Large and ASSOCIATES

BRIEFING NOTE AND QUOTATION

PROPOSAL FOR EVALUATION OF

IAEA COMPLIANCE

OF THE

ANGRA 3 PRELIMINARY NUCLEAR SAFETY REPORT

CLIENT: **********

MINISTÉRIO PÚBLICO FEDERAL
(BRAZILIAN FEDERAL PROSECUTION SERVICE)

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IAEA COMPLIANCE OF THE ANGRA 3 NUCLEAR SAFETY CASE

NUCLEAR POWER GENERATION IN BRAZIL

Brazil currently operates two commercially-sized nuclear power plants, *Angra 1* and *Angra 2*,[1] at a single site on the Angra dos Reis coast between Rio de Janeiro and São Paulo. Nearby these two operational reactors, an area has been set aside and partially prepared for the construction of a third nuclear power plant, *Angra 3*.

ANGRA 1: Construction of Brazil's first civil nuclear power plant commenced in 1971. Much delayed in construction and commissioning, the Westinghouse turn-key supplied pressurised water reactor (PWR) *Angra 1* entered commercial operation in 1985 at a rated 657MW_e capacity.

Availability of *Angra 1* has disappointed throughout its somewhat technically troubled history resulting in lengthy commissioning delays and failure to attain commercial levels of load factor (availability)[2] until 1999 but, even then, setbacks arising from further instrumentation and control system malfunctions, difficulties with plant balancing management and steamside equipment unreliability jeopardised the continuing commercial operation of *Angra 1*. The impact of equipment failures and malfunctions on plant nuclear safety was considered sufficient to justify comprehensive programmes of systems modifications and two-loop, steam generator plant replacement at the cost of complete loss of plant output for 2009.

ANGRA 2: Adopting a policy to become fully self-sufficient in nuclear technology, in 1975 the Brazilian government signed a supply and technology transfer agreement with West Germany[3] for the installation of eight 1,300 MW_e nuclear PWR units[4] over 15 years. The first two units (*Angra 2* and *3*) were to be built immediately, to the design and equipment of the German industrial consortium *Kraftwerk Union* (KWU). Building on this *'joint venture'*, the remaining six units were to comprise 90% Brazilian equipment with second and subsequent reactor core uranium fuel loads being of Brazilian origin, in both uranium enrichment and fuel assembly fabrication. The agreement to transfer civil nuclear technology was overseen by the state-owned *Empresas Nucleares Brasileiras* (NUCLEBRAS) and a number of joint Brazilian-German companies.[5]

However, Brazil's economic difficulties stalled both technology transfer and *Angra 2* and *3* construction programmes resulting in construction of *Angra 2* being postponed until its restart in 1995-6 under the new management of *Furnas Centrais Elétricas SA* (FURNAS) with the previous joint company NUCLEN relegated to mainly engineering aspects of the plant.[6] In light of all of these difficulties, further work on *Angra 3* was abandoned and, after several more lengthy stops and starts, *Angra 2* eventually commissioned and entered commercial generation service in February 2001.

ANGRA 3: A virtual twin of *Angra 2*, progress on Brazil's third nuclear power station was halted in 1986 although much (about 70%) of its engineered plant and machinery has been subsequently supplied and delivered to Brazil where it remains in storage today.

In November 2006 the Brazilian government announced plans to revive and complete *Angra 3* and also build four further ~1,000 MW_e nuclear plants from 2015 at a single site.[7] In December 2008, the *Eletronuclear*[8] signed an industrial cooperation agreement with the French concern AREVA to manage *Angra 3* to commercial operation stage.

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1 At present the installed nuclear energy capacity meets about 13 TWh or 3% of Brazil's annual electricity demand of about 450 TWh. Growth of electricity demand has been strong through the last two decades with per capita electricity consumption rising from 1.5 MWh per year in 1990 to the present level of about 2.2 MWh/yr Commissioning and commercial operation of the *Angra 3* nuclear power plant would increase the proportion of electricity generated by nuclear power to about 6% of the national demand – 13 TWh = 13.10^{12} or 13 million million Watts.

