8-23-2017

Michelle McMunn v. Babcock & Wilcox Power Generat

PRECEDENTIAL

UNITED STATES COURT OF APPEALS
FOR THE THIRD CIRCUIT

Nos. 15-3506, 15-3507, 15-3508, 15-3509, 15-3510, 15-3511, 15-3512, 15-3513, 15-3514, 15-3515, 15-3564, 15-3639, 15-3640, 15-3641, 15-3642, 15-3643, 15-3644, 15-3645, 15-3646, 15-3647, 15-3648, 15-3649, 15-3650, 15-3651, 15-3652, 15-3653, 15-3654, 15-3655, 15-3656, 15-3657, 15-3658, 15-3659, 15-3660, 15-4075, 15-4076, 15-4077, 15-4078, 16-1694, & 16-1965

MICHELLE MCMUNN, personal representative of the Estate of Eva Myers;
CARA D. STEELE; YVONNE SUE ROBINSON;
EDWARD J. MYERS;
LEVI DANIEL STEELE; HAROLD ROBINSON, et al

v.

BABCOCK & WILCOX POWER GENERATION GROUP, INC.;
B&W TECHNICAL SERVICES, INC., FKA B&W Nuclear Environmental
Services, Inc.; ATLANTIC RICHFIELD COMPANY,

predecessors-in-interest,
successors-in-interest, subdivisions and subsidiaries;
BABCOCK & WILCOX TECHNICAL SERVICES
GROUP, INC.

Apollo Facility Plaintiffs, Appellants
in Nos. 15-3506, 15-3507, 15-3508,
15-3509, 15-3510, 15-3511, 15-3512,
15-3513, 15-3514, 15-3515, 15-3564,
15-4075, 15-4076, 15-4077, 15-4078,
16-1964 and 16-1965

Babcock & Wilcox Power Generation
Group, Inc. and Babcock & Wilcox
Technical Services Group, Inc., Appellants
in Nos. 15-3640, 15-3642, 15-3644,
15-3646, 15-3648, 15-3650, 15-3652,
15-3654,15-3656, 15-3658 and 15-3660

Atlantic Richfield Company, Appellant in
Nos. 15-3639, 15-3641, 15-3643, 15-3645,
15-3647, 15-3649, 15-3651, 15-3653,
15-3655, 15-3657 and 15-3659

On Appeal from the United States District Court
for the Western District of Pennsylvania
District Court Nos. 2-10-cv-00143, 2-10-cv-00368,
2-10-cv-00650, 2-10-cv-00728, 2-10-cv-00744,
2-10-cv-00908, 2-10-cv-01736, 2-11-cv-00898,

2-11-cv-01381, 2-12-cv-01221, 2-12-cv-01459,
2-13-cv-00186, 2-13-cv-00704, 2-13-cv-01527,
2-14-cv-00639, 2-15-cv-00844, 2-15-cv-01423
District Judge: The Honorable David S. Cercone

Argued November 10, 2016

Before: SMITH, *Chief Judge*, McKEE, and RESTREPO,
Circuit Judges

(Filed: August 23, 2017)

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OPINION OF THE COURT

SMITH, *Chief Judge*, joined by RESTREPO, *Circuit Judge*, who also joins in the Concurrence.

Plaintiffs assert that they developed cancer[1] after being exposed to excessive radiation emissions from the Nuclear Material and Equipment Company ("NUMEC") facility in Apollo, Pennsylvania (the "Apollo facility"). Plaintiffs do not challenge the District Court's conclusions that their common-law claims against

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[1] For simplicity's sake, we refer to the individuals diagnosed with cancer as "Plaintiffs" even though several of those individuals have died and the executors of those individuals' estates have been substituted as plaintiffs.

Defendants[2] were preempted by the Price-Anderson Act and that only their Price-Anderson "public liability" claims are at issue in this appeal. Although the Price-Anderson Act preempted Plaintiffs' common-law negligence claims, Plaintiffs' Price-Anderson public liability claims require Plaintiffs to prove versions of the traditional negligence elements—(1) duty, (2) breach, (3) causation, and (4) damages.

