

SELLAFIELD – A natural reaction



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Controversy creates mythology. Sellafield is rarely out of the news, and the issues surrounding it are usually contentious ones. Nature, you might be led to believe, is under siege in Cumbria as a consequence of nuclear activities.

The reality, happily, is different, and you do not need to accept the word of Sellafield's operators for that. Last year, Luke Henderson, a 20-year-old physics student from Barrow-in-Furness, took a holiday job at Calder Hall, the nuclear power station on the Sellafield site operated by British Nuclear Fuels plc (BNFL), and he arrived well aware of the lurid stories of deformed fish and vanishing bird-life which occupy the attention of the more gullible (no pun intended) sections of the media from time to time.

Luke decided to carry out some investigations to satisfy his own curiosity. During his lunch breaks he became a nature detective, and he was astonished by what he discovered.

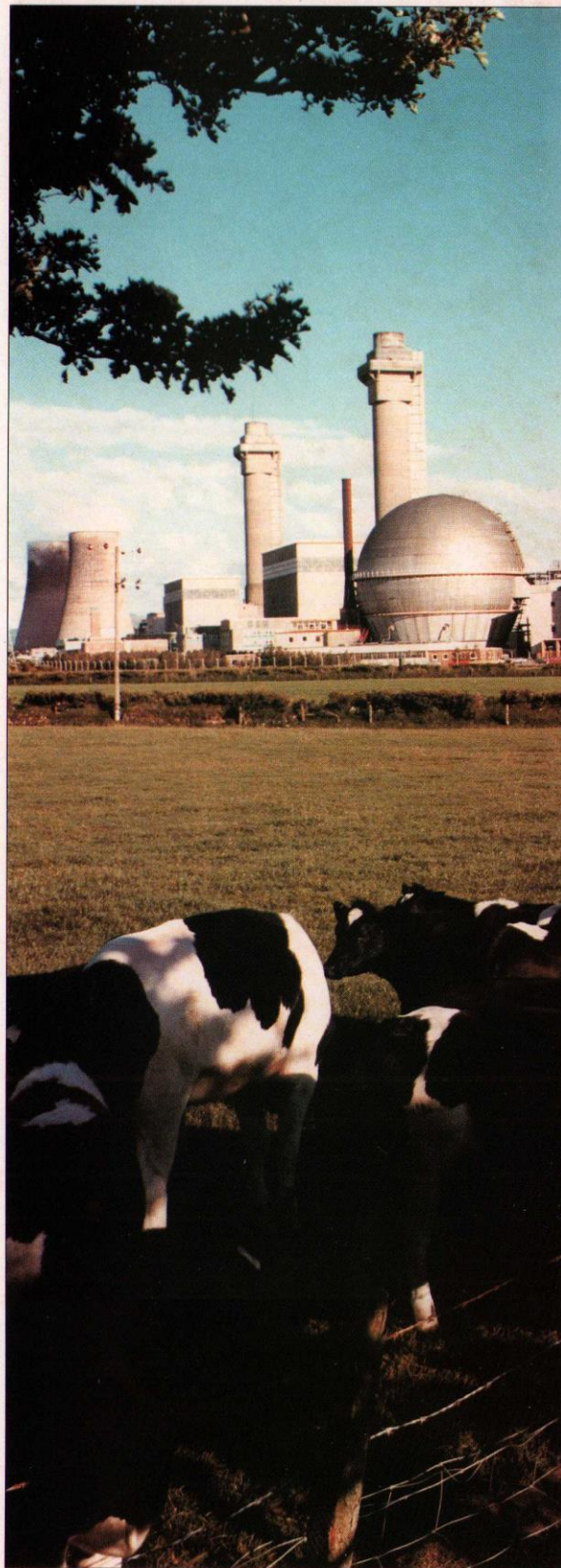
So, too, was Steve Russell, a freelance writer and wildlife enthusiast from Kendal, who helped Luke with his researches and subsequently wrote an article about his findings.

For a start, Luke identified 63 different varieties of birds, in and around the Sellafield site, including the endangered Barn Owl, the Peregrine Falcon and the Redbreasted Merganser. He also recorded a countless array of wild flowers, 20 species of butterflies, 17 types of trees and shrubs, plus assorted mammals, fish, grasses, hedges and rushes.

What particularly impressed Luke was that Sellafield's nuclear operations meant that the two rivers flowing in and around the site remain clear because there is no pollution from chemical effluents. Neighbouring fields owned by BNFL, and neither grazed nor cultivated, are a haven for wild flowers, butterflies and nesting birds.