2 Up until 1999 the lifetime availability (Load Factor) of *Angra 1* was a measly 25% compared to an expectation of 80 to 90% for comparable plants.

3 Including *Co-operation Agreement Concerning Peaceful Uses of Nuclear Energy*, 27 June 1975; *Co-operation Agreement Concerning Peaceful Uses of Nuclear Energy Between CNEN and the Nuclear Research Centre in Karlsruhe* 8 March 1978; *Special Agreement between CNEN and the Research Centre in Jülich*, 8 March 1978

4 The *Angra 2/3* design is a 4-loop PWR similar to the Siemens KONVOI design concept.

5 Joint Brazilian-German companies included: NUCLEP Heavy Components Manufacture, NUCLEN Nuclear Power Plant Architect and Engineering together with the Brazilian state owned enterprise NUCON Nuclear Power Plant Construction.

6 In 1969, Siemens and AEG merged their nuclear activities, forming Kraftwerk Union (KWU). In 1977 AEG sold all its shares in KWU to Siemens. In 1987, Siemens-KWU was integrated into Siemens' Power Generation Group and, in 2001, Siemens merged its nuclear activities with Framatome to form Framatome ANP, which was later rebranded as AREVA NP. In 2009, Siemens announced its intention to sell its 34% interest in the joint venture to AREVA.

7 *Angra 3* construction approval was confirmed by Brazil's National Energy Policy Council in June 2007 receiving Presidential approval in July 2007, and Environmental approval was granted in March 2007 and all other approvals by July 2009.

8 NUCLEN subsequently merged into FURNAS to form ELETRONUCLEAR–ELECTROBAS Thermonuclear and, in 1997, the German company Siemens relinquished its 25% holding in NUCLEN.

NUCLEAR PLANT LICENSING AND THE REGULATORY FRAMEWORK

The governmental organization responsible for the safety licensing of nuclear power plants (NPPs) and other nuclear installations in Brazil is the *National Nuclear Energy Commission* (CNEN) which regulates nuclear safety via its third division the *Directorate of Radiation Protection and Safety* (DRS). CNEN collaborates with the *Brazilian Institute of Environment* (IBAMA) on environmental licensing aspects of nuclear facilities.

Essentially, for detailed application CNEN's regulations and standards[9] are drawn from the framework of *International Atomic Energy Agency*'s (IAEA) recommendations and guides supplemented in detail with a virtual patchwork of various regulations etc., adopted from those countries that have provided the nuclear plants and related technology in the past (US and Germany). CNEN's nuclear licensing process comprises, essentially, five-stages including i) Site Approval, ii) Construction Permit, iii) Nuclear Material Authorisation, iv) Initial Operation Authorisation; and v) Permanent Operation Authorisation. Permission[10] to proceed to Initial Operation is dependent upon a satisfactory safety analysis being submitted by the operator (Eletronuclear) and, once commercial operation commences, thereafter a review of the nuclear safety case is required at 10 yearly intervals.

For *Angra 3* nuclear safety licensing, the established nuclear safety case (*Preliminary Safety Analysis Report* - PSAR) drawn from the operating *Angra 2* PSAR has been submitted to and reviewed by CNEN,[11,12] thus preparing ahead for stage iv) of the CNEN licensing process. The projected date for *Angra 3* to attain stage iv), should construction works commence as planned and proceed within the five to six year build-to-commission timescale, will be around 2016.

The *Angra 3* PSAR is not a publicly available document but, reasonably, it is to be expected that this will extend and supplement the PSAR developed for *Angra 2* in account of, generally, developments in the standards for and approach to nuclear safety over the years from the original *Angra 2/3* design and, specifically, for detailed changes and advances in the *Angra 3* plant design over that of *Angra 2*.

