

The Atomic Weapons Establishment

Chapter 9

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History

- 1 The development of a British atomic bomb began in June 1947 at Fort Halstead in Kent. The site proved too small for the facilities necessary to handle plutonium and so the Atomic Weapons Research Establishment (AWRE) was established in 1950 at an airfield near Aldermaston in Berkshire. The AWRE was originally part of the Ministry of Supply and was transferred to the United Kingdom Atomic Energy Authority (UKAEA) when that body was created¹ in 1954.
- 2 The Ministry of Defence (MoD) assumed responsibility for the AWRE in 1973. In 1987, the AWRE merged with the Royal Ordnance Factories at Burghfield and Cardiff, dropping the word “Research” from its title to become the AWE.² Since 1993, the AWE has been operated by private consortia under a “government-owned, contractor-operated” (GOCO) scheme. It remains responsible for the maintenance of the UK’s nuclear deterrent.
- 3 The occupational health department of the AWE was originally in-house but is now operated by Trident Medical Services Limited (TMS), which is the custodian of all medical records relating to past and present employees of the AWE. TMS assisted the Inquiry by making available the medical records of various deceased former employees of the AWE.³

Monitoring

- 4 The work at Aldermaston involved handling and purification of radionuclides, principally plutonium. It therefore gave rise to the same need to monitor the exposure of the workers to radioactivity as existed at other nuclear installations such as Sellafield. The chosen methods of monitoring were urinalysis and the use of a whole body monitor (WBM) to assess lung burden.⁴ The working environment was also monitored using static air samplers. Personal air samplers, battery-operated devices worn on radiation

1 By the Atomic Energy Authority Act 1954; see chapter 6, “The United Kingdom Atomic Energy Authority”

2 In this chapter, the organisation will be referred to as “the AWE” throughout its history

3 On an application by Dr Nicholas Lewis, a Director of TMS, the High Court (Mr Justice Foskett) declared disclosure by TMS (and by the Inquiry’s other stakeholders) of the medical records of deceased former employees to be lawful because of the public interest in the Inquiry’s investigations: *Lewis v Secretary of State for Health* [2008] EWHC 2196 (QB) [2008] LS Law Med 559. A copy of the order is at appendix D

4 Details of these methods, and a discussion of their drawbacks, can be found in chapter 2, “Science”

workers' clothing, were used *"in a limited and investigative way in, and since, 1968 but ... only ... in routine monitoring [from] September 1977"*.⁵

- 5 In 1978, WBM readings from three women who worked in the laundry at Aldermaston appeared to indicate that they had accumulated plutonium in the lung in excess of the level recommended by the International Commission on Radiological Protection (ICRP), and positive results requiring further scrutiny were also obtained from nine men working elsewhere at the site. An investigation was undertaken by Sir Edward Pochin,⁶ whose report⁷ was submitted in October 1978. Analysis of the results of repeat testing was reassuring, suggesting that in most cases the initial, single high reading probably did not indicate that a significant amount of plutonium was retained in the individual's lungs. Although the report emphasised *"the generally high quality of the industrial safety record, ... and the good record also in the prevention of major radiation exposures"*, it noted deficiencies in both the construction of various buildings at Aldermaston and the management of health and safety, and made a number of recommendations.
- 6 Of 15 employees excluded from radiation work because of WBM readings in 1978, all but three (one of whom⁸ had died) were allowed to return within a year.
- 7 One of the conclusions of the Pochin report was that the static air samplers were of limited use. They were commonly positioned away from and higher than the working position, so the air they sampled did not accurately represent the air that the workers were breathing. The AWE management appears to have agreed: by late 1980, minutes of a board meeting record that, at least in the context of litigation, the organisation *"should maintain the attitude that these records [of readings taken from static air samplers] could be misleading and unhelpful"*.
- 8 Personal air samplers too had drawbacks (as was observed by one witness who gave evidence to the Inquiry, *"by definition personal air samplers tell us what was **not** breathed in by the worker"*) but they were considered to provide more accurate information than static air samplers and had the

5 Pochin report (see note 7, below), paragraph 26

6 Physician, former chairman of the ICRP and founder member of the National Radiological Protection Board, of which he remained a member between 1970 and 1982

7 Pochin, Sir Edward, *Report of an Investigation into Radiological Health and Safety at the Ministry of Defence (Procurement Executive)* (AWRE, 1978)

8 LL: see paragraphs 14–16

advantage over urinalysis that results could be obtained quickly, allowing remedial action, if necessary, to be taken early.

The AWE's role in analysis

- 9 Urinalysis remained a mainstay of screening for exposure to radionuclides at the AWE and elsewhere. However, dosimetry experts at the AWE shared with those at other institutions longstanding concerns over the accuracy with which plutonium levels measured in urine could be used to estimate plutonium retained in the body.⁹ They too were interested in the possibility of validating these estimates by analysis of the plutonium content of organs obtained at post mortem examination from employees for whom urinalysis data were available.
- 10 In written submissions to the Inquiry, the AWE described its role in analysis of human tissue as being:
- a. *to assist the Coroner and Treasury Solicitor (TSol) with Coroner's investigations following the deaths of individuals who had been in the employ of the AWE or who had been Nuclear Test Veterans. This work could also assist with defending claims against MOD and included, in some cases, arranging for the analysis of tissue/organs by other organisations (or sites when AWE was part of UKAEA) and providing interpretation of the results from the analysis of tissue/organs carried out by other organisations or sites;*
 - b. *to participate in a limited amount of research associated with tissue samples taken at autopsy ...*
 - c. *to co-ordinate samples ... for a strontium 90 research programme ... on behalf of the UK and Australian Governments.*

First analysis: KK

- 11 KK died in 1975 of leukaemia. He had initiated a claim for damages against the AWE before his death. His post mortem was performed by Dr E Husband, consultant pathologist at Basingstoke Hospital, and was attended by Dr N Spoor from the AWE, a pathologist instructed by his

9 The reasons for these concerns are discussed in chapter 2, "Science"

widow's solicitors and three police officers. Various organs, including a femur, the liver, a lung, a testis, the sternum, some ribs, some vertebrae and some lymph nodes, were removed. Some were taken by Dr Spoor and sent to the National Radiological Protection Board (NRPB) for analysis; the remainder were collected a few days later by Ms Erica Irlam, secretary to Dr Geoffrey Schofield,¹⁰ and taken back to Sellafield. Expert reports were obtained from Dr Geoffrey Dolphin¹¹ and Professor Patricia Lindop,¹² who differed starkly on whether the leukaemia was attributable to radiation. No inquest was held. The claim was discontinued in 1977.

