This exercise helps to "open" the course. Its purpose is to give students some greater familiarity with the topic of the course and with its concerns, questions and mode of inquiry. To do this, the exercise includes three articles from online news sources of the mass-circulation media, specifically the *Guardian* newspaper. The three articles are:

1. "Can you capture the complex reality of the pandemic with numbers? Well, we tried…" (2 January 2022) about the use of statistics to tell the story of unwanted circumstances like pandemic;

2. "'Dirty 30' and its toxic siblings: the most dangerous parts of the Sellafield nuclear site." (5 December 2023) about managing radioactive waste from nuclear power plants;

3. "Everyday risks: when statistics can't predict the future" (9 June 2013), about the meaning and implications of statistical calculations and representations of dangers and risks (potential harms).

Please answer the questions below for submission. Answers should not be just quoted words or phrases from the articles. They should be formulated in your own words with quotes from the texts where relevant and useful. Answers must be accurate and directly relevant to the question asked.

Due date: Friday, 9 February (Week 2), day end. Via Léa.
Grade value: 10% (part of the 20% "Occasional Exercises and Assignments" evaluation item)
Length: As required. Just answer the questions correctly and completely.
Submission details: Answers must be submitted on the ANSWER FORM. Make sure to keep a copy of your submission. Submit the answers in "Assignments and Dropbox" in Lea. *This is a compulsory assignment. All students must complete it if they want to receive a grade other than 0 for this evaluation item.*

Advice and Guidance:

- Answers should take the form of complete, proper sentences expressing complete thoughts.
- All cited content from the articles must be presented in quotation marks.
- **Authorized** documentary sources for this assignment are, where relevant: dictionaries, College-subscribed encyclopedias, specialized educational web sites, other websites relevant to the assignment, academic books and articles.
- Documentary sources, used in answers must be suitably and correctly referenced. **A reference in the form of a Url alone is not a suitable reference.** Referencing flaws, faults and omissions will give rise to point deductions.
- The Vanier College library webpage gives you access to reference material like dictionaries and encyclopedias.
- Answers will be graded for language proficiency. Spelling, grammar, punctuation and other language formalities will be assessed and will enter into grade outcomes.
- If you are uncertain whether a particular documentary source is valid for the purposes of this assignment, please consult the teacher.

Submissions MUST be each student's own, independent and individual work. Answers must draw on the articlse provided or on authorized sources indicated in the questions.

Read the questions carefully and follow the requirements for each of the five Parts.

Part	Grade weighting	Answer-Question Ratio (A/Q)
1	1.5 points	5/5 (1.1-1.5)
2	2 points	4/4 (2.1-2.4)
3	2.5 points	1/1 (3.1)
4	3 points	7/7 (7.1-7.7)
5	1 point	1/1 (5.1)

1. Staging and Setting (Articles 1, 2 & 3)

Answer all of the questions including all parts of the questions 1.1 to 1.5.(1.5 points)

1.1 Who is David Spiegelhalter (a co-author of Article 2)?
In the answer, indicate the following: his current or latest professional academic position; honorary and professional positions and affiliations (other than his main academic position); his areas of academic and professional interest and activity; some of his noted contributions to the subject of risk.
The information may be found at the end of the articles (in the brief biographical notes) or at the following web pages:
1. *David Spiegelhalter's Personal Home Page*: http://www.statslab.cam.ac.uk/~david/
2. "Professor Sir David Spiegelhalter, People". *Winton Centre for Risk and Evidence Communication*, University of Cambridge.: https://wintoncentre.maths.cam.ac.uk/about/people/.
3. "David Spiegelhalter, Biography". *The Royal Society*.
https://royalsociety.org/people/david-spiegelhalter-12329/
4. "David Spiegelhalter, Panelists". *Nobel Prize Organization, Nobel Week Dialogue*.:
https://www.nobelprize.org/events/nobel-week-dialogue/gothenburg-2019/panellists/adam-smith-2-2/
5. "David Spiegelhalter". *Wikipedia*. https://en.wikipedia.org/wiki/David_Spiegelhalter

Write answers in the blank cells of the Answer table below. It may be necessary to use more than one source. Provide references to the sources used.

1.1 Answer	
Current or latest professional academic position **(academic title and position he holds or held and the name of the institution or university where he held it)**	
Other honorary and professional (academic and non-academic) positions and affiliations	

(organizations or institutes with which he is affiliated and holds or held positions) **Just name TWO positions or affiliations.**	
Areas of professional and academic interest and activity **(topic areas of interest and activity on risk and connected subjects)** **Name three topic areas (one is provided)**	1. *Risk communication. The communication of information about risk and risks* 2. 3.
Noted contributions on the subjects of risk and uncertainty **(publications and media work)** **Just provide the titles of some noted book publications and video documentaries**	
References:	

1.2 Who is Michael Blastland, a co-author, along with Spiegelhalter, of Article 3?

In the answer, indicate the following: what he does professionally (i.e. what he does for a living); what his areas of research and writing interest are; what are his latest book publications.

