been issued with incorrect specifications (for example, radium and uranium limits in the tender documents were much higher than the results achieved by the pilot plant). He then spoke about the need for expediency, and the urgency in getting the plant commissioned prior to the commencement of the 2005-06 Wet season. As a result, it was considered preferable to provide a staged approach to regulating output from the plant with most of the monitoring to occur at GCMBL rather than at the plant for the first season of operation. This would ensure protection of the environment while allowing assessment of plant output levels for future optimisation of regulatory monitoring at source.

5.1.3 Tony Milnes advised that ERA had talked to Weir about the specifications, and that Weir is comfortable with revising the construction specs downwards.

5.1.4 Arthur Johnston then noted that he was unhappy that the ERA figures were wrong, and that he felt uncomfortable with moving forward with the figures in the original construction specifications. He noted that he had expressed his concern with ERA at the time and that ERA had freely admitted the error.

5.1.5 Jill Fitch asked about the design life of the water treatment plant, and David Jones advised that it would be in the area of 20-25 years. He added that, under current proposals, the plant will need to operate until at least 2020.

RL0 Application

5.1.6 Alan Hughes then noted that this issue had been discussed before, and that the background is very well known. He added that the application had been submitted to the MTC in 2004, and was designed to cover the seepage zone near the MBL aquifer adjacent to Pit 1.

5.1.7 Alan Hughes then noted that ERA had withdrawn the RL0 tailings deposition application for later consideration, and that the NLC and other stakeholders had expressed strong views. He noted that the barrier construction application proceeded through the MTC process and was assessed by stakeholders, and has been approved by Minister Vatskalis.

5.1.8 Alan Hughes then noted that the barrier is now half built, and that it now provides enough protection for the coming Wet season. He added that the RL0 application will be resurrected during 2005.

5.1.9 Tony Milnes then explained that it is important to minimize any short-term seepage from Pit 1, and that a study had been undertaken to look at the most appropriate material to prevent any such seepage over a period of approximately twenty years. Ray Evans then queried if the long term issues were not regarded as being of consequence, and Tony Milnes responded noting that in the long term there would be no water in the Pit so the situation would be quite different. He also noted some small degree of seepage is possible over a 10,000 year timeframe.

5.1.10 Ray Evans asked if the relevant studies could be made available to ARRTC members, and Tony Milnes advised that they would be made available upon request.

6 Member Reports and Updates

6.1 ERA (Ranger and Jabiluka)

6.1.1 No report provided.

6.2 Pioneer (Nabarlek)

6.2.1 No report provided.

6.3 Parks Australia

PAN Issues

6.3.1 Peter Wellings advised that the Jabiru futures initiative is still progressing, and that the overall goal is to increase certainty in relation to the future of Jabiru.

6.3.2 He then advised the meeting that Rod Kennett, who had reported to ARRTC on behalf of Parks Australia North during 2004, had left Parks Australia North and was now working on a dugong/turtle project out of the CRC for Tropical Savannas at the Charles Darwin University. He added that he will shortly be recruiting a new person at Kakadu National Park.

6.3.3 Peter Wellings then talked about tourism implications for Kakadu National Park, noting that there are currently some political pressures to increase tourism in the Park. He added that the Traditional Owners are looking for potential long-term opportunities. He then noted the recently-released Morse Report into tourism issues at the Park, noting that the Kakadu Board of Management conceptual plan gave an overview of the Morse agenda in relation to where Kakadu National Park is going.

South Alligator Valley and Gunlom Issues

6.3.4 Julian Barry advised the meeting of several key developments since the last ARRTC meeting. He advised that there had been no further action in relation to Part A of the Gunlom Land Trust (GLT) Rehabilitation Plan as EPBC and ARPANSA approvals are required and that the project is subject to funding.

6.3.5 He advised that, in relation to Part B of the Gunlom Land Trust (GLT) Rehabilitation Plan, monitoring bores were installed at the two potential containment sites in September 2004. They will be monitored for the next twelve months. A paper is being developed on next steps.

6.3.6 He then advised the meeting that there is nothing further to report on risk management actions relating to the three containments of old uranium mining infrastructure, located within the Gunlom Land Trust area. He then noted that regular inspections by the Office of the Supervising Scientist were taking place at the Gunlom residues site and storage facility.