On detailed matters, for example, it is expected that the *Angra 3* plant will not use the somewhat dated *Angra 2* analogue instrumentation and control equipment replacing this with a centralised digital system with its associated software; that the response capacity of the reactor primary circuit and other safety critical components to seismic and transient loading will be upgraded to present levels, each of which (together with other detailed design and/or procedural changes) will necessitate substantial modification to the *Angra 2* PSAR for its application and approval for *Angra 3*. To account for the changes that have developed over the years to the nuclear safety culture, in its *Angra 3* licensing considerations CNEN most certainly would have referred to a number of IAEA recommendations, guides and codes, particularly the *Basic Safety Principles for Nuclear Power Plants*.[13] These general developments now require inclusion and consideration of a more comprehensive treatment of safety culture and the *'defence-in-depth'* rationale; the use of *'Probabilistic Safety Assessment'* (PSA) to evaluate design changes; incorporation of features that facilitate severe accident management; and the broader *'design basis'* approach that accounts for a spectrum of accidents and incidents in place of the single *'Reference Accident'* adopted for *Angra 2*.

In addition to including these general and detailed changes to the *Angra 3* PSAR, CNEN would (or is to) have given cognisance to accidents and incidents to similar nuclear power plants of the same generic type and design age such as, for example, the *Three Mile Island* PWR fuel core melt of 1979; and the fuel rupture incident and radioactive release from the French *Orléans* plant in 1980. Other aspects of nuclear safety, such as the changes in attitudes towards national and international terrorism in account of *9/11* and other incidents, security and safeguarding of nuclear materials, aircraft crash and the susceptibility of nuclear plants to large seismic events.

9 CNEN standards, etc., appropriate here include CNEN-NE.1.04: Licensing of Nuclear Installations, 1984; CNEN-NN.1.16: Quality Assurance for Nuclear Power Plants, 1999; CNEN-NE.1.01: Licensing of Nuclear Reactors Operators, 1979; CNEN-NE.1.14: Operating Reports of Nuclear Power Plants, 2002; CNEN.NE.2.01: Physical Protection of Operational Units of Nuclear Installations, 1996; CNEN-NE.2.03: Fire Protection in Nuclear Power Plants, 1999.

10 Standard CNEN-NE-1.04 establishes the requirements for the licensing process of nuclear installations.

11 The *Angra 3* PSAR was submitted to CNEN in April 2002 and, relating to *Angra 2*, 60 Evaluation Reports have been issued and 40 regulatory inspections have been conducted during recent years.

12 For the authorization for initial operation, CNEN reviews a number of distinct stages or *Hold-Points* including the construction status, the commissioning program, the final *Physical Protection Plan*, and the *Final Safety Analysis Report* (FSAR).

13 *Basic Safety Principles for Nuclear Power Plants*, 75-INSAG-3 Rev. 1 INSAG-12, IAEA

These detailed and general changes will now need to be incorporated in the safety case compilation for *Angra 3* as obliged by Brazil's international agreement commitments.[14] In other words, the *Angra 3* project will be, according to Brazil's international obligations, a stand-alone, new-build nuclear plant rather than simply an adapted continuance of the existing *Angra 2* plant.

Moreover, at the time that the *Angra 2/3* design was set down (about 1975) there was little consistency of nuclear standards with, generally, different countries adopting their own favoured technical standards and guides,[15] so much so that considerable concern was raised in 1991[16] about the lack of a common basis upon which the acceptable level of nuclear safety of all operating nuclear power plants built to earlier standards could be judged.[17] Unification of standards, etc., has been achieved in the European Community member states via adoption of the IAEA nuclear safety standards in 2009, although these IAEA standards have been either introduced afresh and/or considerably updated since the time of the *Angra 2/3* design.[18]

In Summary: It would be inappropriate to simply adopt and adapt the *Angra 2* PSAR for *Angra 3*:

- The advancing nuclear safety culture, improving technology and hardware and the engagement of *defence in depth* and *design basis* approaches disqualify the *Angra 2* PSAR because, over the years that have passed since the generic design of *Angra 2/3*, standards, expectations and requirements of nuclear safety have broadened and risen.
- It is doubtful that the compilation of the earlier version of *Angra 2* PSAR[19] took account of and is compliant with the present requirements of the IAEA nuclear safety standards and recommendations[20] and, indeed, the *Authorisation for Permanent Operation* and the *Probabilistic Safety Assessment* for *Angra 2* may not have been issued/completed.