- 12 The presence at the post mortem of a pathologist instructed by the widow's solicitors would imply that she had agreed to KK's organs being removed for analysis, but the Inquiry has seen no definite evidence to that effect.

Compensation claims after the Pochin report

- 13 Following the publication of the Pochin report in October 1978, some 70 claims for compensation as a result of illness from exposure to radiation were initiated against the AWE. Many alleged only psychological upset caused by concern over the possible consequences of exposure to radiation, but a few individuals claimed that more serious illnesses, including cancer, were the result of such exposure. Three of those claims were the subject of much discussion at the AWE.

LL

- 14 LL died in 1979 from a rare form of rectal cancer. The organs taken from his body at post mortem examination (one lung, the sternum, testes and liver, some ribs, some vertebrae, a femur, a kidney and various mediastinal tissues) were analysed at the request of the coroner by Dr Schofield, who had personally collected them from the pathologist. At the inquest Dr Schofield presented his findings, which were that the body had contained only 1.3% of the maximum amount of plutonium recommended by the ICRP. Dr Robin Mole¹³ and Professor Lindop gave markedly differing expert

10 Chief Medical Officer, British Nuclear Fuels Limited (BNFL)

11 Head of the Biology Department, NRPB

12 Professor of Radiation Biology, University of London

13 Director of the Medical Research Council's Radiobiological Unit until 1977; at this time continuing to work as a member of the Council's external scientific staff

evidence on the interpretation of Dr Schofield's findings and on whether LL's cancer had been caused by radiation or had occurred naturally. The jury returned an open verdict, indicating that it had been unable, on the evidence it had heard from the experts, to determine the answer to that question.

- 15 LL had initiated legal action against the MoD before his death, claiming compensation for injury caused by radiation. The Inquiry has seen no evidence to indicate what happened to that action; it may be that the steps necessary to ensure that it continued after his death were not taken.
- 16 The Inquiry concludes that the organs were properly removed from LL's body for analysis because it was considered that the results might be relevant to the cause of death; Dr Schofield was one of the few people with access to a suitable laboratory and it would seem likely that that was why he was asked by the coroner to perform the analysis.

MM

- 17 MM's death in 1979 was caused by an abdominal cancer of uncertain type. A post mortem examination was performed after which the pathologist expressed the view that the death was natural and due to carcinomatosis. No inquest was held.
- 18 The post mortem report makes no mention of any organs from MM having been retained and the Inquiry has seen no evidence of any radiochemical analysis having been undertaken. Since no inquest was held, the coroner could not have requested such analysis.¹⁴ MM had initiated legal action against the MoD before his death, claiming compensation for injury caused by radiation. The action was pursued after his death by his widow. In this context, it would be unsurprising if organs had been removed, but there is no reference to radiochemical analysis of organs in any of the papers seen by the Inquiry which relate to the litigation.
- 19 However, in 1988, nine years after MM had died, Dr Adam Lawson¹⁵ was sent a summary of MM's health physics records by Mr Edgar Jones,¹⁶ who asked for "*a copy of the post-mortem analysis ... in the case of [MM]*". He replied:

14 See chapter 3, "Law and Guidance", for a more detailed discussion of this point

15 Chief Medical Officer at BNFL

16 Superintendent, Personal Safety at the AWE

I was hoping you would be able to help to identify one of our few remaining sets of non-attributable data highlighted by our recent review of the autopsy files. All we in fact have is a cutting from the Daily Telegraph which indicates that Dr Schofield¹⁷ was conducting radiobiological analysis ... and I was hoping you could help ... in retrospect it would appear that we are both victims of the secrecy which surrounded these examinations.

- 20 Although it appears that, at least in 1988, the AWE was under the impression that there had been analysis of organs taken from MM, it is unclear, despite those press cuttings, whether in fact any organs were taken and, if they were, whether and by whom they were analysed. The AWE was unable to clarify the position.
- 21 The legal action against the MoD was discontinued in 1989.

NN

- 22 NN died in 1980 from a tumour in his chest wall. He had intimated a claim for damages against the MoD before his death and had instructed solicitors. A handwritten note by Dr Husband begins:

Coroner informed as there is a distinct possibility that the tumour is associated [with] exposure to plutonium. Professor Lindop of Barts¹⁸ also contacted re plutonium levels on various organs as this is the only way in which a tie up between the tumour & level of plutonium in body is likely to be established. I have asked the houseman to put the relatives in the picture as the outcome of the Barts studies may be of financial importance to them.

The formal typed post mortem report notes:

As a result of the conversation with Professor Lindop the right femur and the liver, spleen, left lung and mediastinal lymph nodes, as well as tumour tissue, were taken and were deep frozen in order that plutonium levels should be carried out on these tissues ... Professor Lindop telephoned to say that the Treasury solicitor was asking for plutonium levels to be carried out on the entire body. Mrs [NN] and her son gave their permission for this to be carried out. The Coroner's office was informed.

17 Dr Schofield had died in 1985

18 St Bartholomew's Hospital, London

Unless the coroner had formally released the body to the relatives, it was in fact necessary not merely to inform his office but to obtain his permission before such further examination.¹⁹

- 23 A handwritten note in NN's file at the AWE suggests that the reference to the Treasury Solicitor's request was accurate:

J Ward^[20] discussed with Prof Lindop question of autopsy. She had already approached pathologist for organs, but Ward had suggested whole body. Lindop will probably approach family ... Spoke SMO.^[21] Died of cancer (not sure where). Unlikely to be caused by employment and GP inclined to agree.

However, Mr Ward's own note suggests that the request for the whole body to be analysed had come from Professor Lindop.

- 24 It is clear that the sudden acquisition of a whole body took the various researchers by surprise and some debate followed concerning where and by whom the analysis could be done. A note from Mr J A Young²² reads:

It was proposed that the whole corpse be analysed for radioactive contamination but it was learned that this would take about two months in Dr. Schofield's laboratory at BNFL [British Nuclear Fuels Limited] Windscale and take up all of Dr. Schofield's resources. Facilities for this kind of analysis are not widespread and exist elsewhere at Harwell and the UK. It was further suggested that if the analysis could not be done in the UK then the corpse could be flown to the USA for it to be done.