The information for the answer may be found on the following web pages:

Winton Centre for Risk and Evidence Communication, "People": https://wintoncentre.maths.cam.ac.uk/about/people/michael-blastland/

Basic Books, Contributor: https://www.basicbooks.com/contributor/michael-blastland/

Atlantic Books, "Michael Blastland: https://atlantic-books.co.uk/contributor/michael-blastland/

1.2 Answer

1.3 What is the title of the book that Spiegelhalter and Blastland co-authored and published?

It was published, initially, by Profile Books and then, in another edition, by Basic Books. Provide the full title of the book (main title and subtitle) in ***both*** the Profile Books and the Basic Books editions (the titles of the two editions are slightly different). Also, provide the year of publication of the ***first paperback edition***. See the following webpages for help:

Profile Books, "The Norm Chronicles": https://profilebooks.com/work/the-norm-chronicles/

Basic Books, "The Norm Chronicles": https://www.basicbooks.com/titles/michael-blastland/the-norm-chronicles/9780465085705/

Goodreads, "The Norm Chronicles": https://www.goodreads.com/work/editions/25320331-the-norm-chronicles

1.3 Answer
Title, Basic Books edition:
Title, Profile Books edition:

1.4 What is the title, the name of the publisher and the year of publication of the book that Spiegelhalter and Anthony Masters co-authored and published?

Provide the full title of the book (main title and subtitle), the name of the publisher and the year of publication. See the following webpages for help:

Penguin Books: https://www.penguin.co.uk/books/446/446585/covid-by-numbers/9780241547731.html

Goodreads: https://www.goodreads.com/book/show/57961073-covid-by-numbers?ac=1&from_search=true&qid=Y0w9iSq2Cz&rank=1

1.4 Answer

1.5 Spiegelhalter and Blastland are associates of the Winton Centre for Risk and Evidence Communication. One of the Winton Centre's projects is called "RealRisk".

Question: What is the purpose of the "RealRisk" project? That is, what is its principle aim or purpose?
Answer in your own words in three lines or so. If text is quoted in the answer, quotation marks must be used.

To answer, see the following links:
RealRisk: https://realrisk.wintoncentre.uk/;
"Project - RealRisk". Winton Centre for Risk and Evidence Communication:
https://wintoncentre.maths.cam.ac.uk/projects/press-alert/

1.5 Answer

2. Statistical information and knowledge about risk and danger: writing about Covid-19 during the pandemic (Article 1)

Answer all of the questions 2.1 to 2.4 including all parts of the questions (2 points)

2.1 What was the purpose or objective of the weekly column that Spiegelhalter and Masters were writing in *The Guardian* between January 2021 and January 2022? (para. 2)

State, both, what the purpose or objective was in general terms and what the specific topics were that they addressed.

2.1 Answer

2.2 What challenges did Spiegelhalter and Masters say they faced, as statisticians, in writing about Covid-19 numbers on a weekly basis for *The Guardian* between January 2021 and January 2022. (Paras. 3 and 4)

They mention two kinds of challenge that they faced in writing about Covid-19. One challenge has to do with how they presented information and explained statistics. The other challenge had to do with dealing with media demands. Provide both challenges. The answer must take the form of complete sentences in your own words.

2.2 Answer	
Challenges	**Explanation of the challenges**
1. The challenge of presenting and explaining statistics (Para. 3)	
2. The challenge of dealing with media demands (Para. 4)	

2.3 The authors state: "Unfortunately, this pandemic has been rife with false claims and misinformation, particularly about vaccines." (para. 6) Answer the following three questions relating to this statement.

2.3.1 How, or by what means, did the authors deal with "false claims and misinformation" about Covid-19, especially about vaccines? Put differently, what approach did they take to try to combat or counter misinformation and people's acceptance of wrong information? (para. 6)

In the answer, provide the name given to the approach and provide an explanation of the approach. The explanation should be in your own words. The answer may include a quote, but it must also explain.

2.3.1 Answer

2.3.2 What is "empirical evidence"? The authors say that their approach to false claims and misinformation was "supported by empirical evidence". (para. 6)

To answer, provide a dictionary definition of "empirical" (adjective) and then state what "empirical evidence" is. Provide the dictionary reference.

2.3.2 Answer	
"empirical" (adjective): definition (the definition must refer to knowledge and a way of acquiring knowledge)	
"empirical evidence": explanation	
Reference:	

2.3.3 What was the result of their approach or strategy for dealing with false claims and misinformation about vaccines and vaccination, especially in their June 2021 article about Covid-19 deaths among vaccinated older people?

To answer, fill in the following table.

2.3.3 Answer	
Question	Response
(a) What was their claim about vaccines when it was reported that most older people who died from Covid-19 had been vaccinated? (para. 7)	
(b) How was their article and claim interpreted by readers and by people commenting on social media sites? (para. 8)	
(c) What is their general impression about how media handled statistical reporting about Covid-19? (para. 12)	

2.4 According to the statisticians, Spiegelhalter and Masters, *how should* statistical data be treated in and by the media and *why should* it be treated that way? (para. 13)

2.4 Answer

3. Risk and technology: the case of nuclear power and nuclear waste(Article 2) (2.5 points)

Answer the questions 3.1 and 3.2 including all of parts of the questions.

3.1 What is the risk that is being discussed in this article about the nuclear waste that accompanies the generation of energy by nuclear power plants (chiefly in the United Kingdom, but elsewhere as well)?

