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APPLICATIONS BY LONDON ASHFORD AIRPORT LTD
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CONSIDERATION OF CIRCULAR 04/00: PLANNING CONTROLS OF HAZARDOUS SUBSTANCES RELATING TO THE PROPOSED DEVELOPMENT OF LYDD AIRPORT (LONDON ASHFORD INTERNATIONAL AIRPORT) TO DUNGENESS NUCLEAR POWER STATIONS

Client: LYDD AIRPORT ACTION GROUP (LAAG)

Statement of JOHN H LARGE

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1 **QUALIFICATIONS AND EXPERIENCE**

2 I am John H Large of the Gatehouse, 1 Repository Road, Ha Ha Road, London SE18 4BQ.

3 I have given my qualification and experience in LAAG/4/A [¶**4 *to* 7**].

4 My evidence relates to issues relevant to application of the UK Government's demographic siting policy. This policy applies to all nuclear facilities located in the United Kingdom, and is a fundamental cornerstone of the nuclear safety composite generic to all nuclear power plants (NPPs), such a Dungeness A and B.

5 I also briefly review related aspects of the off-site emergency arrangements and how these would apply in the Romney Marsh area should the development proposals for the London Ashford International Airport (LAIA) proceed.

6 I consider myself to be sufficiently qualified, experienced and practised in the topics relating to nuclear safety to provide expert opinion on this matter.

7 **INSTRUCTIONS:**

8 On 10 January 2011 Ms Louise Barton, of the Lydd Airport Action Group (LAAG), asked me to provide a further Witness Statement in support of LAAG's opposition to the proposed development of Lydd Airport (London Ashford International Airport – LAIA).

9 My instructions include to:

10 a) explain and set out the context of the UK Government's demographic siting policy with respect to the proximity of the Dungeness NPPs and the proposed development of LAIA;

11 b) refer to and explicate the evidence provided by senior members of the Health and Safety Executive Nuclear Directorate (HSE – ND) at the recent Planning Inquiry into the proposed development of housing nearby the Atomic Weapons Establishment (AWE) at Aldermaston; and to

12 c) demonstrate that the arguments presented by the HSE at Aldermaston provide further and compelling reasons why the subject planning applications should not be permitted to proceed,

13 All of which should be set out in relation to the commercial operation of LAIA as it is at present, when expanded to 500,000 passengers per annum (ppa), and at 2,000,000ppa.

14 I now address these instructions:

15 **PART A UK GOVERNMENT'S DEMOGRAPHIC SITING POLICY**

16 The underlying basis of nuclear safety in the United Kingdom is that for any nuclear licensed plant, such as the Dungeness A and B NPPs, there is an acceptance that faults will occur and that the outcome, expressed in radiological consequences, will be tolerable.

17 This composite of an acceptable risk of accident and tolerable consequences is referred to as the *'design basis'*.

18 Obviously, the design basis approach requires the engineered plant to be of sound and robust design, to have sufficient engineered safeguards ensuring its safe functioning during both normal operation and abnormal fault conditions. As a final reserve, the NPP should be sited at a location in which, should a fault resulting in a radioactive release occur, the consequential exposure of members of public would be tolerable.

19 The tolerability of the radiological consequences is expressed in terms of an individual risk relating the level of exposure to any individual and, separately, the societal risk of involving numbers of individuals to an unacceptable level of exposure. The demographic siting policy relates only to societal risk and is generally in accord with the requirements of *Target 9* of the HSE Safety Assessment Principles (SAPs) [¶622-628 p103].

20 This final and passive safeguard of siting, augmented by effective off-site emergency planning and response, is simply achieved other factors and needs permitting,[1] by locating the NPP[2] in an area of acceptably low population. This account of demographics, importantly incorporating both population

1 These other factors include, amongst other things, access to copious quantities of cooling water, proximity and connectivity to the electricity transmission grid, links to transport infrastructure, etc – see Hilton J, Senior D, *The Siting of Nuclear Installations in the United Kingdom*, Nuclear Safety Advisory Committee, NuSAC(2008)P12, TRIM 1.14.2.9/. July 2008 [¶2-4, p2]

2 Including associated activities such as, at Dungeness the remote railhead and outward railway track for the dispatch of the highly radioactive spent fuel and, possibly, future decommissioning wastes – see LAAG/4/A.

density and distribution, provides a backstop should a fault at the NPP progress beyond the design basis condition to a severe incident with potential for harsh radiological consequences.

21 In effect, the demographic siting policy implements the most obvious first step of constraining population numbers exposed to harm simply by limiting the number of people put in harm's way.[3]

22 The existence of a *'low population zone'* around a nuclear site, such as Dungeness, is an important element in the mitigation of radiological consequences and represents a buffer between the nuclear site and more concentrated centres of population – this view[4] [¶25 p9] is thoroughly endorsed by the Nuclear Installations Inspectorate (NII) of the Health and Safety Executive (HSE) in its evidence to a recent Planning Inquiry relating to a proposed development near to the AWE nuclear facility.[5]

23 The development and adoption of demographic controls for the then (1970) new generation of AGR NPPs was spelt out in a written answer[6] by the Minister of Technology. A later and effectively the current requirement or *'demographic criteria'* applying to existing NPPs was given by the Minister of Energy[7] in 1988:

24 *"... I am advised by the HSE's Nuclear Installations Inspectorate that the current demographic criteria for assessing potential AGR sites were developed in the late 1960s. These and more restrictive criteria of a similar type are used as guidelines for controlling development in the vicinity of existing AGR and Magnox stations respectively. Once a site has been has been accepted for a nuclear station arrangements are made to ensure that residential and industrial developments are so controlled that the general characteristics of the site are preserved and therefore local authorities consult the inspectorate with regard to any proposed development which might lead to an increase in population close to the site and on larger developments further from the site..."*

3 Proof of Evidence of Derek Lacey on Behalf of The Health and Safety Executive, *A Planning Application by Cala Homes (South) Ltd for The Redevelopment of Land for Mixed Use, including Residential, on Aldermaston Road, Tadley, Adjacent to the Atomic Weapons Establishment at Aldermaston*, September 2010.

4 Proof of Evidence of John Highton on Behalf of The Health and Safety Executive, *A Planning Application by Cala Homes (South) Ltd for The Redevelopment of Land for Mixed Use, including Residential, on Aldermaston Road, Tadley, Adjacent to the Atomic Weapons Establishment at Aldermaston*, September 2010.

