DIIS REPORT

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Governing Uranium in the United Kingdom

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Introduction

This paper provides a history of uranium governance in the United Kingdom, focusing on the front end of the fuel cycle, up to and including the point where safeguards are applied to nuclear material. In this report, the term 'governance' refers to licensing and regulation by competent authorities in the broad context of nuclear nonproliferation, security and safety. The report also provides relevant information on industry best practices in this area. With no prior studies of uranium governance in the United Kingdom, generating a significant volume of relevant and specific data proved challenging. It was particularly difficult to isolate governance issues prior to the point of conversion for study since nuclear regulation in the UK does not focus on this part of the fuel cycle. Nevertheless, extensive desk-based research utilizing on-line resources, specialist books and periodicals, fieldwork in the National Archive and interviews with subject-matter experts, including current and former officials, provided a unique insight into an area that has remained relatively opaque for many years.

The report is divided into the following sections:

- Background and methodology
- History of uranium procurement and usage
- Domestic nuclear legislation, regulation and implementation
- Export/import
- Transportation
- Conclusions
- Annex A: Research questions
- Annex B: Operating and decommissioned UK civil nuclear facilities
- Annex C: National Archive References
- Annex D: Key points in the development of UK nuclear regulations
- Annex E: Abbreviations
- Notes

1. Background and methodology

This case study is part of a larger project on global uranium governance, led by the Danish Institute for International Studies (DIIS), which seeks to identify governance gaps in uranium accountability and control and provide policy recommendations for improving front-end transparency, security, and regulation. The research for the UK case study was driven by a set of detailed questions provided by DIIS; these are listed in Appendix A. Based on the questions, targeted key words searches were used to identify relevant information on-line, in the UK National Archive and in specialist libraries. Fieldwork at the National Archive has focused on documents during the period 1943-1995. A variety of relevant documents were collated from various sources, including the UK Atomic Energy Authority (UKAEA), the Cabinet Office, the Department of Energy, the Foreign and Commonwealth Office, the Foreign Office, the Department of Trade and Industry, the Prime Minister's Office, including their various predecessors where appropriate. On-line research has covered government and company websites, specialist periodicals and news sources. Library research identified relevant books containing background histories on the nuclear industry in the UK. In addition, the research team has conducted structured interviews with current and retired officials with direct knowledge of the nuclear industry and related regulations in the UK. These interviews have been directed at filling gaps not covered by documentary analysis.

2. History of uranium procurement and usage

Sources of uranium

Uranium is not currently mined in the UK, although exploration has been conducted in the past. Between 1945 and 1951, 1957 and 1960, and 1968 and 1982, investigations in the UK revealed only sub-economic mineralisation potential.[2] Consequently, the UK has had to rely on foreign sources of uranium over the years for both civil and defence purposes.[3]

This section examines British uranium procurement efforts from the 1940s onwards, from the early years and the focus on nuclear weapons development, to the launch of the UK's nuclear energy programme, through the period of increasing international and domestic regulation, and up to the present day.

1944-1954: the early years

Towards the end of the Second World War, the UK required uranium 'to initiate an atomic energy project' and, along with the United States, was 'anxious to locate and secure all accessible supplies and deny this strategic material to others, particularly Russia'.[4] The UK first received uranium ore concentrate (UOC) through the Combined Development Trust (CDT) (later the Combined Development Agency, CDA). The Declaration of Trust was signed by the United Kingdom and the United States on 13 June 1944 establishing the CDT 'to secure control of uranium and thorium within the participants' own territories – the United Kingdom taking responsibility for the British Commonwealth (excluding Canada) and the Colonial Empire – and to seek to acquire control of uranium and thorium resources in third countries (known as 'CDT territories').'[5]

The CDT possessed 'wide powers to carry out surveys and explorations; to acquire mines or mining concessions and provide equipment; to conduct research into production methods; to acquire, treat, stockpile and dispose of uranium and thorium; more generally, to undertake any operations conducive "to the effective carrying out of the purposes of the Trust in the common interest"'.[6] By 1945 the CDT was 'well established and had produced a survey of world uranium sources based on field work and literature researches'.[7] Uranium was bought jointly by the CDT and was allocated to the two countries through the Combined Policy Committee (CPC).

The allocations were determined keeping in mind 'supplies from other sources, such as indigenous supplies from the United States and supplies from Canada.'[8]

A large amount of the uranium obtained by the CDT originated in the Belgian Congo. In 1944 a Tripartite Agreement was reached between the Belgian Government and the Governments of the UK and US to place the entirety of the Belgian Congo's uranium and uranium ore at the disposal of the Trust and to give the US and UK first access to it.[9] The CDT concluded three contracts with Union Minière de Haut Katanga, owners of the Belgian Congo deposits. The coverage of these contracts is summarized in the following table.

CDT contracts with Union Minière de Haut Katanga[10]

Date	Coverage
25 September 1944	Purchase of all outputs up to 20,000,000 lbs U_3O_8 in concentrates at $1.9/lb
27 October 1945	Mirrors contract on 25 September 1944
27 October 1945	Purchase of all further U_3O_8 that can be economically mined during the period of the inter-governmental agreement

It was through the CDT, then, that the UK secured access to Belgian Congo ore. The UK managed to retain a large stock of this ore following the war, which was used in the UK atomic programme until 1953.[11] In 1946, for example, the CDT allocated the UK 1,350 tons of U_3O_8, all of which was sent to the Springfields Refinery.[12] The Springfields facility in Lancashire, in the northwest of England, was established as a uranium processing facility in 1946 by the Ministry of Supply as part of the UK's atomic energy programme.[13] Uranium for both the defence and civil programmes was subsequently processed at Springfields.[14]

A series of telegrams in 1945 between the British Air Commission in Washington and the Ministry of Aircraft Production in the UK show that initial stocks allocated to the UK originated in both Canada and the Congo.[15] The reliance on Union Minière in the Belgian Congo and the Port Radium pitchblend deposit in Canada prompted attempts to broaden the supply base as much as possible in the 1940s and 1950s. In 1948, uranium deposits were found in northern Saskatchewan and southern Ontario, although the US maintained control over Canadian supplies until 1956,[16] with documents from the 1940s making it clear that details about Canadian contracts were not known to the UK government at the time.[17] Uranium interests were also developed by the United States in South Africa in the late 1940s and early 1950s in order to meet the demands of their expanding gaseous diffusion enrichment programme. This was done under the CDT with UK participation.[18]

Details of a CPC meeting on 4 July 1945 demonstrate that there was active debate about how uranium stocks would be allocated between the US and the UK. In particular, the question was raised about the consequences of all of the available supplies going to the US during the war. The adopted minute was apparently received well in Britain, with a telegram from Joint Staff Mission (JSM) Washington to the UK's Air Ministry Special Signals Office (AMSSO) stating there was 'nothing sinister in the American attitude' during the meeting.

> The Combined Policy Committee determined that while the war lasts all uranium supplies received by the Combined Development Trust for the account of the United States and the United Kingdom should be allocated to the United States Government for the production of weapons for use against the common enemy. The British members of the Combined Policy Committee called attention to the fact that this policy will leave Great Britain without any reserve of supplies of this material for future use. The Committee noted this statement of the British members and agreed that in so far as the material received by the Trust exceeds the quantity required for the production of weapons against the common enemy in the present war, it should be held by the Combined Development Trust to be disposed of or otherwise dealt with.[19]

The British willingness to allocate the entirety of the uranium stores to the US was based on a belief that, during the war, the US should have at hand all available resources to manufacture weapons for use against the common enemy. This is clear from a draft memorandum on the allocation of trust material sent from AMSSO to JSM Washington:

> While the war lasts the overriding consideration is the production of weapons for use against the common enemy at the earliest possible moment. In so far as it can be shown that the material available can be used in American plants for this purpose, the British Government agree that it should be allocated to the US Government, without setting up any claim on behalf of the British Government to prior consideration in later years.[20]

It was recognized, however, that when the material exceeded the amount required for the production of weapons, the CDT would hold it on behalf of the two governments. The British Government took it 'for granted that the allocation of material should have regard to the special relationship of the two countries established by the agreements between them and to the needs of the UK, and that in assessing requirements and their urgency all relevant facts should be reviewed, and the stocks of weapons and raw materials in the two countries should be taken into account.'[21]

Discussions about uranium allocation continued after the McMahon Act was signed in 1946. Under the terms of the McMahon Act, the US would not share nuclear weapons information with the UK. This move led the Attlee government to initiate Britain's own nuclear weapons programme in 1947. Importantly, in the context of uranium supplies, a memorandum of 13 May 1946 addressed British concerns that the US move not to share weapons information would affect CDT materials being transferred to the UK. Excerpts from the memorandum are included in the following table.

Memorandum, 13 May 1946 [22]

Following the action taken at the April 15, 1946 meeting of the Combined Policy Committee, subcommittee (of Roger Makins (Minister at British Embassy, USA), J. Chadwick (Head of the British Mission for the CDA), Dean Acheson (Chairman of Special Committee for Atomic Energy), and Leslie R. Groves (Head of Manhattan Project)) assigned to work on the allocation of raw materials and agreed on the following:

1 'All raw materials received by the United States as of March 31, 1946 and subject to the allocation by the Combined Policy Committee, and those materials captured in Europe, shall be regarded as allocated to the United States.'
2 'For the remainder of the current year, April 1, 1946 to December 31, 1946 the Combined Policy Committee shall allocate 1,350 tons of contained U_3O_8 to the United Kingdom and 1,350 tons to the United States … This allocation is to be made without prejudice to establishing a different basis of allocation for subsequent years.'
3 'In addition, the United States will transfer to the United Kingdom under suitable arrangement 50 tons of Mallinckrodt oxide and 15 tons of uranium metal.'