However, the Brazil's compliance with IAEA nuclear safety standards alone is unlikely to conclusively demonstrate the PSAR for *Angra 3* because the IAEA standards comprise often bland, generalised and non-specific actions which, in themselves, rely upon the licensing authority (CNEN) having laid down a consistent set of detailed topic regulations and guides. It may be that the present regulatory framework in Brazil is not sufficiently sourced with detailed regulations being confused, or so it seems, via a *mish mash* of standards, etc., from various states that have, in the past, supplied nuclear plant and equipment.

OBJECTIVE OF LARGE & ASSOCIATES ASSESSMENT *ANGRA 3* PRELIMINARY SAFETY ASSESSMENT REPORT

Large & Associates (L&A) is to provide an independent assessment of the present version of the Eletrobrás Eletronuclear *Angra 3* PSAR in terms of the IAEA nuclear safety recommendations, standards and codes of practice:

14 Brazil has entered a number of international treaties since the design acceptance of the *Angra 2* plant, including *Convention on the Physical Protection of Nuclear Material* 8 February 1987, and the *Convention on Nuclear Safety*, 2 June 1997.

15 For example, the original *Angra 2/3* designer KWU would have much relied upon the *DIN German Nuclear Standards Commission* (KTA) recommendations from about 1978 (eg KTA 1404 *Design, Production and Service Performance for Special Valves in the Nuclear Business* which remains in force today) and the instrumentation and control systems for *Angra 2* was subject to the German standard KTA-3501. In other safety areas United States standards have been applied, for example NUREG-711 was adopted for the Human Factors assessment of *Angra 2*.

16 IAEA Conference *Safety of Nuclear Power: Strategy for the Future*, September 1991.

17 *A Common Basis for Judging the Safety of Nuclear Power Plants Built to Earlier Standards*, INSAG-8, International Nuclear Safety Advisory Group, IAEA 1995. However, progress beyond this elementary stage into the detailed topic areas (computer software, containment surety, human factors, etc) has been slow.

18 The present commitment of Brazil to abide (voluntarily) to the IAEA nuclear safety standards is not clear, even though Brazil ratified the IAEA *Convention on Nuclear Safety* in 1997.

19 It seems that CNEN failed to issue an *Authorisation for Permanent Operation* (AOP) for *Angra 2* for at least 4 years following its successful *Authorisation for Initial Operation* (AOI) and, again by late 2004, a *Probabilistic Safety Analysis* had not been undertaken – the present day availability of the AOP and PSA is not known – see *The Impact of the Global Nuclear Safety Regime in Brazil*, Almeida Claudio, CNEN 2004.

20 IAEA Safety Standards NUSS – Safety Series n. 50

TABLE 1 – L&A TASK ELEMENTS

STAGE	TASK	SCOPE
1	**Completeness**	Identification of any significant omissions and/or areas of incompleteness that remain to be determined prior to construction of the plant, including appraisal if such areas might be determined in advance of the 'hold-points' that are likely to be attached to the CNEN *Construction Permit*.
2	**Compliance**	Assessment of the topic, subject and overall compliance of the PSAR with the IAEA nuclear safety regime giving reference to and consideration of the detailed regulatory standards (ie ISO, NUREG, KTA etc) imposed by CNEN for its licensing process, including account of: a) the inclusion of *Defence in Depth* and *Design Basis* reasoning; b) relating to the *Probabilistic Safety Assessment* (PSA) undertaken for the plant; and c) the appropriateness of any dependency upon the existing PSAF for the *Angra 2* plant.
3	**Previous Reactor Incidents**	To establish if lessons learnt from previous operating incidents, such as Three Mile Island in 1979, have been accounted for in the PSAR and to assess if the plant design is sufficiently robust to withstand such events.
4	**External Events**	Analysis of the appropriateness of the PSAR identified *Design Basis Threats*, such sabotage, intrusion and other malevolent acts including aircraft crash, assumed for assessment in the PSA and PSAR.