Describe the risk that is being discussed in this article. Do so by filling in the following table below. Provide the relevant information for all 4 "Elements of Description" in the blank cells in the column headed "Details of Description".

3.1 Answer	
Element of Description	**Details of Description**
1. Identification and definition 1: The general circumstance. What is the **general** circumstance (the situation) of risk of harm, loss or injury with which the article is primarily concerned? (Para. 1, 2, 3, 5, 7, 16, 18 ,19) Identify the general circumstance and not the specific cases of the general circumstance.	
2. Identification and definition 2: The specific cases What are the specific cases of the general circumstance that are mentioned in the article? (Para. 1, 2, 3, 5, 7, 17, 21, 22) There are three specific cases. One case is provided.	1. (paras. 1, 2, 3, 5, 7)
	2. (para. 17)
	3. (paras. 21, 22) There are leaks of radioactive water from the Magnox swarf storage silo (MSSS). The silo was found to be leaking radioactive water into the ground in the 1970s. There are concerns that efforts to retrieve the radioactive waste, now, may reopen historic leak paths and introduce new ones. (para. 22) "There are also grave concerns over leaks from the Magnox swarf storage silo (MSSS) described as 'one of the highest-hazard nuclear facilities in the UK'". (para 21).
2. Identification and definition 3: The harm. What is the potential harm, injury or loss (the risk) that is being identified in the article? (paras. 3, 5, 7, 16) The potential harm is stated indirectly. You have to deduce it from the content. It has to do with radioactivity.	

3. Identification and definition 4: The "primary identifiers" Who are the "primary identifiers" of the potential harm (the risk)? (paras. 5, 6, 22, 23) State who (individuals or organizations) are identifying and naming the risk and making it publicly known, in the first instance. A "primary identifier" is an original, often first-hand, source of information on the risk. A "primary identifier" is involved in naming the risk for the first time based on first-hand information acquired directly or indirectly. In this article, there are four "primary identifiers". One is an individual who possibly works at the Sellafield plant, one is an online media source, one is an individual expert and one is an independent regulatory body. List them all. (Note: one answer is provided.)	Primary identifiers: (1) individual (para. 5): An "anonymous source" who leaked photos of B30 and B29 to an online website concerned with environmental matter. The individual probably works at the Sellafield site since they were able to take photos of B30 and B29.
	(2) online media source and website (paras. 5 & 6):
	(3) expert (para. 6):
	(4) independent regulatory body (paras. 22 & 23):
4. Identification and definition: The "secondary identifiers" Who is/are the "secondary identifiers" of the potential harm (the risk)? State who (individual or organization) in involved in bringing the information about the risk to wider public attention. A "secondary identifier" is a relay or second-hand source for the information. It transmits information from "primary identifiers" to the public. (The name of the "secondary identifier" is provided.)	Secondary identifier: *The Guardian newspaper.*

3.2 What are the probability claims that are made about the risk?

State in what terms probabilities of harm, loss or injury are expressed in the article. Do so by filling in the following table below. Provide the relevant information for the "Elements of Probability Claims" in the blank cells in the column headed "Specific Terms of Probability Claims".

3.2 Answer	
Elements of probability claims	**Specific terms of probability claims**
1. Probability claim 1: statement of likelihood. What claim of probability or likelihood, with regard to the harm, are the "identifiers" making in the article? In what specific terms is the probability or likelihood of harm being expressed and stated? (paras 7, 21) Quote the precise and specific phrases that express probability (likelihood) of an unwanted occurrence and identify the sources of the statements. There are three statements in the article that can be said to express a probability of occurrence and of harm. Present **TWO** of them. One statement is by the nuclear safety expert and two are by the ONR.	1. (para. 7) 2. (para. 21)
2. Probability claim 2: numbers and narratives What form or format is used to express the probability or likelihood of the occurrence of harm? State whether the probability claims are expressed in numerical form (quantitatively) as a percentage or ratio, for instance, or in narrative form (qualitatively) using words that express the likelihood of occurrence.	1. 2.

4. Risk: Conceptual distinctions and clarifications (Article 3)
Answer all of the questions. (4.1 to 4.7) (3 points)

4.1 What are the two sources of evidence about risk that the authors of Article 3 identify? (Para. 2)

> 4.1 Answer

4.2 In paragraph 2, the authors state: "In fact, if there were such a thing as a risk-calculating machine that claimed to give you objective odds on danger, we'd be the first to warn of malfunctions."

Question: What are "odds"? To answer, please find a suitable dictionary definition of the word "odds". You <u>must</u> find the definition that is most relevant to the use of the word in this context. You must provide the dictionary reference.

4.2 Answer
Reference:

4.3 What are "objective odds"? The quoted phrase in 4.3 refers to "objective odds". What does it mean to say that "odds" may be "objective"? State in your own words what quality or character "odds" are given when they are described as "objective".

You may use a dictionary to find the meaning of "objective" (adjective). If you do, you <u>must</u> provide the reference.

4.3 Answer
Reference

4.4 What two generally held beliefs about the reality or fundamental nature of risk do the authors question and contradict and what do they say is, in fact, the case when it comes to the reality of risk? (para. 3)

The authors question, contradict or take issue with two commonly held and closely related views about the *nature and reality* of risk. State what the two commonly held views are and state what alternative views about the reality of risk the authors are advancing.