19 Human Tissue Act 1961, s1(5)

20 Mr John Ward was a solicitor employed by the Treasury Solicitor's Department: see paragraphs 34 et seq

21 The SMO (Senior Medical Officer at the AWE) was Dr Murray Roberts

22 Mr Young worked for the AWE Claims Commission

25 Mr Ward wrote to NN's solicitors:

I further understand your client died recently and that his relatives have agreed to the release of the body to Professor Lindop for medical research and Professor Lindop is proposing that various tests and measurements are to be taken and I will do everything possible to assist her. It is clear that any tests and measurements which are made will be relevant to the claim and I have agreed with Professor Lindop that on the basis that the results of these tests and measurements are shared I would be prepared to share the costs of mutually agreed tests and measurements. To do this I would suggest a meeting be arranged ... I understand the body is currently in St Bartholomew's Hospital and I agreed with Professor Lindop that I would bear the cost of the transport of the body to that hospital.

26 The body was dissected at St Bartholomew's Hospital by Dr Alfred Stansfeld, consultant pathologist. The note of the procedure begins by recording "(Additional unrelated brain and heart found)"²³ and continues by setting out the various component parts of the body which had been separated. As to the destination of the body parts, the note records that:

- the tissues removed at the original post mortem examination had been "sent to Dr Schofield for ashing and division between BNFL and AEA Harwell for chemical measurements of Pu, Am and Ur^[24] [sic]";
- the larynx, trachea and some lymph nodes were to be sent to Professor Denis Henshaw at Bristol University;
- "R side + head and vertebrae, testes; tongue etc. 2° tumour skin" were to go to BNFL for deep-freeze storage;
- "L side + calvarium and dura, sternum, pancreas, kidneys, other lymph nodes, retroperitoneal tissue and diaphragm" were to go to the NRPB, also for deep-freeze storage.

27 Under the heading "Lessons learned", Dr Stansfeld noted:

- deep-freeze storage capacity for a whole body was needed, particularly if it was to be used to calibrate the WBM;
- the post mortem examination should be carried out in conjunction with him and samples taken should be deep frozen;
- a decision was needed on basic tissues of interest in all cases, to include right lobe of liver, lung, femur, three abdominal vertebrae, three ribs,

23 That is, the brain and heart of another individual, who presumably had undergone post mortem examination in Dr Husband's mortuary at the same time as NN

24 Plutonium (chemical symbol Pu), americium (Am) and uranium (U)

spleen, pancreas, testis, skeletal muscle (40g), bone marrow, tracheobronchial lymph nodes, as well as on specific tissues of interest in particular cases.

It is apparent that Dr Stansfeld anticipated that further whole bodies might become available.

- 28 Extensive analysis of NN's body took place by BNFL at Sellafield and by the UKAEA at Harwell. One femur was analysed by the NRPB. The analysis would seem to have been done at least partly at the request of the coroner, but there was some argument later over who should bear the cost, NN's solicitors observing tartly that:

Mrs [NN] had been put into a position whereby great pressure was imposed upon her to agree to the release of her husband's body for purposes of medical research and it is something of a back hander to express gratitude in the form of a bill in excess of two thousand pounds.

It is not apparent by whom this pressure could be said to have been applied: as observed above, the records are unclear as to whether it was Mr Ward or Professor Lindop who had been seeking analysis of the whole body.

- 29 At the inquest, evidence was heard from Dr Husband, Mr Jones, Professor Lindop, Dr Keith Britton²⁵ and Dr Mole. As at LL's inquest, Professor Lindop and Dr Mole disagreed starkly over the part played by radiation in the pathogenesis of the fatal tumour. The jury returned an open verdict.
- 30 Those of NN's organs which had not been analysed were disposed of after permission had been sought from the coroner: the method of disposal is not recorded. The litigation against the MoD which NN had started before his death was carried on by his widow but was eventually discontinued, along with that pursued by MM's widow, in 1989.

Fallout from Pochin

- 31 After LL and MM died in 1979, the AWE immediately realised that the deaths from cancer of two former radiation workers within a very short time of each other, even though coincidental, were likely to provoke a good deal of publicity. Within a couple of weeks of the deaths, it was observed in a note to the AWE's Board of Management that organs taken from LL had been

25 The physician who had prepared the report for the coroner with Professor Lindop

sent to BNFL for analysis and that Professor Lindop had been instructed (by LL's union). This memorandum emphasised the importance of the AWE's obtaining formal evidence on the interpretation of the results: "*we will need a big-name witness*". It discussed briefly tactics at the forthcoming inquest and more generally:

The Board is invited to address the following points:

a. Analysis of organs

We should ensure satisfactory formal answers to the following:

- (i) the measurements and their confidence limits;*
- (ii) a sufficient specification of procedure to ensure only plutonium alphas were measured;*
- (iii) the standardisation of measurements;*
- (iv) background corrections;*
- (v) the levels found in other radiation workers and in non-exposed personnel.*

It concluded:

At the end of the day an open verdict seems most likely. This raises immediately the old question of whether cancer in radiation workers should be classed as an industrial injury or whether (following BNFL in [name deleted]) MOD should pay ex gratia.

The Board is asked to note our belief that the ramifications of this case are serious; even were we to get a favourable decision, the matter will come up with increased force when inevitably an exposed person gets lung cancer.

Litigation

- 32 The Treasury Solicitor's Department acts on behalf of government departments and thus became involved as solicitors for the MoD (of which the AWE was at the time a part) when claims against the MoD were intimated by employees and former employees of the AWE.
- 33 Minutes of a meeting held at the AWE in August 1980 show that there was concern over the way in which litigation was being defended, the effect this

was having on the morale of staff employed there and possible wider implications of the cases:

Mr Davies^[26] also expressed concern at the apparent lack of a common policy and coordination between the UKAEA, BNFL and MOD in relation to claims for damages. The MOD's tactics and policy decisions appeared to be decided unilaterally by one T. Sol solicitor who was dealing with AWE cases. Mr Davies suggested that the outcome of the claims for damages could be prejudicial to the UK nuclear programme (both civil and defence) and that the Board might wish to consider raising the question at a high level in HQ and that the need for close collaboration with UKAEA and BNFL should be emphasised.

