LAAG/4/I

TOWN AND COUNTRY PLANNING ACT 1990 - SECTION 77 AND TOWN AND COUNTRY PLANNING (INQUIRIES PROCEDURE) (ENGLAND) RULES 2000

APPLICATIONS BY LONDON ASHFORD AIRPORT LTD
SITE AT LONDON ASHFORD AIRPORT LIMITED, LYDD, ROMNEY MARSH, TN29 9QL

LYDD AIRPORT PROPOSED DEVELOPMENT: DUNGENESS AIRCRAFT CRASH REPORT ESRT/D0010905 18 JULY 2007

Client: LYDD AIRPORT ACTION GROUP (LAAG)

Statement of JOHN H LARGE

PLANNING INSPECTORATE REFERENCE: APP/L2250/V/10/2131934

LPA REFERENCES: Y06/1647/SH and Y06/1648/SH

INQUIRY DOCUMENT REFERENCE: LAAG/4/I

SSUE	REVISION N°	APPROVED	CURRENT ISSUE DATE
ARY 2010	LAAG-4-I-R3		**28 APRIL 2011**

This pdf version of LAAG-4-I contains hyperlinks to other documents shown thus M3136-A1 will display the whole of the paper, report, etc., referred to providing the host computer is internet connected. The printed hard copy of this document does not contain these links or full citation of the source references - access to the Large & Associates web page displaying the linked documents is direct by entering the Secure Passcode CZ3136 on the Client Zones tab.

LYDD AIRPORT PROPOSED DEVELOPMENT: DUNGENESS AIRCRAFT CRASH REPORT ESRT/D0010905 18 JULY 2007

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 INSTRUCTIONS

5 On 10 January 2010 Ms Louise Barton, of the Lydd Airport Action Group (LAAG), asked me to provide advice on a document bundle that LAAG had obtained from the Health and Safety Executive (HSE). Included within the bundle was a document entitled Lydd Airport Briefing Note, dated December 2008 [APPENDIX 1].

6 I provided a statement on this in LAAG/4/G of 27 January 2011.

7 ESR TECHNOLOGY REPORT CD 13.9 LAAG [APPENDIX 8]

8 At that time I reported that following a year of delay the HSE had eventually provided a copy of the second document, the ESR Technology report. However, the ESR report copy was incomplete, that is not only heavily redacted with three pages removed in entirety, but also most of the even numbered pages had not been included in error.

9 Following a further request M3136-A12 [Section 3 p1 - APPENDIX 2], the HSE provided a second but complete (save the original redactions) version, but this electronic copy was very poorly reproduced and indecipherable in places – this page-complete electronic copy is available as [ESRT/D0010905 – APPENDIX 3].[1]

10 I asked the HSE for a clearer copy - I received a legible but redacted printed copy on 11 February 2011- I reported this and the build-up of delays leading to the acquisition of the third version of the ESR Technology report to Ms Barton of LAAG via M3136-A21[APPENDIX 4].

1 The appended copy of the ESR report contained redacted margin notes and markings.

11 However, on 26 February 2011 I received a further communication from the HSE (2011010158) which promised to provide yet another and fourth version of the EST Technology report, as explained by M3136-A24 [APPENDIX 6]. I received this fourth version in electronic/hard copy format on 7 March 2011 but because this version contained personal information that should have been redacted, I agreed to destroy this copy and await a further version which I received on 9 March 2011, that is 13 months following my initial request M3136-A1 of 19 January 2010 [APPENDIX 5].

12 **NII AND ESR TECHNOLOGY**

13 The HSE Nuclear Installations Inspectorate (NII) relies upon the ESR Technology report for its advice [APPENDIX 7] to Shepway DC in that [¶2 p1]:

14 *". . we have commissioned independent work to review the risk of aircraft impact"*

15 and, similarly, in its Briefing Note to the Department of Environment and Climate Change (DECC) [¶3 p4]:

16 *". . Our {NII} assessment has included . . Independent risk studies by an external consultant with considerable experience in the field of analysing and/or assessing aircraft impact studies".*

my added *{explanation}*

17 The *'independent risk studies'* relied upon the NII is the ESR Technology report http://www.largeassociates.com/3136 LAAG/ESR Report - Reveiw of Dungeness B Aircraft Crash Risk Report Redacted.pdf [APPENDIX 8 – CD 13.9 LAAG].