Here you have to find what the authors say people generally believe to be true about the nature or reality of risk.

4.4 Answer	
Commonly held views about the reality of risk	**Authors' alternative views about the reality of risk**
1.	1.
2.	2.

4.5 In questioning these commonly held views, what do they say must be taken into account to better understand the nature and reality of risk? (Para. 3)

4.5 Answer

4.6 What do the authors say some people <u>mistakenly</u> do with numbers about dangers and hazards? That is, what do they say is the "hazard" with how some people treat "risk numbers" (i.e. numerical expressions of risk and hazard)? State what the mistake is and what it means. (Para. 3)

4.6 Answer

4.7 What criticism do the authors direct at media reporting? What do they say is the media's likely response to the criticism? (Para. 10)

4.7 Answer
Criticism of media reporting:
Possible media response:

5. Argument or main points of Article 3 (1 point)

5.1 What is the argument in Article 3?

To answer, fill in Table **5.1.2** below.
In Table 5.1.1, the Reasons (R) and the Conclusion (C) that make up the argument are provided *in random order*. Put the five statements – four Reasons and one Conclusion - in their proper order in Table 5.1.2. The order of the statements should follow logically from each other such that the three Reasons lead to or produce the Conclusion. Conclusions are like "Therefore" statements: they express the point or the main claim of the argument.
The argument has been simplified for the purposes of this exercise. You can put the entire phrases in the proper places in **Table 5.1.2** or just the numbers of the phrases or both.

5.1 Answer
Table 5.1.1: Argument in Article 3: Random order
1. However, numbers alone can be deceptive and can never be the sole and final word on risks, dangers and hazards. (para. 2 & 4);
2. In addition to numbers, the stories people tell are big influences on the sense of where danger lies (para. 2);
3. Therefore, both numbers and stories have strengths and weaknesses as sources of evidence about risks, dangers and hazards and should both be considered in accounting for risks, dangers and hazards.

4. People think that numbers matter above all as a source of evidence on risks, dangers and hazards (paras. 2);	
5. Numbers and stories, as sources of evidence about risks, dangers and hazards, can each deceive us and distort our sense of risk, but, also, can each give us clarity on the risk (the potential danger or hazard). (paras. 2-5);	

Table 5.1.2: Argument in Article 3: Proper or Organized Order	
R1	
R2	
R3	
R4	
C	

Argument number sequence:

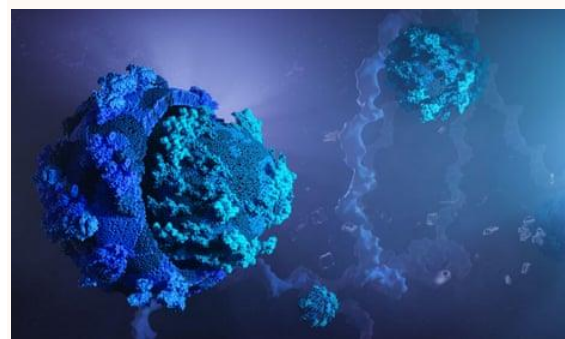**5/5=1 point**
4/5=.75 points
3/5=.5 points
<3= 0 points

ARTICLE 1

Can you capture the complex reality of the pandemic with numbers? Well, we tried...
David Spiegelhalter and *Anthony Masters*

Throughout 2021, two leading lights of the Royal Statistical Society Covid-19 Task Force drew on data for a weekly *Observer* column, and found themselves in the middle of Covid culture wars

Rendering of the Omicron Covid-19 mutation. Photograph: Simon Lehmann/Alamy
Sun 2 Jan 2022 10.00 GMT

1. Individual experiences and suffering are, of course, at the heart of the pandemic. But one way to understand what has happened is through putting those experiences together – and statistics are those personal stories writ large. And this pandemic has brought unprecedented demand to explain all the numbers that have been flying around.
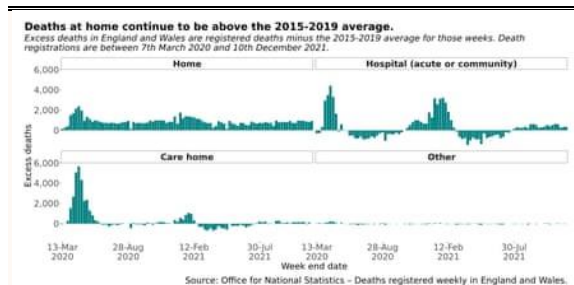
2. This has not been without its problems and we've had to learn some hard lessons, such as the journalistic skill of brevity. Since January 2021, we've been writing a weekly column in this paper about Covid numbers, covering everything from infections to deaths, vaccines to mental health, masks to lockdowns.

3. It can be frustrating not being able to show all the graphs, but the same holds for radio and TV interviews and *More or Less* on Radio 4 has shown how much can be done to explain statistics without visual aids. Mathematical formulae and technical jargon need to be avoided, but we have also had to be sparing with numbers, which is harder when they are so precious to us.

4. We had to agree our purpose, as a particular challenge is to fend off the voracious media appetite for blame, speculation and controversy, naturally fed by the broad spectrum of opinion among experts. One camp has supported viral suppression and even elimination, while others have expressed scepticism about the measures taken; it's become a cliche that their extreme followers can be identified by the phrase "I've done my own research".