More than one-third of all the species of butterflies to be found in Britain are represented locally, and Luke also found that ducks, geese and divers are abundant along the coast and rivers. Salmon can be readily seen from the river banks, and the rare Natterjack toad and adders also thrive in what he calls "this unexpected nature reserve".

The most spectacular sight - and what Luke vividly describes as "perhaps the most obvious sign of nature's romance with the nuclear reprocessing factory" - is the gathering in June of tens of thousands of Six Spotted Burnet Moths. They are a vivid red-and-black in colour with many pigment variations, and Luke





Agriculture is of major importance to the West Cumbrian economy and fields are farmed right up to the Sellafield perimeter fence

BNFL carries out regular monitoring around the Sellafield site, including milk samples from neighbouring areas

counted 100 moths per square metre in one location.

Steve Russell, in his article about Luke's quest, says that just as astonishing as some of the other discoveries was the occasional presence of otters in the River Calder. Steve believes that they are probably transient animals from adjacent river systems, but he also emphasises that there can be no doubt that the Calder is an exemplary river for otters, and due to the fencing round Sellafield it is probably safer for the otters than in pre-nuclear days. Incidentally, salmon also frequent the river and local fishermen still have access to it as it passes through the site.

Trevor Beebee, a biological scientist at the University of Sussex, went so far as to suggest in an article in the "New Scientist" that Natterjack toads, given the choice, would actually prefer nuclear power to any other kind! He bases his reasoning on the fact that sulphur dioxide emissions from fossil-fuelled stations have committed whole populations of Natterjacks to oblivion ever since the Industrial Revolution by acidifying the heathland ponds which were their natural habitat in the South and East of England. Plans for barrages in coastal estuaries threaten the temporary pools occasionally flushed out by high tides which Natterjacks also like.

Mr Beebee concludes that "we all know only too well, perhaps ad nauseam, the possible dangers from nuclear power, and we would be insane to ignore them. What would be a greater folly, though, is to opt for developments which certainly cause damage, as an emotive reaction, against ones which have only an awful potential to do so."

An even more unlikely refuge for wildlife exists just a few miles south of Sellafield at Drigg, where is situated BNFL's low-level radioactive waste disposal site. Fourteen different mammals have been sighted within the boundary fence of Drigg's 200 acres, ranging from roe deer, foxes, hares and rabbits to voles, mice and shrews, as well as 69 varieties of bird-life at the last count. A pure white barn owl has been photographed returning to its nest.

Drigg's situation lends itself ideally because it is some 500 metres from the sea, and the topography is hummocky ancient sand-dunes with varied vegetation and wet areas. Large tracts are rarely visited, and habitats include five hectares of undisturbed coastal heath, wetland, streams, derelict buildings, tall grass meadow, deciduous scrub and conifer woodland.

Sellafield's experience is by no means unique among the plants operated by BNFL in the



North-West of England and the South of Scotland. The Journal of Zoology even carried a paper recently on the "Frequency of vigilance behaviour and group size in rabbits", based on observations carried out at BNFL's Springfields factory, at Salwick, near Preston, in Lancashire. Within the 97-hectare site, surrounded by a wire-mesh fence, there are areas of woodland and lawns, and the rabbit-warrens are situated mainly in the woodland areas. Even in these protected surroundings, they are by no means immune, because weasels, foxes and owls also live there. Springfields is a nuclear fuel manufacturing plant employing some 2,000 people, and Monty Myerscough - a BNFL fitter and a founder-member of Fylde Bird Club - says the site is teeming with birds, insects and animals.

He has seen pipistrelle and noctule bats, weasels, stoats, foxes, great spotted



woodpeckers, tree creepers, tits, various warblers, tawny owls, at least five species of butterflies, waders, ducks, and a Kingfisher. On one occasion he spotted a Pallas's Warbler, which normally breeds in Asia and is an extremely rare visitor to Britain. Some 30 nesting-boxes have been set up for birds, and four for bats.

Encouraging wildlife to flourish is far from being the sum total of the nuclear industry's concern for the environment. It could hardly be otherwise in a business which is subject, fairly or otherwise, to much more searching examination of its impact on health and safety than other industries the effect of which is more immediate and more telling.

BNFL has developed environmental consciousness, not simply as part of a vigorous public relations and advertising policy, but as a matter of deep-rooted corporate philosophy. This

reflects the belief that the long-established company policy to be open and accessible is of particular importance in relation to environmental issues.

It has, for instance, been established as a strategic objective that such issues must be addressed at all stages in the lifetime of any of BNFL's facilities, starting at the conceptual design stage and following on through construction, operation and modification, all the way to eventual decommissioning.