5 Town and Country Planning Act 1990, Planning Inspectorate Ref: App/H1705/V/10/2124548, September 2010.

6 Hansard, HC Deb 23 March 1970 vol 798 cc256-257 (Written Answers) [Appendix A2 pA-2]. In this earlier application of demographic constraint, the *'low population zone'* for a 1st generation Magnox NPP, like Dungeness A, in fact comprises three *safeguarding zones* (inner, middle and outer) which, were set at 1, 2 and 5 mile (~1.6, 3.2 and 8 km respectively). An example and explanation of the application of the safeguarding zones for a Magnox reactor is given for the Sizewell A NPP extending around the market town of Leiston in Suffolk [Appendix C.3 p C13/15]. For a 2nd generation AGR NPP, such as Dungeness B, to restrict residential and commercial developments two safeguarding zones were established with the inner zone at two-thirds of a mile (1 km) and an outer zone out to 2 miles (3.2 km) – these limit systems have now been subsumed into SSA criteria..

7 Hansard, HC 11 March 1988 Vol 129, cc357-358 (Written Answers) [Appendix A2 pA-3].

25 Implementation of these demographic controls is via the guidance of the Government Circular 04/00[8] that includes specific arrangements applied to any proposed development (ie LAIA) near to a licensed nuclear site (ie Dungeness A, Dungeness B):[9]

26 *" . . . **A17.** With regard to proposed developments in the vicinity of licensed nuclear installations, the consultation can vary between sites. The present administrative arrangements will therefore continue to apply, under which HSE specify for each such site a relevant consultation zone and the type of developments on which it should be consulted.*

***A18.** Where the local planning authority is in any doubt about whether HSE should be consulted in a particular case, it is advised to contact the appropriate HSE Area Office . . ."*

27 The latest directive on application of these demographic controls is given by the National Policy Statement for Nuclear Power Generation (EN6)[10] issued by the Department of Energy and Climate Change.

28 Applying to existing and new-build NPPs (and other nuclear facilities), the EN-6 policy statement is quite specific, its overriding objective being

29 *" 4.13.1 The objective of Government's policy on demographics and the siting of nuclear power stations is to **limit the radiological consequences** to the public in the unlikely event of a serious nuclear accident. . . "*

30 And to meet this objective, the Planning Authority (here Shepway District Council) is required to take heed of the NII advice

31 *" 4.13.2 The NII implements this policy by advising planning authorities whether proposed developments near to nuclear facilities are consistent with Government policy. Planning authorities take this advice into account in **considering whether or not to approve** planning applications.*

32 Although EN-6 is primarily aimed at the new-build generation,[11] it equally applies to existing nuclear facilities, such as the Dungeness NPPs

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8 Government Circular 04/00: *Planning Controls for Hazardous Substances*, ODPM, May 2006

9 Although not part of the licensed site, the spent fuel railhead handling large radioactive source term quantities also qualifies.

10 *Draft National Policy Statement for Nuclear Power Generation (EN-6)*, Department of Energy and Climate Change, November 2009 – this statement formed part of the Government's framework for the Strategic Site Assessments (SSA) or evaluation of the 10 nominated sites for suitability for nuclear new-build.

11 HSE NII considers EN-6 to apply to existing plants because it deployed this criteria in its recent evidence opposing a residential development nearby the established Atomic Weapons Establishment at Aldermaston – see Proof of Evidence of John Highton on Behalf of The Health and Safety Executive, *A Planning Application by Cala Homes (South) Ltd for The Redevelopment of Land for Mixed Use, including Residential, on Aldermaston Road, Tadley, Adjacent to the Atomic Weapons Establishment at Aldermaston*, September 2010 [¶35 p14].

33 *" 4.13.5 Furthermore, . . . arrangements will be put in place with Local Planning Authorities and Nuclear Site Licensees which place constraints on development around nuclear sites. These constraints are designed to control residential, **industrial and commercial developments**. The aim is to preserve the general characteristics of the area around the nuclear site throughout its lifecycle, and to ensure that the **basis on which the site is licensed is not undermined**.*

*my truncation . . . and added **emphasis** throughout*

34 The United Kingdom complies with the Convention on Nuclear Safety (1994) with, for example, the UK's Fourth Compliance Report stating

35 *". . 17.28. On 11 March 1988, the Secretary of State for Energy stated that once a site has been accepted for a nuclear station, arrangements are to be made to ensure that residential and **industrial developments** are so controlled that **the general characteristics of the site are preserved**.*

*17.29. The planning and public enquiry processes (see above) require that the **all relevant issues are addressed and discussed**. . . . . **If planning permission is granted for the site, there will be planning controls to ensure that significant and unacceptable population growth does not occur**. In the UK, the area requiring these restrictive controls is out to 8 km from the nuclear site. . .*

*17.30. Continued re-evaluation of external hazards and of the emergency plans is required under LCs 15 and 11 respectively. Guidance on **re-evaluation** of the **specific demographic requirements** on siting is given in SAPs ST.1 - 7. LC15 also requires periodic safety review of all safety documentation to ensure that the plant design still meets its original intent and that all reasonably practicable safety improvements are implemented (see Article 6). This includes the **re-evaluation of external hazards**.*

*17.31 Local authorities consult the HSE with regard to **any proposed development** that might lead to an **increase in population** close to the site and on **large developments** further from the site. . . "*

*my truncation . . . and added **emphasis** throughout*

36 **PART B DEMOGRAPHIC SITING CRITERIA – APPLICATION TO DUNGENESS**

37 The detailed methodology for applying the demographic controls are adequately dealt with elsewhere,[1,12,13] so much so that here it suffices to explain the features of application to the existing Dungeness NPP sites:

39 First and foremost, the application of demographic control is neither *risk informed*[14,15] nor *risk based*,[16] meaning that, essentially, it is not applied in response to the chance of occurrence of any specific accident or incident.

12 *Land Use Planning and the Siting of Nuclear Installations in the United Kingdom*, HSE, note undated.

13 Openshaw S. (1986), *Nuclear Power: Siting and Safety*, Routledge and Kegan Paul – see extract from Highton [Appendix B].

