



KING ETHELRED'S COLLEGE OF ENGINEERING

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DEPARTMENT OF AGRICULTURAL ENGINEERING,
DRAINAGE AND APPLIED WEATHER

NEGATIVE EVIDENCE: HOW A CARDBOARD BOX DETECTED THE ATOMIC AGE

Being a check of a popular account against Dr Webb's paper of 1949; with a note on the river, which did it, the straw, which did not, and the milk, which nobody warned



A departmental research thesis prepared under the College Fellowship Ordinance
(Weather, the Consequences Downstream Thereof)

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*Fortitudine.
Ingenio.
Tea and biscuits.*



ABSTRACT

An account now circulating holds that in 1945 the Eastman Kodak Company discovered the greatest secret of the Manhattan Project because its film started dying; that the straw in its packaging had been made radioactive by the first atomic bomb; that the company sent the United States government a quiet message, to the effect of stop ruining our film or we talk; and that it was rewarded with secret forecasts of nuclear tests, the only private body in the world so favoured.[8] The account was sent to this Department because it contains straw, rain and a river, and the College has nobody else for those.

The Department has checked it against the record: the paper the Kodak physicist himself published in the *Physical Review* in 1949, the museum that holds the fogged film, the Senate hearing of 1997, the article in the *Bulletin of the Atomic Scientists* that the hearing relied on, and three later retellings.[1-7] Of ten claims in the account, two hold, three hold in part and five do not. It was not the straw: Dr Webb cleared the straw and convicted the river. Kodak did not discover the secret, having been in on it: a Kodak subsidiary ran the plant that enriched the uranium for Hiroshima, and the guilty cardboard was made on the day that bomb was announced. Kodak did not threaten to talk. It threatened to sue, which is a different instrument, and it was not the only firm warned, because the whole photographic industry was.

The Department also finds that the retellings disagree with one another about every distance in the story, that one has measured to the wrong building and arrived at the right mill, and that the true account is better than the popular one, which is usually so. What is left when the embroidery is removed is the part that matters, and it is not funny: from 1951 the government told the makers of film where the fallout would come down, and did not tell the people who kept cows. The film was protected by the threat of a lawsuit. The milk had no lawyer.

Research status. This is a fictional thesis of a fictional college. Dr Julian Webb, his paper of 1949, the mills at Vincennes and Tama, the Trinity and Nevada tests, the snow at Rochester, the agreement with the Atomic Energy Commission, the Senate hearing, the National Cancer Institute's findings and every figure quoted from them are real and referenced; the distances and the decay arithmetic are the Department's own and are worked in Appendix A. The Department, its Fellow, the Bursar, Mrs Partridge, Gerald, the Librarian, the Clerk of Works, the Professor of Large Numbers, the Major, the College's war work in Section 7.4 and the trial in Chapter 8 are not; Tube Alloys, and the reason for its name, are real. People were harmed by the fallout this paper describes, and some are still asking to be counted. The jokes are about cardboard, distances and the College. None is about them.

Keywords: Kodak; Julian Webb; strawboard; Wabash River; Trinity test; cerium-141; fallout; rainout; Atomic Energy Commission; iodine-131; milk; downwinders; drainage; negative evidence.

ACKNOWLEDGEMENTS

Miss Honoria Catchpole of the Æthelred Library of Useful Numbers has taken in four published distances between New Mexico and Rochester and four values for the yield of one explosion. She holds them all, as is her practice, and has asked only that the Department stop bringing her numbers from magazines without saying which building they were measured to.

Professor Cuthbert Widdowson-Bligh, of the Chair of Large Numbers and Difficult Formulae, was shown that the contaminated board was made on 6 August 1945, the day of Hiroshima. He is not impressed by coincidence and replied in three words, which are given in Section 7.2.

The Bursar read Chapter 5 with more attention than he has given any paper of this Department, and has asked for a copy of the letter of March 1951. He describes it as the finest thing he has read since the insurers' reply about the fire. He has also asked the Department to stop finding invoices. See Section 7.4.

Mrs Enid Partridge of the Senior Common Room was asked, in plain words, why anybody would warn the film and not the milk. Her answer is in Section 6.3 and is shorter than the Department's.

Mr Arthur Stobbs, Clerk of Works, confirmed that everything that falls on the College leaves by the same culvert, that he knows where it goes, and that nobody has ever asked him before.

Major (Retd.) Alistair MacTavish observed, without being asked, that Kodak held its ground in Rochester for six years, kept a sentry on the roof and moved only when it had to. He regards this as sound.

Gerald was not consulted. A box of film was left on his stool. See Table 8.1.

Statement on nomenclature. 'The account' means the popular account of reference 8. 'The record' means references 1, 2, 6 and 7, in that order of weight. 'The retellings' means references 3, 4 and 5. 'The board' means straw-board, a stiff card made from straw pulp, and at no point a committee.

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NOMENCLATURE

Symbol	Meaning
The account	The popular version: straw, a secret, a threat and a weather map. Reference 8
AEC	The United States Atomic Energy Commission, 1947 to 1975
Beta activity	Electrons thrown out by a decaying nucleus. They pass through card. Alpha particles do not
Cerium-141	A fission product with a half-life of 32.5 days: long enough to reach Indiana and still be there
Fogging	Darkening of film by anything other than the intended picture
Half-life	The time in which half of a radioactive substance decays, whoever is or is not told about it
Hot spot	A small area of heavy fallout, generally where it happened to be raining
Iodine-131	A fission product with a half-life of eight days. It collects in the thyroid, by way of milk
Negative evidence	In law, the absence of something. In this paper, also the film
Rad	A unit of absorbed dose. The sources use it, so the paper does
Rainout	Fallout brought down by rain or snow. The Department claims it as drainage
Strawboard	Stiff card made from straw pulp and river water. The water is the part to watch
Trinity	The first nuclear explosion: near Alamogordo, New Mexico, 16 July 1945
Tube Alloys	The British atomic bomb project, 1941. The name was chosen to mislead, and did. See Section 7.4
Y-12	The uranium enrichment plant at Oak Ridge, Tennessee, run from 1943 to 1947 by a Kodak subsidiary

1 INTRODUCTION

1.1 The account as received

The account reached the Department in September 2026 as a short piece of text of the kind that travels well. It runs to seven paragraphs and tells a very good story. A giant of photography discovers the greatest secret of the Manhattan Project, 'not through a leak, but because their film started dying'. The head physicist finds radioactive straw. He works out that the contamination is falling from the sky and matches it to a secret explosion in New Mexico. The company does not go to the press or the police. It sends a quiet message: we know what you are doing; stop, or we talk. The government strikes a deal, and a private corporation becomes the only body in the world with a nuclear weather map.[8]

The account names no source, gives one date, and has been passed to the Department by a reader who also supplied four things that do have sources: the museum catalogue entry for the fogged film, and three magazine retellings.[2-5] The Department has added the physicist's own paper, the 1997 article in the *Bulletin of the Atomic Scientists* and the Senate hearing that followed it.[1,6,7] The method is the College's usual one. It asks what the record says, in whose hand, and how far away everything actually was.

