

R. v. NUCLEAR ELECTRIC PLC (WYLFA)

NOTE OF OPENING
(on basis of a full Jury trial)

INTRODUCTION

Outline of Facts

- 1920 hours on Saturday, 31 July 93 during refuelling operations operator noticed on remote TV screen that bottom of parasol grab was missing
- Case concerns detachment of that component (the grab weight) into the reactor
 - (i) component should have been so designed that not able to become detached or to fall into reactor (modifications afterwards included increasing size to prevent entry into reactor)
 - (ii) actual component should not have been put into use. It had a defective weld which should have been detected with proper quality control
 - (iii) in any event NE ought quickly to have realised danger of a rogue component in an unknown position and out of view. Reactor ought to have been switched off (i.e. "tripped"). Switching off was anyway necessary if component was within reactor and would have to be retrieved and this was known by at latest 2120 hours
- Instead of which reactor was kept in operation until 0431 hours when it was commercially expedient to switch off - i.e. NE deliberately failed earlier to switch off in case there might be a financial penalty imposed by the National Grid

Outline of Law

1. Cts 3-6 represent serious contraventions of Licence Conditions
 - Ct 3 - Failed to have proper inspection arrangements of plant
 - Ct 4 - Received component and put into use without proper compliance documents
 - Ct 5 - Failed manually to trip reactor when there was a loss of reliable indication of operating conditions
 - Ct 6 - continued to operate when there was no safety case to cover such operation
2. General charges under ss.2 & 3 of 1974 Act
 - only significant difference is that s.2 applies to employees whereas s.3 applies to all other persons (e.g. visitors, subcontractors and members of public at large)
 - Cts 1 and 2 allege that people (employees and others) were put at risk by NE

- risk here means "possibility of harm" NB Crown not have to go further, i.e. if Crown establish existence of risk, then burden of proof passes to NE (see s.40). It is for the Defence to prove "that it was not reasonably practicable to do more than was in fact done to satisfy the duty" imposed on them
- Three stages in considering reasonable practicability:-
 - (i) The inadequacies of the original design and size of component could and should have been remedied by proper appreciation
 - (ii) The defective weld ought to have been detected by proper quality control (note that at the same time a second parasol grab was delivered to NE and also had a defective weld in same place - not detected until NII inspected stores after this incident)
 - (iii) The failure to trip until 0431 hours is anyway indefensible. There was a risk of a channel fire and of subsequent release of radioactive material but NE ignored this and delayed switching off for commercial reasons
- as it turns out, there was no fire and NE and employees and the public at large were lucky .
- nevertheless the reactor did have to be depressurised in order to retrieve the component. This depressurisation was in addition to normal maintenance cycles and in itself caused an unnecessary release of radioactive material into the atmosphere, which release could and should have been avoided by stages (i) and (ii) above

Introduction to Files

- Red (R) contains descriptive material (1000-1073)
- Green (G) contains exhibits (1-328)
- Yellow (Y) contains exhibits (500-869)
- Blue (B) contains statements (NOT FOR JURY)

Introduction to Indictment

Description of Operations and of Radioactivity

- [see description in ██████████ Statement @: B2 onwards]
- [see diagrams in R 1001 onwards]

Description of Refuelling

[see [REDACTED] B6; [REDACTED] B15-16, B31-33]

R 1015 = Photo of Fuelling Machine

R 1024 = Commentary by [REDACTED]

R 1028 onwards = Stills from Video

See Models [photos @ R1046-9]

[Play first Video]

Description of when part fell off and of likely resting places

[see [REDACTED] B70]

R 1063 = Commentary by [REDACTED]

R 1053 onwards = Stills from Video

[Play second Video]

ACCOUNT OF INCIDENT

[see [REDACTED] B 43, 49 onwards]

Detail contained in NE's own documents in Green File

G 225 Abnormal Event Record

- Update of previous reports - simplistic account

G 231 Fuelling Desk Report

- very important document

- timings given:

1920 hours part noticed to be missing

1955 hours Fuelling Machine moved away for inspection

- "bottom end of parasol NOT in mag - presumed gone down channel 02"

G 233 Permit to work issued to authorise inspection of Fuelling Machine

issued 2024 hours - surrendered 2120 hours [see G234]

- so by 2120 hours at latest NE aware that part not in magazine above reactor:

must therefore have been in reactor somewhere

- nevertheless NE continued to operate

Detail clear from other documents:-

G 236 Fuelling Log Report

(new grab withdrawn from stores to check dimensions)

G238 Shift Charge Engineer's Log

(most senior manager on site)

G 24² Permit to work - issued 0015 hours to authorise further inspection inside magazine

G 24⁴ Fuelling Log Report

- conclusion that part jammed in chute
- decision to shut down taken

G 254 Production Operator's Log - gives actual timings

- 0431 hours reactor tripped manually
- signed by [REDACTED] - who at 0343 hours had telephoned National Grid Control