INFORMATION ACCESS REQUIRED BY L&A

The following information and access is required – all information, etc., provided will be treated in the strictest of confidence and remain secured at all times:

TABLE 2 – INFORMATION ACCESS REQUIRED

STAGE	TASK	ACCESS	FORMAT§	NOTES
PRELIMINARY	**MPF instruction**	i) acceptance of L&A terms	i) pdf file + hard copy	Scope and detail of L&A work to be defined by MPF
1	**Completeness**	ii) PSAR iii) CNEN Construct Permit	ii) pdf file + hard copy iii) pdf file	Latest Issue, Full and Unredacted Copies, including Revisions list
2	**Compliance**	iv) PSA v) CNEN Standards Listing	iv) pdf file + hard copy v) Excel Spreadsheet	At this stage detailed listing only of CNEN standards(see footnote 9) NUREG, KTA etc relied upon
3	**Previous Incidents**	-	-	
4	**External Events**	-	-	

§ All text supplied in English

L&A DELIVERABLES

The following reporting schedule over a 20 week timescale, on the proviso that TABLE 2 requirements are satisfied in a timely fashion:

TABLE 3 – PROGRESS AND REPORTING SCHEDULE

STAGE	TASK	WEEK N°	REPORTING	NOTES
PRELIMINARY	**MPF instruction**	2	agreement and exchange of terms	
1	**Completeness**	6 8 14 20	a) Interim Draft for Comment ms WORD b) Interim Final pdf file c) Final Draft for Comment ms WORD d) Final Report pdf file	Dependent on feedback response from MPF
2	**Compliance**			Combined with Stage 1 Report
3	**Previous Incidents**			Combined with Stage 1 Report
4	**External Events**			Combined with Stage 1 Report
WRAP UP	**Representation**	20	Meeting + Illustrated Presentation	TeleConference or Visit

LARGE & ASSOCIATES

John Large[21] and Large & Associates have already completed a number of projects relating specifically to the safety and vulnerabilities of Generation I, II and III nuclear power plants, particularly the EPR units presently under construction at Olkiluoto[22,23] and Flamanville;[24,25] and provided written submissions and evidence to the UK Hinkley Point Public Inquiry of 1990[26] when acting for a consortium of 18 UK Local Authorities and, separately, the UK Fire Brigades Union.[27] John Large has also given evidence to the UK Parliament House of Commons Environment[28] and Energy[29] Select Committees on nuclear power plant performance, operational safety and decommissioning and on the UK justification process;[30] on the transportation risks of MOX fuels and plutonium at hearings of the United States Nuclear Regulatory Commission (NRC),[31] to the Foreign and Defence Committee of the Government of New Zealand,[32] and Authorité de Sûreté Nucléaire (ASN).[33]

OUTLINE FEES & EXPENSES AND TERMS OF ENGAGEMENT

The fee structure is as follows with expenses and essential disbursements as incurred:

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21 John H Large is a Consulting Engineer, Chartered Engineer, Fellow of the Institution of Mechanical Engineers, Graduate Member of the Institution Civil Engineers, Member of the British Nuclear Society, Member of the Nuclear Institute and a Fellow of the Royal Society of Arts. From the late 1960s through to the late 1980s John Large was a full-time member of the academic research staff at Brunel University on behalf of the United Kingdom Atomic Energy Authority (UKAEA) and other government agencies undertaking research in the nuclear area. In the mid-1980s he founded and headed the Large & Associates, Consulting Engineers specialising in nuclear technology and its applications. John Large and Large & Associates have been engaged by a number of overseas states and agencies, including the New Zealand Government, the Government of Gibraltar, South Korea, the Russian Federation, the Republic of Ireland, The States of Jersey, Finland and others – in 2001 John Large was awarded a commemorative medal by the Russian Federation authorities for his contribution to the salvage of the sunken nuclear powered and armed submarine *Kursk* – see http://www.largeassociates.com/KurskRINA.pdf. A full bibliography of the technical reports published by John Large and Large & Associates is directly accessible at http://www.largeassociates.com/PapersReports.htm