40 In this respect, the demographic controls are not responsive to an aircraft crash deriving from increased air traffic around LAIA, or any other design basis event at Dungeness, since the policy is a measure of prudence over and above the regulatory requirements imposed, via the nuclear site licence, on nuclear operator to prevent such accidents.

41 The HSE, via the NII and on behalf of the Secretary of State for Business, Enterprise and Regulatory Reform, administers the demographic control policy. The NII fulfils this function by advising planning authority, here Shepway DC, whether the proposed LAIA development near to the Dungeness NPP sites is consistent with Government policy.

42 My understanding is that Shepway DC is required to take this advice into account when considering whether to grant planning applications. In other words, account of the site demographic is a *material consideration* in the planning process.

43 In application, the demographic criteria includes weighting factors to determine the *'acceptable'* population limits in 30^{o} sectors around the Dungeness sites.

44 There are two sets of population reference limits adopted: A stringent limit being referred to as *'remote'*[17] and a less limiting limit being defined as *'semi-urban'*[18] – these definitions were set out by the Minister of Technology in 1988 [¶23-24].

45 More recently,[12] a new population density constraint limit has been introduced for new build NPPs, such as that proposed but now deferred at Dungeness C, at one-third the *semi-urban* limit.[19]

46 The acceptable population levels all around the site and in a 30^{o} sector tapering out from the site (rather like slices of a cake), are adjusted by weighting factors in account of local weather and atmospheric conditions that prevail around the site, thus accounting for the dispersal (and unit or

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14 *Risk Informed* - an approach to regulatory decision making, in which insights from probabilistic risk assessment are considered **together** with other engineering insights.

15 Some might argue that with the differentiation between Magnox and AGR NPPs in the safeguarding zones [¶44] the criteria is *Risk Informed* because it takes account of and compensates for the claimed superior containment design of the AGR pressure vessel.

16 *Risk Based* - An approach to regulatory decision making that considers **only** the results of a probabilistic risk assessment.

17 *Remote* population constraint density defined by the HSE to be 30^{o} sector 1,000 persons per km^2 and all round the site 250 persons per km^2.

18 *Semi-Urban* population constraint density defined by the HSE to be 30^{o} sector 5,000 persons per km^2 and all round the site 1,250 persons per km^2, applied out to 20 miles (~32km). This compares with the Nuclear Regulatory Commission (NRC – USA) *Regulatory Guide 4.7 rev.2* (1998) [p12] of 500 per square mile (193 per km^2) for any radial distance out to 20 miles (~32km).

19 *New Build* population constraint density defined as 1,667 persons per km^2.

specific dilution) of radioactive material from the point of release and, hence, the levels of radioactive dose uptake by members of the public positioned at various locations around the site.[20]

47 Since the primary purpose of the demographic control is to provide passive protection against radiation exposure to unacceptable numbers of population around the site (the societal risk), any site at Dungeness that continues to maintain a radiological hazard, should be considered for demographic control.

48 In my opinion, the remote railhead qualifies for the same demographic control because the handling and presence of considerable quantities of intensely radioactive spent fuel represent a very significant radiological hazard.

49 **THE DUNGENESS DEMOGRAPHIC CONTROL SITES**

50 **Dungeness A:** TABLE 1 of my evidence LAAG/4/A outlines the continuing presence of various radioactive hazards on the Dungeness A site.

51 The higher section of CHART 1 shows the estimates periods through which these various radioactive hazards will be active on the Dungeness A site. In TABLE 3 I have listed some sample accident/incident scenarios that could trigger a release of these radioactive materials [items 5, 6, 7 and 8].

52 I consider that so long as the irradiated spent fuel remains on the Dungeness A site, presently in temporary storage in the reactor cores and/or in the fuel ponds, it is appropriate for the *'remote'* demographic constraint to remain in place. This is because the 'remote' limit was specifically adopted for the Magnox NPP design in account of the lack of any secondary containment and because of the pyrophoricity of the Magnox elemental uranium, metal fuel and its magnesium alloy cladding.[35]

53 At this time, removal of the spent fuel is estimated for completion in or about 2015, although this is now five years beyond the 2010 defuelling date originally anticipated following Dungeness A shut down in 2006. I would not be surprised if further delays occurred to the complete defueling the

20 The radiological exposure to the population is assumed to derive from exposure to the plume formed from a ground level release of radioactive material. The developing plume is contained within a tear-drop plume shape generated by steady state dispersion of airborne contaminant, with the plume front concentration weakening with distance from the release point – the development and concentrate weakening of the plume follows observed dispersion behaviour (the Gaussian plume model) with the adopted level of atmospheric stability (F) constraining the plume within a 30^{o} sector.

Dungeness and other Magnox NPPs because of fuel storage and reprocessing delays presently accumulating at the BNFL Sellafield plant to which the spent fuel is dispatched.

54 Once that the Magnox spent fuel has been removed, the hazard dominating the Dungeness A site is the 4,300m^3 of graphite core assemblies remaining inside the reactor hulks. This graphite - radioactive, charged with Wigner Energy and carbonaceous dust[21] - will remain in situ within the reactor hulks until the final phases of dismantling to final site clearance (FSC), in or about 2100.

55 The graphite risk is twofold:

56 i) during the dormant, in situ period until 2100, or thereabouts, the graphite is susceptible to an external event failing the temporary containment (see Berkeley), enabling a fire and providing for a Wigner energy release,[22] air reactivity, and atmospheric dispersion of a significant radioactive C-14 source term; and

57 ii) during the ultimate reactor dismantling stages, around 2080 or thereabouts, when the final biological shield and reactor pressure vessel containments are opened to remotely remove and package the graphite, there will be heightened risk of release and dispersion of the graphite by much the same mechanisms of i) foregoing.

58 There exists a range of external events that could, at a future time and given the appropriate circumstances and severity, trigger a release of the core graphite - these might include earthquake, aircraft crash, sabotage, etc..

59 Also, it is possible that the steel reactor pressure and inner core support and restraint structures, and/or the reinforced concrete biological shield and pile cap could collapse provoking air reaction[24] and release of graphite ash, etc.. Such an incident might arise because of general materials/structural degradation over the lengthy time periods involved – little has been published on the detail of how these structures are to be adequately preserved over the decommissioning dwell periods (C&M Preps

21 The carbonaceous dust accumulates over the operational life of the reactors, being generated by the irradiation of the trace quantity of carbon monoxide impurity that persists in the carbon dioxide coolant gas Although some of the dust is routinely removed as it swept around the coolant circuit and significant quantity builds up and is retained in the interbrick passages that serve to provide lateral cooling to the graphite core.