Y 527 Transcript of telephone conversation

(This supercedes previous transcript. By use of better quality equipment it is possible to hear not only conversation but background comments at Wylfa's end: these are included on new tape and on transcript at Y 527 [see [REDACTED] B72])

- Note:
- time of call 0343 hours - over 6 hours after 2120 hours
 - reluctance to come off supply if any penalty
 - [REDACTED] Statement B100 - that there would not have been any penalty imposed by NG [see also [REDACTED] B73-76]

Nevertheless - NE decides to be sure to avoid penalty and not to come off supply immediately = yet further delay

Chronological picture completed by later documents:-

G 256 Shift Charge Engineer's Log - dated 4 August 1993

missing part found at bottom of GTA (Guided Tube Assembly) [see R1061 & 1058]

As it turned out, Reactor cooled down and no harm to health or safety was caused (except for the unnecessary depressurisation and release of coolant gas into the atmosphere for the retrieval of the part)

INDIVIDUAL CHARGES

Licence - Four Counts are contravention of Licence Conditions

Cts 3 & 4 relate to defects in component

Cts 5 & 6 relate to continued operation

- By s.1 Nuclear Installations Act 1965 no site in UK may be used for operation of any commercial nuclear installation without a licence being in force

- Contravention of conditions is an offence [see s4(6) of NIA 1965]
[see Queen's Printer's Copy in Law Bundle plus an amended version of Act - penalties are now covered by s33 of the Health and Safety at Work Act 1974, with the penalty on indictment for a breach of licence conditions being an unlimited fine - see Redgrave Schedule I p.424 and footnote: 1965 Act is a relevant statutory provision]

- G 2 Licence
- G 4 Index

Cts 3 & 4

Breaches of LC 28(1) and 24(1)

- see G 26
- see G 24

See how put in Indictment

See [REDACTED] Statements (B16-28, B34-41)

History of component set out in documents

G60 Purchase Order 22 May 92

Refers to two grabs - other grab was inspected in Stores by [REDACTED] and found also to have defective weld [see photo G73]

Refers also to QA form - see G61 & 62

- note ticks in boxes

- grab categorised as Plant Classification 2 and Quality Assurance Grade 2

G 81 MCP No.4 "Graded Application of Quality Assurance"

G 83 - states purpose

G 84 - Para 4.1.2 see (a)(3) Class 1 should include "all components in the reactor gas pressure boundary"

- note words - so includes components within fuelling machine as within gas pressure boundary while refuelling

- so part ought to have been Class 1 by applying NE's own criteria [see B38]

G 86 See para 4.3(c) Enhanced QA Grading

- note e. inaccessability of part

- so a reason for classifying as Grade 1 in fact part was graded as 2 - [see G61]

- did require QA Inspection Services and Inspection by Stores Foreman with documentation review

- G 60 States order placed with GEC
- G 65 Subcontracted by GEC to [REDACTED]
 - Delivery Note dated 15 Dec 92
- G 66 Inspection to be carried out by [REDACTED] and [REDACTED] but G 69-71 no independent check of welding carried out
- G 171 Checking by [REDACTED] purports to have been carried out all on same day (8 Dec) although work would have taken several months
- G 146 onwards Checks by [REDACTED] and [REDACTED] appear to have been by viewing plans only

Nowhere in any of documents is there anything to indicate that importance of weld was recognised

- [REDACTED] considers (B 34) that there ought to have been:-

1. functional specification indicating critical features
2. specification for production of an approved welding procedure
3. specification for the use of an approved welder
4. specification for extent & type of non-destructive testing
5. functional testing
6. certification afterwards - to prove all requirements complied with

- Inspection arrangements in place can only be described as perfunctory

- on any view failed to detect defect in weld

- no answer to Ct 3

Ct 4 Same comments apply

- charged as a breach of LC 24(1) [see G 24] which requires compliance with operating instructions

G 179 Stores Receipt of Goods Instructions

G 181 Purpose and Scope; Procedure

G 184 see 4.6 Full inspection (Grades 1 & 2)

- 4.6.2 Stores Foreman must check documentation as required on original Purchase Order

- see G 62 - Order - required a "Certificate of Conformity" (item 23 as ticked) [defined on G 207]

No Certificate of Conformity was sent to NE until after incident

- see G 221 & 222 (note dates; although parts delivered on 15 Dec 92,

certificate not signed by GEC until 6 Jan 93 and by [REDACTED] and

[REDACTED] until 22 Jan 93 and not sent to NE until 15 Sept 93)

Stores ought to have embarked on Non-Conformance Procedure

G 195 Non-Conformance Instructions

G 197 Procedure - see 4.3 item must be placed in quarantine etc [see flow chart @ G 199]