In July 1946 the US and UK made a temporary agreement to divide uranium approximately equally between them[23] and, in January 1948, another temporary agreement was reached to allow the US to receive the entirety of the Belgian Congo output, as well as an option on part of the British uranium stockpile, until 1949. In exchange, the US promised to give Britain nuclear data in certain areas but nothing related to weapons. This was called the Modus Vivendi agreement under which the UK would export uranium supplies to the US in exchange for limited non-weapons related atomic information.[24]

In 1947 the Department of Atomic Energy commissioned a legal advisor to look into whether or not the Tripartite Agreement of 26 September 1944 permitted the UK to use uranium from the Congo for civil purposes.[25] The legal advisor concluded that there was no limitation in the agreement about what the governments of the US and UK could do with the ore, and no requirement for them to inform the Belgians of its intended industrial use. While the legal advisor concluded there was no need to tell Belgium, a top secret letter on this matter sent from Roger Makins, Assistant Under-Secretary of State, to the Foreign Office makes clear his belief that Britain should consult the Americans before using the uranium for civil purposes.[26]

Following this assessment, D.E.H Pederson wrote in a draft letter to Gordon-Munro that, 'Until recently we have been working under the assumption that the Tripartite Agreement of September 26th, 1944 debarred us from using any of the Congo ores for commercial purposes. The Foreign Office Legal Adviser has recently been consulted, however, and has expressed the opinion that the Agreement contains no such limitation other than provision that the Belgians must be let in on any proposal to use the ores for the production of nuclear energy.'[27] Furthermore, Pederson agreed that the British government was under no requirement to consult Belgium but felt that, 'we ought to consult the Americans in view of their recently issued regulations on "The control of source materials,"' which seemed to prohibit the use of uranium in ceramics and glass products except under special circumstances.[28]

Britain's connections with her former colonies convinced officials in both Washington and London that CDT contracts would be more easily negotiated in South Africa and Australia if British officials were involved. By the late 1940s, there was also a real concern throughout the British Government that the US had the upper hand in their strategic relationship. In 1949 the British Minister of Supply, George Strauss, noted that Britain had to 'make a real effort to see that our experience in relation to uranium from South Africa does not follow that of the Belgians in the Congo, where the Americans have taken the lot.'[29]

Meanwhile, smaller amounts of uranium were found in Portugal and Australia and obtained through the CDT.[30] Small mines in Portugal were developed under CDT management and small contracts signed in Australia (Radium Hill & Rum Jungle).[31] A Cabinet Office report from 1948 notes that uranium reserves existed in the Belgian Congo, Canada, South Africa, Portugal, USA, Sweden, and Argentina.[32]

Between May 1946, when the CPC allocated 1,350 tons U_3O_8 to the UK, and April 1950, the UK received a total of 3,247 tons of U_30_8 in shipments. As of 1 April 1950, the UK stockpile of 'uncrushed' uranium was equivalent to 1,970 short tons U_3O_8, of which 1,897 tons were unallocated and it was thought there were around 140 tons in the pipeline.[33]

Concerned that the present sources would be insufficient, the British government requested the government of Portugal to export 100 tons of U_3O_8 per year to the UK in the form of concentrates over the period of 1951-57.[34] Negotiations for uranium production with Portugal had actually begun in June 1947 and, in July 1949, letters were exchanged between the British and Portuguese governments providing for the 100 tons per year arrangement.[35] The US government also accepted the terms of this arrangement with the CDT, formally noting it in September 1949. Prior to September 1949, 'the British took full responsibility' for the arrangement.[36]

As Gowing and Arnold note, 'British interest in radium mining' in Portugal 'dated from 1926, and during the war a British Government agency [the UK Commercial Corp] had acquired the controlling interest in the concessions to prevent them falling into German hands'.[37] The first uranium consignment from Portugal arrived in the UK in February 1952,[38] although material received from this source was only ever used in Britain in 'research quantities'.[39] For example, the 111 tons acquired from Portugal and allocated to the UK in 1951 and 1952 were subsequently transferred to the US.[40] In 1962, control of the mine and the plant were given to the Portuguese 'free of charge as a going concern'.[41]

In 1951 the UK's Atomic Energy Research Establishment and the Dutch Foundation for Fundamental Research on Matter (FOM) made an agreement through which the Dutch would give Britain uranium oxide in exchange for metal rods to be used in the

Dutch JENNER reactor. Norway and the Netherlands cooperated in this endeavour, with Britain playing an important role.[42] On 25 May 1951, 103 50kg containers of Dutch uranium oxide were shipped to Britain in exchange for three metric tons of British uranium metal to Norway.[43] Also in 1951, the CDA established a South African firm, Calcined Products (Pty) Limited (Calrpods), to produce uranium and the British Labour government attempted to negotiate a bilateral agreement with Australia to obtain uranium. Britain was rebuffed, and thus Australian uranium went to the CDA until at least 1960/1963.[44]

United Kingdom: Estimated Uranium Requirements, Deliveries and Allocations, 1946-52
(in tons of uranium oxide, U_3O_8)*

Year	Estimated requirements	Deliveries from the Congo	Allocations	Unallocated stockpile
1946	--	1,857	1,350	507
1947	--	1,390	--	1,897
1948	580	--	--	1,897
1949	555	--	--	1,897
1950	650	--	505	1,392
1951	650	--	561	831
1952	561	--	503	328
	2,996	3,247	2,919	

* *Taken from Gowing and Arnold (1974)* [45]

As of 1953, the CDA continued to buy uranium for the atomic energy programmes of the UK and the US from the Belgian Congo, Portugal, South Africa and Australia.[46] While the British policy at the time – of supporting the US in 'keeping down the price of uranium, including uranium from Commonwealth sources, and in persuading Commonwealth countries to produce and sell uranium more quickly than regard for their own economic interests might suggest' – had initially been developed to ensure 'the safety of the Western world' by helping the United States 'acquire, as quickly as may be, the largest possible stockpile of atomic weapons,' there was growing concern that this was no longer in British interests.[47]

This concern was driven by several factors in the early 1950s, including a recognition that the main source of uranium in the future would likely be in Commonwealth countries rather than the Belgian Congo; recognition that the US did not need an unlimited stockpile of weapons; growing awareness of the potential commercial uses of uranium in industry; and the desire to secure independent uranium stockpiles for industrial purposes. These doubts raised the question of whether the UK should identify itself 'more closely with the Commonwealth as sellers than with the United States as buyers.'[48]

1954-1961: the UK initiates a nuclear power programme

A key development at this time was the recognition that uranium had purposes outside of building bombs. Indeed, in 1953 the British Electricity Authority established 'a nuclear power branch in their Chief Engineer's Department to study, plan, design and eventually arrange for the construction of nuclear stations.'[49] In November 1953, the UK government also issued a White Paper on the 'Future Organisation of the United Kingdom Atomic Energy Project (Cmnd. 8986)', which 'accepted the recommendations of the Waverley Committee (reported unpublished) and dealt with the transfer of responsibility for nuclear energy from the Ministry of Supply to a non-departmental authority'. This led to a bill being introduced 'providing for the establishment of the United Kingdom Atomic Energy Authority which received the Royal Assent on 4 June 1954' under the Atomic Energy Authority Act 1954. The UK Atomic Energy Authority (UKAEA) was established on 19 July 1954.[50] The Springfields facility became part of the UKAEA in 1954, with the UKAEA now also responsible for procuring uranium.[51]

In February 1955, the UK government initiated a ten-year 'Programme of Nuclear Power (Cmnd. 9389)' for the UK. This followed the recommendations of a 'Treasury working party' which reported in 1954 'on the economic feasibility of a civil nuclear power programme', specifically recommending 'some 1,700 MW of nuclear capacity by 1965 from 12 reactors'. The coal shortage at the time influenced the decision to pursue nuclear power. Gas-cooled graphite-moderated (Magnox) reactors using natural uranium fuel were chosen, due to the UK lacking an indigenous uranium enrichment capability at the time.[52]

To meet the UK's expected future nuclear energy needs, contracts were negotiated with Australia (the Mary Kathleen and Alligator Mines), South Africa (three mines) and Canada in 1954.[53] The British desire to secure uranium for industrial purposes is clear from this point on. In 1954, for example, the UK requested its CDA allocation that year to be made up of 400 tons of South African uranium and 100 tons of uranium from the Belgian Congo, as the South African ores were thought to be of higher quality.[54]

By 1955 enormous mining efforts were underway, and the main uranium sources for defence needs had been found.[55] International developments continued to increase the drive for civilian nuclear power, with the Suez Crisis in particular making Britain doubt the wisdom of relying on oil as an energy source. The UK government forecast a huge rise in civil uranium ore requirements from 1967 onwards, prompting a second and third contract to be signed with Canada and a further contract with the South African Harmony Mine.[56] Additionally, the UKAEA began to engage in prospecting in Rhodesia and East Africa.[57]

In 1956 Britain reached an agreement with Australia. The two countries agreed that, beginning in 1958, Britain would receive uranium from Australia's Mary Kathleen Mine. In exchange, Britain would help Australia build a Harwell-type DIDO reactor at Lucas Heights near Sydney in return for operating reports and concessions on future surplus uranium supplies.[58] Also in 1956, an agreement was made between the British government and the Netherlands for the exchange of strategic materials, information, personnel and expertise.[59] In 1958, the DIDO reactor at Lucas Heights went critical, with Australian scientists trained at Harwell and various British universities. This was a British-designed, Australian-built plant which used British-manufactured fuel rods made from Australian (CDA) uranium.[60]

Fuel production for the civil programme started at Springfields in 1958.[61] However, cutbacks in the British nuclear power programme in 1959 caused the current stocks of uranium to fall out of balance with requirements. As contract cancellation proved impossible, the UKAEA negotiated delivery ceilings and stretch-outs. The final delivery dates for uranium under the second and third Canadian contracts, for example, were stretched to 1968 and 1971 respectively, while the 9,450 tons remaining to be delivered on the South African contract in 1961 were pushed back to 1966-1973. In total, this reduced the commitments to £75 million, including interest.[62]

The Plowden/Padmore Agreement of 1959 in the UK was meant to address the problems facing the nuclear power industry at the time, including the high cost of imports and the burden of interest. The Agreement defined the commitments between the defence area, the Generating Boards and the Treasury, dividing the current contracts according to circumstances and their origin.[63]

Plowden/Padmore Agreement 1959

	Usage	Quantity	Source
Category 1	Military and R&D (all supplies free of restriction)	Military usage and national stock figures omitted for security reasons. Calder Hall/ Chapelcross: 1,735 tons provided by defence settlement, 3,250 provided by 1971/80 Ministry 'contract'	Congo, South Africa CDA (less three specified mines), and Harmony, Radium Hill, and Rum Jungle
Category 2 (Civil I)	First five stations and exports (Canadian supplies restricted to civil use)	20,150 tons	Canadian first and second contracts, Mary Kathleen and Alligator, SA three specified mines, and Harmony
Category 3 (Civil II)	Sixth and subsequent stations	12,000 tons	Canadian third contract

Another significant point of note at this time was the decision to terminate CDA deliveries sooner than expected. Uranium deliveries under the CDA were initially due to finish in 1966, but instead terminated in 1961, with the division of the South African deliveries into separate US and UK contracts.[64]

1961-1970: Beyond CDT/CDA

The responsibility for British uranium stocks continued to develop in 1963 with the Defence Settlement. At this time, most of the stock had transferred from ownership of the UKAEA to ownership by the Ministry. The 1963 Settlement divided this stockpile into a Military Float and an Electricity Float. The Military Float was set aside for military use and was exhausted by 1972. From this point military needs were 'met from year to year by ore from the existing South African contract with the excess going to swell the national stockpile.' The Electricity Float of 1,735 tons constituted as part of the Defence Settlement was designated to meet needs of Calder Hall and Chapelcross from 1964-1970.[65] The last import of uranium from South Africa occurred in 1973.[66]