22 Self-heating via release of the Wigner energy capture by and stored in the graphite – the Magnox reactors were not annealed (ie controlled release of the Wigner energy) prior to shut down by which time the reactors had reached about 80% of the so called Wigner limit, so there remains risk of some internal core or external heating incident triggering off a self-sustaining energy release within the graphite – the Windscale fire of October 1957 was triggered by a Wigner energy release whilst the reactor core was being managed-annealed and, because of this event, the subsequent Magnox reactors were never Wigner annealed as originally intended. The AGR graphite cores operate at a sufficiently high temperature to be effectively self-annealing.

and C&M - LAAG/4/A) for which, to my knowledge,[23] nothing was planned for at the time of the original design of the Magnox (and AGR) NPPs.

60 Again, I consider that so long as the graphite remains untreated on the Dungeness A site, because of the risk of uncontained Wigner energy release and the enhanced reactivity in air,[24] then the *'remote'* demographic constraint should remain in place.

61 **Dungeness B:** Similarly, TABLE 2 of my evidence LAAG/4/A outlines the continuing presence of various radioactive hazards on the Dungeness B site - the lower section of CHART 1 shows the estimates periods through which these various radioactive hazards will be active on the Dungeness B site.

62 So long as the Dungeness B reactors are maintained in power operation, the hazard is dominated by the in-core reactor fuel. Nuclear power operations at Dungeness B are presently scheduled to continue until 2018, although life extensions may be granted extending the operation until 2024 or, possibly, 2028.

63 Once that Dungeness B ceases power operation, the in-core spent fuel has to be transferred to the fuel pond where it has to remain for cooling for at least five years before it is available for dispatch to Sellafield.[25] In account of the slow defueling rate of each of the two Dungeness B reactors, spent fuel could remain on the site 10 or more years.

64 And, like Dungeness A, the final decommissioning and dismantling of Dungeness B will extend onto the distant future with the risk graphite release and dispersion during the lengthy in situ storage period and, in preparation for FSC, during the extraction from each of the reactor hulks occurring sometime around 2105 to 2125.

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23 Large J H, *Decommissioning of Civil Nuclear Power Stations* - Evidence to House of Commons Select Committee on Energy, January 1987 – Large J H *Decommissioning of the United Kingdom Magnox Reactor Programme* – Proc Environment 2000 Conference, Sheffield, 12 December 1989 – Large J H *Decommissioning of Nuclear Reactor Systems*, Int Conference, IMechE, February 1992 04 – Large J H *Decommissioning of Nuclear Reactor Systems*, Proc IMechE, PT A, J Power & Energy, V206, 1993 – Large J H Independent Advisor to *National Stakeholder Dialogue – Magnox Power Station Decommissioning*, Environment Council (UK) Magnox Electric and other participants, including 2) *Wigner Stored Energy in the Magnox Graphite Core during and at the end of the Safestore Period* – June 200, 4) *Potential Degradation of Concrete and Steel Structures over the Extended Safestore and Final Dismantling Period* – August 2001, 5) *Potentials for Graphite Core Degradation and Instability over the Extended Safestore and Final Dismantling Period* – September 2001, 7) *Passive Civil Engineered Structures – the Civil Engineering Profession's View of Risk and Consequence* – March 2002.

24 Irradiated graphite reactivity in air is 'oxidation' and not burning (ie supporting flame) and it requires an elevated temperature under which the oxidation mechanism triggers, although this threshold temperature lowers when the graphite as been exposed to a sodium chloride laced atmosphere (ie sea air).

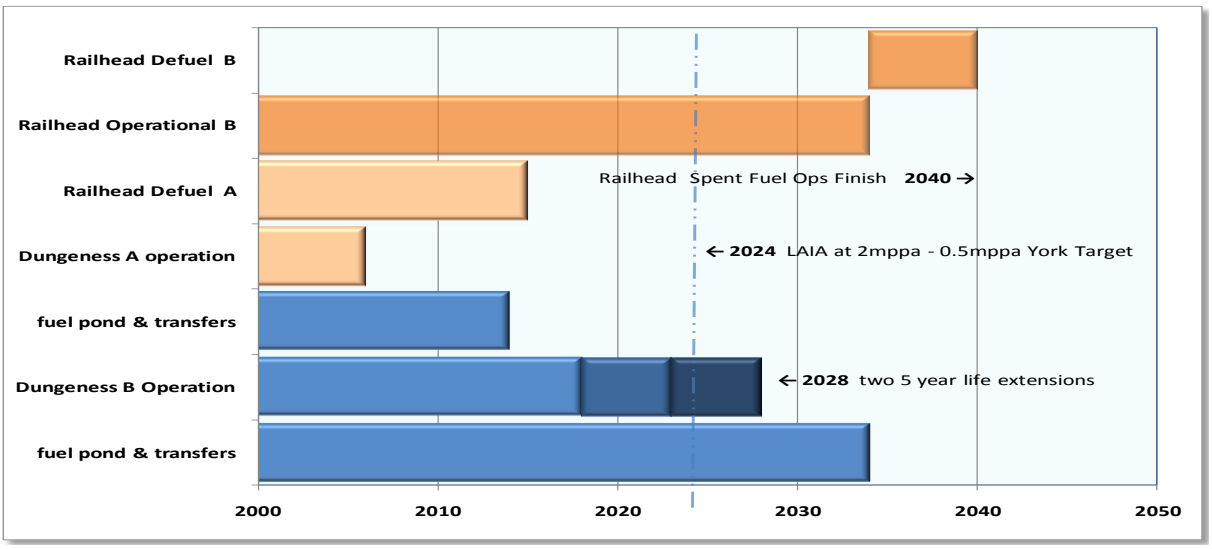
25 The 5 years post core cooling period at the NPP is to allow for i) the natural decay of the iodine-131 fission product gas in the fuel, because this presents a significant radiological risk in the aftermath of a transport flask incident, and ii) the permit the overall radioactive decay down to an acceptable heat emission load for the transport flask.