18 **ESR REPORT – UNCERTAINTIES WITH THE METHODOLOGY/APPLICATION**

19 **AEA -*v*- Byrne Methodology**: ESR refers to the methodology as the *'AEA Technology methodology'* [¶1 page i] although this generally seems same as the Byrne methodology referred to by others in their evidence to this Inquiry – see Pitfield [LAAG/5/A]. However, ESR notes that the AEA Technology methodology

20 *". . . also gives consideration to other aspects of the impact that influence the severity of the consequences, for example impact mass distributions and impact velocity distributions that provide the basis for determining the ability of structures to withstand an impact and aircraft fuel fires".*

21 That said, there is no explanation whatsoever how this *'consideration'* is applied to the built structures of the Dungeness B nuclear power plant (NPP).[2]

22 **Application:** The ESR analysis applies only to Dungeness B NPP and there is no assessment of aircraft accident impacts on the Dungeness A NPP, or to the highly radioactive spent fuel being handled at the remote railhead, and the transit of trains laden with spent fuel within 200m of runway 21.

23 **Current Safety Case Overview:** Referenced to the acceptable risk criterion of 10^{-7} per annum per reactor year for a significant radiological release [¶8 page i], ESR reckons the AEA derived risk of radiological detriment is broadly acceptable for commercial aircraft [¶1 p2], although ESR cautions:

24 *". . The proposal for expansion of LAA is clearly of potential significance to this safety case since it would increase the number of movements of heavy commercial aircraft in the vicinity of Dungeness B and may therefore lead to an increase in the estimated frequency of an impact of aircraft in that category and hence potentially increase the estimated frequency of a radiological release arising from that hazard".*

25 ESR acknowledges the potential for a commercial aircraft impact to result in a *significant* radiological release [¶2 p2]:

26 *". . The frequency of aircraft impact with the potential to lead to significant radiological release was estimated at [redacted]. This risk relates to the impact of [redacted] causing direct mechanical damage to the bio-shield and the fuelling machine"*[3]

27 However, ESR goes on to note that, considered on a frequency basis alone, a commercial aircraft crashing onto the Dungeness B NPP and causing damage severity sufficient to result in a significant radiological release would be an incredible event ($<10^{-7}$).

28 In other words, although ESR acknowledges that a commercial aircraft crashing into the built structures of Dungeness B could result in a significant radiological release,

2 This is misleading because the Byrne paper *'The Calculation of Aircraft Crash Risk in the UK'* includes only a general description of aircraft impact parameters and no numerical methods by which the impact damage severity might be quantified is provided. In effect, the Byrne methodology stops at the point in time when the aircraft impacts in to the target area, thereafter no analysis or outcome of the aftermath is offered.

3 The same radiological release scenarios are expanded upon in LAAG/4/A [¶133 Table 3 p25]

this event is dismissed solely on grounds that, as chance would have it, it is most unlikely ever to happen.[4]

29 This is why the reliable prediction of the aircraft crash rate, particularly any increase deriving from the expansion of London Ashford International Airport (LAIA), is crucial to the determination of the acceptable risk and tolerable consequences related to the juxtaposition of the Dungeness nuclear plants and air traffic operations of the LAIA.

30 As shown by Pitfield (LAAG/5/A), the AEA methodology adopted by ESR is uncertain and limited in its capacity to assess the overall risk, so much so that the NII should not rely upon it so exclusively when arriving at a consideration of the nuclear safety of the Dungeness NPPs.