The District Court held that Defendants were entitled to summary judgment as a matter of law on the Price-Anderson claims because Plaintiffs failed to show that there was a genuine dispute of material fact as to elements of duty, breach, and damages. Plaintiffs appealed. We agree with the District Court: Plaintiffs are missing critical elements, and therefore their claims fail.

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[2] Defendants are Atlantic Richfield Company and Babcock & Wilcox Power Generation Group, Inc., Babcock & Wilcox Technical Services Group Inc., and B&W Technical Services Inc. Atlantic Richfield Company and Babcock & Wilcox Power Generation Group, Inc., were owners of the NUMEC facility at different points in time. *See, e.g.*, JA1467 (stating that Atlantic Richfield bought the Apollo facility from NUMEC in 1967 and Babcock & Wilcox purchased the facility in 1971).

Accordingly, we will affirm the judgment of the District Court.

BACKGROUND

I. THE PARTIES AND EMISSIONS

A. The Parties

Plaintiffs are more than seventy individuals[3] in a group of consolidated cases who claim that excessive radiation emitted by Defendants—more specifically, radiation from uranium effluent from the Apollo facility—caused them to develop various cancers.

Almost all of the Plaintiffs lived near Apollo, Pennsylvania, for many years, including the 1960s, and *almost* all of the Plaintiffs were diagnosed with at least one form of cancer between 2007 and 2011.[4] The

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[3] At oral argument, even Plaintiffs' counsel was unable to fix the exact number of plaintiffs. *See* Oral Arg. Tr. at 4:6–19.

[4] This period of time when most Plaintiffs were diagnosed with cancer may reflect that another group of individuals who developed cancer had previously sued Babcock & Wilcox and Atlantic Richfield Co. Their lawsuit apparently settled before trial. *See* Docket, *Hall v. Babcock & Wilcox*, No. 94-951 (W.D. Pa.); *see also*

similarities among the Plaintiffs end there. By our count, Plaintiffs alleged that they suffered from more than a dozen different types of cancer.[5] Plaintiffs were of widely varying ages at the times of their diagnoses—with at least one individual under 30 and at least five individuals over 80. *See* JA3460 (81); JA3478 (82); JA3479 (88); JA3482 (81); JA3485 (29); JA3491 (82). Many of the Plaintiffs had extensive smoking histories, and some had multiple cancer diagnoses over their lifetimes. *See*, *e.g.*, JA3474 ("smoked about half a pack per day for 40 years"); JA3463 ("diagnosed with breast cancer in 1986 and then again in 2008 at the age of 67").

Hall v. Babcock & Wilcox, No. 94-951, 2007 WL 1740852 (W.D. Pa. June 14, 2007). The diagnosis date range here may also reflect statute of limitations concerns. The statute of limitations is not an issue in this appeal.

[5] *See*, *e.g.*, JA3447 ("Non Hodgkin's Lymphoma"); JA3448 ("lung cancer"); JA3449 ("breast cancer"); JA3450 ("esophageal cancer"); JA3451 ("colorectal cancer"); JA3455 ("thyroid cancer"); JA3457 ("kidney cancer"); JA3458 ("endometrial cancer"); JA3459 ("bladder cancer"); JA3465 ("melanoma"); JA3474 ("prostate cancer"); JA3479 ("metastatic ovarian cancer"); JA3485 ("squamous cell tumor of her pelvis").

B. The Facility

The Apollo facility was a "warehouse style building that was not specifically constructed to house the complex manufacturing operation involving radioactive materials." JA1427. As Plaintiffs emphasize, the Apollo facility was adjacent to a steel mill and "in the immediate neighborhood of residential areas." JA1576.

The Apollo facility operated from approximately 1953 to 1983 with uranium fuel manufacture beginning in 1958 and decommissioning beginning in 1978. *See* JA1467; *McMunn v. Babcock & Wilcox Power Generation Grp.*, 131 F. Supp. 3d 352, 356 (W.D. Pa. 2015).

The Atomic Energy Commission ("AEC") was the federal regulatory body in charge of overseeing the Apollo facility. During the time that the Apollo facility operated, the Nuclear Regulatory Commission ("NRC") became "the statutory successor to the Atomic Energy Commission." *In re TMI*, 67 F.3d 1103, 1112 (3d Cir. 1995).