Cts 3 & 4 go hand in hand

- reason why so much emphasis on quality control is because of potential for harm if a component is defective

Contraventions can only be described as lamentable

- at level of foreman and upwards

Counts 5 & 6

Breaches of Conditions LC 23(3) & 23(1)

Both relate to continued operation of Reactor

- evidence to be given by [REDACTED] [see B 60 onwards]

Count 5 (Manual Tripping)

G 23 LC23(3) requires compliance with operating rules

G 35 Wylfa Operating Rules

G 43 see 6.5 Operator shall trip reactor manually if (c) reliable indication of reactor operating conditions is lost

Crown contend that reliable indication was indeed lost

- Part was found subsequently at bottom of GTA [see G 256 & R 1061]
- that position ought to have been recognised as a possibility once magazine had been excluded as a resting place [see above & e.g. G 231] i.e. at latest from 2120 hours onwards
- if there had been a channel fire [see [REDACTED] B 62] i.e. a fully blocked top of channel, there would be no meaningful single channel BCD signal nor temperature warning from the affected channel [see R 1060]. This is recognised in NE's own Safety Report (see third main para on G 259)
- so operator would have to rely on indications only from group and bulk systems which would not uniquely identify the affected channel and would be less sensitive due to dilution, decay times and the requirements for a driving force to dispense fission products from the channel. For same reasons the coolant gas temperature measurement would also be rendered misleading, which indication is the only warning of an impending event
- once operators knew that part was not in fuelling machine they must have known that reliable indication of operating conditions was

lost, since there was no single channel BCD signal nor temperature warning available if single channel was blocked - in any event contravention is absolute. Since reliable indication was lost, breach is established

Count 6 (Safety Case)

G 23 LC 23(1) = basis of charge

G 8 Definition

G 17 Safety Documentation

G 23 Effect = NE must only operate within a Safety Case which has been produced in advance to demonstrate safety of that operation

Nowhere in any of NE's documents is approval given to continued operation of reactor while a rogue component was within it or if blockage of channel was possible

So operation was not within Safety Case and should not have been continued of subsequent instructions which prohibit continued operation in such circumstances

Y 503 Special Temporary Instructions [see para 4]

Y 509 Station Operating Instructions [see e.g. 511]

Again, an absolute offence and self evident on facts that not covered by Safety Case (as recognised by NE's experts - see quote on left side of B 81)

Counts 1 and 2

As above, only significant difference is that s.2 applies to employees (wherever they are) and s.3 applies to all others. (Penalty on indictment is unlimited fine; see s.33(1A) of 1974 Act)

- On present facts all Crown have to establish is the existence of a risk to health and safety (see in law bundle R v. Board of Trustees of Science Museum (1993 ICR 876 @ 880GH, 882B-883A) and R v. Associated Octel Co Ltd (1994 4 All ER 1051 @ 1063J))
- Crown has to establish existence of risk (i.e. possibility of harm) so that Jury is satisfied as to be sure
- Thereafter by s.40 burden of proof passes to Defts to prove on balance of probabilities that "it was not reasonably practicable to do more than was in fact done to satisfy the duty"

"Reasonably practicable" was defined in Edwards v. NCB see law bundle: summary in Redgrave Introductory Notes @ lxxxii - see Asquith LJ @ 712, lines 6-14 in judgment) - note that this was a civil case whereas in the 1974 Act the emphasis in s.40 is applied: the prosecution have only

to establish the existence of a risk, however slight, for a prima facie case to be made out

Risk obvious on facts - see [REDACTED] [B106-131] and [REDACTED] [B132-153]

It is emphasised that the Crown do not wish to put case higher than facts merit - this is especially so since subject is so easily misunderstood

Nevertheless - risk of a channel fire is obvious from the happening of the blockage and if an unrelated, separate fault had occurred the combination of the two events could have had severe consequences. The blockage was therefore a serious erosion of the Defence in Depth principle [see Y727]

Melting - It is surprising that without the reactor being tripped the blockage did not cause overheating, leading to overheating and melting of the magnox clad within minutes [REDACTED] B107].