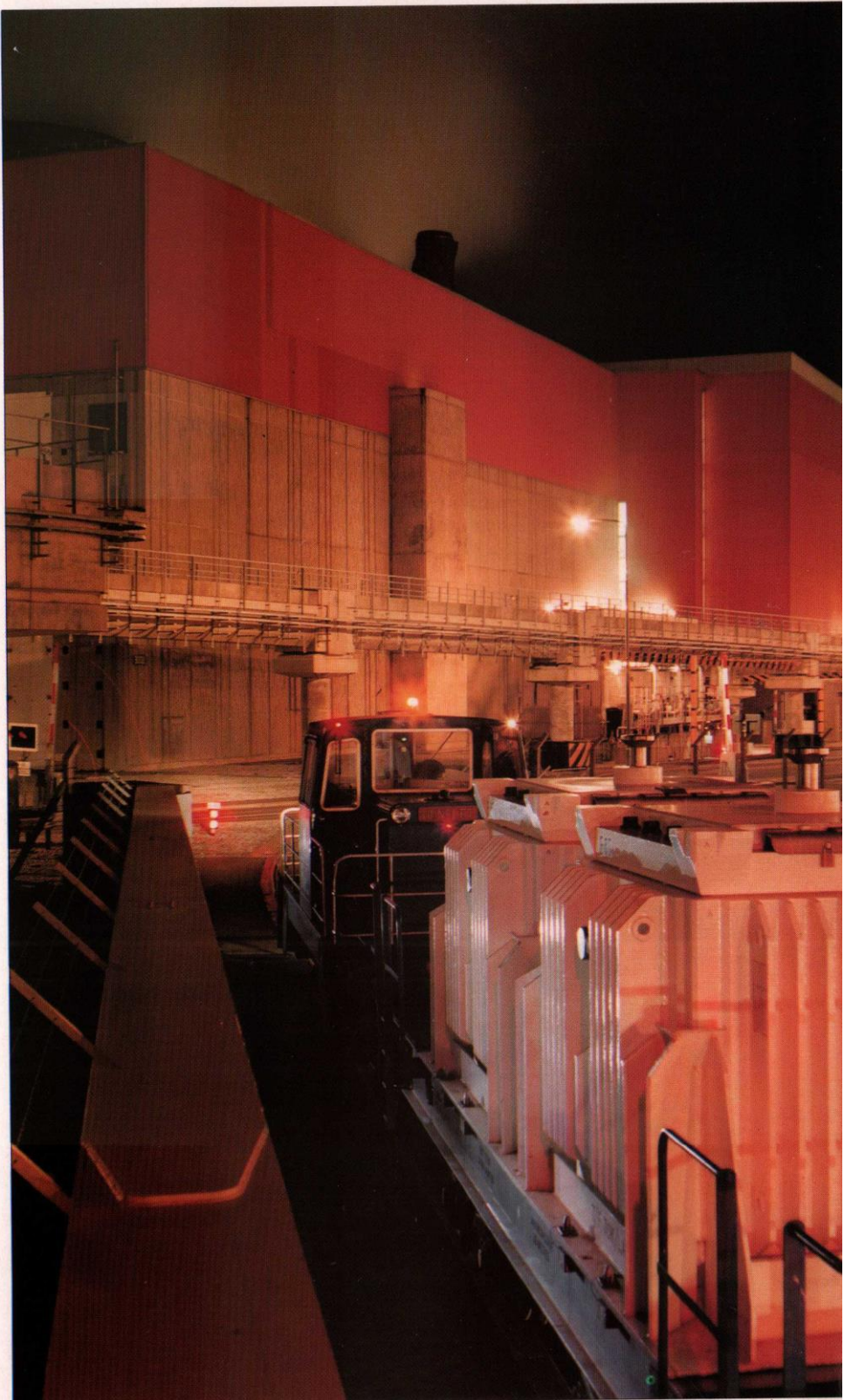
The company is required by certificates of authorisation to ensure that radiological discharges to the environment and radioactive disposals to land sites should be not only within regulatory limits but further reduced using the best practicable means. The same basic concepts are applied to non-radiological discharges and disposals.