The Apollo facility emitted radiation as a necessary byproduct of manufacturing uranium fuel. Plaintiffs argue that that radiation was in excess of regulatory limits. The focus in this dispute is on radiation emitted from the stacks, vents, and fans on the Apollo facility's roof.

C. Evidence of Excessive Emissions

Much of Plaintiffs' evidence of excessive emissions indicates that emissions from the stacks or vents on the roof exceeded the maximum permissible concentration ("MPC") for the facility. Plaintiffs do not contest that the relevant maximum permissible concentration is 8.8 disintegrations per minute per cubic meter (dpm/m^3). *See McMunn*, 131 F. Supp. 3d at 373 n.24; Pls.' Br. 10; *cf.* JA3642.

As discussed below, under the applicable regulations, the maximum permissible concentration is determined at the boundary of the "unrestricted area." Defendants argue that the boundary of the unrestricted area is the boundary of the roof, while Plaintiffs argue that any emissions from any part of the roof—including emission from any stack, vent, or fan—should be less than the maximum permissible concentration.

Plaintiffs point to evidence that they believe supports their position. In a June 5, 1964 letter, the Director of the Division of State and Licensee Relations of the AEC implied that the NUMEC had not shown that the roof was a restricted area: "[T]he roof area of the NUMEC facility is an unrestricted area unless access to this area is controlled from the radiation safety standpoint." JA5314. Consistent with the 1964 letter implying that the entire roof may be unrestricted, Plaintiffs argue that NUMEC and AEC's course of conduct shows that they both thought that stack

emissions were a regulatory concern because NUMEC and AEC compared stack emissions to the maximum permissible concentration. For instance, in a 1967 report, a NUMEC employee wrote, "[T]he measured stack concentration frequently exceeds permissible levels." JA5201. The AEC similarly expressed concern about releases from stacks, as though the regulations created limitations on the stacks. In a February 5, 1969 letter, the Director of the Division of Compliance of the AEC warned, "Based on your recorded data, the concentrations of radioactive material released from the facility through exhaust stacks to unrestricted areas exceed the limits specified in Appendix B, Table II of 10 CFR 20, contrary to 10 CFR 20.105(a), 'Concentrations in effluents to unrestricted areas.'" JA4700.

In addition to the evidence about emissions from the stacks or vents, Plaintiffs' evidence of excessive emissions fits into one or more of the following three categories: (1) evidence that the monitoring of emissions was not completely comprehensive; (2) data that there was excessive radiation in the area surrounding the facility; and (3) data showing excessive radiation being released but seemingly only for specific, and short,

periods of time (such as when the facility's incinerator was being used).[6]

Plaintiffs marshaled a large number of documents that they alleged created a genuine issue of material fact. The highlights of Plaintiffs' documents are below:

- In an April 20, 1964 letter, NUMEC Manager E.V. Barry wrote to Eber R. Price at the AEC that "average yearly concentrations at our property line" were being exceeded "when the winds are from the south quadrant" or in sections "when the winds are from the east quadrant." JA5163.

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[6] Our summary of Plaintiffs' evidence mirrors Plaintiffs' own summary presented at the conclusion of oral argument. When asked about "discharges measured at the roof edge," Plaintiffs' counsel (1) asserted that Defendants' "roof edge monitoring . . . is remarkably incomplete"; (2) pointed to an April 20, 1964 letter (discussed below) in which NUMEC admitted that it sometimes exceeded permissible concentrations at the boundary of the roof; (3) highlighted the airborne concentrations of effluent when the plant's incinerator was operating; and (4) noted "environmental monitors in the community." Oral Arg. Tr. at 39:10–40:20.

- Data for part of the year 1966 shows a high of 41.5 dpm/m^3 and an average of 13.0 dpm/m^3. *See* JA5188. But, as Plaintiffs admit, the "high" refers to only one day. *See* Pls.' Br. 47–48 (referring to "the same day" that the sampler gave its "highest reading"). Additionally, this data comes from a nearby building and not the roof of the Apollo facility. *Compare* JA5188, *with* JA5189.

- An August 18, 1967 internal memorandum about the Apollo facility's incinerator states, "Ever since the incinerator has been in operation it has been a consistent source of airborne contamination causing an over exposure [sic] to the operators and air levels above the M.P.C. in and out of the plant." JA4428.