- Two reasons why no melting [REDACTED] B108]
 - higher than expected gas flow
 - heat transfer was greater than estimated
- Likely explanation is higher gas flow from increased out of channel leakage and leakage through cracks caused by graphite damage
- Effect of clad melting is to cause a release of fission products into the gas circuit, with uranium fuel melting occurring within about a minute, causing further fission product release
- Alarms ought to cause tripping within short time of clad melting and a channel fire may be avoided. If fire occurs, as ought to be assumed for safety purposes, this is likely to lead to a larger fission product release than for clad and fuel melt alone

Increased Risk - Safety margin was eroded (as above) and risk of clad melt was much higher than normal

- Estimate by [REDACTED] that risk of a channel fire while operating with a blocked channel could have been about 1000-10,000 times higher than without a blocked channel' [REDACTED] B113]
- See G276 - NE's own list of faults within reactor
 - must assume all could cause a channel fire if also a blocked channel
 - note that e.g. loss of 1 Gas Circulator occurs on average once per year
- If coincident fault was a depressurisation fault, then fission products released would have ready route to environment and significant release of radioactive material would occur ([REDACTED] B124)

- Three situations [see [REDACTED] B135]
 1. Single channel fire with a contained reactor
 - need for restriction of foodstuffs within 1 km [see Y749]
 - routine radiation doses to people on site increased
 2. Single channel fire with reactor fully depressurised due to uncontained fault

In addition to above

 - need for people near site to shelter [see Y747]
 - restrictions on consumption of milk and green vegetables out to about 50 km [see Y750]
 3. Single channel fire with the reactor undergoing depressurisation due to an uncontained fault

In addition to above

 - need for evacuation up to about 0.8 km from site and for sheltering up to nearly 6 km [see Y748]
 - need for people to take potassium iodate tablets
 - restrictions on milk and veg to about 60 km [see Y751]
- Doses - [REDACTED] [B141 onwards; Y754] has calculated worst case scenario that exposed person might receive: 180 mSv if grab weight had caused single channel fire in one of inner fuel channels; or 15 mSv if in actual fuel channel
 - To put in perspective see Y834 [same as B146 Table 2]
 - see also INES Scales [G268][B148]
 - three situations above could be INES 4, 4 and 5
 - Iodine - 131 releases - see Table 3 [B149 & Y835]
 - Cancer risk - worst case scenario gives expectation of 15 non-fatal cancers [B149] and 1.75 cancer deaths, plus hereditary effects and mental retardation: in addition there would be severe psychological stress [B150]
 - but note that all radiation doses increase likelihood of cancer occurring subsequently [see B151]
 - so every time reactor is depressurised some of the activity present in the coolant gas is discharged. Thus, even if reactor had been tripped immediately, the need to depressurise and to release gas in order to retrieve the part itself caused an increased risk of cancer, both to

employees and subcontractors on site and elsewhere, and to the public at large

Reasonable Practicability

Overall Crown says case on existence of (increased) risk is overwhelming

- arises at all three stages and at none can it be argued that it was not reasonably practicable for NE to do more than it did to discharge duty imposed on it
- 1. The inadequacies of the original design and size of component could and should have been remedied by proper consideration
 - it was a simple matter subsequently to redesign the parasol grab so as to avoid welds and to make it effectively solid and to increase its size so that it could not enter the reactor charge chute [see Y517]
 - this would wholly have prevented the incident
- 2. The defective weld ought to have been detected by proper quality control
 - the procedures adopted were lamentable
 - fault cannot be dismissed as being at lowest level since foremen and managers above were directly involved in failing properly to classify the parasol grab or to enforce quality control procedures
 - note that the second parasol grab ordered also had a defective weld
 - again, if properly carried out these procedures ought to have prevented the incident
 - on any view, even if reactor was tripped immediately, depressurisation and release of radioactive coolant gas into atmosphere became necessary [see above]
- 3. The failure to trip until 0431 hours [G 254] is indefensible
 - the magazine in the Fuelling Machine was inspected between 2024 hours and 2120 hours [Permit to Work G233] and thereafter NE was on notice that the missing part was within the reactor [see G231 - "NOT in mag - presumed gone down channel"]
 - nevertheless NE continued to operate reactor when likelihood of channel blockage with all attendant risks was obvious
 - reasons why failed trip?
 - (a) Commercial - wanting to avoid a penalty [see telephone conversation Y527] but no evidence of penalty
 - evidence is to contrary [see ████████ B100]
 - for NE to prove and it is unthinkable that should seek to rely on such an argument

- in any event, if a channel fire had occurred, reactor would have had to be closed down for six months or so, with huge loss of income (Wylfa supplies electric power equivalent to the combined needs of Liverpool and Manchester)

(b) Cosy culture within NE

- Saturday night
- routine work, where need for good supervision essential if employees are to be properly motivated and to avoid being dulled by monotony and complacency
- cosiness likely to discourage employees from making waves and pointing out possibility of problems. (There are unlikely to be many other jobs for nuclear power station workers on Anglesey.)

Situation summarised in statement of [REDACTED] Chief Inspector of NII [B161-164]

- continued operation was a severe violation of defence-in-depth principle
- operators were prepared to continue to operate without knowing exact coolant conditions in the core
- patently obvious that potential risk of a channel fire could have been eliminated by straightforward act of shutting down
- failure to shut down was a blatant failure in safety culture
- incident a matter of grave concern - event potentially the most serious in UK during his time as Chief Inspector

[REDACTED] EC4