A revival in confidence about nuclear power in 1963, clear from announcements to build Oyster Creek in the US in 1963 and Dungeness B in the UK in 1965, led once again to a rapid rise in forecasts for uranium demand.[67] In August 1966, an agreement was negotiated with Rio Algom Co., Canada, to buy 8,000 short tons between January 1973 and December 1980 at the rate of 1,000 tpa. The contract included two options to increase total tonnage to 10,000 short tons, with delivery of 1,250 tpa and the opportunity to increase this by 15%, as well as provisions to allow the UK Authority to vary tonnage by up to 15% per year.[68]

Also in 1966, the Ministry of Defence accepted that Calder Hall and Chapelcross would need to remain unsafeguarded until 1980, and therefore would need to use Category I unsafeguarded material. Arrangements were thus made for 'contract' with the Authority: 3,250 short tons bought from the National Stockpile for these facilities.[69]

In 1968 a further contract was negotiated for additional supplies of uranium to be bought from Canada. This agreement was concluded with letters of intent by which the UK Generating Boards undertook to bear 90% of the cost and financing charges, with the remaining 10% assumed by the Trading Fund. This resulted in a total financial commitment of £90 million (without escalation).[70]

1970s-1980s

In October 1970 the Secretary of State for Trade and Industry took over responsibility for civil atomic energy in the UK. This was followed shortly afterwards, in April 1971, by the Atomic Energy Authority Act, which transferred UKAEA's 'Production Group and Radiochemical Centre to British Nuclear Fuels Ltd (BNFL) and the Radio-chemical Centre Ltd (TRCL) respectively'.[71] BNFL had been established in February 1971 specifically to take on 'responsibility for the production of nuclear fuel and associated services'.[72] This included taking over responsibility from UKAEA of the Springfields site. A draft letter in 1970 had stated that 'It is clear that the AEA could no longer be responsible for uranium procurement after the passing of the Atomic Energy Authority Bill.' The letter goes on to say that the UKAEA supports the view that 'the balance of advantage is in favour of this function being transferred to British Nuclear Fuels Ltd., rather than to the generating boards.'[73]

Annex to 'Draft Note: Participation of Uranium Producers in British Nuclear Fuels Ltd.: Summary of discussions between AEA, CEGB, BNFL [74]

The Annex describes the British nuclear fuel cycle at the time as follows:

- Mining
- Milling
- Purification and Conversion to Hex
- Enrichment (at present by diffusion, in future also by centrifuge)
- Fuel Fabrication
- Transport of fuel elements to reactor
- Transport of irradiated fuel elements from reactor
- Reprocessing (recovery of useful isotopes and of plutonium and uranium for further fuel).

Under the proposed changes, BNFL would carry responsibility for every step of the above process, with the exception of mining and milling, which would remain in the hands of individual mining companies.

Up to this point, the purchasing policy on nuclear materials had involved UKAEA purchasing nuclear material mostly in the form of uranium ore from Canadian and South African sources. The purchases fell under long-term contracts, and the timing and quantity of specific orders was based on the forecasting requirements of the Generating Boards. It was decided that this arrangement would continue in the future, even as BNFL took over for the UKAEA as the main purchaser of uranium in the UK.[75] However, a lot of discussion took place in the early 1970s about whether uranium acquisition and procurement should be taken over by the BNFL. UKAEA, as an R&D organisation, did not want to remain responsible for procuring ore. The argument was that, due to BNFL's expertise in the fuel cycle, knowledge of the mining industry and contacts with the uranium industry internationally, BNFL would be better suited to carry out this responsibility in the future. Both the Central Electricity Generating Board (CEGB) and BNFL thought BNFL should take over procurement from UKAEA, arguing that BNFL fulfilling the role of chief purchaser would facilitate better relationships with mining companies.[76] BNFL argued that its position and standing in international commercial markets and its understanding of the whole fuel cycle would allow them to carry out procurement. Additionally, BNFL thought procurement would strengthen its status as a company for uranium suppliers and would allow it to take every opportunity to extend its activities and business further.[77]

While there was general consensus between the AEA, CEGB and BNFL about BNFL taking over uranium procurement for UK civil and defence needs, there were questions about how stock shares in BNFL should be distributed. BNFL was wary of shareholders limiting their freedom, while CEGB worried about uranium companies taking up shares in BNFL, arguing it would make procurement less transparent and impartial, would put uranium companies in a privileged position, and might give them insider knowledge.[78] Meanwhile, groups outside AEA, CEGB and BNFL were upset that the transfer decision was made within these three organizations. The Department of Trade and Industry (DTI) was particularly upset that the Generating Boards decided to pass responsibility to BNFL without consulting the DTI first.[79]

The change – made at first for a trial period of two years – officially occurred on 1 April 1974, although there was a lag of a few months in the responsibility for shipments, with BNFL only taking full responsibility for incoming shipments from September 1974.[80] After the decision was made to transfer the responsibility for procurement to BNFL, it remained to be negotiated how the transfer of shipments would take place. The process remained roughly identical to the process for imports under UKAEA, as demonstrated by a letter on 13 September 1974 to Alltransport International Group, Ltd., Manchester, making it clear that 'the Authority's functions in connection with the regular importation of uranium ore concentrates from Rio Algom Mines Ltd. in Canada, which have hitherto been undertaken by this branch, have been transferred to the Headquarters of British Nuclear Fuels Ltd.' It also added that 'Arrangements for the containerized movements of the drums of concentrates to BNFL's Springfields Works ... remain unchanged and the only differences in documentation (apart from the change from the Form C188 Customs procedure) will be that with effect from the next shipment (consignment No. 30), the concentrates will be consigned to BNFL instead of the Authority.'[81]

The original source of R&D material in the UK fell under Category 1. After the Ministry of Defence expressed a wish to keep unsafeguarded material for its own use, the Treasury agreed to allocate unsafeguarded ore from the civil stock to meet R&D developments. The UKAEA decided to continue to use material from Civil I for R&D purposes from 1974-1980.[82]

In July 1979, the CEGB, the South of Scotland Electricity Board and BNFL created the British Civil Uranium Procurement Directorate (BCUPD). It was responsible 'for ensuring that uranium was available to meet the needs of the civil nuclear programme'. The BCUPD was administered by the CEGB, but it was later dissolved in March 1991 after 'changes in the organisation of the electricity supply industry'. Nuclear Electric plc, Scottish Nuclear Limited and BNFL became 'responsible for their own procurement'.[83]

According to H. Page, by April 1986 '… some 80,000 tU equivalent of uranium ore concentrate' had been 'converted to nuclear fuel or nuclear fuel intermediaries at Springfields'.[84] In January 1990, the UK government noted in Parliament that the total 'uranium consumption' for civil electricity production in the UK up to and including 1989 had been 38,800 tons. The table below provides a yearly breakdown for the period 1970-1989, although the source of the information – the BCUPD – was 'unable' to breakdown the 10,000 tu figure by year in the pre-1970 period. In 1990, BCUPD advised that 'uranium consumption' for civil electricity production in the UK in 2000 would be 'around 1,200 tons'.[85]

Uranium consumption for civil electricity production in the UK up to 1989 [86]

Year	tu	Year	tu
1970	900	1980	1,900
1971	1,000	1981	1,300
1972	1,200	1982	1,300
1973	1,300	1983	1,300
1974	1,400	1984	1,500
1975	1,300	1985	1,500
1976	1,400	1986	1,800
1977	1,300	1987	1,500
1978	1,100	1988	2,000
1979	1,900	1989	1,900
	Pre-1970:	10,000 tu	
	1970-1989:	28,800 tu	
	Total:	38,800 tu	

The UK government noted in Parliament in January 1989 that '... over the calendar years 1983 and 1984 the CEGB, on behalf of the British Civil Uranium Procurement Directorate (which is responsible for meeting the uranium requirements of the UK's civil nuclear programme), imported some 1,300 tons of uranium from the Rossing mine in Namibia. This contract ended in 1984, and since that time the CEGB has not imported any uranium of Namibian origin.'[87] It was further noted in Parliament in July 1989 that 'uranium imported from Namibia since 1979 for use in the British civil nuclear programme is currently located either at BNFL's processing facilities, or at the generating boards' power stations. All this uranium is subject to Euratom safeguards.'[88]

In January 1989 the UK government also stated that 'The CEGB is currently receiving uranium from both the United States and Canada, and, in addition, it has recently entered into a contract to take supplies from Australia from 1989'.[89] Moreover, it was noted that '... British Nuclear Fuels Limited processes uranium on behalf of overseas customers for subsequent re-export. The origin of that ore is a matter for BNFL's customers.'[90]

In 1979, the UK had signed a nuclear cooperation agreement with Australia that specifically mentions transfers of nuclear material. Under this agreement the UK must obtain Canberra's written consent if it plans to transfer nuclear material it has received from Australia to a non-EU state.[91] Moreover, in the early 1980s, the CEGB discovered mineralisation in the sandstones of Kayelekera, Malawi. Drilling from 1982-1988 produced 9,800 tU at average grade of 0.13% uranium. Work finished at this site in 1991, as the CEGB concluded the project was uneconomic due to the low uranium prices at the time.[92]

Sources of yellowcake processed at Springfields up to June 1980*

Country	Source
Australia	Rum Jungle, Northern Territory; Radium Hill, South Australia; South Alligator, Northern Territory; United Uranium, Northern Territory; Mary Kathleen, Queensland.
Canada	Rio Algom, Elliot Lake, Ontario; Macassa, Bancroft, Ontario; Beaverlodge, Saskatchewan; Denison, Elliot Lake, Ontario; Dyno, Bancroft, Onatario; Faraday, Bancroft, Ontario; Gunnar, Saskatchewan; Milliken Lake, Elliot Lake, Ontario; Northspan, Elliot Lake; Ontario; Rayrock, Elliot Lake, Ontario; Stanleigh, Elliot Lake; Ontario; Stantrock, Elliot Lake; Ontario.
USA	Cotter, Canon City, Colorado; Susquahanna, Falls City, Texas; Susquahanna, Edgemont, South Dakota; Susquahanna, Three Rivers, Texas; Western Nuclear, Jeffrey City, Wyoming; Utah, Shirley Basin, Wyoming; Utah, Gas Hills, Wyoming; Anaconda, Bluewater, New Mexico; Petrotomics, Shirley Basin, Wyoming; Federal American Partners, Riverton, Wyoming.
Africa	Nufcor; Palabora; Games Estates; Somaire.
Miscellaneous	Belgian Ionex; Swedish; Spanish; Yugoslavian; Argentinean; Portuguese; German
* Taken from H. Page (1980) [93]	