22 *European Pressurised Reactor at Olkiluoto 3, Finland - Brief & Interim Review of the Porosity and Durability Properties of the In Situ Cast Concrete at the Olkiluoto EPR Construction Site*, June 2006 - http://www.largeassociates.com/3149%20Olkiluoto/R3149-A1%20Final%20Issue.pdf

23 *European Pressurised Reactor at Olkiluoto 3, Finland - Review of the Finnish Radiation & Nuclear Safety Authority (STUK) Assessment*, R3123-A2, July 2005 - http://www.largeassociates.com/R3123-a2%20final%20Issue.pdf

24 *Assessments of the Radiological Consequences of Releases from Existing and Proposed French EPR/PWR Nuclear Power Plants*, February 2007 - http://www.largeassociates.com/3150%20Flamanville/r3150-final-1.pdf

25 *Additional Analysis and Comments on the Threat of Terrorist Attack to the Proposed 3rd Nuclear Power Plant at Flamanville, France*, States of Jersey, R3155-3, August 2006 - http://www.largeassociates.com/3155%20Jersey/R3155-3.pdf - Large J H. Marignac Y, Submission to the International Atomic Energy Agency - Convention on the Physical Protection of Nuclear Material (CPPNM) – IAEA InfCirc/274 & InfCirc/225/Rev.4 - IAEA Requirements on Design Basis Threat Assessment - *Non Compliance of Eurofab LTA shipment from US to France on UK Vessel: Security and Physical Protection Issues*, IAEA 20 September 2004 - http://www.largeassociates.com/JointAssessmentIAEA.pdf

26 *Proof of Evidence PWR - Aspects of Abnormal Operation - The Safety Case. Proof of Evidence PWR - Aspects of Normal Operation - The Safety Case. Proof of Evidence - Consent, Regulation and Licensing. Proof of Evidence - Quality Assurance - Past and Projected. Proof of Evidence - Comparisons with Overseas Regulation and the Resource of HM Nuclear Installations Inspectorate. Proof of Evidence - The Pressurised Water Reactor - Decommissioning. Proof of Evidence - PWR - Radioactive Waste Arisings, Proof of Evidence - On Site Generation and Storage of Radioactive Wastes*. Evidence to Hinkley Point C Public Enquiry. Somerset County Council - Consortium of Opposing Local Authorities (COLA) - March 1989

27 Proof of Evidence - PWR at Hinkley Point C - The Health and Safety of Firefighters. The National Executive of the Fire Brigades Union - May 1989, The Hinkley Point Public Inquiries, HMSO, London 1990.

28 *Radioactive Waste and Long Term Storage* - Evidence to House of Commons Environment Committee, August 1985 - *Corrosion of Magnox Cladding* - Evidence to House of Commons Environment Committee, November 1985; by order of the H of C Environment Committee - *Information on the Nuclear Industry* - Evidence to H of C Environment Committee, November 1985; by order of H of C Environment Committee

29 *Hinkley Point Power Station: Standpipe Distortion* - Evidence to the Select Committee on Energy, January 1987 - *Decommissioning of Civil Nuclear Power Stations* - Evidence to Select Committee on Energy, January 1987

30 *Justifying UK New Build Nuclear'*, Call for Independent Inquiry - Technical Omissions in the Justification Process, Palace of Westminster, London 11 March 2010 - http://www.largeassociates.com/3187%20Justification/S1387-A1.pdf

31 *NRC Hearing Disposition of Surplus Weapons Plutonium Using Mixed Oxide Fuel*, US Nuclear Regulatory Commission Hearing, 2004 - http://www.largeassociates.com/NRC1.pdf