6.4 Department of Business, Industry and Resource Development

6.4.1 Keith Taylor, representing Richard Jackson, noted the recent restructure of DBIRD's Minerals and Energy areas following a recent organisational review. He also noted that Tony McGill had now left DBIRD.

6.4.2 Jill Fitch then asked about a possible EPA for the Northern Territory, querying whether it might impact the operations of DBIRD. Keith Taylor was unable to offer a comment on what might happen as the decision was in the hands of Cabinet.

6.5 Northern Land Council

6.5.1 Brendan Lewis noted that Elaine Glen's position with the Northern Land Council had not yet been filled following her resignation. He added that only 12 months funding was now available for the position. He added that the Northern Land Council is in a tight financial situation, and that the organisation is awaiting possible Commonwealth Government announcements on the future of the *Aboriginal Land Rights (Northern Territory) Act 1976*. He noted the possibility of the Commonwealth seeking to transfer land rights legislation to the Northern Territory Government.

6.5.2 Brendan Lewis then noted that the Mining Agreement with ERA is still under negotiation, and that the parties have had a "without prejudice" meeting several months ago with the focus now on environmental issues.

6.5.3 Arthur Johnston then raised the status of Section 44 Agreement negotiations, noting that he is not aware of any recent progress in that area.

6.6 Supervising Scientist

6.6.1 Arthur Johnston noted that Max Finlayson had now left ERISS to take up a position as a Principal Researcher with the International Water Management Institute in Colombo, Sri Lanka.

7 Other Business

7.1 Discussion on operations of ARRTC

7.1.1 Barry Hart then asked the meeting to consider the ways that ARRTC had operated since being reconstituted in 2001. He particularly sought feedback on what the new ARRTC had done well, what it had done badly, and what it could do better. He also asked for suggestions on possible improvements to the system.

7.1.2 Barry Hart started by asking what had been done well.

7.1.3 Members suggested that positive aspects of the revised ARRTC included:

- a diversity of expertise is represented on ARRTC which allows a high level of discussion to occur on important issues;
- the committee has knitted together and the members work well together;
- the identification of the Key Knowledge Needs during 2003 and 2004, which has brought direction to research programs;
- the committee is viewed positively by the Northern Land Council and other stakeholders;
- the new planning/reporting meeting cycle will assist in assessing progress towards addressing the Key Knowledge Needs;
- the use of out-of-session work involving specific ARRTC members has been beneficial; and
- there is now a greater awareness of the body of scientific research on the Alligator Rivers Region.

7.1.4 Barry Hart then asked members to raise possible negative issues with the revised ARRTC, and the following points were raised:

- the limited time available during meetings (2-3 days, twice yearly) imposes limitations on the breadth and depth of what ARRTC can achieve;
- the difficulty ARRTC members face in assimilating the vast body of knowledge;
- the committee is still lacking clarity on its role in relation to the strategic versus operational level of detail, with the correct balance unresolved (it was, however, noted that the Key Knowledge Needs improved this process);
- the problems with meeting papers and other information being provided to members too close to the meeting dates to allow proper consideration;
- the lack of an appropriate induction/orientation process for new members (with members strongly supporting a site visit to Ranger in September 2005);
- the existence of gaps in the committee's expertise, particularly in relation to geotechnical/engineering and geomorphology/modelling issues; and
- the delays in building effective working relationships between ARRTC members and the individual researchers in ERA and ERIS;

Chair of ARRTC

7.1.5 Gerald Nanson then raised the issue of the ARRTC chair. He asked Barry Hart how he viewed the role of the chair and whether it could be restructured or better resourced through the provision of more time. Barry Hart responded, noting that these issues are very

much dependent on the individual person holding the chair, and that there is a need to balance time allocated between ARRTC and other professional activities. Barry Hart then noted that the chair does not do much more than what occurs in-session. Gerald Nanson then advised the meeting that he thinks Barry Hart is a very effective chair.

7.1.6 Peter Wellings then noted the very apparent division between the seven independent scientific members and the other members of ARRTC. He noted that this division extended as far as the meeting seating arrangements.

7.1.7 Jill Fitch then added that another site visit to the Ranger plant and mill complex would be useful, and that she would prefer an onsite face-to-face meeting with Ian Marshman and Alex Zapantis rather than a video link-up. Terry Hillman then advised that he would like a Ranger site visit to see the context for rehabilitation and revegetation.