1990s to the present

In 1993 the 'world's newest conversion facility' was built at Springfields.[94] While BNFL announced in 2001 that the Springfields facility would close in 2006,[95] on 16 March 2005 it was stated that Canada's Cameco Corporation had 'signed a toll-conversion agreement with British Nuclear Fuels plc (BNFL) to acquire uranium conversion services (UF_6) from BNFL's Springfields plant in Lancashire, United Kingdom. Under the 10-year agreement, BNFL will annually convert a base quantity of 5 million kilograms of uranium (kgU) as UO_3 to UF_6 for Cameco.'[96] The 'feed [UO_3] is from Cameco's Blind River refinery in Ontario, Canada.'[97] Cameco controls 'about 25% of the world conversion capacity' and is 'the world's only commercial supplier of natural UO_2.'[98] Cameco notes that it 'has secured most of the production capacity of the Springfields conversion facility' under the ten-year agreement, although it did not own the Springfields facility.[99] In 2005, Cameco noted that 'Cameco will then deliver the UF_6 to its utility customers, who ultimately use it for fuel in nuclear reactors after further processing. Cameco currently has more than a quarter of the western world's UF_6 conversion capacity from its Port Hope plant.'[100] Moreover, it noted that the company 'will invest about $6 million to expand production and drum-filling facilities at its Blind River refinery and $4 million to construct drum tipping and washing facilities at BNFL's Springfields plant.'[101] Shipments from Blind River to Springfields began in mid-2006.[102]

In April 2005 responsibility for the assets and liabilities of Springfields was transferred from BNFL to 'Britain's Nuclear Decommissioning Authority (NDA), a government agency established to take responsibility for the majority of the United Kingdom 's civil nuclear assets and liabilities.'[103] The role of NDA is to 'oversee and manage the clean-up and decommissioning of the nuclear sites under its responsibility'. At the same time Springfields Fuels Limited was established to operate the site, which itself was 'managed and operated by Westinghouse Electric UK Ltd on the NDA's behalf'. An agreement between NDA and Westinghouse was reached on 1 April 2010 under which Westinghouse has 'a long-term lease of the Springfields site'[104] and manages the '6,000t/yr licensed conversion plant.[105]/[106]

Previously in 1996, Westinghouse, then a subsidiary of BNFL, had formed Uranium Asset Management (UAM), and since then it has been 'at the forefront of commercial uranium supply for BNFL and Westinghouse, and also for a growing portfolio of international customers.'[107] Westinghouse was subsequently acquire by Toshiba in 2006 and UAM was renamed Advanced Uranium Asset Management (AUAM), 'a new UK-based joint venture' designed 'to undertake uranium-related transactions in the front end of the nuclear fuel cycle'. It is based at Springfields, with the company 60% and 40% owned by Toshiba and Westinghouse respectively.[108]

Today, most uranium used in the UK is imported from Australia.[109] As noted above, the UK and Australia signed an agreement in 1979, and Australia has a long history of providing the UK with uranium through both the CDA and the UKAEA. For example, between 1956 and 1962 alone uranium entered the UK from the Radium Hill, Rum Jungle, Mary Kathleen, Moline, and Rockhill mines in Australia.[110] In 2007, the British-based company Uranium Resources undertook joint exploratory drilling with Australia's Western Metals in Tanzania.[111]

Neither the UK nor Westinghouse owns any of the uranium that passes through the facility. Instead, Springfields and other UK nuclear sites offer fuel cycle services, so it is the customer that owns the uranium.[112]

The UK has over the years imported uranium from just about all uranium-producing states, and today the origins of the uranium flowing through the UK are very much driven by market forces.[113] The UK has not received uranium in the form of yellow-cake for over five years, and it currently arrives in the UK as UO_3.[114] This is because Springfields no longer operates the 'wet' solvent extraction part of the front end of the fuel cycle for a combination of environmental and financial reasons.[115]

3. Domestic nuclear legislation, regulation and implementation

The first part of this section provides a brief overview of the current UK nuclear legislative and regulatory framework (safeguards, safety and security), with particular attention to the governance of uranium prior to conversion. Where available, information is also provided on current implementation measures.

Current regulations and enforcement

In the United Kingdom, the Office for Nuclear Regulation (ONR), working under the auspices of the Health and Safety Executive (HSE), a non-departmental public body reporting via the Department for Work and Pensions (DWP), is the primary body responsible for nuclear regulation. The ONR works alongside two other regulatory bodies – the Environment Agency and Scottish Environment Protection Agency – with whom the ONR has memoranda of understanding. The ONR also provides annual reports to the Department of Energy and Climate Change (DECC).

The ONR was formed in April 2011 and constitutes a key step in the UK government's plan to establish an independent nuclear regulator that would ultimately become an independent statutory corporation. The ONR incorporates the safety, safeguards and security functions of HSE's former Nuclear Directorate, the Office for Civil Nuclear Security, the UK Safeguards Office and Radioactive Materials Transport (formerly within the Department for Transport).

The creation of the ONR was the result of work begun in 2007 to consolidate the UK nuclear regulatory structure with the aim of improving the consistency of regulation and facilitating the development of a more accessible nuclear regulatory framework for relevant stakeholders. The ONR was envisaged as a single, integrated regulator responsible for all aspects of the UK nuclear industry – safety, security and safeguards.

Of course, the establishment of the ONR as a centralised domestic interface is a recent and ongoing development. The history of nuclear regulation in the UK reveals a much more fragmented regulatory landscape marked by a number of important developments and shifts. A brief account of the evolution of nuclear regulation in the United Kingdom is provided below.

In terms of uranium governance before conversion, the ONR is responsible for implementing domestic and international legislation and agreements relating to safety, security and safeguards. The ONR is also responsible for monitoring compliance with UK regulations.

Safeguards

Within the United Kingdom, the UK Safeguards Office (UKSO) is responsible for overseeing the application of safeguards in the domestic nuclear industry. At a broader, policy level, the Department of Energy and Climate Change (DECC) is responsible for policy matters relating to safeguards. The UK Safeguards Office (UKSO) was transferred from the then Department of Trade and Industry (DTI) to what was HSE's Nuclear Directorate in 2007. The UKSO was then incorporated into the new ONR in 2011.

The UKSO serves three main functions:

1 To provide the UK Government with informed independent assessments of safeguards application and compliance in the UK, including being in a position to support and intervene as necessary with the international safeguards inspectorates of the European Commission and the IAEA and/or UK organisations subject to safeguards requirements, so that safeguards obligations for the UK are met in a proportionate manner;
2 To fulfil the international and domestic safeguards-related reporting obligations that are the direct responsibility of the UK Government (as opposed to nuclear operators in the UK);
3 To provide advice and support to the Department of Energy and Climate Change (DECC) and other government departments on safeguards implementation in the UK, the effectiveness of regulation and associated policy development.

In general terms, however, implementation and enforcement are carried out by the inspectorates of the IAEA and Euratom. There are no distinctly national safeguards in place in the United Kingdom. Rather, regulations reflect safeguards obligations under international treaties and agreements.

Euratom Safeguards

In the United Kingdom, the application of safeguards to uranium prior to the point of conversion occurs in the context of the Euratom Treaty of 1973. Natural uranium/UOC becomes subject to Euratom safeguards upon entry into the United Kingdom.

The UK began applying safeguards to imports of natural and enriched uranium under this treaty on 1 January 1973.[116] The Treaty is legally binding and affects all but the smallest quantities or certain ores. Indeed, while Euratom Regulation 9 excludes uranium ores containing less than 0.1 per cent uranium, Euratom safeguards 'require that any batch of yellowcake that rounds up to one kilogram is reportable'.[117]

The safeguards reporting requirements that derive from the Euratom Treaty are detailed in Commission Regulation (Euratom) 302/2005. This Regulation updated Commission Regulation (Euratom) 3227/76 of 19 October 1976 concerning application of the provisions on Euratom safeguards under Articles 78 and 79 of the Euratom Treaty. It is important to note that, under Commission Regulation (Euratom) 302/2005, natural uranium is subject to the same reporting requirements as any other nuclear material – Material Balance Report, Physical Inventory Listing, Advance Notification of Imports/Exports, and so on.

Euratom safeguards are applied at UK civil nuclear sites, including those that historically were used by the UK for military purposes.[118] This includes the conversion facility at Springfields. Euratom inspectors visit Springfields once a month, and there are two rigorous inspections a year.[119] These inspections involve a book inventory (every six months) and a physical inventory (every twelve months). During the physical inventory, Euratom inspectors will be on site for approximately one week, with the site shut down (uranium flow stopped) two weeks in advance.[120] In a worse-case scenario, it might take Euratom inspectors up to six months to detect a missing drum of UOC, but as outlined below in the section on nuclear material control and accountancy, it is likely that this would be picked up almost immediately by internal controls.[121]

IAEA Safeguards

Although the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) does not require nuclear-weapon states (NWS) to adopt safeguards, the United Kingdom has, along with the other NWS, concluded a voluntary offer safeguards agreement with the IAEA, in part to allay concerns expressed by non-nuclear weapons states (NNWS) that their nuclear industries could be at a commercial disadvantage.[122]

The UK voluntary agreement entered into force in 1978 and is a tripartite safeguards agreement between the UK, Euratom and the IAEA.[123] Under this agreement, the United Kingdom accepts the application of IAEA safeguards on 'all source or special fissionable material in facilities or parts thereof within the United Kingdom, subject to exclusions for national security reasons only'.[124] The agreement is implemented in the UK under the Nuclear Safeguards and Electricity (Finance) Act of 1978.[125]

Crucially, however, this agreement provides for the application of safeguards to uranium from the point of conversion, not before. Article 34 states that 'Safeguards under this Agreement shall not apply to uranium or thorium until they have reached the stage of the nuclear fuel cycle where they are of a composition and purity suitable for fuel fabrication or isotopic enrichment'.[126]

The United Kingdom also has an Additional Protocol (AP) with the IAEA and Euratom. The UK Additional Protocol was implemented in the United Kingdom by the Nuclear Safeguards Act 2000 and came into force in 2004.[127] In this agreement, the UK accepted measures that addressed the primary purpose of the Additional Protocol, namely to detect undeclared nuclear material and activities in NNWS, as well as measures that would improve the efficiency of IAEA safeguards in the UK. Consequently, Article 2 declarations are given on all work that is conducted in collaboration with, or is otherwise relevant to, a NNWS. No site declarations are given (and hence there is no provision for complementary access on sites, although complementary access is permitted to address questions or inconsistencies). It is worth noting that, in the case of research and development, the United Kingdom goes further than the model AP by declaring research and development carried out in collaboration with a NNWS if it involves nuclear material, because the IAEA might otherwise not be aware of such work.