Mr John Ward

34 The solicitor to whom Mr Davies was referring was Mr John Ward. Mr Ward had qualified as a barrister/solicitor in New Zealand. He was employed by the Treasury Solicitor's Department from 1976/77 to 1989 and acted on behalf of the MoD and the AWE during that time. His duties included appearing on behalf of the AWE at inquests into the deaths of former employees and advising the AWE on its defence in claims for damages for illnesses alleged to have been caused by exposure to radiation. He worked with senior safety managers at the AWE, including successive Board Members for Safety, and was a frequent visitor to the Aldermaston site. Minutes of a meeting held at Aldermaston in June 1980 record, in the course of a discussion of NN's case, that:

Mr Ward said that his role in relation to the claims was to clarify the issues involved. Decisions on policy relating to settlement of the claims would be made by the Claims Commission.

35 Mr Ward was also involved in advising on data to be acquired to help in the defence of any potential claims. One way in which this was done was by his suggesting to coroners that they should hold inquests into deaths of former employees and offering them advice as to how they might best conduct their investigations. There was concern in some cases, in which the death would otherwise have been certified by the general practitioner, that the worker, aware of the provisions of the Official Secrets Act 1911 and concerned about the secrecy of his work, might have kept information on work-related

exposure to radioactive materials from that doctor. An inquest would involve fuller investigation of the history.

- 36 In some cases, Mr Ward's involvement extended to the preparation of the evidence to be presented: the coroner at one inquest told the jury that "*Mr Ward has in fact done all the spadework and has produced all this evidence which is going to be put before you today*". This dual role, in advising both an interested party to an inquest and the coroner presiding over it, had the potential to give rise to a conflict of interest in two situations.
- The coroner wished to have organs removed and analysed for plutonium content but the AWE was concerned that if this were to be done, high levels would be discovered which would suggest a link with the death and hinder its ability to defend a claim. It could therefore suggest to the coroner that analysis would be unnecessary and the results unlikely to assist him with his role in determining the cause of death.
 - The AWE wished to have organs removed and analysed for plutonium content because it suspected that the levels would be found to be low and hence potentially useful in its defence to any claim, but the coroner or the deceased's doctor was prepared to issue a death certificate without further investigation. The AWE could suggest to the coroner that the results of radiochemical analysis of organs taken from the deceased at post mortem examination could be of relevance to the cause of death.
- 37 In either scenario, the possibility existed that the coronial process could be manipulated to proceed in accordance with the AWE's wishes. A coroner's experience of investigating the deaths of former radiation workers would inevitably be limited. He would be likely to be readily influenced by advice given by government solicitors whom he would perceive, correctly, as having ready access to expertise from within the nuclear industry. The Inquiry has, however, seen no evidence that this potential conflict actually arose in practice. In general, the Inquiry noted the thoroughness with which the documents indicate that inquests into the deaths of former AWE employees were conducted: proceedings often extended over several days and were held before a jury, the interested parties having full legal representation.
- 38 The meeting proposed by Mr Ward²⁷ shortly after NN's death took place in his office on 28 March 1980. Although called primarily to discuss NN's case, the matter of "*the procedures for following up workers after they had left the Establishment and what sort of Register of radiation workers there was*" was

27 See paragraph 25

raised, not by Mr Ward or the AWE but by Dr Britton, the physician instructed alongside Professor Lindop by NN's family. A note of the meeting continues:

There was also a discussion on a warning system involving the Coroner and the Pathologist and whether it was best to send off a list of names to a Coroner or advise GPs or what was the best method of ensuring that the body was not ruined for quantitative assessment.

No further details of the discussion of the proposed "warning system" are available and the Inquiry has seen no evidence that any action was taken to design or implement such a system.

- 39 On 15 October 1980, Mr Ward visited AWE Aldermaston, attending a meeting with senior management "to consider a variety of issues concerning the future handling of claims for damages". One topic discussed by Mr Ward was "the considerations which he had to take into account in deciding whether T. Sol should ask for a Coroners Inquest". No witness was able to assist the Inquiry in detailing what those considerations were or might have been.

- 40 A paragraph from the minute of the meeting reads:

The view was expressed that although analysis of body tissues of all deceased AWRE R/A workers could produce some useful scientific evidence, consideration would have to be given to the effect on morale of AWRE staff. The agreement of relatives would also be required.

- 41 In submissions to the Inquiry, the AWE indicated that it had at that time regarded data derived from analysis of organs taken at post mortem examination:

as useful for developing and validating biokinetic models for determining intake of actinides in the human body and the resulting radiation dose. External measurements and measurements from urine and faecal samples were variable and involved a number of assumptions and the biokinetic models were unproven and generic depending on the solubility of material.

The scientific view that post mortem analysis might provide a more accurate determination of radionuclide intake, and hence radiation dose, during life was widespread at the time. It was considered that results could be of assistance both to the coroner, in determining the cause of death, and to employers, in improving the accuracy of *in vivo* estimates of exposure. The AWE's view is now different:

The data gained from analysis of organs is of no use for routine business since biokinetic models are now much improved. Such data might be of use for providing assistance to threat reduction ... research and in circumstances where sufficient bioassay data is not available.

- 42 The AWE's explanation of its then motive is supported by minutes of a subsequent visit by Mr Ward to Aldermaston on 8 May 1981. Reference was made to "*opportunities for autopsies not to be missed*" and under the heading "*Autopsies*" it was noted that:

Ward intends to try for autopsies on all decedents who are considered likely to be the subject of a claim, on the basis that analytical findings at autopsy appear to rectify over-estimating in operational estimates during life. Every effort should be made to inform him as early as possible of deaths or impending deaths (what can we do to improve our information supply on these?).

Later in the minute it is recorded that "*James^[28] is seriously concerned about the problem of keeping tabs on ex-radiation workers into their retirement*".