- In a February 5, 1969 letter, the Director of the Division of Compliance of the AEC wrote, among other things, "Based on your recorded data, the concentrations of radioactive material released from the facility through exhaust stacks to unrestricted areas exceed the limits specified in Appendix B, Table II of 10 CFR 20, contrary to 10 CFR 20.105(a),

'Concentrations in effluents to unrestricted areas.'" JA4700.

- A November 30, 1972 internal memorandum memorializing a phone call from the AEC states that the AEC commented that "NUMEC has been the worst offender of AEC regulations over the years," that "[t]he AEC is strongly considering imposing civil penalties," and mentions NUMEC was implementing corrective actions in, among other things, its "Liquid Waste Management Program," and "Building Ventilation and Surveillance Program." *See* JA4439–40.

- In a February 12, 1974 letter, a NUMEC employee criticized the Apollo facility for releasing too much radiation. *See* JA4422 ("It is . . . apparent from review of the data that said operations at the Apollo Site are not conducted so as to provide a minimal radiological impact on the environment . . . ."). The same letter further states that there was heightened radioactivity in the area near the Apollo facility, many times in multiple of the background radiation because of "radiologically contaminated gaseous effluents." *Id.*

- A July 9, 1974 internal memorandum complains about "stack and liquid discards of SNM [special nuclear material] from the Apollo Plant" and tremendous losses of uranium through "gross irresponsibility." *See* JA4427.

However, AEC/NRC approved NUMEC's operations at least three times. First, in a report timestamped July 29, 1966, the AEC wrote, "No item of noncompliance with respect to [NUMEC's] concentrations of radioactive effluents released to unrestricted areas was noted as a result of this investigation." JA5051. Second, in 1968, the AEC concluded that NUMEC's roof edge samples were below the maximum permissible concentrations. JA5057 ("As can be seen, these average sample results are below 8.8 [dpm/m^3]."). On May 26, 1969, the AEC granted an amendment to NUMEC's license, "authoriz[ing] the discharge of radioactive material from any stack effluent . . . in concentrations up to one-hundred . . . times the applicable limits . . . in accordance with the statements, representations and conditions specified in your application dated March 5, 1969." JA5112.

Finally, in 1995, the NRC issued a report investigating another NUMEC facility in Parks, Pennsylvania. *See* 60 Fed. Reg. 35,571, 35,573 (1995). In that report, the NRC stated that, despite the 1969 license amendment setting limits for stack emissions, the

regulatory limits were set at the boundary of the roof: "Accordingly, even though NUMEC was authorized to discharge at the stack up to 100 times the value specified in Appendix B, Table II, [under the 1969 license amendment,] NUMEC was still required to meet the limits at the site boundary (see footnote 8)." 60 Fed. Reg. 35,571, 35,573 (1995). Footnote 8, in turn, states, "The values set forth in 10 CFR Part 20, Appendix B, Table II, are the regulatory limits applicable at the site boundary, not at the stack." 60 Fed. Reg. 35,571, 35,573 n.8 (1995).

II. THE SCIENCE OF CANCER

This Court's previous opinion, *In re TMI Litigation*, 193 F.3d 613 (3d Cir. 1999), set forth the basic scientific principles regarding the relationship between radiation and cancer. *See* 193 F.3d at 629–55. No party disputes those background principles. Because we rely on these principles here, we consider it helpful to summarize them. Ionizing radiation can damage human cells. *Id.* at 639–40. "If cellular damage is not repaired, [the damage] may prevent the cell from surviving or reproducing, or it may result in a viable but modified cell." *Id.* at 640. When an irradiated cell is only "modified rather than killed," stochastic (or probabilistic) effects result. *Id.* at 642.

As the word "probabilistic" indicates, what happens next to the modified cell is uncertain. In some cases, "cancer induction" occurs. *Id.* As we explained in

In re TMI Litigation, any increase in radiation exposure above zero is believed to increase the probability of carcinogenesis[7]:

> The probability that cancer will result from radiation increases proportionally with dose. However, it is currently believed that there is no threshold dose below which the probability of cancer induction is zero. . . . The linear risk model posits that each time energy is deposited in a cell or tissue, there is a probability of the induction of cancer.