5. In the theatre of political combat, numbers are often weapons to beat opponents, but they should really be used to raise the quality of the debate. So we see ourselves as part of a group who have attempted to keep away from policy disputes and some of our most trusted sources are skilled individuals doing analyses in their spare time, who then share their insights on Twitter – to inform rather than persuade.

6. Unfortunately, this pandemic has been rife with false claims and misinformation, particularly about vaccines. One approach for dealing with this, supported by empirical evidence, is the idea of "inoculation" – pre-empting misinformation and telling people about the incorrect interpretation before they catch it in the wild.

Deaths at home continue to be above the 2015-2019 average.
Excess deaths in England and Wales are registered deaths minus the 2015-2019 average for those weeks. Death registrations are between 7th March 2020 and 10th December 2021.

Source: Office for National Statistics – Deaths registered weekly in England and Wales.

Photograph: ONS

7. We tried this strategy back in June 2021 when Public Health England first published data showing that, among older people who had recently died with Covid-19, most had been vaccinated. We wrote an article pointing out that this did not mean the vaccine was ineffective – just that it was imperfect – and that the great majority of people had been vaccinated: in essence, a small proportion of a large number can be bigger than a larger proportion of a small number. Another useful analogy is with seatbelts: most people who die in car accidents are wearing seatbelts, but this does not mean that seatbelts are not effective – it's just that nearly everyone wears one and they are not perfect.

8. The response to our "pre-bunking" was not encouraging. The Twitter link to our article included only its title, Why most people who now die with Covid in England have had a vaccination, and not the subhead, Don't think of this as a bad sign, it's exactly what's expected from an effective but imperfect jab. As such, it was mistakenly interpreted as an anti-vaccination article (or worse) and circulated online. This, in turn, led to critical comments suggesting that we had encouraged vaccine scepticism and even an extraordinary tweet saying we (and the paper's editors) were "genocidal" and should be "hunted down and destroyed". We made light of this, saying this seemed a bit harsh, but we had had worse referees' reports. That account was subsequently removed from Twitter.

9. Among the repeatable insults, DS has been called an "idiot", a "shameless liar" and "Nazi collaborator". Of course, this is mild compared to what others have received (although "fossil" did hurt).

10. It got more complicated in September 2021 when ITV's political editor, Robert Peston, tweeted (and later deleted) "Infections higher among double vaxxed for those 40 to 79 than for non-vaxxed". Surprisingly, he was not referring to the absolute case numbers, which could be explained using the reasoning above. Instead, this referred to the case rates per 100,000 people reported by Public Health England. That seems strange, but can be explained by PHE's use of National Immunisation Management System (NIMS) for population figures, which uses GP lists and so tends to overcount due to many and defunct registrations. Using Office for National Statistics (ONS) population estimates, themselves uncertain, leads to the expected lower case-rates in vaccinated than unvaccinated groups.

11. This UK data, apparently showing higher case rates in the vaccinated than the unvaccinated, was later used by Brazil's President Bolsonaro to support his bizarre claim that vaccines cause Aids. Complaints by the watchdog Office for Statistics Regulation have had little impact and PHE's successor, the UK Health Security Agency, stubbornly refuses to change its publication (even though unvaccinated rates are in a lighter font), so that these misleading numbers continue to feed vaccine misinformation.

12. These stories might give a poor impression of how the media has handled Covid-19 numbers. But, on balance, our impression is that a valiant attempt has been made by most outlets to explain their complexities. All, of course, impossible without the extraordinary behind-the-scenes work of those who produce the Covid dashboard, the ONS Infection Survey, and the other sources that it is too easy to take for granted.

13. We started working together through the Royal Statistical Society, since statisticians care deeply about the use of numerical evidence in public debate. Data does not speak for itself – it needs people to speak honestly and carefully on its behalf. A misunderstood statistic could have terrible consequences – in health, wealth and justice. By contrast, better statistics should lead to better debate and, we hope, better decisions.

David Spiegelhalter is chair of the Winton Centre for Risk and Evidence Communication at Cambridge. Anthony Masters is statistical ambassador for the Royal Statistical Society. Their book, *Covid by Numbers: Making Sense of the Pandemic With Data*, is published by Penguin

https://www.theguardian.com/commentisfree/2022/jan/02/2021-year-when-interpreting-covid-statistics-crucial-to-reach-truth

END of Article 1

ARTICLE 2

'Dirty 30' and its toxic siblings: the most dangerous parts of the Sellafield nuclear site

Cracks in ponds holding highly radioactive fuel rods lead to safety fears

- Sellafield nuclear site has leak that could pose risk to public
  by Alex Lawson and Anna Isaac

Tue 5 Dec 2023 13.00 GMT

-
- **Radioactive sludge**
  1. In the early 1950s, a huge hole was dug into the Cumbrian coast and lined with concrete. Roughly the length of three Olympic swimming pools and known as B30, it was built to hold skip loads of spent nuclear fuel.

  2. Those highly radioactive rods came from the 26 Magnox nuclear reactors that helped keep Britain's lights on between 1956 and 2015. When B30 was first put to work, it was designed to keep the fuel rods submerged for only three months before reprocessing work was carried out.