- 43 In evidence, the AWE expressed itself unable to assist the Inquiry in explaining:
- how Mr Ward intended to "*try for autopsies*";
 - the criteria to be applied in assessing whether decedents were "*likely to be the subject of a claim*";
 - what, if any, steps had been taken "*to improve our information supply*";
 - why "*keeping tabs on ex-radiation workers*" was thought to be necessary or desirable;
 - how such tracking could have been implemented.
- 44 The AWE's motive for "*keeping tabs on*" its former employees, in ensuring that they underwent post mortem examination and in obtaining organs for analysis, might not have been mere scientific curiosity. Plainly, if analysis of organs taken from radiation workers who had died from cancer showed that they contained very low levels of radionuclides, the argument that the cancer had been caused by radiation would be weakened. Obtaining such evidence in the context of a civil claim would be perfectly proper, provided the organs were removed either under coronial jurisdiction or with the consent of the relatives.²⁹

28 Mr R James was Chief Administrative Officer at the AWE

29 Human Tissue Act 1961: see chapter 3, "Law and Guidance"

- 45 The AWE told the Inquiry that no system for tagging ex-workers and following them into retirement in anticipation of their deaths had ever been implemented. The organisation came to hear of such deaths as and when they occurred, in particular when litigation had been initiated while the individual remained alive.

Cost

- 46 While MM's and NN's claims were in progress, consideration was given within the MoD not only to whether they could be successfully defended (on the grounds that the deceased men's cancers could not be shown to have been caused by radiation) but also to the likely financial consequences of out-of-court settlement. Although the two individual cases were of fairly limited value, calculations contained in an internal memorandum prepared by the Assistant Under-Secretary at the MoD in March 1982, and circulated to the Secretary of State for Defence,³⁰ estimated the likely cost of settling similar claims which might be brought against the MoD by radiation workers, past, present and future, in excess of £100 million. An objective interpretation of the facts underlying this conclusion suggests that the true potential liability was very significantly lower.

The Specials file

- 47 Among the extensive documentation disclosed to the Inquiry by the AWE was a file, headed "Specials", containing extracts from medical and dosimetry records of a number of employees.
- 48 The Inquiry heard that this file had been opened in the early 1980s and contained records relating to individuals, the results of whose routine WBM scans had not been within normal limits: that is, anyone who had given a repeatedly elevated result. Those results would have been discussed at dose evaluation meetings. The file was maintained by the staff of the Dosimetry Section as it would be necessary to consider with particular care the results of analysis of urine specimens taken from individuals who were known to have had previous exposure to actinides. The AWE indicated that *"while certain dose assessment staff knew of the collection of documents constituting*

the Specials file, certain senior safety managers and health physicists may also have known of it”.

The “P.M. requirement” list

- 49 One document within the Specials file was a single-page, handwritten list containing the names of 44 AWE employees. The list was prepared by Ms Jane Jefferies, then a scientific officer at AWE Aldermaston, probably in 1984. Ms Jefferies told the Inquiry that she had intended to make and maintain a comprehensive list of individuals whose WBM test had given results outside normal levels. The list was held on her own file, to which only a very small number of people had access.
- 50 A column headed “P.M. requirement” contained, adjacent to some of the names, entries such as “*hand (RHS) Ax LNs+Brachial LNs*”, which the Inquiry understands to mean the right hand and the axillary and brachial lymph nodes. Those entries appear to correspond to individuals known to have sustained wounds contaminated by radionuclides and it is obvious why the AWE might have wished to analyse the parts of the body in which any radionuclides absorbed from the wound would have been concentrated. At the foot of the column is the note, “*For all take liver, lung, TBLN [tracheobronchial lymph nodes] and bone samples*”.
- 51 Ms Jefferies remembered being asked to add that column to the list by Mr Norman Taylor.³¹ The rationale was that the AWE would in the future be able to help anyone, such as a coroner, who might request assistance in deciding what tissue could usefully be analysed. She did not recall any such request having been made.
- 52 According to evidence given to the Inquiry by the AWE, of the 44 individuals whose names appear on the list:
- 22 are known still to be alive;
 - 18 are known or presumed³² to have died;
 - the status of the remaining four is unknown.

The Inquiry obtained a variety of documents, including occupational health records,³³ from the AWE relating to each of the individuals named on the list, which enabled it to exclude the possibility that organs had been

31 Head of the dose assessment section at the AWE

32 Because they had more than two years’ service, are over pension age and are not receiving an occupational pension

33 As permitted by Foskett J’s order: see note 3, above

removed at post mortem in any case of which the Inquiry had previously been unaware.

- 53 Of those known to have died, three underwent post mortem examination at which organs were removed at coronial request for analysis by the NRPB. Documents seen by the Inquiry suggest that in all three of those cases the deceased's relatives were aware of what was done.
- 54 Both Ms Jefferies and the AWE denied that the list had been circulated or that it had been used by anyone within the AWE as a source of information to indicate that attempts should be made, in due course, to obtain organs at post mortem examination from the individuals listed. It remains unclear to the Inquiry, if that were the case, what the motive for preparing the list might have been.

“Claimants for particular attention”

- 55 A typed note dated 25 January 1980, prepared by Dr Stanley Jackson³⁴ and addressed to Mr Davies, is headed “Claimants for particular attention”. It lists 28 employees in whom estimates of chest radionuclide content (assessed by WBM) were or had been considered to be elevated, or who had been removed from “contact” (work with radioactive isotopes). Over the subsequent few weeks, Dr Jackson produced three further handwritten notes for Mr Davies, with the same heading, adding a few names and a little more information. Five of the names on the list appear also on the handwritten “P.M. requirement” list described above.
- 56 These lists were not contained within the Specials file. The AWE indicated that they comprised individuals who had had evidence of measurable intake of actinide sufficient for them to be placed on restricted duties and who had initiated claims against the AWE. Knowledge of the intake would be a relevant factor in the AWE's handling of the claims and would be of interest to the health physicists working in the Dosimetry Section. According to evidence given to the Inquiry by the AWE, of the 28 individuals whose names appear on the list:
- 14 are known still to be alive;
 - 11 are known or presumed³⁵ to have died;

34 Group Leader, Biological Assessment, AWE

35 Because they had more than two years' service, are over pension age and are not receiving an occupational pension

- the status of the remaining three is unknown.

As it had done when investigating the “P.M. requirement” list, the Inquiry obtained a variety of documents, including occupational health records,³⁶ from the AWE relating to each of the individuals named on the list, which enabled it to exclude the possibility that organs had been removed at post mortem in any case of which the Inquiry had previously been unaware.

- 57 Of those known to have died, two underwent post mortem examination at which organs were removed and then analysed for radionuclide content at the request of the coroner. Documents seen by the Inquiry suggest that in both of those cases the deceased’s relatives were aware of what was done.