As noted above, the Nuclear Safeguards Act 2000 is the implementing legislation for the AP in the UK. Moreover, the Nuclear Safeguards (Notification) Regulations 2004 under the 2000 Act make it an obligation for those conducting the activities mentioned in Annex I of the UK AP to notify the government of their existence, so that they can be requested to provide the necessary declarations.

All the information that the United Kingdom is obliged to declare under the AP is collected by the UK Safeguards Office at the ONR and declared to the Agency via Euratom on behalf of the British government. Euratom already has the necessary information in this regard by way of the nuclear material reporting requirements in place under existing Euratom regulations.

Nuclear Material Control and Accountancy

In the context of the United Kingdom's safeguards, security and safety obligations, the Office for Nuclear Regulation places great emphasis on nuclear material accountancy and control (NMA&C). The UK Safeguards Office provides guidance for nuclear operators based on 'extensive consultation with and substantial input from those across the UK nuclear industry involved in nuclear material accountancy'.[128]

The UKSO states that 'effective nuclear material accountancy is of fundamental importance for compliance with UK nuclear regulation and for independent verification by international nuclear safeguards inspectorates'.[129] The guidance issued by the UK Safeguards Office contains nearly one hundred good practices relating to NMA and safeguards and aims to support nuclear operators in fulfilling their safeguards and security obligations. Guidance covers everything from physical inventory taking (PIT) to on/off site movements of nuclear material. With regard to the transport of nuclear material, it is worth noting that each nuclear site has a nominated person with overall responsibility for nuclear material in transit to or from the location.[130]

In order to maximize plant efficiency, UK operators ordinarily apply strict NMA&C measures. Those measures applied by the operator at Springfields, for example, are more rigorous than what is required under the Euratom Treaty. While Euratom obligations require NMA&C reporting on the scale of a large warehouse, the operator at Springfields applies NMA&C at various sub-levels within the warehouse. Consequently, if a drum were to be stolen from Springfields, internal accounting procedures would likely pick this up within a matter of days or at the latest a couple of weeks.[131]

Enforcement

As mentioned above, there are no distinctly national safeguards in place in the United Kingdom. Consequently, safeguards-related enforcement action is first and foremost a matter for the Euratom inspectorate.

To this end, Article 83 of the Euratom Treaty states that, 'In the event of an infringement on the part of persons or undertakings of the obligations imposed on them by this Chapter, the Commission may impose sanctions on such persons or undertakings'. The Treaty sets out four sanctions of increasing severity:

1 Written warning;
2 Withdrawal of special benefits, such as financial or technical assistance;

3 Placing a facility for a period not exceeding four months under the administration of a person or board appointed by common accord of the Commission and the State having jurisdiction over the undertaking;
4 Total or partial withdrawal of source materials or special fissile materials.

Nuclear operators and relevant personnel in the United Kingdom have been subject to sanctions under Article 83 of the Euratom Treaty. For example, a 1992 Commission Decision addressed a warning to the UKAEA Dounreay site for failing to fulfil its reporting requirements under Euratom safeguards.[132] Then, in 1996, Jenson Tungsten Ltd. received a warning under Commission Decision 96/671/Euratom for inadequate nuclear materials accounting and its failure to declare in time a dispatch of a substantial part of its nuclear inventory.[133]

Enforcement actions are also provided for under the AP. In this case, however, enforcement actions are set out in the Nuclear Safeguards Act 2000 since this is the implementing legislation for the AP in the UK. According to Provision 9, offences under the Act are punishable by a fine or, in certain cases, imprisonment.[134]

Security

The Office for Nuclear Regulation (ONR) serves as the United Kingdom's designated competent civil nuclear security authority. Through its Civil Nuclear Security (CNS) programme, the ONR is responsible for approving security arrangements within the civil nuclear industry and enforcing compliance to prevent the theft or sabotage of nuclear or other radioactive materials, the sabotage of nuclear facilities, and to protect sensitive nuclear information.

ONR (CNS) conducts its regulatory activities on behalf of the Secretary of State for Energy and Climate Change under the authority of the Nuclear Industries Security Regulations 2003.[135] ONR (CNS) also undertakes the vetting of nuclear industry personnel with access to sensitive nuclear material or information. It works in close conjunction with nuclear security policy officials in DECC and with other government departments and agencies, as well as with overseas counterparts. Annual reports are provided to the Secretary of State for Energy, Department of Energy and Climate Change (DECC) by the Deputy Chief Inspector (Civil Nuclear Security), who heads ONR (CNS).

Through the CNS Programme, ONR regulates the security of:

- Nuclear and other radioactive materials on civil licensed nuclear sites;
- Nuclear materials off licensed sites;
- Domestic transport of nuclear materials by road, rail and sea; and
- International transport of nuclear and other radioactive materials by UK flagged vessels;
- Sensitive nuclear information wherever it is held

It does this in accordance with the Nuclear Industries Security Regulations (NISR) 2003 (as amended) and the Ionising Radiation Regulations 1999.

The CNS Programme at the ONR is also responsible for overseeing the implementation of the United Kingdom's obligations under the Convention on the Physical Protection of Nuclear Material (CPPNM) and taking account of the recommendations made by the IAEA in its publication, *The Physical Protection of Nuclear Material and Nuclear Facilities* (INFCIRC/225/Rev5). The ONR also produces Technical Assessment Guides (TAG) with the aim of advising and informing its security inspectors in the exercise of their regulatory judgement.[136]

In 2011, a team of nuclear security experts visited the UK as part of the International Physical Protection Advisory Service (IPPAS).[137] The team assessed the UK nuclear security framework, including laws and regulations pertaining to nuclear material and nuclear facilities. The IPPAS team also assessed compliance with the CPPNM and INFCIRC/225. The team visited the Sellafield civil nuclear site and Barrow port to see how nuclear security measures are implemented in practice. The UK was the first nuclear weapons state to open up its civil nuclear security regime for inspection in this way.

Enforcement
The United Kingdom has also introduced a number of domestic legislative measures to fulfil its obligations under the CPPNM. The offences required by the CPPNM are implemented in UK law through a mixture of generally applicable criminal offences (for example murder, criminal damage and theft) and by the provisions of the Nuclear Material (Offences) Act 1983 passed to implement the CPPNM. This Act was brought into force in 1991 to coincide with UK ratification of the CPPNM.[138]

The 1983 Act created offences to fill particular gaps in UK law and also created extraterritorial offences as required by the CPPNM. Thus section 1 of the Act in effect created extraterritorial versions of a number of existing UK offences, while section 2 created new offences constituted by conduct either within or outside the UK.[139] The 1983 Act also includes a reference to uranium prior to the point of conversion, specifically 'uranium containing the mixture of isotopes as occurring in nature other than in the form of ore or ore-residue'.[140]

Civil nuclear security in the United Kingdom is also supported by a dedicated policing body, the Civil Nuclear Constabulary (CNC). The CNC operates across the civil nuclear sector, providing protection for civil nuclear licensed sites, safeguarding nuclear materials, nuclear site operators, policing and nuclear regulators, and interlinking with Home Office forces. Previously the United Kingdom Atomic Energy Authority Constabulary, the organisation was renamed the Civil Nuclear Constabulary in 2005.[141]

The CNC is overseen by the Civil Nuclear Police Authority (CNPA), which in turn operates under the strategic direction of the Department of Energy and Climate Change (DECC). Set up under the Energy Act 2004, the role of the CNPA is to maintain the efficiency and effectiveness of the CNC, ensuring that the organisation meets the policing requirements of primary stakeholders in the nuclear industry.[142] Policing requirements at each nuclear site are agreed with nuclear operators in accordance with the Nuclear Industries Security Regulations 2003 (NISR) and approved by the ONR.

Threat Assessment

The Deputy Chief Inspector (Civil Nuclear Security) is a member of the UK's Joint Terrorism Analysis Centre (JTAC) oversight board. The civil nuclear security programme also maintains a permanent presence within JTAC. This presence guarantees the fastest possible identification and notification of intelligence that indicates changes to present and foreseeable threats to civil nuclear activities.[143]

The ONR (CNS) representative in JTAC also contributes to the regular production of a comprehensive nuclear threat assessment, from which the UK's design basis threat – the nuclear industries malicious capabilities planning assumptions paper (NIMCA) – is compiled. This aims to provide a common basis for determining the industry's nuclear security needs. This document is protectively marked and is not available for public reference.[144]

Under the Nuclear Industries Security Regulations (NISR) 2003, both responsible persons at nuclear facilities and carriers are required to report a range of events and occurrences that may be of interest from a security viewpoint, including perceived threats.[145]

Once again, however, it is important to note that uranium prior to the point of conversion does not fall under the requirements set out in UK nuclear security regulations.

Safety

Historically a greater emphasis has been placed on safety than security when it comes to regulation; the regulation of nuclear security in the context of contemporary understanding did not gain momentum until the 1990s. Before this date, site plans, for example, would be assessed primarily from a safety perspective, with security featuring less prominently. As part of this process, an operator would make an application for a new nuclear site, carry out preliminary safety reports and pass these to the regulator for approval. However, no such measures were in place for security, which was assessed and dealt with on a less structured basis. BFNL, for example, consulted with MI5 on security issues.

Uranium prior to the point of conversion is subject to all relevant provisions of UK health and safety legislation. Under the Health and Safety at Work etc. Act 1974, UK employers are responsible for ensuring the safety of both their workers and the general public, including operators of nuclear sites. This responsibility is reinforced for nuclear installations by the Nuclear Installations Act 1965 (NIA) and its subsequent amendments. Under the relevant statutory provisions of the NIA, a site cannot have nuclear plant on it unless the user has been granted a site licence by the Health and Safety Executive (HSE).

The NIA stipulates that only a corporate body – a legally united body that can act as one individual, such as a registered company or a public body – can hold such a licence. This licensing function is administered on HSE's behalf by the Office for Nuclear Regulation (ONR). The legal regime is complemented by the Ionising Radiations Regulations 1999 (IRRs), which provide for the protection of workers in all industries from ionising radiations, and by the generality of health and safety regulations which ONR also enforces on nuclear sites.

The ONR periodically issues guidance to its inspectors in the form of Safety Assessment Principles for Nuclear Facilities (SAPs). This guidance is designed to support regulators in the nuclear permissioning process. First published in 1979, the most recent version of the SAPs was published in 2006.