  3. But when 1970s miners' strikes shut down coal power stations and forced greater reliance on nuclear plants, more spent fuel than could be quickly reprocessed was generated. The silos and ponds, built to prevent airborne contamination if the fuel or radioactive sludge dried out, rapidly filled up. Meanwhile, the fuel corroded in the water, breaking down into radioactive sludge.

  4. Debris from elsewhere within Sellafield was later added and the pond was abandoned when new facilities were built in 1986, clouding over and leaving workers on

site with little idea what lay beneath its murky waters.

'**A nightmare job with no blueprint**'
5. In 2014, photos of B30 and nearby B29 leaked via an anonymous source to the Ecologist led to concerns over the radioactive risk associated with the poor repair of the ponds.

6. The two facilities were used until the mid-1970s for short-term storage of spent fuel until it could be reprocessed and used for producing plutonium for the military.

7. The Ecologist pictures showed hundreds of highly radioactive fuel rods in ponds housed within cracked concrete overgrown with weeds, with seagulls bathing in the water. The images, taken over a period of seven years, led the nuclear safety expert John Large to warn that any breach of the wall would "give rise to a very big radioactive release".

8. At the time, the Office for Nuclear Regulation (ONR), the nuclear safety regulator, said that while the old ponds bring "significant challenges", their appearance "does not mean that operations and activities on those facilities are unsafe".

The B30 pond carries a higher risk of radiation than other parts of the site. Photograph: gov.uk

9. It took 15 years and £1.5bn to bring B30 to a point where decommissioning could begin several years ago, with builders limited to working only half an hour a day

close to the pool to prevent them from exceeding radiation exposure limits. Remotely operated vehicles, normally used to help with submarine rescues, were originally deployed but quickly failed, often within hours, because of the overpowering radiation. Newer models have since been used to vacuum up nuclear sludge, which is then moved to alternative long-term storage.

10. Sellafield hopes to have drained the pond by the early 2030s, and demolished it by the 2050s.

11. A new facility, the sludge packaging plant, has been built to receive radioactive sludge from B30. The nuclear watchdog said there have been some "regulatory challenges along the way … including noncompliance with fire regulations".

12. Although the reservoir is still nicknamed "Dirty 30", it was officially rebranded in 2018 as the First Generation Magnox storage pond.

13. But one former longstanding employee says that, despite the cracks, the contents of the ponds are gradually improving: "I have seen it at its worst. The water quality was horrendous; you could stand on the roof and look down and not see a single thing in there.

14. "In the control room, there are a group of lads using PlayStation-like controls for robots to pick up bits the size of a 50p piece and hoover up the sludge. It's cutting edge."

15. He adds: "[Decommissioning Sellafield] is the biggest job in nuclear and there is no blueprint. It's a dream and a nightmare job. There has been real progress – every skip that comes out makes it safer and reduces the hazard risk."
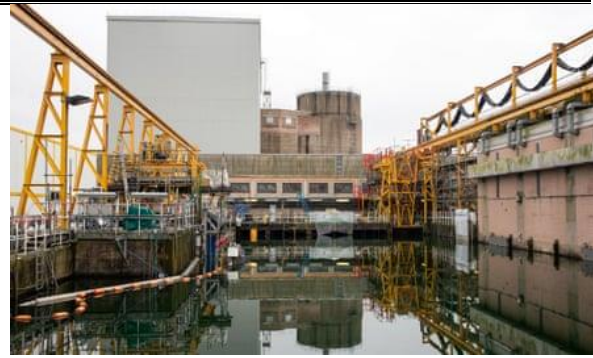
A 2016 image of the pile fuel storage pond, which is on a separate part of the site from the Magnox storage. Photograph: Bloomberg/Getty Images

Toxic neighbours
16. B30 sits in a "separation zone" that requires greater security checks, and carries a higher risk of radiation, than the rest of the town-sized site. Although B30 is the most notorious crumbling building on Sellafield's sprawling estate, it is far from the only problem child.

17. Nearby is B38, used to store highly radioactive cladding from reactor fuel rods. It was also used heavily during the miners' strike of 1972, when nuclear plants were relied on to produce extra power, and it proved impossible to process all the waste that was being generated. Two years later, the public's view of the nuclear industry was sharpened by the launch of the Protect and Survive advice on surviving a nuclear attack.

18. In B29 lie the toxic remains of Britain's attempt to become an atomic superpower during the cold war.

A radiation warning sign on a railing near the pile fuel storage pond. Photograph: Bloomberg/Getty Images

19. Windscale, a former munitions factory, was selected to host the first atomic reactors, known as Pile 1 and Pile 2, after the second world war. They produced plutonium for nuclear weapons, and efforts were rushed through to allow Britain to explode its own atomic bombs by 1952.

20. The toxic waste from this programme was stored in B29 – which stretched between Piles 1 and 2 – and a massive silo, B41. There have been efforts to secure and remove the waste in B41 in recent years.

21. There are also grave concerns over leaks from the Magnox swarf storage silo (MSSS), described as "one of the highest-hazard nuclear facilities in the UK". It was constructed as a radioactive waste store in four stages between 1964 and 1983 and has not been in active use since the 1990s. The waste is stored under water to prevent ignition and to maintain constant temperatures.