Post mortem analyses

Analysis

- 58 The AWE had facilities for analysis of environmental samples. It was able to assay radionuclides in human tissue, but in the cases discussed in this chapter generally did not do so: the analyses were performed either by the NRPB or by BNFL. The only analysis of human tissue done by the AWE itself was in the course of research projects which are discussed later in this chapter.³⁷

Employees

- 59 The Inquiry is aware of 20 former employees of the AWE (including the four cases discussed at paragraphs 11–30) and of a further two individuals employed at other government institutions (MoD Woolwich and MoD Greenwich) who underwent post mortem examination and from whom organs were or might have been retained with a view to radiochemical analysis. In the majority (12 out of 18) of the cases not considered above, the analysis was undertaken by the NRPB at the request of the coroner. In all of those, the coroner was of the legitimate view that the analysis would assist in the determination of the cause of death and in the majority, the deceased’s family and/or legal representative had also raised the issue.

36 As permitted by Foskett J’s order: see note 3, above

37 See paragraphs 80 et seq

The taking of organs was appropriate and the instruction of an independent third party was sensible.

- 60 Of those 12 cases, two bear further comment as the circumstances were unusual.
- In one, the coroner told the jury at the start of the inquest that he would not have held an inquest had it not been for the advice of the Treasury Solicitor.³⁸
 - In the other, organs were retained and analysed by the NRPB at the request of the coroner. Some of the tissue was given for further analysis to Professor Henshaw at Bristol University and a file note records, *“It was impressed on [Henshaw] that nothing must be said at this stage as otherwise Ward might be upset. Anonymity must be preserved and there must be no publication of results.”*³⁹
- 61 Two of the remaining six cases illustrate the difficulties encountered in establishing the facts so long after the event.

OO

- 62 OO died in 1979. A lung, the liver and some vertebrae were removed at post mortem examination. The Senior Medical Officer at the AWE, Dr Murray Roberts,⁴⁰ personally delivered those organs to Sellafield, a round trip from Aldermaston of over 600 miles. The organs were analysed on behalf of Dr Schofield and the results sent to Dr Roberts, who forwarded them to Mr Jones, at Aldermaston. In 1981, following a request from Mr Taylor, Dr Roberts wrote to Dr Schofield asking for more detailed information about the results of the analysis. Dr Schofield replied a couple of months later and Dr Roberts passed his reply to Mr Taylor. In his oral evidence to the Inquiry, Dr Roberts denied any recollection of his involvement in this case. The Inquiry has seen no evidence to indicate why or at whose request organs were taken and analysed or that these actions were taken with the knowledge or consent of OO’s relatives. The legality of the harvest and analysis therefore remains uncertain.

38 And indicated that Mr Ward had prepared all the evidence: see paragraph 36

39 See also chapter 8, “The National Radiological Protection Board”, paragraph 127

40 Dr Roberts was Senior Medical Officer at the AWE from 1976 to 1985, having previously worked for BNFL at both Sellafield and Springfields

PP

- 63 PP died in 1985. At post mortem, there was an extensive harvest of organs: half femur, half sternum, six ribs, 12 vertebral wedges, kidney, part of clavicle, part of liver and parts of both lungs. The organs were analysed by the NRPB and the results sent to Mr Taylor. A few months later, in response to a question from Mr Paddy Ashdown MP,⁴¹ the NRPB prepared a list of analyses which it had reported to coroners since 1980. There were 11 names on the list, including PP; his was the only case in which the NRPB indicated that the analysis had been done at the request of the AWE. The coroner had certified the death “*after post mortem without inquest*”. Any analysis could not therefore have been at proper coronial request⁴² and would have been lawful only with the relatives’ consent, of which the Inquiry has seen no evidence.
- 64 The AWE was asked to assist the Inquiry in relation to those two cases (OO and PP) but expressed itself unable to provide any further information.

Further cases

- 65 In two further cases, organs were removed but it appears that no radiochemical analysis was undertaken:
- In one, the Inquiry has seen a handwritten note which records that lung tissue was sent to the Pneumoconiosis Research Unit at Cardiff and, after reference to his employment at the AWE, “*Tissue taken ... lung, liver, bone marrow*”. It is unclear whether any radiochemical analysis was performed or how the retained organs might have been disposed of.
 - In the other, organs were lawfully retained⁴³ at the post mortem examination. The AWE informed the pathologist that the deceased had had only slight exposure to radiation and the coroner, advised by the pathologist, decided that no inquest was necessary. The body was cremated. The pathologist ascertained from the AWE that it had no interest in analysing the retained organs and an AWE memorandum records that he “*said he will now ‘quietly’ dispose of the tissues*”. The documents seen by the Inquiry do not indicate the cause of death, which organs were retained or what was the method of disposal.

41 Then Member of Parliament for Yeovil

42 Under s22 of the Coroners (Amendment) Act 1926: see chapter 3, “Law and Guidance”

43 Because the pathologist suspected that analysis might be relevant to the cause of death: rule 9 of the Coroners Rules 1984: see chapter 3, “Law and Guidance”

- 66 Of the two remaining cases not discussed above, one was a former AWE employee who died in the early 1980s. A claim had been intimated before his death; two days after he died his solicitors advised Mr Ward that a post mortem was to be carried out and that Professor Lindop would attend. A variety of organs, including the liver, a lung, brain, heart, a testis, stomach, femur, mediastinum, kidneys, spleen and bladder, were removed and analysed at Sellafield, the results being reported to Dr Schofield. The involvement of solicitors suggests that the widow was aware that the organs were to be removed.
- 67 The one remaining case is straightforward. The deceased, an MoD employee at Woolwich, donated his body to the NRPB and accordingly no issues arise of concern to the Inquiry.

Nuclear test veterans

- 68 The Inquiry is also aware of 15 ex-servicemen who were or were at some time thought to be veterans of the UK's nuclear tests and whose organs were or might have been removed at post mortem examination with a view to radiochemical analysis. The circumstances differ widely but a common theme is that the AWE's involvement appears to have been confined to advising the MoD, the deceased's family and/or the coroner as to the likelihood of the individual having been exposed to harmful radiation in the course of the test explosions.
- 69 The earliest of those 15 deaths were in the late 1950s. In two, the femur alone was taken and assayed at Woolwich laboratory for strontium-90, the analysis was undertaken at the request of the coroner and an inquest was held.
- 70 In four of the remaining 13 cases, while there is evidence that organs were lawfully removed at coronial post mortem there is none that they were actually subjected to analysis. All four men died in the mid-1980s.
- In one, the widow was aware that organs had been removed by the pathologist. There was no analysis; the organs were disposed of seven years later when the pathologist retired.
 - In one, the pathologist removed organs for analysis but both the AWE and the NRPB told the coroner that the results would be of no value.
 - In one, the post mortem report records that the liver and a femur were taken but no analytical results have been found and it is unclear whether any inquest was held.