65 **Spent Fuel Railhead:** The railhead, located about 2.6km south-east from the LAIA terminal building is to continue in use until about five to six years following the final closure of Dungeness B which, with life extensions, could be until 2040.

66 The crossover between nuclear activities at the Dungeness NPP sites, including spent fuel operations at the remote railhead, and the proposed development of the LAIA commercial air traffic operations are summarised by CHART A.

67 I have previously discussed why the spent fuel rail head should also be subject to the demographic siting criteria [¶48 p8 & footnote 28 p13].

68 **CHART A SPENT FUEL HANDLING AND TRANSIT OPERATIONS AT THE REMOTE RAILHEAD**



69 **PART C PHASING THE LAIA EXPANSION *v* NPP ACTIVITIES**

70 In her evidence Louise Congdon, of York Aviation (LAA/4/A) [Table 5.4 p46] assumes that both lower and higher growth scenarios will achieve about 500,000ppa by 2030, although she opines that given certain conditions about 500,000ppa could be achieved by 2024 [¶5.63 p54].

71 However, in October 2004 when promoting the airport development, LAIA stated [3rd slide]:[26]

26 Lydd (London Ashford Airport), *Slide presentation to Channel Chamber and KCC*, 22 October 2004.

72 *". . Lydd's immediate plans are to develop the airport in order to cater for 2 million passengers per annum by 2014. . ."*

73 If this 2004 projection is adopted, then period of 10 years for development from virtually negligible passenger air traffic to a commercial level of 2mppa in 10 years, by far outstrips Louise Congdon's somewhat conservative Lower and Higher growth rates.

74 CHART A shows the high likelihood that Dungeness B will be in full operation until 2028 and that, thereafter, defueling operations with transfers from the fuel pond to the remote railhead continuing until 2040.

75 Thus, there is an overlap of operations of the Dungeness NPPs and associated spent fuel activities, and the proposed expansion LAIA from about 2014 through to 2024, when it could be at full 2mppa commercial operation.

76 In other words, LAIA could reach full commercial operations whilst the major radiological hazards (continuing Dungeness B reactor operation and spent fuel storage) remain active at the NPP site. It is only following 2040 (or thereabouts) the Dungeness NPP sites will be free of the spent fuel hazard, although thereafter the decommissioning radwastes remain active on the sites as hazards of varying degrees.

77 **PART D APPLYING THE DEMOGRAPHIC ASSESSMENT**

78 As I have previously explained, the UK Government adopts a demographic assessment methodology for the siting of new nuclear plants and for the periodic reappraisal of existing nuclear plants and activities [¶15 - 36].

79 In its most recent publication, for the Strategic Site Assessment (SSA)[10] exercise, undertaken for the determination of the suitability of nominated sites for new nuclear build NPPs, the Government adopted the *'semi-urban'*[18] siting criteria as an exclusionary limit.[12,27]

80 Since the HSE has endorsed this approach to be neither *risk informed* nor *risk based* [¶39], this most recent application of the demographic assessment and its criteria must equally

27 Highton J, Senior D, *The Siting of Nuclear Installations in the United Kingdom*, Nuclear Safety Advisory Committee, NuSAC(2008)P12, TRIM 1.14.2.9/. July 2008 [¶2-4, p2].

apply to the existing nuclear activities at the Dungeness NPP sites and the remote railhead.[28]

81 Moreover, since the UK commits to an international undertaking to apply these controls out to 8km [¶34 - 35] from the nuclear activity, the demographic assessment should be applied afresh to the conjugate formed between the Dungeness NPPs and the proposed development of LAIA. This is because once a site has been accepted for a nuclear power station then:

- the general characteristics of the site must be preserved [17.28];
- significant and unacceptable population growth does nor occur [17.29];
- periodic re-evaluation of external hazards should take place [17.30]; and
- local authorities should consult with the HSE with regard to any proposed development that might lead to an increase in population [17.31].

82 Essentially, the demographic siting assessment compares the population in the vicinity of a nuclear facility and/or activity with a standard reference population distribution. This involves the definition and determination of a generic *Site Population Factor* (SPF) which is factored against a reference weighted population to account for the dilution with distance of a dispersing plume of radioactivity.[20]

83 The absolute value of the generic SPF gives a direct indication of the relative risks associated with different sites or, importantly in this application at Dungeness, the risks associated with projected changes in the actual population numbers and distribution in the area around the NPPs.

84 So for the demographic re-evaluation, the existing population density and distribution around the NPP activity (at least out to 8km) are compared with the projected changes associated with the proposed development (in this case LAIA).

85 Ideally, the existing population data set should be that adopted for the previous

28 In evidence to the recent Aldermaston Planning Inquiry - see Footnote 5 – John Highton giving evidence on behalf of the HSE, when referring to the Aldermaston site that does not presently have an operational nuclear reactor, noted *"Further, the NuSAC 2008 paper demonstrated to the satisfaction of the NuSAC members that the Hansard (1988) model was readily extendible to non-reactor nuclear facilities (NNFs) when cast in terms of site population factors (SPFs) and they endorsed its application in that form to new-build nuclear plant"* [¶(g) p32] – the radioactive source term available from three Magnox M2 or three AGR A2 flasks of spent fuel represent a significant radiological risk so much so that a radioactive release from the remote railhead warrants separate consideration for site assessment– see LAAG/4/A [¶46 and 63].

demographic siting assessment but, although requested from the NII,[29,30] I have yet to receive a response and any further information on this.

86 So, and in account of LAAG's resource limitations, instead of using the national population census data, I have adopted the data locating residential properties etc., out to 3 to 4km available in the Kent County Council REPPIR off-site emergency plan,[31] applying a broad brush, uniform multiplier to yield the population numbers. For locations further afield, I have referred to Shepway DC electoral ward statistics and 'head-counting' to determine a gauge of the population density and distribution out to 8 to 10km from the NPPs. Similarly, I have repeated the exercise for the same distance and radial distribution centred from the remote spent fuel railhead.

87 Following recommended practice,[12] I have grouped this data into 1km wide annular rings, sub-divided into 30^{o} sectors, but only extending out to 10km and not 30km as deployed by the HSE, and my assessment includes somewhat unqualified assumptions for summer residency of users of the various caravan/mobile home sites within my catchment area, and for a limited number of services personnel on the Ministry of Defence range.