1.2 Why this Department

The story is generally filed under physics, photography or espionage. The Department of Agricultural Engineering, Drainage and Applied Weather claims it entire. The material was straw. The carrier was a river. The delivery was by rain in Indiana and by snow in New York. The warning that followed was a weather forecast, and the people who did not receive it were dairy farmers. There is a physicist in the story, and the Department gives him his due in Chapter 3, but he spent the summer of 1945 doing what this Department teaches in AW115, The Cost of Rain: finding out what had come down, where it had drained to, and who was going to pay.

1.3 Method

Chapter 2 takes the account apart claim by claim. Chapter 3 follows Dr Webb's reasoning, which is the best thing in the story and is missing from the account altogether. Chapter 4 checks the arithmetic of the respectable retellings, which needed it. Chapter 5 covers the snow of 1951 and the agreement. Chapter 6 covers who was not told. Chapter 7 deals with what Kodak already knew. Chapter 8 is the Department's own trial, which is fiction and says so. Distances are great-circle distances, in miles because every source uses miles, and are worked in Appendix A.

College hypothesis. A story that improves each time it is told was usually better the first time. The Department expects to find the record more interesting than the account, and the physicist more impressive than the blackmailer who has replaced him.

2 THE ACCOUNT, MARKED

2.1 The mark

The account makes ten claims that can be checked, and the Department gives the result first, which examiners do not. Allowing a half for each claim held in part, the account scores three and a half out of ten. This would not pass the KEAT, and the Proctor would add that the candidate has not shown any working. The Department's interest is in the pattern of the errors. Every one of them makes the story more like a film. A methodical physicist becomes the head physicist. A river becomes radioactive straw, because straw can be held up in one hand. A solicitor's letter becomes a whispered threat. An industry-wide circular becomes a secret map for one corporation. Nothing has been added that was dull.

What the account leaves out is the reasoning, the second mill, the six years between the two incidents, the fact that Kodak was a contractor on the bomb, and everybody who drank milk. These are taken in turn.

2.2 Ten claims

Table 2.1 sets each claim against the record. The Department has marked as it marks the KEAT: credit for what is right, no credit for confidence.

	The account says	The record says	Mark
1	In 1945 Kodak discovered the greatest secret of the Manhattan Project	The spoiled film was packed in board made on 6 August 1945, the day Hiroshima was announced to the world. A Kodak subsidiary had run the Y-12 enrichment plant since 1943.[1,10] See Chapter 7	Not held
2	For years Kodak had been receiving complaints	The complaints came about a month after the test.[6,7] Kodak had an older trouble with radium in salvaged card, and had already solved it.[2,3]	Not held
3	The company's head physicist, Julian Webb	Dr J. H. Webb of the Kodak Research Laboratories: a physicist in the research department in 1945, head of the physics division by 1951.[1,3]	In part
4	The straw was contaminated	Webb cleared the straw. It had been months in a warehouse and anything in it would have decayed. The contaminant came in with the river water.[1,3]	Not held
5	Hundreds of miles from any known radioactive site	The mill at Vincennes, Indiana, is 1,109 miles from the test site; the second mill, at Tama, Iowa, 948. The account has understated something, which is to its credit	In part
6	The contamination was falling from the sky	Yes. The board was more active after heavy rain.[3]	Held
7	It matched the Trinity test	Yes. Webb, 1949: the most likely explanation was a wind-borne fission product from the detonation in New Mexico on 16 July 1945.[1]	Held
8	Kodak didn't go to the press	Within four months. In November 1945 Eastman told newsmen it had found 1,000 radioactive specks a sheet in a shipment of strawboard, and TIME printed it; the company then "preferred to say no more". Webb published the whole matter in 1949, and in 1951 Kodak gave the Associated Press a statement about radioactive snow.[1,3,25]	In part
9	A message: stop ruining our film, or we talk	No source gives this message. In March 1951 Kodak threatened to sue for damage to its products. Silence was what the government asked for, not what Kodak offered.[3,6]	Not held

	The account says	The record says	Mark
10	The only entity in the world with a nuclear weather map	The entire photographic industry was warned, through its trade association, with maps and forecasts.[6,7]	Not held

Table 2.1: The account, marked against the record. Two held, three in part, five not held.

Finding. Three and a half out of ten. The account is right that the film fogged, that the cause fell from the sky and that it came from New Mexico. It is wrong about the straw, the secret, the threat and the map, which are the four things people repeat.

3 THE INSTRUMENT: WHAT DR WEBB ACTUALLY DID

3.1 A company that already distrusted cardboard

X-ray film is more sensitive than ordinary film and is spoiled by very little. Before the war Kodak had learned, to its cost, that card made from salvaged paper could carry traces of radium from the instrument trade, and that radium in contact with film for a few weeks leaves spots.[2,3] It therefore arranged for its packaging board to be made from chosen raw materials at mills it could supervise. One was at Vincennes, Indiana, on the Wabash River, and made strawboard, the stiff card placed between sheets of film.[1,3]

This matters to everything that follows. The spots of 1945 were found by a firm that had already had spotted film, had already traced it to packaging, and had already built a supply chain to prevent it. When the spots came back, Kodak knew at once that they should not have.

The College understands the position. Mrs Partridge has kept the Senior Common Room's biscuits in tins since an episode with a cardboard box and the boiler-house damp which she does not discuss, and the College's regulations state that biscuit tins are not structural members precisely because the Trebuchet Research Group once found that they nearly are. An institution that has been let down by packaging does not forget it.