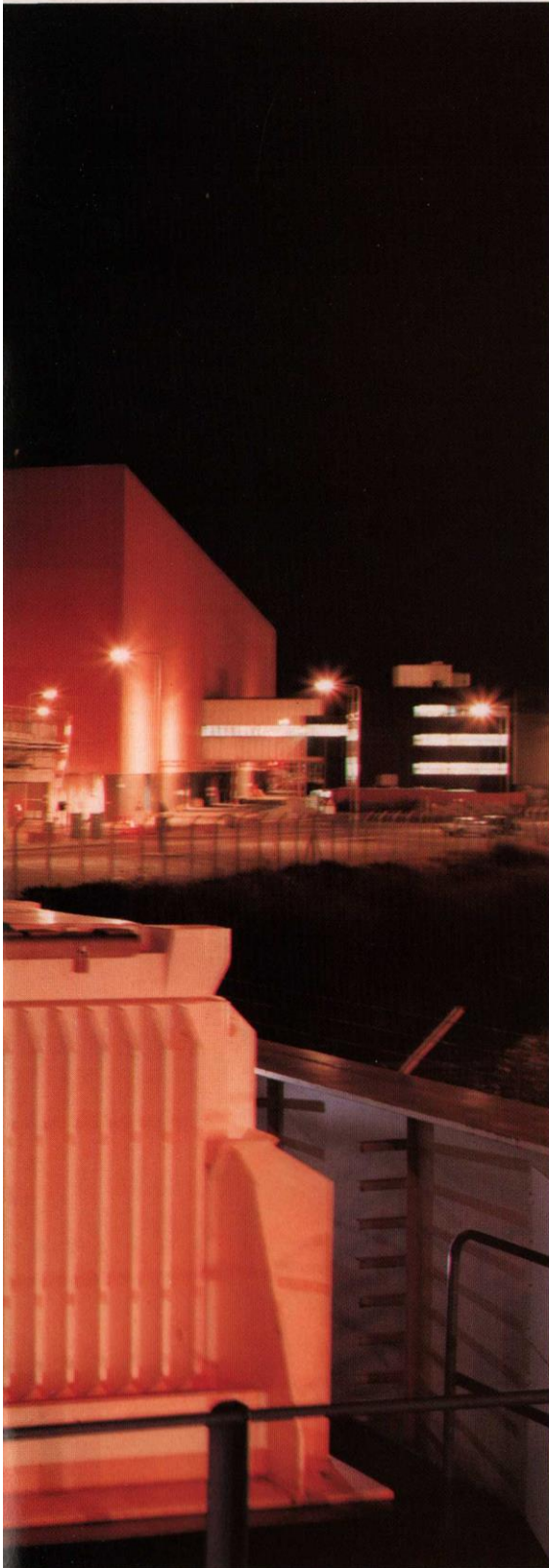
In a recent advertising campaign BNFL asked the provocative question: "Just how green are you about nuclear power?" The message conveyed in the text was clear and concise: that fossil-fuel power stations produce carbon-dioxide, which contributes to the Greenhouse Effect, but nuclear power stations do not. No claim is being made that nuclear provides the sole solution to the Greenhouse Effect, but the advertisement concludes with the question: "Might we suggest that those people who say that you cannot possibly support a nuclear future and be green might be looking a little on the black side?"

There has even been national recognition of BNFL's achievements in reducing low-level liquid discharges to the Irish Sea. A "green" commendation was earned last year in the prestigious Better Environment Awards for Industry, and at a ceremony in London the Duke of Gloucester presented the company with a certificate in the Pollution Abatement Technology category of the scheme. This was in recognition of the technological and environmental success of Sellafield's £140 million Site Ion Exchange Effluent Plant (SIXEP), which almost entirely removes the radioactive substances, strontium and caesium, from storage pond water.

The Better Environment Awards for Industry aim to identify, encourage and promote technical design, manufacturing and management initiatives which have helped to improve the environment and conserve resources. The scheme is sponsored by the Environment Foundation, the Department of the Environment, and Shell UK, and promoted by the CBI, the Financial Times and the Royal Society for the Encouragement of Arts, Manufacture and Commerce.

A rail wagon carrying two steel containers of spent nuclear fuel approaches Sellafield's fuel handling plant. Sellafield is the UK Centre for nuclear reprocessing, by which unused uranium and the by-product, plutonium, are chemically extracted for future use. Highly active waste is separated for storage





Sellafield deals with spent fuel which has been sent for reprocessing after use in electricity-generating nuclear power stations. The fuel is stored in water-filled ponds prior to the start of the reprocessing operations which will separate out valuable uranium and plutonium for re-use from radioactive waste, and this storage inevitably leads to a small amount of corrosion of some fuel cans and to the release of soluble activity, mainly caesium and strontium, into water.