- In the last, the post mortem report records only “*routine tissues retained*”. A note held by the AWE indicates that in view of the widow’s wishes, the family’s solicitor and the coroner did not want to prolong the inquest. No analytical results have been found.

Only in the first of those four cases is there any evidence to indicate what ultimately became of the organs removed at post mortem. It is clear, however, that the pathologist removed them in a genuine belief that analysis might assist in determining the cause of death and so the removal was legitimate, notwithstanding the absence of subsequent analysis.

- 71 Two further cases involved veterans of the British nuclear tests who died of mesothelioma in the 1980s and whose lungs (and heart in one case) were taken at post mortem for independent investigation of asbestos content. In each instance the coroner was aware of the retention. No radiochemical analysis was performed. Radiation from the nuclear tests was considered (and dismissed) as a possible cause of death.
- 72 Six of the remaining seven cases were straightforward. These test veterans died in the 1980s and 1990s. In one, the deceased had wished to donate his body for scientific research; in the others,⁴⁴ the coroner had properly taken a view that his determination of the cause of death would be assisted by radiochemical analysis of organs and had instructed the NRPB to undertake it. In one of those cases, Dr Mole attended the post mortem and advised the pathologist which organs should be taken. In evidence to the Inquiry, the coroner confirmed that he had been content with that approach and that the analysis was undertaken both at his request and with the widow’s knowledge.
- 73 In those six cases it is therefore clear that organs were lawfully removed and analysed. The one case in which the Inquiry did see evidence giving rise to concern was that of QQ.

QQ

- 74 QQ was an ex-serviceman who died of lung cancer in 1985. At the request of the coroner, the pathologist retained large quantities of tissue (the liver and left lung, six ribs, four vertebral sections, the left clavicle, left femur and left kidney), some of which were subjected to analysis at the Royal Marsden Hospital, and the results were given in evidence at the inquest. There can be

44 Including Christopher Kersley, whose widow made a formal witness statement to the Inquiry: a Christmas Island test veteran, he died of lung cancer in 1994

no criticism of this procedure. However, the inquest transcripts and other records indicate that two further samples, taken from unidentified individuals who had not been exposed to radiation, were also provided by the coroner's officer to the pathologist and analysed to provide reference readings. There is no evidence that consent was obtained from the relatives of those individuals for tissue to be taken for scientific purposes unconnected with their deaths. The coroner had no power to authorise the removal, even if the individuals were the subject of post mortem examinations done under his jurisdiction, since the results of any analysis could not possibly bear upon the cause of those individuals' deaths. In the absence of consent, the removal of the tissue was unlawful. It is of some interest that the AWE was given the opportunity to analyse the retained organs but declined because of the likely cost, estimated at £3,000.

Removal and transport

- 75 The AWE was not involved with the removal of organs at post mortem examination, which was done by the pathologist.
- 76 In most cases, the means by which the organs were transported to the laboratories where they were to be analysed is not apparent from the documents seen by the Inquiry. However, there is some evidence that Dr Roberts was involved in the transport of two sets of organs, the first of which was OO, discussed in paragraph 62.
- 77 The second man, who is one of the 12 referred to in paragraph 60, died in 1985. One femur, the liver and a lung were removed at post mortem examination and analysed by Dr Donald Popplewell⁴⁵ on the instructions of the coroner. Contemporaneous documents indicate that both the coroner and Dr Jackson of the AWE were under the impression that Dr Roberts had attended the post mortem examination. Dr Roberts denied having actually been there (he is not mentioned in the list of people which appears on the post mortem report) but he did remember having taken the organs from the mortuary in Berkshire to the NRPB at Harwell. Both the harvest and analysis would appear, on the limited information available to the Inquiry, to have been at reasonable coronial request and so lawful.

Registry discussions

- 78 Dr Roberts was involved in discussions concerning the possible establishment of a registry of radiation workers. It was intended that those workers be asked to agree that organs could be taken and analysed after their deaths, to increase scientific understanding of the way in which radionuclides were taken up by, stored in and excreted from the body. These plans are described in detail in chapter 10, “Registries”. It is apparent from that description that while the managements of all the organisations involved in those discussions were eager to see a registry established, that of the AWE was perhaps the most supportive.

Strontium

- 79 The AWE was not involved with the UK studies into strontium levels in human bone. It did have some peripheral involvement between 1957 and 1961 in corresponding studies using bone taken at post mortem examinations in Australia and ashed before being sent to England. A more detailed description of the strontium research may be found in chapter 11, “Strontium and the Medical Research Council”.

Publications

- 80 The Inquiry identified eight publications arising from research in which AWE employees had been involved.
- One involved analysis of thyroid glands and is discussed in detail later in this chapter.⁴⁶
 - Three⁴⁷ involved analysis of tissue taken at post mortem examination from a single former employee of the AWE.

⁴⁶ See paragraphs 83 et seq

⁴⁷ Jefferies SJ and Gunstone KJ, Further work concerning a case of Am contamination in the lateral axillary lymph nodes, *Health Physics*, 1986, 50: 839–42; Tancock NP and Taylor NA, Derivation of a new expression to describe the urinary excretion of plutonium by man, *Radiation Protection Dosimetry*, 1993, 46(4): 229–39; Tancock NP, Taylor NA and Wormald S, A test of plutonium metabolic models developed by Leggett and Priest using measurements from an intake case, *Radiation Protection Dosimetry*, 1993, 46(4): 247–51

- Two⁴⁸ appear to relate to the same research project. The first described as part of the investigations analysis of “*a post mortem bone sample*”. No further details were given. The second referred to analysis of nine very small quantities of bone (200mg) and four of brain tissue (500mg). The source of the tissue is not specified in the report, but presumably at least the brain tissue was taken at post mortem examination. Both papers indicate that the analytical methods described had been used extensively in other medical research programmes, data from which were to be published.
- Two⁴⁹ were written in collaboration with employees of the NRPB and are discussed in chapter 8, which describes that organisation.