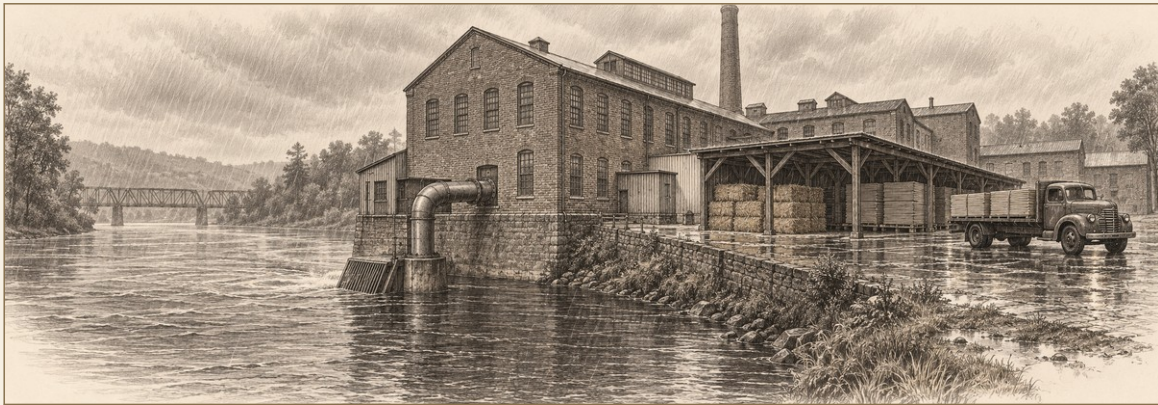


Figure 3.1: The strawboard mill at Vincennes, on the Wabash, August 1945. The Department's reconstruction. The straw is in the dry. The river is not.

3.2 The measurements

Dr Webb traced the fogged film to one run of strawboard, made at Vincennes on 6 August 1945. Film packed with that board showed fogged spots after about two weeks.[1] He then measured the spots on the board itself, and the abstract of his paper gives the results in four sentences that the Department sets as a model of the form. There was no alpha activity, which ruled out radium and every other natural source. There was fairly strong beta activity, with a maximum energy of about 0.6 MeV. The half-life was approximately thirty days. Chemistry on the ash showed a rare earth. Energy and half-life together were compatible with cerium-141.[1]

The accepted half-life of cerium-141 is 32.5 days.[13] Dr Webb, working from the darkening of photographic film and a bench counter, in a packaging dispute, was within eight per cent of it. He described what he had found as a new type of radioactive contaminant not hitherto encountered,[3] which was accurate: nobody outside a small number of fenced sites had encountered it, because it had not existed in quantity before 16 July.

The Department asked Professor Widdowson-Bligh whether an error of eight per cent, from a man timing the decay of something nobody had told him existed by how dark it made a photograph, was good. He replied that the Department's own estimate of the College's date of foundation carries a tolerance of '(ish)', and that he would not press the point.

3.3 The acquittal of the straw

The account convicts the straw. Dr Webb tried the straw and acquitted it, and his reasoning is the part of the story the Department most admires. The straw had been stored under cover for a considerable time before it was pulped. A contaminant with a half-life of a month, had it been in the straw at harvest, would have decayed to almost nothing by the time the board was made. The activity in the board was strong. Therefore it had arrived late, and the only thing that arrives late at a paper mill in quantity is the water.[3] The Department keeps straw itself, for AW101, in a barn, and can confirm from the 2019 bales that nothing whatever happens to straw in a barn. This is the chief attraction of straw.

The straw theory is older than the river theory and was published first. In November 1945 Dr Robley Evans of M.I.T. told TIME the board was made of straw cut in Illinois on 6 August, twenty-one days after the explosion, and that fallout had come down with the rain on the fields; the only other possibility was silt in the Wabash.[25] Webb had the board, the warehouse receipts and four years, and chose the second.

He then found a second case. A run of strawboard from a mill at Tama, Iowa, made within a month of the first, was fogging film in the same way and failed the radium test in the same way. The two mills were hundreds of miles apart and had one thing in common: each stood on a river, the Wabash at Vincennes and the Iowa at Tama. And at both, the board made after heavy rain was the more active.[3]

That is the whole chain. Something artificial, a month old, carried on the wind, washed out by rain over the Middle West, drained by two rivers into two mills, pressed into card, boxed with film, and left for a fortnight. In 1949 he wrote that the most likely explanation was a wind-borne fission product from the atom-bomb detonation in New Mexico on 16 July 1945.[1] The Department notes the words 'most likely'. The account says he realised. Dr Webb said he inferred, and showed how.

3.4 Why the film saw cerium and not iodine

A box of film is an integrating detector with a slow response: it needs a fortnight of contact to register anything. Board made three weeks after the test, and film examined five weeks after it, can only record what is still there. Figure 3.2 shows that 47 per cent of the cerium-141 was still there, and 5 per cent of the iodine-131.

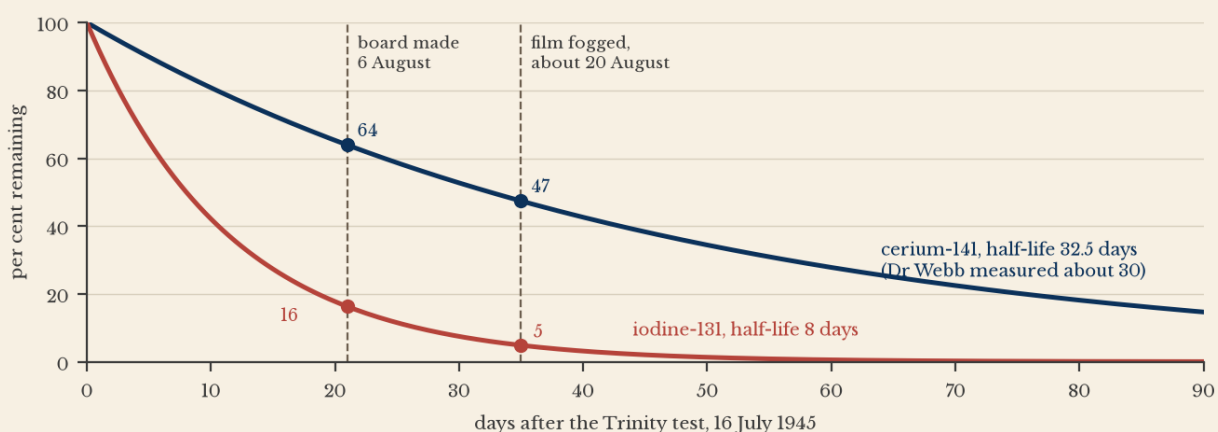


Figure 3.2: What was left of two fission products by the time the film met the board. Half-lives from references 13 and 14; dates from reference 1; the arithmetic is in Appendix A.