88 Although my compilation of the local population data is, I have to admit, somewhat rough and ready, I have adhered to established guidelines[32] wherever practicable. I have drawn my data from a variety of sources so there might be some inconsistencies over the data set, although not enough to have a significant effect on the overall result.

89 My local population data is presented, first, centred on the Dungeness A and B NPP sites and, second, centred on the remote railhead.

90 My SPF analysis centres on the impact of LAIA as it is staffed is at present; if it were to operate at around i) 500,000ppa and at the projected ii) 2mppa; and if during the course of its operating schedules some event created a snarl-up or log jam of departing passengers being processed through the terminal.

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29 Large & Associates to NII, Freedom of Information Act 2000 request M3136-A1 of 18 January 2010 – awaiting a response and because of the delays, over 1 year *vs* the 20 working day limit required by S10 of the Act, the matter is subject to Internal Review by the HSE.

30 Large & Associates to NII, Freedom of Information Act 2000 request M3136-A5 of 11 January 2011– awaiting a response

31 *Radiation (Emergency Preparedness and Public Information) Regulations 2001* (REPPIR) – *Dungeness Off-Site REPPIR Plan* November 2002 – this is a somewhat dated and incomplete copy – [Table Section 10.4] – M3136-A9.

32 IAEA (2002), *Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants*, Safety Guide NS-G-3.2, International Atomic Energy Agency, Vienna [¶5.1-5.15 p 25-27].

91 Louise Congdon, of York Aviation (LAA/4/A) [¶4.5-6 p24] gives the current direct employment (48 + 24=) 72 at the LAIA, added to which are 40 indirect and induced jobs [Table 6.1 p59] which gives a total employment of 110. Louise Congdon suggests the present passenger capacity is limited to handling one commercial airliner of 78 seat capacity at any one time [¶4.15 p27]. So, with aircrew, incidental and other personnel, transport (bus and taxi drivers, and so forth), the present maximum number of individuals frequenting the LAIA terminal and its environs might be around 200.

92 For the proposed development of LAIA operations, Louise Congdon projects direct employment to be 500 jobs per million passengers per annum [¶3.7 p57] although this, she admits, is for a *'low employment density airport'*.[33] To this direct employment it is reasonable to add the same ratio of indirect employment [¶91], so (40/72*500=) 278 indirect and induced jobs per mppa, with additional aircrews, transport personnel etc..

93 My compilation of the number of persons likely to be at LAIA at any one time, gives an aggregate value and includes no account of seasonal fluctuations, such as the increased activity expected to occur during holiday periods.

94 **TABLE 1 EXISTING AND PROJECTED AVERAGE OCCUPANCY LEVELS FOR LAIA**

	INDIVIDUALS LIKELY TO BE ON LAIA SITE					
LAIA DEVELOPMENT STATE Passengers per Annum	DIRECT STAFF	INDIRECT STAFF	AIRCREW, ETC[§]	OTHER[†]	PASSENGERS[ξ]	TOTAL
EXISTING LAIA	72	40	5	7	78	202
250,000	125	70	7	19	114	335
500,000	250	139	14	38	228	669
2,000,000	1000	556	55	150	913	2674

§ Assumes that one-fifth of the aircrews visiting on any day will be on the ground at the same time; 5 aircrew per aircraft, that generally air traffic movements are based on aircraft carrying 100 passengers, and takes no account of seasonal fluctuations in daily passenger and air movement numbers.

ξ Passengers take, on average, 2 hours to process through ticket, security checks, and immigration.

† Taxi and bus drivers, etc., assumes at about 10% of direct and indirect staff – rounding errors may occur in tabulated data.

95 Now assume a scenario where aircraft are, for some reason,[34] held up in the region and, particularly at LAIA. In this scenario, all outgoing flights are cancelled and incoming flights are held in the parking areas once passengers have been disembarked. Incoming passengers continue to arrive at LAIA and are cleared from the terminal building, leaving homebound by bus, taxi, etc., (there are no transfer flights assumed). However, would-be

33 The LAAG/8/A evidence assumes a different LAIA employment rate, being between 250 to 450 per mppa.

34 The are a number of recent examples of this with, in April 2010, the eruption of Eyjafjallajökull in Iceland causing an abrupt halt to air traffic, similarly in December 2010 the log jamming of Heathrow and Gatwick, and other airports, due to inclement weather, and occasionally the disruption of air traffic occurs for reasons of force majeure, etc.

departing passengers continue to arrive at the LAIA terminal, to join the growing number of delayed passengers and grounded aircrews.

96 Assuming that the individual airline operators are slow to react to and resolve the mounting log jam, the build up of individuals over a 12 to 24 hour period ignoring seasonal fluctuations would be expected to be as follows:

97 **TABLE 2 PASSENGER, ETC OUT FLIGHT LOG JAMMED AT LAIA OVER 12 TO 24 HOURS**

	INDIVIDUALS LIKELY TO BE ON LAIA SITE					
LAIA DEVELOPMENT STATE Passengers per Annum	**DIRECT STAFF**	**INDIRECT STAFF**	**AIRCREW, ETC**[§]	**OTHER**	**PASSENGERS**[ξ]	**TOTAL**
250,000	125	70	34	19	599	904
500,000	250	139	68	38	1199	1808
2,000,000	1000	556	55	150	4795	7231

§ All aircrews (incoming and departures) remain for the first scheduled day of operations..

ξ 100% of would-be departing passengers log jam for first 12 hours, second day only 50% of that day's would-be departing passengers arrive.