In the context of the SAPs, uranium prior to the point of conversion is included in the definition of 'nuclear matter'.[146] The most recent SAPs set out a range of provisions aimed at ensuring safety with regard to nuclear materials. For example:

- **Nuclear matter should not be generated on the site, or brought onto the site, unless sufficient and suitable arrangements are available for its safe management**. Arrangements should include handling provisions; flasks, containers, and other packages; treatment and processing facilities; designated storage areas, of appropriate capacity, including spare and buffer capacity where necessary; and rail and road transport provisions.

- **Nuclear matter should be appropriately controlled and accounted for at all times.** This includes: origin and ownership; the receipt of nuclear matter onto the site; shipments of nuclear matter from the site; internal movements of nuclear matter on the site and within facilities; nuclear matter stored or accumulated on the site; and details of containers and packaging.[147]

See Annex C for an overview of key points in the development of nuclear regulations.

4. Export/Import

The UK's export controls on uranium are defined by membership of the Nuclear Suppliers Group (NSG) and membership of the EU. As a member of the NSG, the UK is required to control uranium ore concentrate. This is achieved in practice through EU regulation 428/2009,[148] which is implemented at the UK level through the UK Strategic Export Controls List.[149] However, the EU regulation is in some ways tougher than the NSG controls, extending controls to smaller quantities of yellowcake than the NSG.

Specifically, as derived from the EU regulation, under designation 0C001 on the UK's dual-use list –'Category 0: Nuclear Materials, Facilities and Equipment' – UK export regulations cover natural uranium 'in the form of metal, alloy, chemical compound or concentrate', although 0C001 does not provide for control where four grams or less are 'contained in a sensing component in instruments'.[150] The NSG requirement is for exports of 500 kg or more of natural uranium to be reported.

A 'single individual export licence' (SIEL) [151] (the default) or an 'open individual export licence' (OIEL)[152] is required to export uranium ore concentrate. For both types of licence, an exporter needs to provide details of both the end user and the end use. As uranium ore concentrate is on the 'trigger list', the UK requires government-to-government assurances unless a bilateral nuclear cooperation agreement is already in place with a particular country. Trigger list exports to all destinations, including those in the EU, require an export licence. EU and UN sanctions also ban the export of natural uranium to Iran and North Korea. In practice, export licences for transfers to countries with nuclear weapons programmes, such as Israel and Pakistan, would also not be issued.

In terms of importing uranium ore concentrates (commodity code for importing: 2612101000) to the UK, individual import licences are required 'unless consigned from a member state of the European Community'. On 26 March 2007, ONR Civil Nuclear Security (CNS) took over responsibility for these individual licences from the Import Licensing Branch (ILB) of the Department for Business Enterprise and Regulatory Reform (DBERR). In short, UK importers must 'apply to CNS for a licence to import' uranium ore concentrates from outside the EU. ONR also notes that, 'in order for the UK to meet its international obligations it is unlikely that a licence would be granted to import nuclear materials from a state not party to the Convention on the Physical Protection of Nuclear Material'.[153] Specific restrictions also exist on imports from Iran and North Korea.[154]

5. Transportation

The UK applies transport regulations for nuclear material derived from IAEA standards on safety and security, and the Radioactive Materials Transport (RMT) team within ONR, which covers road, rail, sea and air, oversees them.[155] However, for yellowcake and UO_3 'no real security measures are applied'.[156] For example, there are no armed escorts or GPS trackers on the lorries.[157] In the UK all nuclear material at the front end of the fuel cycle is transported by road.[158]

According to a recent report on the transport of nuclear materials by sea in northern Europe, all of the uranium shipped to Springfields for conversion services 'currently comes as UO3 from the Cameco Blind River Refinery in Ontario, Canada'. This is 'transported to the UK by sea'[159] through the port of Liverpool. The two shipping companies cited as 'most frequently used' in the transport of fuel cycle materials 'through Northern European waters' are Atlantic Container Line (ACL) and Uranium Asset Management (UAM). ACL has five large roll-on/roll-off (RORO) vessels. UAM also uses RORO ships, although does not own them. According to one report, 'front end materials are carried on general cargo vessels.' [160]

In terms of the regulations covering transport in this area, the IAEA's Regulations for the Safe Transport of Radioactive Material governs the transport of nuclear materials. Moreover, the International Maritime Dangerous Goods (IMDG) Code 'also has requirements for carrying radioactive materials and the Irradiated Nuclear Fuel (INF) Code specifies ship requirements when carrying certain types of radioactive materials'. [161] The IMDG Code 'has some requirements for the carriage of radioactive materials but most can be carried on board container ships, roll-on/roll-off ships or general cargo ships. These of course are subject to standard inspections and requirements for regular cargo ships'. Furthermore, 'For carrying other dangerous goods on UK vessels, there are some additional ship requirements to do with fire prevention & extinction. A compliance certificate is obtained but ships carrying radioactive materials are not required to have this'.[162]

The CPPNM imposes specific requirements regarding the transport of natural uranium. Annex 1 of the Convention states that, 'for natural uranium other than in the form of ore or ore-residue, transportation protection for quantities exceeding 500 kilograms uranium shall include advance notification of shipment specifying mode of transport, expected time of arrival and confirmation of receipt of shipment'.[163] As already mentioned, these provisions of the CPPNM were implemented in the United Kingdom through the Nuclear (Offences) Act 1983.

These requirements are complemented by the provisions of the Nuclear Industries Security Regulations 2003. In particular, the operator (or his agent) is responsible for ensuring that:

- an approved carrier is used for road and rail movements within the UK (even where a non-British carrier is involved);
- if the operator is the shipper, he makes advance notification to the receiving facility and receives confirmation of the latter's readiness to accept delivery;
- appropriate containers (packages) are used to ensure security; and
- if the operator is the recipient, they confirm their readiness to accept delivery and promptly notify arrival of the consignment to the shipper.

Furthermore, the 2003 Regulations require that 'a nuclear operator's arrangements for the preparation of receipt and dispatch of nuclear material will be detailed in his Security Plan for the premises concerned, a plan which requires separate approval under the regulations'.[164]

6. Conclusions

The United Kingdom is a uranium 'destination state', an importer and consumer of natural uranium, initially for defence and later for civil purposes. It is one of only six countries with a commercial-scale conversion facility. Uranium has never been mined in the United Kingdom, although it has been prospected for, and the UK has invested, and been directly involved, in uranium mining in other countries since the 1940s. Uranium has traditionally been imported into the United Kingdom in the form of yellowcake, although for the past five years uranium has only been imported as UO_3. Euratom safeguards are applied to natural uranium upon entry to the United Kingdom, with Euratom inspectors visiting the Springfields conversion once a month and carrying out two rigorous inspections (a book and a physical inventory) a year.

Theft or diversion of uranium would quickly be detected, particularly as NMA&C measures are applied at Springfields at the sub-facility level in order to maximize plant efficiency. Missing drums of UOC are likely to be detected in a matter of weeks if not days. It is perhaps more likely that theft or diversion of uranium would occur during transit within the United Kingdom, since only minimal security measures are applied for lorries carrying UOC, which do not have GPS trackers or armed escorts. Again, however, any such occurrence would be rapidly detected, as under Euratom safeguards it is necessary to give advance notification of imports of UOC.

In more general terms, the UK has a robust nuclear governance architecture that has undergone significant changes in recent years. The Office for Nuclear Regulation (ONR), for example, was formed in April 2011 and constitutes a key step in the UK government's plans to establish an independent nuclear regulator that will ultimately become an independent statutory corporation. The ONR brings together safety, safeguards and security under one dedicated organisation and aims to harmonise and strengthen the UK approach to regulation in this field. These developments indicate a strong commitment to implementing the required and necessary nuclear governance measures on the part of the United Kingdom.

Annex A: Research questions

- What is the evolution/history of domestic regulation (safety, security safeguards) governing natural uranium (uranium ore concentrate) from the very first regulation until today?
- At what point does natural uranium become subject to domestic safeguards?
- How does the UK implement international treaties and regulations (i.e. CPPNM, UNSC resolutions) and IAEA Recommendations and Guidelines (i.e. INFCIRC/225.Rev5)
- What is the UK's domestic regulatory interface between nuclear security, safety, and safeguards?
- How does the UK implement and report the Additional Protocol? How does the UK's application of the Additional Protocol compare with other NWS and NNWS?
- How do the regional/multilateral export control regimes that the UK follows filter down into domestic nuclear law?
- How are laws enforced (inspection regime, penalties, etc.)?
- What is the licensing/permit process for UK industry?
- How many bilateral agreements does the UK have for *importing* uranium?
- What are the national requirements for short- and long-term threat assessments?
- How long before a missing drum of uranium ore concentrate would be noticed?
- Which mines (outside the UK) have provided uranium for nuclear weapons purposes? How much natural uranium has been used for civil uses, and how much for weapons purposes?
- Is trade in natural uranium between the UK and other countries reported? And if so, where and to what level of detail?
- What are the transportation rules and regulations (safety and security) governing natural uranium?
- How is natural uranium transported to conversion centres?
- What types of domestic inventory control measures are in place?

Annex B: Operating and decommissioned UK civil nuclear facilities

This annex provides a brief overview of operating and decommissioned civil nuclear facilities in the UK. Nuclear power today generates around 18% of the UK's electricity. Sixteen nuclear reactors are operational at nine plants, although all but one are scheduled to be retired by 2023. The majority of the modern reactors (14) are advanced gas-cooled reactors (AGR). There is one pressurized water reactor (PWR) and one Magnox reactor (this is due to close in 2014). There is also a nuclear reprocessing plant at Sellafield. The UK is building a new generation of nuclear power plants, and the government aims to have 16GWe of new nuclear capacity by 2030.[165]

Date of First Power at the UK's Nuclear Facilities			
Operational	*Decommissioned*	*Facility Name*	*Reactor Type*
1950s	1994	Dounreay	Fast Breeder and Test reactors
1956	2003	Calder Hall	Magnox
1959	2004	Chapelcross	Magnox
1962	1989	Berkeley	Magnox
1962	2002	Bradwell	Magnox
1964	1990	Hunterston A	Magnox
1965	2000	Hinkley Point A	Magnox
1965	1991	Trawsfynydd	Magnox
1965	2006	Dungeness A	Magnox
1966	2006	Sizewell A	Magnox
1967	2012	Oldbury	Magnox
1971	2014-2015 (estimate)	Wylfa	Magnox
1976	2023 (estimate)	Hinkley Point B	AGR
1976	2023 (estimate)	Hunterston B	AGR
1983	2018 (estimate)	Dungeness B	AGR
1983	2019 (estimate)	Hartlepool	AGR
1983	2019 (estimate)	Heysham 1	AGR
1988	2023 (estimate)	Heysham 2	AGR
1995	2035 (estimate)	Sizewell B	PWR

Other fuel cycle-related facilities

Sellafield[166]

Sellafield is the largest and most diverse nuclear site in Europe and contains one of the largest inventories of untreated nuclear waste in the world. There are over 1,000 interdependent nuclear facilities at the Sellafield site. The operations at Sellafield range from hazard and risk reduction, decommissioning, reprocessing and fuel manufacturing to nuclear waste management. The facility has been reprocessing nuclear fuel for over fifty years and continues to do so. The reprocessing at Sellafield allows 97% of used fuel to be recycled into new fuel.