Iodine-131 is the fission product that did the harm described in Chapter 6. Its half-life is eight days,[14] so it is nearly gone in a month, and film in cardboard never sees it. But milk is a fast detector. Grass to cow to milk to child takes days, not weeks.[6,15] The photographic industry's in-

strument was slow and recorded the isotope that lingered. The dairy industry's was fast and delivered the isotope that did not. Only one of the two industries had been issued with a physicist.



Figure 3.3: Dr Webb and the board. The Department's reconstruction. The film on the bench has been exposed to nothing, which was the difficulty.

3.5 The chain of custody

Table 3.1 sets the chain out with its dates, since the account supplies only a year. The journal took three and a half months over the paper. The spot on the film had taken four years to reach the editor.

Date	Event	Where
16 July 1945, 05.29	The Trinity device is fired on its tower	New Mexico
Following weeks	Fission products travel on the wind, are washed out by rain and carried by the Wabash to the mill intake	The Middle West
6 August 1945	The contaminated run of strawboard is made	Vincennes
About 20 August	Film packed with it shows fogged spots, after about two weeks	In the box
Within a month of the first run	A second contaminated run, on a second river	Tama, Iowa
12 November 1945	TIME prints 'The Active Straw': the specks, the bomb guessed at, straw or silt	Everywhere
18 April 1949	The <i>Physical Review</i> receives the paper	Rochester
1 August 1949	Published, in the open literature	Everywhere

Table 3.1: The chain of custody. Sources: references 1, 2, 3 and 9.

Finding. It was not the straw. It was the river, and Dr Webb proved it with a warehouse receipt, a second mill and the rainfall. The account has replaced a piece of reasoning with a bale.

4 THE RETELLINGS, MEASURED

4.1 How far is Rochester

The three magazine retellings are careful, sourced and a great improvement on the account. They also disagree about every distance in the story. *Popular Mechanics* puts Rochester 'more than 1,900 miles' from Alamogordo, and 'two thousand' in its standfirst; it puts Rochester 2,500 miles from the Nevada site, and Tama 450 miles from Vincennes.[3] *Business Insider* says the trail led '1,111 miles to the northeast', to physicists in the Eastman Kodak Company headquarters.[4] The Department has measured. Figure 4.1 gives the results.

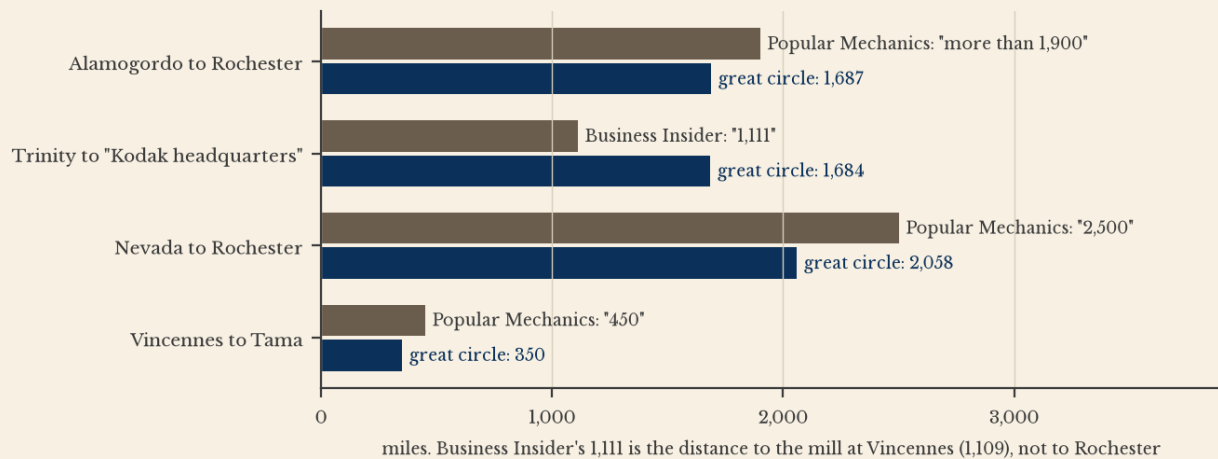


Figure 4.1: Distances as printed and as the fallout flies. Printed figures from references 3 and 4; great-circle distances worked in Appendix A.

Rochester is 1,687 miles from Alamogordo and 2,058 from the Nevada site. The printed figures are about right for a motorist, and the Department has no quarrel with motorists, but fallout does not go by road. The *Business Insider* figure is more interesting. From the Trinity site, 1,111 miles to the north-east does not reach Kodak's headquarters, which are 1,684 miles away. It reaches, to within two miles, the strawboard mill at Vincennes. Somebody measured correctly to the right place and the sentence then delivered the number to the wrong building. Miss Catchpole has filed it under both.

4.2 Other small matters

Source	As printed	The record
Business Insider [4]	The government 'dropped' the first bomb on a remote Army base	The Trinity device was hoisted to the top of a 100-foot steel tower and fired there.[9]
Business Insider [4]	A photograph captioned as the first H-bomb explosion, 1952, 'performed at the Nevada proving grounds'	The first hydrogen bomb test, Ivy Mike, was on 1 November 1952 at Enewetak Atoll in the Pacific.[16] It yielded 10.4 megatons. Nevada would have noticed.
Popular Mechanics [3]	Trinity released 18.6 kilotons	That is the figure from soil samples in July 1945. The official estimate is 21 and a re-analysis in 2021 gives 24.8, plus or minus 2.[9] See Figure 4.2.
Popular Mechanics [3]	'Manhattan Project leader Robert J. Oppenheimer'	J. Robert. The caption on the same page has it right.

Source	As printed	The record
Popular Mechanics [3]	Senator Harkin 'incorrectly said' corn husks, not strawboard	The Senator took corn husks from the <i>Bulletin</i> article, whose author the magazine thanks for supplying its materials.[6,7] Dr Webb, who handled the board, says straw.[1]
Wikipedia, Kodak [11]	Fallout that had travelled 'thousands of miles'	1,109 miles. One thousand, singular.
Wikipedia, Trinity [9]	Cardboard pulp made from corn husks	As above. The husk has now outlasted the cerium by eighty years.
Google AI Overview, September 2026 [26]	'It was the straw that Kodak originally noticed'	It cites Wikipedia, which says the river. The straw is the hypothesis of November 1945 (Section 3.3), now eighty-one years old and being retold by a machine that has read its refutation.
History Facts, 2024 [27]	The bomb was detonated 'near Los Alamos'; driving distance from Los Alamos to Tama, 1,050 miles	Los Alamos is where the bomb was designed. It was fired 153 miles south of it, and 948 miles from Tama as the fallout flew. The same article rules out the straw, correctly, in one sentence.