22. The silo was first found to be leaking radioactive water into the ground in the 1970s and there are concerns that work to retrieve the waste, planned over the next three decades, has the "potential to reopen historic leak paths" and introduce new ones, according to the ONR.

23. Earlier this year, the ONR warned that a leak from the MSSS was likely to continue to 2050, with "potentially significant consequences" if it gathered pace.

24. The government's long-term plan is to bury Britain's nuclear waste deep underground in a geological disposal facility. The project, estimated to cost between £20bn and £53bn, would receive intermediate-level waste from nuclear facilities by 2050 and high-level waste and spent fuel from 2075.

25. It will echo similar projects in Sweden, France and Finland, which is nearing completion of its storage cave. A government body, Nuclear Waste Services, which is running the project, is in the process of engaging with different communities – two near Sellafield, and another near Mablethorpe on the east coast – in an attempt to win local approval for the plans.

The original article may be found here:

'Dirty 30' and its toxic siblings: the most dangerous parts of the Sellafield nuclear site | Energy industry | The Guardian

END of Article 2

ARTICLE 3

The Guardian

Everyday risks: when statistics can't predict the future

Statistics, it seems, can reveal our chances of being affected by anything from crime to serious illness. But number-crunching itself is a hazardous business

- Michael Blastland and David Spiegelhalter
- The Observer, Sunday 9 June 2011.

1. We love data. For the past two years we have crunched numbers about dangers of every kind. And there are plenty of dangers about.

2. But – a big but – we're certainly not calculating machines. In fact, if there were such a thing as a risk-calculating machine that claimed to give you objective odds on danger, we'd be the first to warn of malfunctions. That's partly because although we think the numbers matter, they can never be the final word: the stories people tell are big influences on their sense of where danger lies – and why shouldn't they be? – since neither source of evidence, neither numbers nor stories is perfect. Each has strengths and weaknesses.

3. This is a perhaps surprising conclusion from writers at times almost geeky enough to have two hoods on our anoraks; that we think risk is seldom objective, nor solely a property of the world out there, but intimately bound up with our own perspectives, and so personal perspectives on danger are, usually, perfectly reasonable. More than that, we think they're essential. In fact, we think that one of the hazards with hazards is the way that some people use risk numbers almost as if they can foretell your fate. We prefer to think of risk as typically more like an uncertain bet on a horse using scraps of imperfect information mixed with your own judgment: the horse might come in. Or it might not…

4. So there are plenty of ways in which our sense of risk can be distorted, plenty of ways in which people can get the dangers wrong, and plenty more in which the numbers can be deceptive, too.

5. In the end, if we had to offer advice to the wary about risk, it would be to try to get to know the data that matter to you, get to know your own mind and the stories that influence you, and so learn how both stories and numbers can help… and deceive. Then do what you feel like.

6. Here are just five more of the hazards about hazards.

1 Don't let the news worry you

7. To put it crudely, we worry more that something might get us not because it's more likely to get us but because it would make better telly. Why does it make better telly and get on the news? Because it's vivid (and perhaps exciting), all of which makes it easier to call to mind. And if it's easier to call to mind, we think there's more about.

8. Researchers in the 1970s ran dozens of human experiments to discover what influenced people's estimation of risk. They noticed that after a natural disaster people took out more insurance, then with time took out less, because the risk is more salient immediately after a disaster, and people think about it. They called these habits of mind the availability heuristic.

9. It was found that tornadoes were seen as more frequent killers than asthma, although the latter caused 20 times more deaths. Thus vivid events are recalled not merely more vividly but in the belief there are more of them. In contrast, problems that are common are not surprising and are less likely to qualify as news. Another smoking death? And?

10. Although we'd be justified in describing this as a reporting bias, the media have no trouble justifying it on the grounds that people want to know about what's unusual and new. There is no way they could report risk proportionately and still be in business. It would mean thousands of times more articles on smoking than on death from measles. But it is a bias nevertheless. The unusual is, by the nature of news, disproportionately in your face, so you might think there's a lot of it about.

11. One effect is that it's easy to forget how radically reduced many fatal accidents are – the death of child pedestrians for example. In 2008 in England and Wales there were 1,471,100 girls aged between five and nine. The Office for National Statistics says 137 of them died from all causes. One was a pedestrian in a traffic accident. In 2010, there were no pedestrian deaths in this category.

2 Be wary of health screening

12. Reassurance – peace of mind – is often the health industry message. And screening sounds like a good way to get it. The impulse to "find out", to "check", imagines a day when doubt is put to rest. It's also easy nowadays to find clinics to examine and scan us for a worrying range of diseases that we might have without realising. There are effusive testimonials from people who have been "saved" by these tests. What could be the harm in having a check up? Possibly, quite a lot.

13. There are two main problems. First, there's an awful lot of ruin in a body that might, strangely, never do you much harm. "Finding out" worries us with all the things some of us never had to worry about. For example, one of the writers of this article has around a 50/50 chance of having prostate cancer at the moment and the other will have too, very shortly, since it is estimated from post-mortem data (from deaths in unrelated accidents) that about half of all men in their 50s have histological evidence of cancer in the prostate, which rises to 80% by age 80, according to Cancer Research UK.