Sellafield Ltd is owned by Nuclear Management Partners, a parent body organization made up of URS, Areva and AMEC. Nuclear Management Partners owns the site on behalf of the Nuclear Decommissioning Authority (NDA), a non-departmental public body created through the Energy Act in 2004. The NDA owns a total of nineteen sites and the associated civil liabilities and assets previously under control of the UKAEA and BNFL. Sellafield Ltd. holds and is responsible for the site licence at Sellafield.

Springfields[167]

Since its establishment in 1946, Springfields has provided nuclear fuel, chemical and mechanical fabrication for AGR and Magnox fuel, and conversion for uranium hexafluoride. Springfields was the first plant in the world to produce fuel for commercial power stations, and today it meets most of the fuel requirements for the UK's nuclear power stations. Around 15% of all of the electricity generated in the UK comes from power stations using nuclear fuel manufactured at Springfields. The main activities taking place at Springfields today are the manufacture of uranium hexafluoride, processing of residues, decommissioning of redundant plants and buildings, and production of oxide fuels and fuel products.

Springfields is run and operated by Springfields Fuels Ltd. and is under the management of Westinghouse Electric UK Ltd. Westinghouse manages the site under a long-term lease from the NDA.

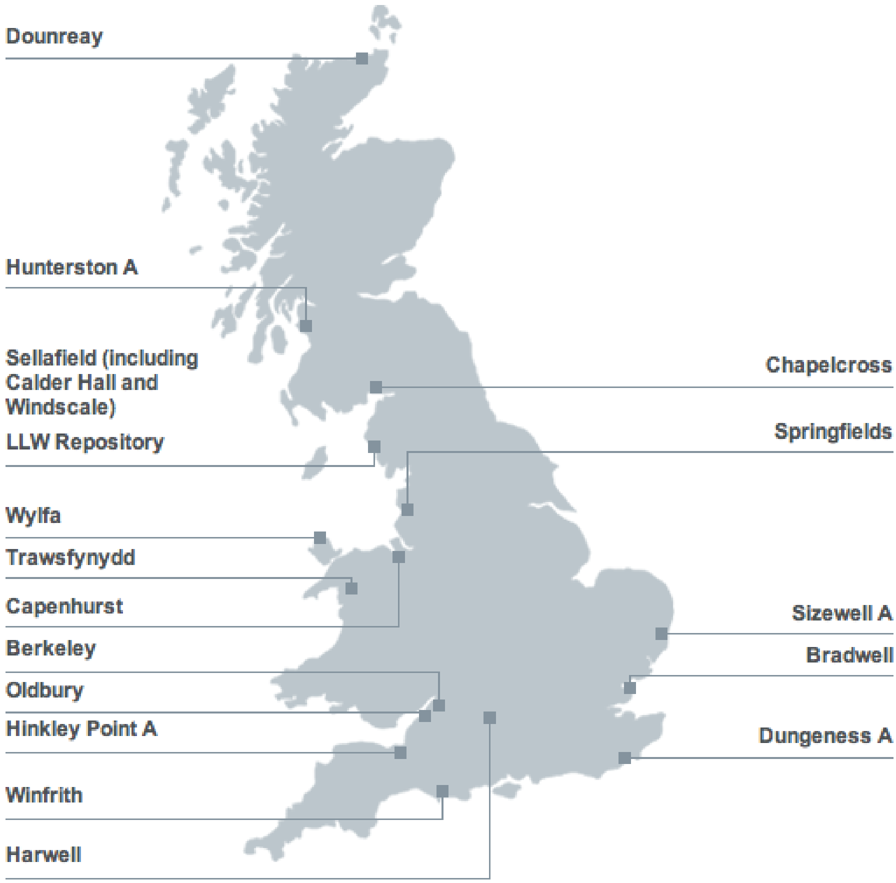
Capenhurst[168]

In 2012 the Capenhurst sites were integrated under Capenhurst Nuclear Services (CNS). Until this point, there were two adjacent facilities at Capenhurst, one run by the NDA and the other run by Urenco. Capenhurst (NDA) was home to a gaseous diffusion uranium enrichment plant originally built for defence purposes in 1946. The facility was subsequently transformed to produce low-enriched uranium for nuclear reactors. The Capenhurst (NDA) site ceased uranium enrichment activities in 1982, and the facilities began to be decommissioned. The site is currently used for the storage of uranic materials from Sellafield and from the uranium enrichment process at the Capenhurst (Urenco) site.

Capenhurst (URENCO) produces enriched uranium for nuclear fuels at its gas centrifuge facility. In 2011 the NDA signed an agreement with Urenco UK to transfer the activities carried out at the Capenhurst (NDA) site to Urenco. A new Urenco Group company, Capenhurst Nuclear Services (CNS), was established to contract with NDA. CNS is a wholly owned subsidiary of Urenco Ltd. that now has a long-term contract with NDA to run and operate the integrated site.

Harwell[169]

Harwell was established in 1946 as Britain's Atomic Energy Research Establishment. The Harwell site consisted of five research reactors, research facilities, plutonium handling facilities, radioactive laboratories, nuclear waste treatment facilities and storage facilities. The site is currently being decommissioned: two of the reactors have been removed, as has the fuel from the other three. The remaining facilities are also being decommissioned. These activities are expected to be completed by 2025. Research Sites Restoration Ltd. (RSRL) manages and operates Harwell on behalf of the NDA. RSRL holds the site licence and discharge authorization for the site.



Source: http://www.nda.gov.uk/sites/
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Annex C: National Archive References [170]

Reference	Date Range	Collection	File
AB 7/18211	01/01/66-31/12/66	Records of the UKAEA and its predecessors	The transport of irradiated natural uranium fuel elements: Safety Report.
AB 16/2851	01/01/58-31/12/62	Records of the UKAEA and its predecessors	Procedure for authorization of exports of fissile material and of natural or depleted uranium
AB 42/20	01/01/72-31/12/75	Records of the UKAEA and its predecessors	Transfer of responsibility for procurement of supplies of uranium (U3O8) to BNFL
AB 42/228	01/01/73-31/12/77	Records of the UKAEA and its predecessors	Loan of uranium ore concentrates to BNFL for hire to Urenco
AB 48/77	01/01/63-31/12/67	Records of the UKAEA and its predecessors	Procedure for authorization of exports of fissile material and of natural or depleted uranium
AB 48/174	01/01/62-31/12/65	Records of the UKAEA and its predecessors	Supply of material under the civil bilateral agreement; enriched uranium for general purposes in the UK and for export
AB 48/624	01/01/66-31/12/72	Records of the UKAEA and its predecessors	Uranium: new contracts for delivery in the 1970s, and negotiations with HM Treasury and Ministry of Technology on the financing of imports
AB 48/1190	01/01/74-31/12/75	Records of the UKAEA and its predecessors	Extraction of uranium from seawater: UKAEA/BNFL/CEGB working party
AB 48/1324	01/01/74-31/12/75	Records of the UKAEA and its predecessors	Study of security of uranium supplies to the UK

Reference	Date Range	Collection	File
AB 48/1408	01/01/70-31/12/73	Records of the UKAEA and its predecessors	USA: imports and exports of nuclear material and services; enriched uranium for the UK
CAB 126/58	18/01/45-09/04/1945	Records of the Cabinet Office	Uranium and thorium: sources of supply and allocation
CAB 126/59	09/04/45-15/09/45	Records of the Cabinet Office	Uranium and Thorium: sources of supply and allocation
CAB 126/60	26/09/45-12/12/46	Records of the Cabinet Office	Uranium and Thorium: sources of supply and allocation
CAB 126/61	13/12/46-29/03/50	Records of the Cabinet Office	Uranium and Thorium: sources of supply and allocation
CAB 126/62	19/04/50-31/12/52	Records of the Cabinet Office	Uranium and Thorium: sources of supply and allocation
CAB 126/63	29/01/53-04/03/55	Records of the Cabinet Office	Uranium and Thorium: sources of supply and allocation
CAB 126/64	18/10/43-09/07/44	Records of the Cabinet Office	Uranium and Thorium: sources of supply : Belgian Congo
EG 9/29	01/01/63-31/12/72	Records created or inherited by the Department of Energy	British Nuclear Fuels Ltd (BNFL): uranium procurement
FCO 93/1618	01/01/78-31/12/78	Records of the Foreign and Commonwealth Office and predecessors	Export of uranium to Israel

Reference	Date Range	Collection	File
FO 93/18/67	01/09/78-01/09/78	Records created or inherited by the Foreign Office	Exchange of Notes concerning the application of safeguards to the proposed export to Brazil of uranium enriched in the UK by Urenco
FO 93/68/134	12/05/95-16/05/1995	Records created or inherited by the Foreign Office	Exchange of Notes concerning the Export of Uranium to Norway Place of Signing: Oslo
FO 93/77/164	11/07/49-11/07/49	Records created or inherited by the Foreign Office	Exchange of Letters regarding the Export of Uranium etc. to UK place of Signing: Lisbon
FV 70/28/1	01/01/73-31/12/77	Records created or inherited by the Department of Trade and Industry	Part 1 of 2 Registered Files
FV 70/28/2	01/01/73-31/12/77	Records created or inherited by the Department of Trade and Industry	Part 2 of 2 Registered Files
PREM 19/924	27/09/79-22/03/82	Records of the Prime Minister's Office	Soviet Union Trade Relations: credit agreement; uranium enrichment contract; grain sales; controls on strategic exports.

Annex D: Key points in the development of UK nuclear regulations

Nuclear regulation in the United Kingdom has a relatively long and colourful history. From the nascent legislative framework of the 1950s, to the complex regulatory environment of the 1990s and early 2000s, to recent efforts to streamline and centralise regulatory bodies and functions, nuclear regulation in the UK has undergone significant change. This section sets out some of the key development in the evolution of nuclear regulation in the United Kingdom.