32 *Review of the Sea Transportation of Mixed Oxide Fuel: i) Transportation Risks and Hazards , ii) Physical and Dispersion Characteristics of MOX Fuel, iii) MOX Fuel, a UK Perspective*, Evidence to the New Zealand Government Foreign Affairs, Defence and Trade Select Committee, May 2001 - http://www.largeassociates.com/R3063-MOX1.pdf

33 Joint Assessment, WISE-Paris/Large & Associates *Safety and Security Concern / FS47, Plutonium in France, Safety and Security Concerns over the FS47 Transportation Cask*, Yves Marignac, Xavier Coeytaux, John H. Large, 21 September 2004, http://www.largeassociates.com/JointAssessmentIAEA.pdf

TABLE 4 – TENTATIVE FEE STRUCTURE

PROJECT STAGE		REPORTING STAGE	FEES	NOTES
ALL STAGES		Subject to Negotiation Prior to Contract	At Quantum to Agreed Rates Schedule	MPF to determine depth of analysis and assessment required at pre-contract stage

TABLE 6 – QUANTUM MERUIT FEE RATES

TASK	£/HOUR	TYPICAL APPLICATION	DAY RATES & EXPENSES	£
R&D		general research	**FULL DAY**	
ANALYSIS		analysis/computing etc	**HALF DAY**	
ADMIN/e-MAIL		reading		
REPORT		report preparation	**e-MAIL**	
MEETING		UK only	**PHONE LOCAL**	
SITE VISIT		UK only	**PHONE TRUNK**	
TRAVEL		office hours only	**FAXES**	
LETTER		letters/e-mail attachments	**PHOTOCOPIES**	
MEMO		administrative	**MILES**	

For Quantum Meruit engagements a budget ceiling of fees may be agreed prior to contract.

This quotation and offer remains open for 30 days from the closing date of 08 August 2010 – the contract, instruction and responsibility for payment of fees and charges will be with the instructing Client or its agents, as appropriate.

Terms are net monthly E&OE and interest is charged at 5% above UK Barclays Bank rate for accounts over 1 month outstanding - no further work will be undertaken on overdue projects until outstanding accounts are settled – a fully detailed breakdown of times and expenses is generated with each invoice, together with a statement of the carbon emissions generated by the L&A involvement with the project.

UK VAT is charged at the appropriate rate to UK-based clients, for consultancy services invoices to EU and overseas based clients are subject to 0% VAT rate.

Accounts to be rendered for electronic transfer payment via

BANK ETR **-**-** ********
IBAN GB94 BARC **** **** **** **
SWIFTBIC ********

REFERENCES

An illustrative listing of clients is available at http://www.largeassociates.com/clients.htm and, if requested, referees drawn from past clients will be provided.

CONFIDENTIALITY

Client confidentiality is paramount with all reported work, etc., being transferred to full copyright and intellectual ownership of the instructing Client (unless otherwise agreed) upon full and final settlement of the agreed invoice amounts.

PROFESSIONAL INDEMNITY COVER

Projects involving high hazardous products are not covered by professional indemnity insurance. If required, professional indemnity cover will be obtained for the requisite period into the future (usually the statute barred period) at an extra-over cost to the project.

FREEDOM OF INFORMATION ACT 2000

The information made available in this quotation Ref Q1016-MPF is considered to be exempt from disclosure under the UK *Freedom of Information Act 2000*, it is to be treated as *Reserved Information* on the grounds for exemption that its disclosure to third parties would prejudice the commercial interests of Large & Associates and it must remain reserved information until the closure date specified previously or until the completion of the contract by whichever organisation/person has undertaken and completed the contract, whichever date is the later.

APPLICABILITY

This issue supersedes all earlier revisions and issue dates of Quotation Ref N^{o} Q1016-MPF.

JOHN H LARGE
LARGE & ASSOCIATES
CONSULTING ENGINEERS, LONDON