SIXEP is a building at Sellafield more than 100 metres long, 50 metres wide, and 33 metres high. It houses a treatment process based on ion exchange, and the principle is that some materials are able to extract ions (electrically charged atoms in solution) from the solutions passed through them. A naturally-occurring aluminosilicate called clinoptilolite is particularly effective in removing caesium and strontium ions, and BNFL has imported enough supplies for the plant's lifetime from a source in the Mojave desert in California.

Sand pressure filters in SIXEP remove sludges and suspended solids as a first step, and then pressurised columns remove soluble activity. The process, started in 1985, is making a major contribution in reducing discharges to the Irish Sea to no more than 2 per cent of previous peak levels.

Between now and the end of this century BNFL will spend £5,500 million on new plant and equipment. A total of £140 million has already been spent on plants to reduce discharges to the Irish Sea, and a further £500 million is committed to low activity liquid effluent management over the next few years. EARP (Enhanced Actinide Removal Plant) is due to come into operation in 1992 and will further reduce marine discharges of plutonium and americium, while the new Thermal Oxide Reprocessing Plant (THORP), also starting in 1992, has been designed to meet very stringent effluent standards and will make only a limited contribution to site liquid discharges.

All industrial chemical plants produce waste effluents, some of which are discharged to the environment, and the manufacture and reprocessing of nuclear fuel is therefore no exception to any rule. What it is important to remember, though, is that all discharges from BNFL sites are made according to strict rules set down by Government authorities - the Department of the Environment and Ministry of Agriculture, Fisheries and Food in England, and the Scottish Office in Scotland.

These departments issue Certificates of Authorisation which impose conditions on the discharge and disposal of wastes, the types and



**Collecting
grass samples
for analysis**

quantities of radioactivity permitted to be discharged over specified time periods, the environmental samples to be taken and analysed, and the records to be kept. In addition to conforming to these discharge limits, BNFL is required to use the best practicable means to limit the radioactivity of the wastes discharged. Regular monitoring by the Authorising Departments ensures that this is being done. For each route or pathway by which radioactivity in discharges from nuclear sites may reach members of the public, a small group of people who receive the largest radiation dose is identified by the authorising departments. The group which receives the largest radiation dose from a particular pathway is called the 'critical' group, and it follows that all other members of the general public will receive smaller radiation doses. Surveys are conducted and regularly reviewed by the Ministry of Agriculture, Fisheries and Food to obtain information on the lifestyles of members of the critical groups, including details of consumption rates for specific foods, or occupancy in certain areas showing increased radiation levels due to discharges. The radiation dose to each critical group is assessed using this information, together with that from environmental radioactivity monitoring programmes and from knowledge of the metabolic behaviour of radionuclides. In establishing radioactive discharge limits for

BNFL's operations, the authorising departments take account of the objectives of radioactive waste management as stated in Government White Papers. In 1986 the Government announced that as part of its radioactive waste management objectives, the radiation dose limit to representative members of the critical groups from all man-made sources, excluding medical exposure, should be 1 mSv in any one year. This is less than half the average radiation dose received annually by members of the general public from natural sources. However, radiation doses of up to 5 mSv are permissible in some years provided that the total radiation dose does not exceed 70 mSv over a lifetime. The Radioactive Waste Management Advisory Committee (RWMAC) has advised that radiation doses to the critical group should not exceed 0.5 mSv per year from a single site, and subsequently the National Radiological Protection Board (NRPB) has issued similar guidance.

BNFL made public its intent to achieve similar levels at the Windscale Inquiry in 1977 and these have been achieved.

Under the terms of the discharge authorisations, the Company has an obligation to carry out defined monitoring programmes for discharges and for environmental radioactivity so that doses to members of the public can be assessed. BNFL does more environmental survey work, both inside and outside BNFL sites, than it is required to do by the authorisations. Thousands of samples are taken and analysed every year including air, water, soil, sand, seaweed, fish, shellfish, meat, milk and vegetation, while several other organisations, including the authorising departments themselves, carry out their own surveys of environmental radioactivity and publish the results.

Radiation comes from many sources. Naturally occurring radioactive gases - such as radon - which rise from the ground and accumulate in the air inside buildings, account for almost half the average radiation dose to a person in the UK. This average is about 2.5 millisieverts (mSv) per year, of which about 2.2 mSv (or 87 per cent) is from natural sources. Medical radiation makes up almost all of the remaining 13 per cent from man's activities. Radiation exposure of average members of the general public from the normal operation of the whole nuclear industry (including Sellafield) accounts for less than 0.1 per cent. Next time you read a newspaper article headlined "N-scare" or "N-worry", you might ponder on the fact that, in some parts of the country, the natural radon in your lounge provides you with about a thousand times more radiation exposure than does all the nuclear power industry put together!