31 **Potential for Radiological Release:** Obviously, it follows that the location of the aircraft impact on the NPP built structures is the final determinant in the cascade of accidental events that could lead to a significant radiological release. This is because to arrive at the potential for a significant radiological release some part, or parts, of the reactor pressure containment must fail.[5]

32 ESR refers to the crash locations as target areas, noting that a separate assessment by AMEC NNC for the operator of Dungeness B had determined the appropriate target areas, although [¶5.1 p19]

33 *". . We understand that the target areas for the relevant parts of the plant have been determined* [redacted] *Information upon which the estimates of the target areas are based has not been made available for detailed review."*

34 Thereafter three whole pages have been removed but with ESR concluding that [¶5.1 p23]:

4 The projected accidental impact of light aircraft on to the reactor building is more frequent at 10-6 but, ESR argue, the severity of damage would not be sufficient to remove all lines of protection [¶2 p2], by which I assume ESR mean that the reactor primary circuit containment would not be breached.

5 Here the assumption is that the aircraft impacts, and the forces generated therefrom, are sufficient alone to breach the pressure envelope – of course, rather than immediately break through the containment the crash itself could set in train a series of events that would lead the reactor itself to break through the containment – ie a Chernobyl-like scenario.

> *". . The target areas concerned is a further relevant parameter in this context. We have no specific information on the detail of the Nuclear Plant against which to check the estimates provided by Amec NNC.* [redacted] *"*
>
> original redactions [redacted] throughout.

36 And [¶5.2.2 p29]:

37 > *". . The impact consequence assessment {ie the radiological outcome} provided by Amec NNC, which we understand to have been based on the AEA Technology methodology, has not been considered in detail as part of this review. This would require reference to information on the site layout that has not been made available to us."*
>
> my added *{explanation}*

38 In other words, ESR admits that for its assessment of the risk of a radiological release from an aircraft impact damaged Dungeness B NPP, it has not been provided with sufficient information of the Dungeness B NNP design. In this important respect, I have considerable doubt over the confidence expressed by the NII in the independence and reliability of the ESR findings [¶12 to 16 p3], particularly because ESR depend upon the findings of Amec NNC in the absence of having access to important and defining details of the Amec NNC analysis.

39 **Inconclusiveness of ESR Technology Report:** ESR raises a number of doubts over the validity of the AEA methodology to model and predict certain crash conditions.

40 For example, the skidding crash scenario, where the aircraft crashes from a shallow descent and skids along the ground, could place the final impact at a vulnerable low level section of the Dungeness B NPP building, suggesting that [¶8 p32]:

41 > *". . The possibility of a skidding impact at a location some distance from critical targets at the {NPP} site, followed by travel along the ground, possibly several hundred metres, has been identified as having the potential to increase the probability of an impact leading to a radiological release . . . Whereas* ***it will be appropriate for this issue to be formally considered in the aircraft crash hazard element of the plant safety case****, in practice it is not expected that this would lead to a significant increase in the estimated risk . . "*
>
> my ***highlighting***, truncation . . . and *{explanation}*

42 The inferred implication here is that the present nuclear safety case for Dungeness B NPP does not, at present, include account of aircraft impact at a low level on the built structures.

43 Since skidding crashes are associated with a shallow descent angle, this type of crash scenario is very much more likely to arise from local LAIA air traffic than from background, higher altitude aircraft movements. In other words, expansion of LAIA to include frequent commercial aircraft movements (take-offs and landings) will introduce a new, and hitherto not assessed challenge to the Dungeness B NPP.

44 **Information Release and Availability:** The NII has made no information publicly available and even with its advice to Shepway DC, it did not provide any numerical quantification of the risk of aircraft crash, instead stating that:

45 *". . The Inspectorate is satisfied that the risk to the Nuclear Installations at Dungeness in their current plant states is sufficiently remote that we have no grounds for objection to the proposed development on the grounds of Nuclear Safety."*