Table 4.1: Small matters in the better sources. None affects the story. All were checkable.

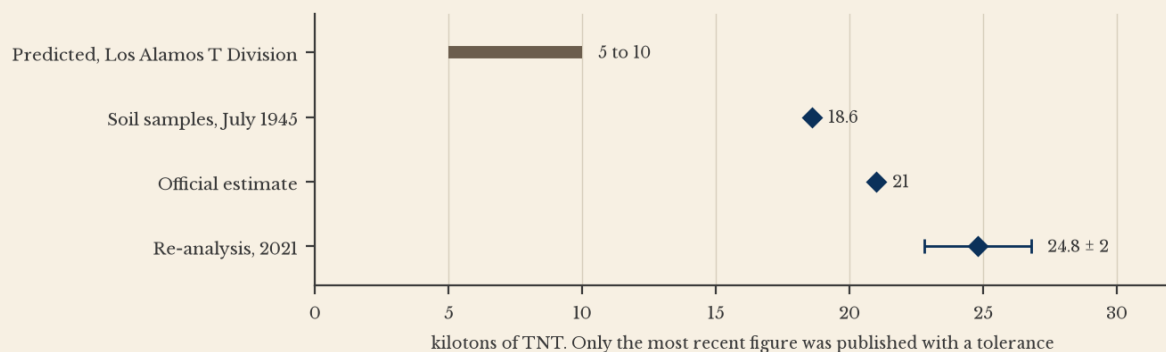


Figure 4.2: The yield of the Trinity test, by who was asked and when. Source: reference 9.

None of this damages the retellings, which get the straw, the river, the lawsuit and the milk right. The Department records it for the reason the College records everything: the story is about a man who would not accept a spot on a film without knowing where it came from, and it seemed poor manners to tell it with the distances wrong.

Departmental observation. The error that survives longest is the one that can be pictured. Nobody can picture river water as the carrier of a fission product. Anybody can picture a corn husk. The husk has reached the Senate record and two encyclopaedia articles, and it was never in the mill.

5 THE SNOW OF 1951, AND THE LETTER

5.1 Six fairly quiet years

The account has Kodak keeping the matter dark. In fact the matter was in *TIME* on 12 November 1945, under the heading 'The Active Straw'. Dr Chauncey Suits of General Electric, hearing of the trouble, told newsmen that Eastman was probably getting 'a drizzle of uneasy isotopes' from the bombs in New Mexico or Japan; Eastman confirmed the specks, said the batch had been discarded, and preferred to say no more.[25] So four months after the test, a physicist had guessed the source in print, the company had confirmed the symptom, and nobody appears to have minded. The secret, such as it was, lay not in whether the film had fogged but in what the measurements showed, and those Kodak kept.

After that Kodak did two things. It began collecting rainwater at Kodak Park and fitted samplers to the air intakes of its buildings, so that it would know before its film did.[2,11] And Dr Webb, recognising the sensitivity of what he had found, waited until 1949 to publish it.[2] His paper appeared in the open literature on 1 August 1949, under a title beginning 'The Fogging of Photographic Film', and stayed there, available to anybody, for forty-eight years before a Senator read its contents into the record.[1,7] The Department regards the *Physical Review* as the most secure place in which a secret has ever been kept. The College's own arrangements are similar. Its findings are published on a website with a footer that says none of it is real, and nobody has yet been alarmed by any of them.

A consultant to Los Alamos wrote to Dr Webb in 1947 asking for whatever he had learned about film destroyed by fission products.[2] The letter is declassified, and the museum reproduces it beside the film. The government, that is, was writing to Kodak for information, which is not the direction of travel the account describes.

5.2 The snow

On 27 January 1951 the first test at the new Nevada site, a one-kiloton device called Able, was dropped from an aircraft over Frenchman Flat.[12] A few days later it snowed in Rochester, 2,058 miles away, and the Geiger counters at Kodak recorded twenty-five times the normal level.[3,6,7] The photographic manufacturers' association put figures on it to the Commission: about 10,000 counts a minute, where Rochester ordinarily showed about 400.[5] Major MacTavish has asked the Department to record that the instrument was on watch, on a roof, in January, six years after the last alarm, and that somebody had evidently kept it in batteries. He says this is what winning looks like and that it is never in the film.



Figure 5.1: The roof at Kodak Park, late January 1951. The Department's reconstruction. The snow is ordinary in every respect but one.

5.3 The letter, and what it bought

Kodak told the Commission, which said it would look into the matter and that there was little to worry about. The Commission went so far as to let the company tell the Associated Press that the snow in Rochester was measurably radioactive, with the assurance that there was no possibility of harm to humans and animals.[3] So far from threatening to talk, Kodak talked, with permission, to a news agency.

In March 1951 the company's patience ended, and it wrote that it would hold the government responsible for the considerable damage to its products from the Nevada tests, or from any further tests.[3] That was the threat, and it was a threat to sue. The Commission's own summary of its dealings with the industry that year records what followed: Kodak would have advance information on future tests, including the expected distribution of radioactive material, in order to anticipate local contamination.[6] Dr Webb, by now head of physics, received schedules and maps. In return Kodak was to keep what it knew to itself.[3]

The account has this the wrong way round, and the difference is not small. In the account, silence is Kodak's weapon. In the record, silence is the government's price. Kodak's weapon was the civil courts, in which the questions asked would have been how far fallout travels, who knew, and since when.

Nor was Kodak alone. Throughout the atmospheric tests the Commission gave the photographic industry, through its national association, maps and forecasts of expected contamination, so that its members could buy clean materials and protect their stock.[6,7] The Bursar has studied this chapter closely. He observes that a firm which threatens to talk may expect a visit, a firm which threatens to sue may expect a map, and that the College has, in his time, threatened neither.

Finding. Kodak did not threaten to talk. It threatened to sue, six years after the account says, and the forecasts it won went to the whole industry. The secret map for one corporation was a circular.