7.1.8 Arthur Johnston then raised the original World Heritage Committee recommendation, noting that the government opted to reconstitute ARRTC as the recommended independent scientific advisory committee. He added that the old ARRTC was much less effective than the current ARRTC.

7.1.9 Barry Hart then thanked ARRTC members for their contributions to the discussion on the role, functions and operations of ARRTC.

7.2 Resignation of Gerald Nanson

7.2.1 Gerald Nanson advised the meeting that he is on sabbatical leave during the second half of 2005, and that this will make it difficult to maintain involvement with ARRTC. He advised that meeting that he would, therefore, be resigning following the 15th ARRTC meeting.

7.2.2 Barry Hart and ARRTC members thanked Gerald Nanson for his services to ARRTC since 2001 and noted his “useful perspective that complements” the other committee members.

7.2.3 Barry Hart then asked the meeting about the types of skills gaps in the membership of ARRTC. Tony Milnes advised that he felt that expertise in the area of geotechnical engineering is missing.

7.2.x Arthur Johnston noted the role of FASTS in identifying and nominating the ARRTC independent scientific membership.

7.3 Resignation of Max Finlayson

7.3.1 Barry Hart noted that Max Finlayson had resigned from ERISS to take up the position of Principal Researcher Wetland Ecology with the International Water Management Institute (IWMI) in Sri Lanka.

7.3.2 Barry Hart and other members noted their appreciation of his work. Barry Hart then noted that he would write to Max Finlayson to formally express his thanks.

8 Close

8.1 Next Meeting

8.1.1 Members discussed possible dates for the 16th ARRTC meeting, and decided that the meeting will be held on 12-14 September 2005 and will include a site visit to the Ranger mine.

Attachment A – List of Actions/Outcomes

Action/Outcome No 2A:

ARRTC endorsed the draft summary record of the 14th Meeting of ARRTC, held in September 2004, subject to the changes described in paragraphs 2.1.1 and 2.1.2 of this summary record.

Action/Outcome No 3A:

ARRTC:

- Noted several changes to the Key Knowledge Needs documents, as described in paragraphs 3.1.3 to 3.1.8 of this Summary Record; and
- Requested that Ian Loftus circulate the amended Key Knowledge Needs document, including the tabular prioritised version, as a PDF document to ARRTC members.

Action/Outcome No 3B:

ARRTC:

- Thanked ERISS for its paper and overview on the proposed 2005-06 research program; and
- Noted broad satisfaction with the overall direction and content of the program, subject to specific comments on projects as noted in paragraphs 3.2.1 to 3.2.135 of this Summary Record.

Action/Outcome No 3C:

ARRTC:

- Thanked ERA for its papers and overview of its research and development program; and
- Requested Tony Milnes to provide a paper and report for the 16th ARRTC meeting, consistent with the issues raised in paragraphs 3.3.3 to 3.3.6 of the Summary Record.

Outcome/Action No 3D:

ARRTC:

- Thanked David Jones for his paper and presentation; and

Noted satisfaction with the project, subject to comments by members in paragraphs 3.3.11 to 3.3.19.

Outcome/Action No 3E:

ARRTC:

- Thanked David Klessa for his paper and presentation; and
- Noted satisfaction with the project, subject to comments by members in paragraphs 3.3.20 to 3.3.30

Outcome/Action No 3F:

ARRTC:

<ul style="list-style-type: none"> • Thanked Ian Hollingsworth for his paper and presentation; and • Noted satisfaction with the project, subject to comments by members in paragraphs 3.3.31 to 3.3.34.
<p><i>Outcome/Action No 3G:</i></p> <p>ARRTC:</p> <ul style="list-style-type: none"> • Thanked Ian Hollingsworth for his paper and presentation; and • Noted satisfaction with the project, subject to comments by members in paragraphs 3.3.35 to 3.3.41.
<p><i>Action/Outcome No 4A:</i></p> <p>ARRTC:</p> <ul style="list-style-type: none"> • thanked Alex Zapantis and Ian Marshman for the presentation and document; and • noted that ERA's document could be improved through the incorporation of changes suggested in paragraphs 4.2.1 to 4.2.29 of the Summary Record.