14. CRUK then goes on to point out that "only one in 26 men (3.8%) will die from this disease". So, if 50% of men in their 50s discovered they had prostate cancer (13 out of the 26) but only one in 26 was to die from it, what do they all do, when no one knows if they are one of the 12 who will on average be OK or the one who won't? Finding out what you've got doesn't answer the doubt about whether there's anything to worry about, and so raises new doubts about what to do.

15. The second problem with finding out is that you might be told you've got something you haven't, and in some cases treated for it. False positives are common for the simple reason that if you test a million healthy people, even with a 99% accurate test, you will still have 10,000 wrong results.

3 We're probably not experiencing a crime wave

16. Here's a radical insight about numbers: they go up and down. Oh yeah. From one week to the next, the number of murders, for example, varies. Everyone knows this. No one expects the same number of crashes on the road every day. No one thinks the short-term pattern of events will be perfectly smooth. So what happened when there were four independent murders in London on one day? What happened was a giant public scream – in the belief that it revealed a worsening pattern of violent behaviour far beyond the normal ups and downs of the short-term murder rate.

17. The question is: how do we know it's out of the ordinary? This is a case where stats can be powerful and helpful. Every murder is tragic, devastating families and friends. So it's important to know how many it takes on one day for us to tell if things are getting worse.

18. Imagine the calendar laid out on the floor, 365 blank spaces. Take last year's murder total, then count out an equivalent number of pieces of rice. Finally, throw the rice in the air over the calendar, aiming for a random distribution of

rice grains/murders. One thing we can predict for sure is that the rice grains will not space themselves evenly. We can also be pretty sure that, in places, they will cluster, entirely by chance. So how likely is it that four grains will land on one square? Given London's total of murders, probability theory tells us that four grains in one space can be expected once in every three throws, ie four murders on one day can be expected to occur once every three years. And this is what happened. One of us, David Spiegelhalter, was able to predict almost precisely the number of days on which there would be one murder, two murders, three murders and four, and that over three years there would be 18 gaps of seven days between a murder (in the event, there were 19 such gaps). No new trend was necessary to produce these results.

4 Losing your job may be 16 times more likely than it looks

19. The rise in unemployment looks not too bad, given the size of the recession. At least, despite the misery of unemployment, plenty of economic commentators have been puzzled by why the numbers are lower than they expected. But is counting the unemployed the best measure of the risks of unemployment? Put aside suspicions of fiddled figures and this sounds like a stupid question. What else is there?

20. Well, there is the difference between stock and flow, and an argument to be had about which is most relevant to people's sense of the dangers of being jobless. Think of the job market like a great revolving door. On the inside are people in work; on the outside, the jobless. The stock of unemployed is the number of people outside the door at any one time. It is about a million higher than before the recession in 2008.

21. But the flow is the number of times someone goes through the door and stays on the wrong side long enough to be counted either as unemployed or inactive. This is dramatically bigger. Not 1 million, but more like 16 million

jobs lost since late 2008 (though note that one person can lose more than one job in four years).

22. Once you're out, the flow back in is slower and more uncertain. By one measure, you're about twice as likely to get stuck outside for more than 12 months – and according to some research (much debated), you have an increased annual risk of death during your unemployment equal to smoking 12 cigarettes a day.

23. This flow turns out to be a torrent pretty much all the time, in boom and bust. The consequences, though, are not the same. In the decade before 2008, the rapidity of the flow back inside was usually at least equal to the flow out. The point is that the risk of being part of the flow now, a flow that is greater than we might judge from the unemployment numbers alone, takes on a more sinister aspect. And many more than 1 million have felt today's more uncertain chill of being on the outside.

5 If you must gamble, try roulette

24. Risk is the downside of chance. As a final example, here's one from the upside, gambling. Well, we say that, but of course the odds are that you will lose. Though if the UK lottery jackpot reaches more than £14m, it is possible to win for sure by buying tickets for all combinations of numbers, of which there are 14 million. Although tricky to organise, it would win all the subsidiary prizes as well, so you could make a tidy profit. Well, perhaps.

25. Because what if someone else wins too, and the jackpot is shared? You might be ruined. So even a sure thing can be risky.

26. So let's say you fancied a £100,000 Maserati, but sadly had only a pound. And let's assume you are a cool, rational customer who wants the best odds (admittedly this is an implausible combination of characteristics). If you buy a single lottery ticket, and if your choice of six numbers matches five winning balls plus the bonus number (a seventh ball drawn), then this

generally wins about £100,000 and has a probability 1 in 2,330,636.

27. Or you could go for an accumulator on the horses: pick a meeting with six races, and in each race choose a horse at medium odds of around 6-1. An accumulator, in which the winnings of each race are passed to the next horse, will give you $7×7×7×7×7×7 = £117,000$ if they all win. Given a bookmaker's margin of, say, 12% each bet, the true odds may be around 1 in 230,000 – 10 times as good as the lottery.

28. If you can find a casino that will let you bet just £1, place it on your lucky number between 1 and 36. When it wins, leave the £36 there or move it to another number. When that comes up, do the same again. Win and you will have £46,656. Move it to red, win and you will have £93,312, almost enough for your Maserati. The chances of this on a European roulette wheel with one zero are $1/37×1/37×1/37×18/37 = 1$ in 104,120, twice as good as the horses.

http://www.theguardian.com/science/2013/jun/09/risk-statistics-data-blastland-spiegelhalter