6 WHO WAS NOT TOLD

6.1 The milk

This chapter has no jokes in it until the College appears, and few then. In August 1997 the National Cancer Institute reported that the Nevada tests, most of them between 1951 and 1958, had exposed American children to between fifteen and seventy times as much radiation as Congress had previously been told.[6] The dose was to the thyroid, from iodine-131, and it arrived chiefly in milk: fallout on pasture, pasture into cows and goats, milk into children, who drank more of it than adults and had smaller, growing glands.[6,15] The Institute estimated that about 160 million people, nearly everybody alive in the country at the time, had received some dose.[6]

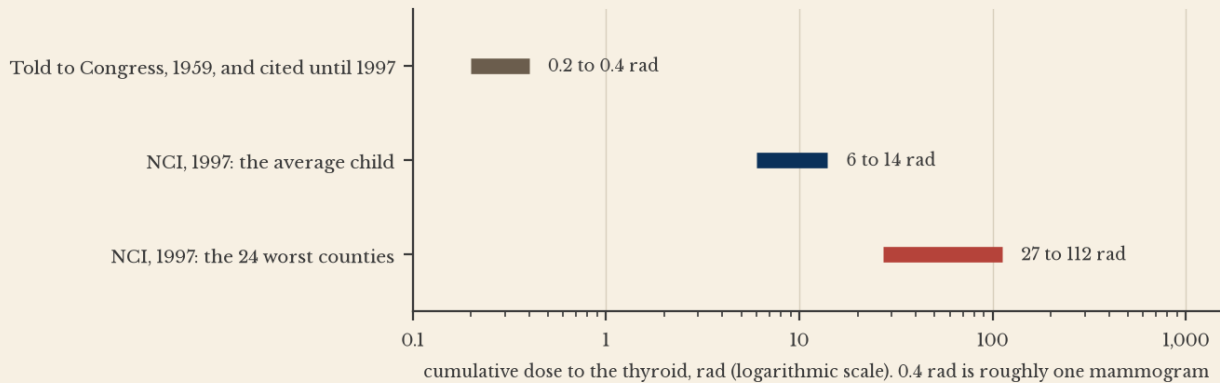


Figure 6.1: Dose to the thyroid of American children from the Nevada tests, as reported to Congress and as estimated by the National Cancer Institute in 1997. Source: reference 6.

The heaviest doses were not all near Nevada. Rain brought the fallout down in hot spots in the Middle West, New England, Idaho, Montana and the Dakotas,[6] which is what it had done in Indiana in 1945, and what a packaging physicist in Rochester had demonstrated, with two mills and a rain gauge, in a journal anybody could buy. Researchers at the time of the hearing expected between 10,000 and 75,000 additional thyroid cancers.[6] The Institute's present advice is that the disease is usually slow and highly treatable, that few of those exposed will develop it, and that those who were children then, drank milk and lived in the affected regions should discuss it with a doctor; it publishes a calculator for the purpose.[15]

6.2 What Britain did

The comparison the *Bulletin* drew in 1997 is with this country, and the Department reproduces it without satisfaction. In October 1957 a fire at the Windscale works released between 16,200 and 27,000 curies of radioactive iodine. The authorities tested the milk, found it contaminated, and had the milk from 200 square miles poured away for about a month.[6,17] The iodine-131 released by the American tests of the 1950s came to about 150 million curies, between five and nine thousand times as much, and at no point was milk ordered to be dumped.[6] In 1962 the Federal Radiation Council concluded that diverting milk might do more harm than good.[6]

6.3 The question, as put in the Senate

Senator Tom Harkin of Iowa, whose own family had thyroid trouble, put the matter to the hearing on 1 October 1997. The government had warned the entire photographic industry and given it maps. Where, he asked, were the maps for dairy farmers? The government had protected rolls of film, but not the lives of children; there was, he said, something wrong with this picture.[7] Later he asked the witnesses directly why the government had seen fit to tell Kodak where the hot spots would be and had not said to the public: for the next couple of months, in this area, you ought not to drink milk.[7]

One witness replied that the Commission's own monitor at St George, Utah, on the day of the test called Harry in 1953, had been told by his superiors to burn his clothes and shower thoroughly, and that not one word was said to the townspeople, who could have done the same. He could only assume the fear was that safety measures would close the test site.[7]

The Department put the Senator's question to Mrs Partridge, in plain words, as is the College's practice with questions that matter. She said that the film had somebody whose job it was to look after it. The Department has spent some weeks trying to improve on this and has not. The film had a physicist, a research laboratory, a trade association, counsel and an address to which a forecast could be sent. The milk had several million separate owners, none of whom had been told there was anything to ask about.

6.4 Those still asking

The people nearest the first test were told least of all. Residents around the Trinity site were unaware of the project, were given a cover story about an ammunition magazine, and were left out of the Radiation Exposure Compensation Act of 1990, which covered those downwind of Nevada.[9,18] The Act expired in July 2024. It was re-authorised by an Act enacted on 4 July 2025, and the Department of Justice now lists the whole of New Mexico as an affected area, for anyone present there for a year between 24 September 1944 and 6 November 1962; claims may be filed until 31 December 2027.[18,24] The people nearest the first test have therefore been counted, eighty years after it. The Department observes that the cardboard was compensated, in effect, in 1951.

Finding. The scandal is not that Kodak blackmailed the government. It did not. It is that a threat of litigation from one film manufacturer obtained, in a few weeks, a fallout forecast that the parents of 160 million people never received. The forecast existed. It had a distribution list.

7 WHAT KODAK ALREADY KNEW

7.1 The contractor

The account's first sentence has Kodak discovering the greatest secret of the Manhattan Project. Kodak was in the Manhattan Project. After a meeting in 1943 between Kenneth Mees, its director of research, and General Groves, a team of Kodak scientists went to Oak Ridge to enrich uranium,[11] and the company's subsidiary, Tennessee Eastman, was engaged by the Army to run the Y-12 electromagnetic plant there, which it did from 1943 until May 1947.[10] Y-12 separated the uranium-235 for the bomb dropped on Hiroshima.[10] Dr Webb had himself worked at Oak Ridge.[4,11] The *Bulletin* put it gently: the physicist's knowledge of the secret project was not altogether surprising.[6]

So the picture of an innocent film company stumbling on the bomb will not do. The firm whose film was fogged by the first atomic explosion had been paid to help make the second. What Kodak did not know, because nobody did, was the finding itself: that the products of a test in New Mexico could come down in the rain over Indiana, a thousand miles away and three weeks later, in a quantity sufficient to take their own photograph.