46 However, various requests[6] to the NII have yielded the following data:

47 **TABLE 1 AIRCRAFT CRASH AND RADIOACTIVE RELEASE DATA**

		DUNGENESS A per annum		DUNGENESS B per annum		
ANALYST	**ppa**	**CRASH**	**RELEASE**	**CRASH**	**RELEASE†**	**COMMENTS**
BNFL[ξ] [APPENDIX 10]	500,000	1.40 E-6	**REDACTED**			Only impacts on safety related plant considered
AREVA [APPENDIX 11]	500,000			5.58 E-7	UNASSESSED	Adopts nuclear island as target area
NII Briefing	CURRENT			EXCLUDED	7.40 E-8‡	Updated - e-mail of 10 01 11
NII Briefing	500,000			EXCLUDED	6.90 E-8‡	Updated - e-mail of 10 01 11[ß]
ESR AEA NATS[§]	~500,000 ~500,000			**REDACTED** **REDACTED**	1.06 E-8 2.46 E-9	Heavily redacted throughout
AMEC NNC	~500,000			**REDACTED**	**REDACTED**	Included in ESR report

† Significant radiological release per reactor year
§ National Air Traffic Services
ξ British Nuclear Fuels Limited
‡ sic as supplied – figures may be reverse
ß It is not clear from the e-mail of this rate derives from 2,000,000 or 500,000 ppa

6 Requests made under the *Freedom of Information Act 2000* and *Environmental Information Regulations 2004*.

48 TABLE 1 shows, first, that because of the almost willy nilly redaction throughout the ESR report, it is not possible to directly correlate the relationship between aircraft crash and radiological release; second, the unaccountable ~x25 disparity between the AEA and NATS predicted frequencies; and, third, the justification for the NII's updating of the ESR AEA derived radiological release frequency by a factor of about x6 in account the 2 year dwell between the original date of the ESR report and its revision in 2009.[7,8]

49 **IN CONCLUSION**

50 The release of the heavily redacted ESR Technology report reveals a number of inadequacies and shortfalls in what the NII claims to be [¶3 bullet 2 p4]*". .the robustness of the methodology used"*, particularly:

51 a) **Dungeness A and Remote Railhead**

52 The ESR Technology report does not include any consideration whatsoever of the Dungeness A NPP or the remote railhead.

53 The accidental aircraft crash risk assessment for Dungeness A seems to be little more than a rudimentary 2005 update of sections of the Periodic Safety Review [APPENDIX 10] undertaken in 1985. Like the ESR Technology report for Dungeness B, all of the aircraft crash rate data in the updated Dungeness A aircraft crash risk assessment has been redacted.

54 I can find no record of an assessment of the accidental aircraft crash rate ever being undertaken for the remote railhead.

---

7 The NII states in its e-mail (APPENDIX 10] that this data comes from the ESR report and that the table provided in the NII Briefing is a summary this and that further work was undertaken by HSE in early 2009 to update the 2007 report based on updated crash data to 2006 (previously data was current to 2002). The NII also claims that comparison with the 2007 data indicates that the new figures are all within 10% of the old ones, and the net change in total risk is a small reduction of 2.9% by 2014 but, because the heavy redactions of the ESR report, it is difficult to fathom this out.

8 Incidentally, this is example of the cat-and-mouse game of obtaining information from the HSE-NII - whereas when asked for the crash assessment report relied upon the NII provided the original 2007 ESR report and it required a 2nd request to obtain the updated assessment results.

55 In fact, the NII has not quantified the risk of the Dungeness A NPP in its closed down state, reckoning that its qualitative judgment is sufficient when compared to the operational Dungeness B NPP.[9]

56 b) **Crash Impact Development into a Significant Radiological Release**

57 To my recollection, the NII has never previously acknowledged that an aircraft impact onto the built structure of a NPP could result in a *'significant'* radiological release and consequences.

58 Although ESR acknowledges that the impact of a commercial aircraft could strip away all of the safety system redundancy, either by sufficiently damaging the bio-shield containment and/or fuelling machine, enough to trigger a significant radiological release, there is no explanation how such an event might develop.

59 ESR identifies a skidding type crash to present a challenge to the NPP with the potential outcome of a significant radiological release – this type of commercial aircraft crash challenge would almost uniquely derive from local air traffic movements to and from the developed LAIA. The implication of the ESR reporting on this scenario is that the current nuclear safety case, and hence the vulnerability of the NPP, gives no consideration to this type of impact.