98 In account of the projections of **TABLES 1** and **2**, the SPF has been determined for the following cases:

99 **TABLE 3 SITE POPULATION FACTOR – SPF *v* VARIOUS LAIA PASSENGER, ETC OCCUPANCY**

	POPULATION SITING CRITERIA				
LAIA STATE Passengers per Annum	**SPF_{MAX}**		**MAXIMUM POPULATION**		
ON NPP SITES	**NORMAL/LOGJAM**	**% CHANGE**	**MAXIMUM POP**[†]	**% *remote*** [ξ]	**% *semi-urban***[†35]
EXISTING LAIA	0.126/	-	210	21%	4%
250,000	0.129/0.142	~9%	215/237	22/24%	4/5%
500,000	0.137/0.162	~15%	228/270	23/27%	5/5%
1,000,000	0.152/0.202	~25%	253/337	25/34%	5/7%
2,000,000	0.181/0.308	~41%	302/513	30 /51%	6/10%
ON REMOTE RAILHEAD					
EXISTING LAIA	0.621/	-	1035	104%	21%
250,000	0.621/0.621	~0%	1035/1035	104/104%	21/21%
500,000	0.621/0.621	~0%	1035/1035	104/104%	21/21%
1,000,000	0.621/0.805	~23%	1035/1342	104/134%	21/27%
1,500,000	0.621/1.162	~46%	1035/1924	104/192%	21/38%
2,000,000	0.621/1.520	~59%	1035/2534	104/253%	21/51%

† Maximum Population Density = SPF_{max} x Reference Density (1667/km^2) ξ These are the 30° Sector limits of Footnotes 17 and 18.

35 There is good reason to maintain the *remote* category for any activities relating to Magnox spent fuel. Essentially, this is because the elemental metal Magnox fuel is highly pyrophoric with air exposed ignition temperatures at about 220°C or much lower, down to ambient, if the fuel surface has been exposed and hydrides have formed - the magnesium alloy fuel element cladding (from which the reactor type derives it name *'Magnox'*) will ignite in air at a temperature of around 700°C. Burning of the elemental metal Magnox fuel produces finely divided uranium oxides that increase the release fraction (ie more material is liberated to atmosphere) and, once airborne, the greater fraction of these are readily respirable – for a detailed explanation of this and the potential for the M2 and A2 spent fuel transportation flasks to fail under high energy external events (such as aircraft crash) see *Risks and Hazards arising from the Transportation of Irradiated Fuel and Nuclear Materials in the United Kingdom*, March 2006.

100 **TABLE 3** illustrates the changes in societal risk to numbers of individual members of public brought about by the introduction of commercial operations at LAIA.

101 To reiterate, the Site Population Factor or SPF provides a simple indication of the relative risks associated with the changes that have (or could) occur in an area surrounding a site occupied by some nuclear activity. The risk here is expressed in terms of the comparison of the numbers of persons who might be exposed to the radioactivity dispersing from a hypothetical release – the SPF is not a measure of the risk of the hypothetical release occurring.

102 For example and centred on the Dungeness **NPP** sites: If LAIA was to log jam when operating at 2mppa there arises a 41% change to the relative risk under which conditions the fraction of the *remote* and *semi-urban* population limit would be 51% and 10% respectively. As illustration, the increase to 51% of the *remote* limit density of 1,000 persons/km^2 represents an increase from 21% to 51%, that is about 30% of the allowable population is taken up by expanded LAIA activities under log jam conditions, and 21% to 30%, or about 9% under normal operating conditions at 2mppa.

103 If the demographic assessment is centred on the remote **railhead**, the outcome of moving the point of the hypothetical release about 2.5km nearer the LAIA terminal (and importantly the population concentrations of Lydd and New Romney) results in a more significant uptake of the reserve capacity for future residential development in the Lydd and New Romney environs. For example, for all levels of commercial operation but with no log jamming, normal airport activities take 106% of the *remote* and 21% of the *semi-urban* limits respectively.[36] If LAIA log jams, at 2mppa the rising accumulation of would-be departing passengers, grounded aircrews, etc., exceeds the *remote* limit by 253% and 51% of the semi-urban limit.

36 Government determines that if a SPF for any location proposed new site exceeds the *semi-urban* demographic siting criteria previously used for Advanced Gas-Cooled Reactors (AGRs), then the local population density is too high to permit the siting of a nuclear power station at that location. This led to the adoption of an *Exclusionary Criterion*, in the Government's Strategic Siting Assessment process, being based on the *'semi-urban'* constraint limit.

104 **SUMMARY OF PART D: THE DEMOGRAPHIC SITE ASSESSMENT**

105 TABLE 3 illustrates that if log jamming occurs and is accepted as a factor to be included in the demographic assessment, then this has the potential to exceed the *remote* limit with LAIA operating at 1mppa.

106 Following the Government's present policy on preserving the site population characteristics, if the *semi-urban* criterion is assumed, the proposed LAIA activities will stunt the potential for population/industrial (in the non airport sector) growth by 6% to 10% (NPP centred) and by 21% to 50% (railhead centred).

107 The detailed demographic analyses[37] suggest that these restrictions would particularly limit, for the NPP centred application, residential, etc. development in Lydd and, for the railhead centred case, residential and campsite development along the south-east coast road running toward to New Romney, and further afield.[38]

108 Generally, TABLE 3 indicates the impact of the proposed LAIA expanded operations and potential log jamming to be significant enough to warrant re-evaluation of the Dungeness NPP sites, as recommended by Circular 04/00 [¶A17-A18], and as committed to by the UK Government's Fourth Compliance Report [¶17.29 -17.31] to the Convention on Nuclear Safety.

109 That said, the results of my demographic site assessment should be treated with caution because of a number of limitations and constraints that I have referred to previously [¶85-88].[39]

110 However, this should not be of any great concern because, first, the purpose of my demographic assessment is to indicate trends and not generate hard-and-fast limits and, importantly, it is to demonstrate that expanding the operation of the LAIA should have warranted this specific type of input to the planning process from the HSE.

37 The detailed analyses comprises interactive spreadsheet calculations that require manipulation of the input data set via drop down tables and, because of this, if made available on the internet links such would be open to corruption – a working spreadsheet will be made available to the Inquiry if required.

38 The weighting factors applied to the population in the annular zones have an important bearing on the population that can be accommodated further field, say out to 20 miles from the NPP. For example, a development to accommodate say 1,000 people newly introduced within one mile of the NPP could reduce the possible population that could be located in the 5 to 10 mile zone by 20,000.

39 Also, I have not refined the SPF calculation by sidestepping 5^{o} incremental rotations to identify the most densely populated 30^{o} sector.

111 Put another way, Shepway DC should have sought advice [¶25-26] from the HSE once that it became apparent that the LAIA development was likely to be accompanied by a significant change to the population characteristic – my limited calculation of the SPF is sufficient to show the trend of the population characteristic change – and the HSE should have responded to Shepway DC by re-evaluating of the demographic population assessment in accord with the undertaking given by Government [¶34-35 – para A18].