7.2 The sixth of August

The contaminated run of strawboard at Vincennes was made on 6 August 1945.[1] The bomb was dropped on Hiroshima at about a quarter past eight that morning, Japanese time,[19] which was the evening of the 5th in Indiana, and it was announced from Washington on the 6th. The board that would reveal the first explosion was therefore pressed on the day the world learned of the second, from river water that had been carrying the evidence for three weeks. It also disposes of the secret. By the time any film had lain against that board for a fortnight, the existence of the atomic bomb was the best-known fact on earth. Dr Webb considered whether Hiroshima itself could be the source and dismissed it on the timing.[9]

The Department took the coincidence of dates to Professor Widdowson-Bligh, expecting to be told that it was not chance. He replied: 'It is a date.' Pressed, he added that a mill makes board most days, that the contaminant was in the river for weeks, and that a run was bound to fall on some date or other; the Department should be more impressed that Webb found the date than that the date was found.

7.3 The same physics, on purpose

There is a last irony, and it is an engineering one. The film badge, the dosimeter worn by radiation workers, is a piece of photographic film in a holder, developed at intervals to see how dark it has gone. It was devised by Ernest Wollan on the Manhattan Project.[20] Inside the fence, the project was using film to detect radiation deliberately, one worker at a time. Outside the fence, a warehouse of the same material was doing the same job by accident, for the whole of the Middle West, and the results were being returned by customers as faulty goods.

7.4 The College's own part

This section is fiction, apart from its first paragraph. The British atomic bomb project was authorised in August 1941 under the Department of Scientific and Industrial Research, and its director, Wallace Akers, gave it the deliberately misleading name of Tube Alloys. It was folded into the Manhattan Project by the Quebec Agreement of August 1943.[23]

The reader who sent the account asked whether the College had been engaged on the Manhattan Project. The Department put the question to Miss Catchpole, who went to the South Atlantic Map Cupboard, on the ground that anything important will have been filed under the wrong ocean, and came back with a folder. In October 1941 the Directorate of Tube Alloys wrote to the College, as it seems to have written to everybody with a laboratory, asking in guarded terms what assistance it could offer. The name had been chosen so that anyone reading it would think of tubes and of alloys. The College read it and thought of tubes and of alloys. It replied by return with a report

of forty pages on the corrosion of boiler tubes, drawn from the Annual Inspection of the Boilers since 1841, and an invoice for eleven guineas.

The Directorate acknowledged the report with thanks and did not write again. The Department has considered this carefully and finds that the College is the only institution on which the cover name is known to have worked completely. Others were told the secret and kept it. The College was told nothing, suspected nothing, and cannot be shown to have let anything slip in eighty-five years, including the report, of which it kept no copy. General Groves asked for no more than that. One Fellow did leave for war work in 1943, having been told to tell nobody where he was going. He told nobody. The College does not know where he went, and the workshop records show his stool as unoccupied from that year until 1998.

The invoice was never paid. Successive Bursars have carried the eleven guineas forward each year under 'debtors, H.M. Government, tubes', and the present Bursar, shown Chapter 5, has asked whether a letter of the kind Kodak sent in March 1951 might now be in order. The Department has advised him that the College would first have to establish what it supplied, to whom, and why, and that on all three points the file is a credit to wartime security.

Finding. Kodak did not discover the secret of the bomb. It helped to keep it. What its physicist discovered was the thing that was not yet a secret because nobody yet knew it: how far the consequences travel, and that they travel by drainage.

8 THE DEPARTMENT'S TRIAL

8.1 Method

This chapter is fiction, as is the College. The Department reasoned that if one company could be running a continental radiation detector without knowing it, other institutions might be running instruments they had not commissioned. It obtained a quantity of dental X-ray film, packed it between sheets of strawboard, and left a box in each of seven places in the College for a fortnight. The risk assessment was made on the College's form of 1979.[22] Under 'persons at risk' the Department entered 'none', and under 'persons informed' it entered 'all', which it notes is the reverse of the arrangement in Chapter 6.

8.2 First, the water

Dr Webb's method begins with knowing where the water goes. Before setting out any film the Department therefore asked Mr Stobbs where the College's water goes. He produced, from memory, the whole of it: the Lawn to the ha-ha drain, the roofs to the quad gullies, the boating lake by its overflow, and all of it by one culvert of 1790 under the Crown Works to the Piddle. Anything that fell on the College, he said, would be at the culvert grating by the next morning, and he would be the first to know, because he is the one who clears it. The Department asked whether anybody had ever asked him to keep a record of what he finds there. Nobody had. He has kept one since 1987. It is mostly 10 mm sockets.

8.3 Results

Where the box was left	After a fortnight	Explanation
The Porters' Lodge, on the mantelpiece	Fogged: a clear image of ten past four	The Lodge clock has a luminous dial of 1938. Radium, as Kodak found before the war. The clock has been photographing the post since Munich
The Senior Common Room, in the biscuit cupboard	Clear	Mrs Partridge states that nothing in her cupboard is more than a week old and that she could have told the Department that
The Library, on the front step	Faintly and evenly fogged	The step is granite, which is mildly radioactive and always has been. Miss Catchpole has catalogued the step under Apparatus
The boiler house	Clear	The boilers have been inspected every Michaelmas since 1841 and have nothing to hide
The Bursar's office, under the current ledger	Not recovered	The cat was on the ledger. It is there still
The Fellows' Lawn	Not deployed	Mr Stobbs. No trial on the Lawn without the Clerk of Works; permission was last given in 1643
The workshop, on Gerald's stool	Clear, and the box had been moved two inches	See below

Table 8.1: The Department's trial. Declared fiction. Granite and radium dials do fog film; the College's examples of them do not exist.

The Department records two results. The first is the clock. The College has had a radioactive source on the mantelpiece of the Porters' Lodge for eighty-eight years and has detected it by the method of 1945, in a fortnight, with a box of film. The Bursar has been informed and has asked whether it affects the insurance. The second is the stool. A detector that found a bomb at 1,109

miles found nothing at all on Gerald's stool, except that somebody had moved it. The Department regards this as the strongest negative evidence it has ever obtained and does not know of what.

8.4 Action taken

The Department has made three recommendations to Governing Body, all of which follow from Chapter 6 rather than from the film. First, that Mr Stobbs's record of the culvert grating be read by somebody other than Mr Stobbs, once a term. Second, that the Lodge clock remain where it is, since it has done no measurable harm in eighty-eight years at the far end of a mantelpiece, but that the porters be told what it is, on the principle that the people nearest a source are the first who should hear of it and were, in 1945, the last. Third, that when the College learns something that matters to its neighbours downstream, it tells the neighbours and not merely its suppliers.