- 81 There is evidence of consent to the provision of tissue in respect of only one of the papers, which involved analysis of fetal tissue.⁵⁰
- 82 The AWE was asked to describe the procedures in place by which ideas for research were converted into formal proposals, how such proposals were assessed and how funding and ethical issues were considered. A committee, the Technical Policy Committee, existed in the 1970s and 1980s to consider research central to the AWE’s remit, namely the development of nuclear warheads. Its records contained no reference to any research falling within the Inquiry’s Terms of Reference. The AWE suggested that smaller projects might have been assessed more informally by a Director or Assistant Director, but was not able to assist the Inquiry further.

The thyroid study

- 83 A little more information is available on the provenance of thyroid glands used in another study, which is therefore described in more detail.
- 84 The body’s iodine is concentrated in the thyroid gland, where it is used in the manufacture of the two thyroid hormones, thyroxine and tri-iodothyronine. Iodine exists in a number of isotopic forms, of which some occur naturally and others exist only as by-products of nuclear reactions.

48 Goode GC, Howard CM, Wilson AR and Parsons V, Some applications of neutron activation for the analysis of human bone, *Analytica Chimica Acta*, 1972, 58: 363–68; Goode GC, Herrington J and Goddard PC, Neutron activation analysis for aluminium in bone and tissue samples, *Radiochemical and Radioanalytical Letters*, 1977, 31(2): 87–94

49 Popplewell DS, Ham GJ, McCarthy W and Morgan M, Isotopic composition of plutonium in human tissue samples determined by mass spectrometry, *Radiation Protection Dosimetry*, 1989, 26(1): 313–16; Prosser SL, McCarthy W and Lands C, The plutonium content of human fetal tissue and implications for fetal dose, *Radiation Protection Dosimetry*, 1994, 55(1): 49–55

50 Prosser et al: see note 49, above

Iodine-129 is an example of the latter and in the 1960s and 1970s the only major source of this isotope in the UK was Sellafield (then known as Windscale).

- 85 In 1970, the AWE produced a paper,⁵¹ marked “Official use only”, by two employees, Dr Malcolm Dean⁵² and Dr I Trevena. The results were reported of the analysis of 18 human thyroid glands obtained at post mortem examination from “*a hospital near Windscale, Cumberland*”.
- 86 The authors were not investigating any possible danger to health which the presence of iodine-129 might have posed to Sellafield workers or those living near the plant: the isotope is not dangerous. Rather, they observed:

A frequent problem encountered by the police is the identification of the dead. In the absence of personal effects it might prove rewarding to consider what constituents of the environment of the living person might be retained by the body after death and be revealed by analysis.

In evidence to the Inquiry, Dr Dean was less disingenuous as to the primary reason for the research (and the reason why it was treated with secrecy): the scientific technique was suitable for investigating activities at nuclear reprocessing plants in other countries by looking at their emissions of iodine-129.

- 87 The findings indicated that the average ratio of man-made iodine-129 to naturally-occurring iodine-127 in the thyroid glands of people who had lived within 20 miles of Sellafield was significantly above the expected average for the remainder of the country. The authors concluded:

It may be that a correlation between the ratio and distance from Windscale exists; if this can be established a valuable tool could be developed for forensic science.

- 88 On 29 July 1970, in a letter to Dr Greg Marley of the UKAEA Radiological Protection Division at Harwell, Dr Dean described his work as “*classified*”. A month later, he wrote again to Dr Marley indicating that “*We plan to extend this work in the future*”. In fact, no further work was done.

51 Dean MH and Trevena I, *I-129/I-127 in Human Thyroids near Windscale: a Preliminary Investigation*, AWRE Report O92/70 (AWRE, 1970)

52 Radiochemist; later, Board Member for Safety at the AWE

Obtaining the organs

89 How were the thyroid glands obtained for the study? The paper's authors thank "Dr. E.D. Dyson of the Authority Health and Safety Branch, Harwell who arranged the provision of samples".

90 The Inquiry has seen extracts of the minutes of meetings of the Authority Health and Safety Branch (AHSB) of the UKAEA. The first reference, probably in 1968,⁵³ to thyroid glands records:

Arrangements have been made, with the help of Dr. G.B. Schofield at Windscale, to collect human thyroids from Whitehaven Hospital. It is proposed to have these thyroids analysed for total iodine content, in order to obtain representative values of iodine per gram wet weight of thyroid.

91 At what was probably its next meeting later that year,⁵⁴ the AHSB was told:

Human thyroids from the West Cumberland Hospital at Whitehaven have been obtained with the help of Dr. G. B. Schofield from Windscale. After inspection and weighing, Dyson has dispatched these to Aldermaston for chemical analysis.

A later minute, probably dating from 1969, records that results of analysis had been received.

92 In evidence to the Inquiry, Dr Dean was unable to remember how the glands had been obtained. He himself had had no contact with any pathologists. Dr David Smith, consultant pathologist at West Cumberland Hospital, recalled taking thyroid glands at post mortem examination for research at various times but his name rang no bells with Dr Dean.

93 The harvest and analysis of the thyroid glands could not have been for coronial purposes (even if the post mortem examinations were performed at the coroner's request), since there is no suggestion that the results were or could have been considered relevant to the cause of death: in some cases, for example, the individuals had died in road traffic accidents. The Inquiry has seen no evidence that appropriate, or indeed any, steps were taken to obtain the consent of the relatives of the deceased to the removal and analysis of the glands.

53 The exact date of the meetings of the AHSB cannot be determined from the documents obtained by the Inquiry

54 The minute is undated but was probably prepared in 1968

Summary

- 94 The AWE and the MoD, its parent organisation for much of the material time, were chiefly concerned with defending themselves against adverse findings at inquests into the deaths of former employees and ex-servicemen and against any claims for damages arising out of deaths or other injuries. Although there was some discussion of positive action to be taken, the AWE's role remained reactive, responding to deaths and claims only as and when they arose.
- 95 Such research as was conducted by the AWE that involved analysis of organs taken at post mortem examination was, save for one study conducted in the early 1990s, without appropriate consent. The deceased people from whom organs for the studies were taken were few in number and the amounts of tissue taken from the bodies were small. Nevertheless, whether the post mortem examinations were coronial or hospital, agreement to the removal of the tissue for research should have been obtained in every case. Without that agreement, the tissue was not lawfully removed.