112 Since I have no information to the contrary,[40,41] I can only assume that a demographic site assessment was not undertaken in conjunction with the subject planning applications.

113 In this respect, the proposed development fails to comply with the clearly set out Government policy that population factors around nuclear licensed sites should be taken into account.

114 PART E IMPACT OF LAIA ON OFF-SITE EMERGENCY ARRANGEMENTS

115 So far, I have considered a hypothetical release of radioactivity to determine the site population characteristics.

116 If a real radiological incident occurred then the pre-prepared emergency plan (prepared under REPPIR),[31] would be implemented in response. The proposed development of LAIA would increase the number of individuals that would be subject to a radiation emergency (as defined by REPPIR) should the incident extend beyond the Detailed Emergency Planning Zone (DEPZ) of 2.4km (but assumed for the REPPIR plan to be 3km) radius from the origin of the incident [¶1.5.9 – 1.5.10].

117 The increases in the number of individuals possibly subject the emergency countermeasures, should radiological conditions extend beyond the 3km DEPZ, are given in TABLES 1 and 2.

118 At the projected LAIA 2mppa, the increase for normal airport operation is 2,674 and for a departure-based log jam 7,231. Of course, the greater number of these individuals

40 I have searched through the documents available at Shepway DC but I have not discovered any documents that relate to a demographic site assessment being requested from the HSE or being undertaken independently by Shepway DC. Also, I have requested [¶5) p2] from Shepway DC the results of analysis or advice that it has received from the HSE on any demographic siting assessment undertaken in respect of the LAIA planning applications. Similarly, I have also requested from the HSE whether it has undertaken a demographic siting assessment for the existing Dungeness NPPs. To date, I have not received any response from either Shepway DC or the HSE to my inquiries

41 I have also asked Ms Louise Barton of LAAG but she, even with her thoroughgoing knowledge of the planning applications, has no information to add in this respect.

comprise would-be departing passengers unfamiliar with local area, transport means and, for those with their own transport, the most efficacious self-evacuation routes.

119 A large number of airport visiting individuals self-evacuating, whether on or in disregard of official advice, could in the absence of local knowledge congest the limited number of road routes available to emergency services responding to the radiation emergency incident.

120 Compared to the domicile population of Lydd of about 5,800, at 2mppa LAIA introduces a 46% (normal) and 125% (log jam) increase in the total number of individuals that might require some intervention measure/management during a radiation emergency.

121 In a recent planning inquiry relating to the nuclear licensed site at Aldermaston in Berkshire, a senior HSE nuclear inspector expressed the strong opinion[3] [¶(g) p17] that a (268/15,000=) 2% increase in local Aldermaston residential population would be a material factor in traffic management controls during an off-site radiation emergency and, moreover, he concluded that a 268 increase in residential population *" . .would introduce a substantial increase in the numbers of people put into harm's way"* [[¶14.4(b) p29].

122 There also arises considerable ambiguity about the REPPIR *Regulation 16* requirement to provide prior information to these short-term visiting individuals about radiation emergencies (see REPPIR *Schedule 9*). The HSE suggests that individuals outside the DEPZ but who, nevertheless, *"are liable to be affected by a radiation emergency"* should be entitled to this information [¶406 p79].[42,43]

123 In this regard, it is very doubtful that such short term visitors to the area, that is those assuming to pass through the departure lounge in a matter of an hour so, would have any inclination, nor could they be persuaded to learn about how to sensibly react in a radiation emergency.

42 *A Guide to the Radiation (Emergency Preparedness and Public Information) Regulations 2001*, HSE 2002

43 The countermeasure action applied would be sheltering followed, most probably, by supervised evacuation – in the aftermath of an operational reactor incident and release, the radio-prophylactic measure of stable iodine could be used to avert excessive uptake of radioiodine-131, although this would not be necessary for an incident involving spent fuel at the railhead.

124 **SUMMARY OF PART E: LAIA IMPACT ON OFF-SITE EMERGENCY ARRANGEMENTS**

125 I have only briefly considered the impact of the developed LAIA on the effectiveness of the off-site emergency response to a radiological incident emanating from either the NPP sites and/or from the remote railhead.

126 I have not considered at all the risk and outcome of an incident involving an aircraft and spent fuel flask train when the train is passing within 200m of the LAIA runways 21 and 03 (say arising from a runway excursion event). I have not done so because I assume that commonsense will dictate in having the existing air traffic restriction, UK AIP AD 2-EDMD-1-6, amended to prohibit all and not just training flights whilst a spent fuel train is passing.

127 I consider that the proposed development and expansion of LAIA will introduce a significant group of visiting or transient population who are individually unlikely to be familiar with the locality. Moreover, their lack of knowledge of the presence of the Dungeness NPPs, the local road routes for self-evacuation and, generally, being uninformed about what best to do in a radiation emergency will result in

- more people being put in harm's way in and around a location that will require emergency arrangements and response;
- to assist this mainly visitor group, a larger number of emergency personnel will be required to work in potentially hazardous locations for longer periods of time, at risk of higher radiation dose uptake; and
- self-evacuation by the visitor group might hinder access to emergency services vehicles and personnel, such that it could possibly compromise the effectiveness of the emergency response to the radiation emergency and, in doing so, result in greater overall radiological consequences to all of those at potential exposure to the radiation emergency.

110 **In Conclusion:** I am of the opinion that the proposed development of the London Ashford International Airport (LAIA)

111 a) fails to meet clearly expressed Government policy and its international obligations on population limitation in order to minimise the societal risk to a tolerable level;

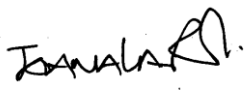
112 b) increases the number of people potentially placed in harm's way near to the Dungeness A and B nuclear licensed sites;

113 c) compromises the effectiveness of any emergency response to a radiation emergency; and

114 d) places emergency services personnel and other responders at increased risk of radiation exposure should a radiation incident occur.

115 Given the facts and opinion that I and the other experts acting for LAAG have presented, taken together with the commonsense notion that it would be folly indeed for such a development to proceed so near to the highly hazardous NPPs, radwastes and continuing radiological activities of Dungeness, the Inquiry should wholly reject this Planning Application.

116 I state here that I confirm that I have made clear which facts and matters referred to in this Statement that are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. The opinions I have expressed represent my true and complete professional opinions on the matters to which they refer.



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