Governing Body has accepted the first two. On the third it has asked what the College might ever learn that would matter to anybody downstream. The Department has referred it to the Trebuchet Research Group's open day and to the boating lake, and awaits a reply.

Departmental observation. Every institution is running detectors it has not commissioned, and employs somebody who reads them and has never been asked. At Kodak it was a packaging physicist. Here it is the Clerk of Works. The Department recommends asking.

9 CONCLUSIONS

The Department was asked whether the account is true. It finds as follows.

- The film did fog, the cause did fall from the sky, and it did come from the Trinity test. Those three claims hold, and they are remarkable enough.
- It was not the straw. The straw was the first guess, aired in TIME within four months of the test, and Dr Webb cleared it on the evidence of a warehouse and convicted the river on the evidence of a second mill and the rain. The guess has outlived its refutation by seventy-seven years and is now repeated by machines. The contaminant was compatible with cerium-141, whose half-life he measured to within eight per cent using the product he was trying to protect.
- Kodak did not discover the secret of the bomb. Its subsidiary ran the plant that enriched the uranium for Hiroshima, its physicist had worked there, and the guilty board was made on the day that bomb was announced.
- Kodak did not threaten to talk. In 1951, after radioactive snow, it threatened to sue. Silence was the government's price. The forecasts went to the whole photographic industry.
- The better retellings have the story right and the distances wrong. One measured 1,111 miles correctly, to the mill, and then addressed it to the head office.
- The matter that deserves the attention is the one the account omits. A forecast of where fallout would come down existed from 1951 and was sent to the makers of film. It was not sent to the people who kept cows, and the dose to their children was understated to Congress by a factor of fifteen to seventy for nearly forty years.
- A slow detector with a physicist attached outperformed a fast one with none. The difference between the film and the milk was never the physics. It was whether anybody had the job of looking.

Mrs Partridge's ruling. The film had somebody whose job it was.

The Professor's ruling. 'It is a date.'

Principal finding. The popular account scores three and a half out of ten and is less interesting than the truth. Nobody blackmailed anybody. A careful man noticed a spot, refused to blame the straw, followed the water, and found the atomic age in a river in Indiana. Six years later his employer's solicitors obtained the fallout forecast. The lesson for engineers is that the forecast existed, and that a warning goes to whoever is organised enough to ask for it. The College has begun by asking Mr Stobbs.

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APPENDIX A - SAMPLE CALCULATIONS

A.1 Distances

Great-circle distances on a sphere of radius 3,958.8 miles, by the haversine formula. Positions: Trinity site 33.677 N, 106.475 W; Alamogordo 32.900 N, 105.960 W; Vincennes 38.677 N, 87.529 W; Tama 41.967 N, 92.577 W; Rochester 43.157 N, 77.609 W; Frenchman Flat 36.827 N, 115.959 W.

Trinity to Vincennes 1,109 miles. Trinity to Tama 948. Trinity to Rochester 1,684. Alamogordo to Rochester 1,687. Vincennes to Tama 350. Frenchman Flat to Rochester 2,058. The town of Alamogordo is 61 miles from the test site named after it.

A.2 Decay

Fraction remaining after t days = $0.5^{(t / \text{half-life})}$. From 16 July to 6 August is 21 days; to about 20 August, 35 days.

Cerium-141 (32.5 days): $0.5^{(21 / 32.5)} = 0.64$; $0.5^{(35 / 32.5)} = 0.47$. Iodine-131 (8.02 days): $0.5^{(21 / 8.02)} = 0.16$; $0.5^{(35 / 8.02)} = 0.05$.

Dr Webb's half-life of about 30 days against 32.5: $(32.5 - 30) / 32.5 = 7.7$ per cent low.

A.3 The warehouse argument

Straw stored for six months before pulping, say 180 days: $0.5^{(180 / 32.5)} = 0.02$. Two per cent would remain of anything that had been in it at harvest. The period of storage is the Department's assumption; reference 3 says only 'a considerable amount of time'.

A.4 The snow

10,000 counts a minute / 400 counts a minute = 25. The sources agree with one another and with the arithmetic, which the Department records as unusual.

A.5 The iodine

150,000,000 curies / 27,000 curies = 5,556. 150,000,000 / 16,200 = 9,259. Windscale's milk was poured away at one part in five to nine thousand of the American release.

A.6 The dose

6 rad / 0.4 rad = 15. 14 rad / 0.2 rad = 70. This is the 'fifteen to seventy times' of reference 6.

A.7 The mark

Two claims held (2) + three held in part ($3 \times 0.5 = 1.5$) + five not held (0) = 3.5 out of 10.

APPENDIX B - THE BURSAR'S CARD

Item	Figure	The Bursar's note
Cost to Kodak of a solicitor's letter, 1951	Not recorded	Whatever it was, cheap
Obtained by it	Schedules, maps and forecasts for the rest of the test programme	Note the method
Time between the snow and the letter	About six weeks	Brisk
Time between Dr Webb's paper and the Senate reading it	48 years	Nobody reads the journals either
Thyroid dose, as told to Congress	0.2 to 0.4 rad	Somebody initialled that
Thyroid dose, average child, as estimated in 1997	6 to 14 rad	I should like to see the working
One box of dental film and strawboard	Petty cash	Approved
Debtors, H.M. Government, tubes (1941)	Eleven guineas	Carried forward. Eighty-five years. I should like to discuss interest
The Lodge clock	In service since 1938	Do not tell the insurers until I have read the policy

Table B.1: The Bursar's card. Figures from references 1, 3, 6 and 7. He has initialled the seventh line only, and underlined the eighth.

APPENDIX C - DEPARTMENTAL NOTE

The Department of Agricultural Engineering, Drainage and Applied Weather teaches the BEng of that name (KE18), three years, weather permitting. Its position is that most things of consequence arrive by weather and leave by drain, and that the engineer's first question is therefore where the water goes. It has held this position on fields, taxes and culverts, and now holds it on the atomic age.

From Michaelmas 2026 module AW115, The Cost of Rain, will include Dr Webb's paper of 1949 as a set text, with the question: 'The straw was innocent. Show how he knew.' Candidates who blame the straw will be referred to the river.

The Department thanks the reader who sent the account, and asks that further accounts be accompanied, where possible, by a distance and the name of the building it was measured to.

Persevera Etelred