60 c) **Confidence in the ESR Technology Report**

61 ESR itself acknowledges that key information on the vulnerable target areas of the Dungeness B built structures *". . has not been made available . ."*, a fact that I consider undermines the reliability and applicability of the ESR Technology assessment and report.

---

9 The NII justifies its judgment that Dungeness A is a 'low level' risk mainly, or so it seems, on the basis of comparison with a higher risk of the Dungeness B operational NPP in that *"The risks have not been quantified numerically. Instead, the qualitative judgement on Dungeness A is based on the principle that risk at this station, in its current shutdown state is greatly reduced, compared to levels of risk at the station in an operational state (when risks were fully quantified). Additionally, the removal of nuclear fuel from the Dungeness A, which is currently underway, is expected to have progressed significantly by 2014 (when Lydd is projected to be handling 2m passengers per year), and will reduce further the consequences (and therefore risk) arising from an aircraft crash onto the station. Further, Dungeness A, in its partially defueled, shutdown state, is judged to present less risk than Dungeness B, which is still operational and where the risk has been quantified."* In other words, because the risk has reduced from its previous operational state, this does not necessarily mean that the reduced risk is an acceptable risk.

62 Since the NII seem to rely exclusively upon the ESR Technology report for its own assessment, then its somewhat brief advice to Shepway DC should be considered irresolute.

63 d) **Consistency and Availability of Information**

64 I am concerned over the apparent reluctance (or at least reticence) of the HSE-NII to release the full information and data relating to assessments that it has commissioned in order to arrive at its advice to Shepway DC.

65 ESR Technology has acknowledged that the impact of a large commercial aircraft operating from LAIA could " . . *lead to significant radiological release"* so, it follows, it should be an important topic for this Planning Inquiry.

66 I am surprised, therefore, by the absence of the HSE-NII at this Inquiry, particularly when its judgment not to oppose the development appears to be based on serious inconsistencies in its risk assessment.

67 TABLE 1 illustrates the inconsistencies of the predictive assessment for aircraft crash and the resulting radiological release undertaken by various parties.

68 Moreover, the predicted risks or frequency of aircraft crash is so absurdly low as to defy commonsense. Accidents are accidental events - unsinkable ships do sink, the most advanced space shuttles do fail missions, offshore oil rigs do explode, and aircraft do crash, sometimes for inexplicable and unpredictable reasons – and accidents occur, by definition, unexpectedly.

69 For example, earthquakes and the accompanying tsunamis present definable challenges to nuclear power plants, in that these can be readily prescribed and defended against by the engineered and built structure. However, at the Fukushima Dai-ichi nuclear complex the cascade of adverse events befuddled the best thought-out and prepared safety systems, resulting in radiological

disaster as three nuclear reactors failed their respective containments and a fourth sustained a massive explosion in its spent fuel pond.[10]

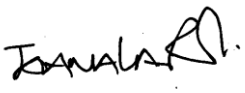
70 Put another way, the fact that these accidents did happen contrary to the findings of the analysts who projected that in all probability they would not, simply illustrates that it is beyond the wit of mankind to predict reliably all of the challenges that can beset a nuclear power plant.

71 In the specific application to aircraft arriving at of flying out of LAIA, it might be concluded that the risk is not just the risk of failure of the airframe and/or crew, but also in being overly trusting of and reliant upon the risk analysis itself.

72 This final conclusion so aptly applies here because although ESR Technology acknowledges that aircraft crash onto the Dungeness B plant could lead to a significant radiological release, it largely discounts this via a probabilistic risk analysis of the chances of aircraft crash, an analysis that it admits is unreliable and flawed.

73 In other words the NII judgment to rely upon the ESR Technology report and its findings [¶13 to 17 p3] was wrong.

74 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.



JOHN H LARGE
LARGE & ASSOCIATES
CONSULTING ENGINEERS, LONDON

10 *Incidents, Developing Situation and Possible Eventual Outcome at the Fukushima Dai-ichi Nuclear Power Plants,* Large J H, R2186-A1, 10 April 2011 – this report has yet to be released by the instructing client, although a copy of this is available on request.