The Origins of Nuclear Regulation: 1950-1970

The early years of the UK nuclear industry were characterised by a lack of domestic governance. The Atomic Energy Act was passed in 1946, but this legislative measure was simply an initial, simplistic attempt to regulate what was then a new and largely unknown industry.[171] It was only with the establishment of the UKAEA in 1954 that nuclear regulation began to make any significant advances. The UKAEA was formed as a result of the Atomic Energy Authority Act 1954. Chapter 32 of this Act gave the UKAEA powers:

- To produce, use and dispose of atomic energy and carry out research into any matters connected therewith;
- To manufacture or otherwise produce, buy or otherwise acquire, store and transport any articles which in the opinion of the Authority are, or are likely to be, required for or in connection with the production or use of atomic energy or such research; and
- To manufacture or otherwise produce, buy or otherwise acquire, treat, store, transport and dispose of any radioactive substances'.[172]

At the time, the UKAEA was responsible for both the civil and military nuclear programmes in the UK. Early achievements included opening the world's first full-scale nuclear power station at Calder Hall and the Dounreay Fast Reactor, which went critical in 1959.[173]

The next major piece of domestic legislation in the context of nuclear regulation came in the form of the Nuclear Installations Act 1959, which established the Nuclear Installations Inspectorate within the Ministry of Power. The move to legislate at this time was influenced by a major incident at the Windscale nuclear site on 8 October

1957.[174] The Nuclear Installations Inspectorate was given responsibility for licensing future civil reactors in the UK.

This Act was followed, six years later, by the Nuclear Installations Act 1965. The 1965 Act consolidated the Nuclear Installations Acts of 1959 and 1965 and imposed licensing and other regulatory requirements on nuclear facilities and materials. The 1965 Act formed the basis for much of the subsequent legislation on nuclear regulation. The Nuclear Generating Stations (Security) Regulations 1996, for example, precursor to the Nuclear Industries Security Regulations 2003, draws on definitions set out in the 1965 Act.

Nuclear Regulation, Safety and Safeguards: 1970-1990

It is important to note that the emphasis was firmly on safety in the formative years of UK nuclear regulation. The Windscale incident had a lasting impact and effectively framed developments in an industry that was rapidly expanding. In 1971, the UKAEA was split and a portion of its responsibilities – for fuel production, isotope production and radiological protection – were transferred to other organisations. A number of separate entities were created, including BNFL, Amersham International and URENCO. The National Radiological Protection Board also took on some of the UKAEA's responsibilities following passage of the Radiological Protection Act 1970.

At this time, there was little interest in the security aspect of the nuclear industry. The UKAEA Constabulary had existed since 1955 with the task of policing the majority of UKAEA establishments. However, this force, initially numbering some 320 officers, was unarmed and underwent a series of reductions throughout the 1960s and early 1970s.[175] It was only in 1976 that the force was armed as a result of the Atomic Energy Authority (Special Constables) Act 1976.

More generally, archival sources show that, in the mid-1970s, security occupied a minor role in the minds of policy-makers. The UK Home Office and the Ministry of Defence (MOD) were struggling to quantify the threat and the necessary response, as shown by correspondence from 1974 stating, '[t]he threat of terrorist activity in the UK is obviously real but there is no intelligence evidence to suggest that any terrorist group is planning an attack upon any element of the UK nuclear programme.'[176]

In this context, safeguards and safety were the main areas of regulatory development. As mentioned above, the United Kingdom began applying Safeguards to imports of natural and enriched uranium under the Euratom Treaty on 1 January 1973. This was followed by the voluntary agreement to apply IAEA safeguards, agreed between the United Kingdom, Euratom and the IAEA in 1978. Indeed, the UK has consistently advocated strong safeguards. In a speech on 19 May 1977 at Chatham House, the Secretary of State of the Foreign and Commonwealth Office stated that 'as part of the overall UK position on nuclear non-proliferation it was necessary to strive constantly to make the international safeguards system as watertight as possible'.[177] In this regard, the UK supported the general application of full fuel-cycle safeguards to the IAEA and drew up a model agreement to allow nations not party to the NPT to accept full fuel cycle safeguards.

On the safety front, a major piece of legislation came in the form of the Health and Safety at Work etc. Act 1974. Described as a 'bold and far-reaching piece of legislation' by John Locke, the man who would become the first Director of the Health and Safety Executive the following year, the Act made UK employers, including nuclear operators, responsible for ensuring the safety of both their workers and the general public.

This was followed by the establishment of the Health and Safety Executive in 1975. A number of regulatory and scientific organisations were transferred to HSE at this time, including the Nuclear Installations Inspectorate.

The 1980s saw a number of legislative measures, most notably the Nuclear Material (Offences) Act 1983 passed to implement the CPPNM and signed by the United Kingdom in 1980. However, this Act did not come into force until 1991, when the United Kingdom ratified the CPPNM. This was followed by the Ionising Radiations Regulations 1985, which applied new measures, including restriction of exposure, designation of controlled areas and of classified persons, and control of radioactive substances to work with ionising radiation.

Safety, Safeguards and Security post-1990

From 1971 through to the early 1990s, the UKAEA Security Directorate, while fully embedded in the UKAEA, acted on behalf of the Department of Trade and Industry to help set standards and audit security on both UKAEA and other civil nuclear licensed sites (i.e. those of BNFL and URENCO) which were subject to ministerial direction under the terms of the Atomic Energy Act of 1971. However, as already mentioned, security was less of a priority than safety and safeguards during this period.

Threat perceptions related to the prospects for nuclear terrorism began to increase in some quarters during the 1990s, and the regulation of nuclear security in the context of the contemporary understanding of the term therefore began to develop momentum. The end of the Cold War prompted widespread fears regarding so-called 'loose nukes' in the former Soviet Union. Throughout the 1990s, there were also concerns that nuclear materials might become the target for terrorists rather than a fully developed weapon. In the United Kingdom, for example, 'Al-Qaeda's desire to get hold of nuclear material is longstanding and was recognised by British intelligence at least as early as 1998'.[178]

In this context, the mid-1990s saw a shift in attitudes towards nuclear security, and this was reflected in regulatory changes. The UKAEA Security Directorate became the Directorate of Civil Nuclear Security (DCNSy), and its position was modified by the government to make more explicit its independence of action in nuclear security regulation, acting as the technical arm of the DTI, the statutory regulator.[179] In terms of operations, it is worth noting that, despite this change, the DCNSy remained 'tenuously linked to the UKAEA, reliant on UKAEA simply for pay and rations administration'.[180] Although the Director continued to report formally to the Chairman of the Board of the UKAEA, the DCNSy was outside the UKAEA Chief Executive's line of responsibility. In practice, the DCNSy worked for the DTI on a day-to-day basis.

The DCNSy was formally transferred from the UKAEA to the DTI on 1 October 2000 in response to a recommendation by the Trade and Industry Committee of the House of Commons, following an inquiry into various safety and security issues at the Dounreay facility.[181] It was felt that the existing structure whereby the Government's security regulator was legally a component of a nuclear operator, itself subject to regulation, was untenable and contrary to guidelines set out by the IAEA.[182] The new organisation, the Office for Civil Nuclear Security (OCNS), functioned within the Department of Trade and Industry as an independent unit, with full autonomy in regulatory matters. The OCNS remained part of the Department of Trade and Industry until 2007, at which point it was relocated within the Health and Safety Executive.

In terms of safety and safeguards, the regulatory landscape underwent little substantive change throughout the 1990s. While there were advances – the Nuclear Safety Research Management Unit (NSRMU) was established within the Health and Safety Commission in 1990 – there were no major developments until 2000, when the UK Additional Protocol was implemented by the Nuclear Safeguards Act 2000. The UKAP came into force in 2004. This was followed, in 2005, by Commission Regulation (Euratom) 302/2005, a significant update in Euratom safeguards reporting requirements and the first since 1976.

More recently, the mid-2000s represented an important milestone in the evolution of UK nuclear regulation. The government's approach to nuclear regulation was influenced by the findings of a series of reports, such as the Hampton Report in 2005 and the Stone report in 2008. Recommendations in the Hampton Report, for example, influenced the decision to transfer the security activities of the Office for Civil Nuclear Security (OCNS) to the Health and Safety Executive (HSE) in April 2007.

As mentioned earlier, changes at this time were part of a broader effort to consolidate and streamline the UK nuclear regulatory structure. This effort reached its latest stage in 2011 with the establishment of the ONR, bringing UK safety, safeguards and security regulatory functions under one organisation.

Annex E: Abbreviations

ACL	Atlantic Container Line
AERE	Atomic Energy Research Establishment
AGR	Advanced Gas-Cooled Reactor
AMSSO	Air Ministry Special Signals Office
AP	Additional Protocol
AUAM	Advanced Uranium Asset Management
AUM	Advanced Uranium Management
BCUPD	British Civil Uranium Procurement Directorate
BNFL	British Nuclear Fuels Limited
CEGB	Central Electricity Generating Board
CO	Cabinet Office
CDA	Combined Development Agency
CDC	Combined Development Committee
CDT	Combined Development Trust
CNC	Civil Nuclear Constabulary
CNPA	Civil Nuclear Police Authority
CNS	Civil Nuclear Security
CPC	Combined Policy Committee
CPPNM	Convention on the Physical Protection of Nuclear Material
DECC	Department of Energy and Climate Change
DTI	Department of Trade and Industry
DWP	Department for Work and Pensions
FCO	Foreign and Commonwealth Office
FO	Foreign Office
FOM	Dutch Foundation for Fundamental Research on Matter
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
IMDG	International Maritime Dangerous Goods
INF	Irradiated Nuclear Fuel
INFCIRC	Information Circular
IPPAS	International Physical Protection Advisory Service
IRR	Ionizing Radiation Regulations
JSM	Joint Staff Mission

JTAC	Joint Terrorism Analysis Centre
NA	National Archives
NDA	Nuclear Decommissioning Authority
NIA	Nuclear Installations Act
NIMCA	Nuclear Industries Malicious Capabilities Planning Assumptions
NISR	Nuclear Industries Security Regulations
NMA&C	Nuclear Material Control and Accountability
NNWS	Non-Nuclear Weapons State
NPT	Non-Proliferation Treaty
NSG	Nuclear Suppliers Group
NWS	Nuclear Weapons State
ONR	Office for Nuclear Regulation
PIT	Physical Inventory Taking
PWR	Pressurized Water Reactor
RMT	Radioactive Materials Transport
RORO	Roll-on Roll-off
SAP	Safety Assessment Principles for Nuclear Facilities
SIEL	Single Individual Export Licence
TAG	Technical Assessment Guides
TRCL	The Radio-Chemical Center Limited
UAM	Uranium Asset Management
UKAEA	United Kingdom Atomic Energy Authority
UKSO	United Kingdom Safeguards Office
UOC	Uranium Ore Concentrate

Notes

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27 Despite intense searching to date, the institutional roles of D.E.H Pederson and Gordon-Munro have yet to be uncovered. CAB 126/61 (Redacted paragraph in draft letter to Gordon-Munro from D.E.H. Pederson, May 6th, 1947).

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