Id. at 642–43 (citations omitted).

Even with state-of-the-art data, it is impossible to determine with certainty that radiation is the cause of a given incidence of cancer for three reasons. First, numerous factors other than radiation may cause cancer. That is, "a given percentage of a defined population will contract cancer even absent any exposure to ionizing radiation." *Id.* a 643–44.[8] Second, there is no clear

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[7] "Carcinogenesis is currently believed to be a multistep process requiring two or more intracellular events to transform a normal cell into a cancer cell." *In re TMI Litig.*, 193 F.3d 613, 643 (3d Cir. 1999).

[8] "[T]he task of establishing causation is greatly complicated by the reality that a given percentage of a

difference between cancers caused by radiation or by other factors. No characteristic of a given cancer (such as its type or severity) are known to suggest that "manmade" radiation or even any radiation was the cancer's cause. *See id.* at 643 ("[M]edical evaluation, by itself, can neither prove nor disprove that a specific malignancy was caused by a specific radiation exposure."). Third, because the relevant changes occur on the cellular level, they are not detected or detectable at the time they occur. It can take many years—seemingly a variable number of years—between an exposure to radiation and the "possible detection of a resulting cancer." *Id.* (defining the "latency period" as "[t]he period between exposure to radiation and possible detection"). Thus, in a case like this one, the factfinder will always have to use ex-post data to ascertain whether any radiation—let alone any particular radioactive exposure—disrupted the cell in the past.

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defined population will contract cancer even absent any exposure to ionizing radiation. In industrialized countries where the life expectancy averages about 70 years, about 30% of the population will develop cancer and about 20% of the population will die of cancer." *In re TMI Litig.*, 193 F.3d at 643–44.

III. THE DISTRICT COURT'S RELEVANT RULINGS

We are reviewing the orders granting Defendants' motion for summary judgment. In its summary judgment orders, the District Court adopted the reasoning of the Magistrate Judge to whom all pretrial motions had been referred. *See* Order, *McMunn v. Babcock & Wilcox Power Generation Grp.*, No. 2:10-cv-00143-DSC-RCM (W.D. Pa. Aug. 24, 2011), ECF No. 79.

Two earlier rulings set the stage for the summary judgment motion. Those two rulings are (1) a September 12, 2012 order following a "*Lone Pine*" case management order,[9] and (2) a February 27, 2014 order adopting in part and rejecting in part the Magistrate Judge's recommendations with regard to excluding the parties' experts under *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

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[9] A *Lone Pine* order is a pretrial order, based on *Lore v. Lone Pine Corp.*, No. L-33606-85, 1986 WL 637507 (N.J. Super. Ct. Law Div. Nov. 18, 1986), that "require[s] plaintiffs to provide facts in support of their claims" including by expert evidence "or risk having their cases dismissed." *In re Asbestos Prods. Liab. Litig. (No. VI)*, 718 F.3d 236, 240 & n.2 (3d Cir. 2013).

A. *Lone Pine*

On January 25, 2012, the Magistrate Judge issued the *Lone Pine* order, requiring Plaintiffs to provide prima facie evidence of, among other things, the "name of the specific radionuclide(s) released from Defendants' facilities in excess of the applicable federal permissible limits" and "an identification of each exposure pathway(s) through which each Plaintiff was exposed to each specific radionuclide." Order at 1, *McMunn v. Babcock & Wilcox Power Generation Grp.*, No. 2:10-cv-0143-DSC-RCM (W.D. Pa. Jan. 25, 2012), ECF No. 109.

On September 12, 2012, following the parties' responses to the *Lone Pine* order, the Magistrate Judge issued an order limiting Plaintiffs' theories of recovery. *See McMunn v. Babcock & Wilcox Power Generation Grp.*, 896 F. Supp. 2d 347 (W.D. Pa. 2012). In that order, the Magistrate Judge held that the Plaintiffs would be allowed only "to pursue, offer or rely upon evidence referring or relating to any claim based upon exposure through . . . airborne exposure to uranium . . . from . . . the Apollo facility during its years of operation." *Id.* at 358–61; *see also id.* at 364. Plaintiffs do not challenge this *Lone Pine* order on appeal.

B. *Daubert*

On July 12, 2013, the Magistrate Judge recommended that the District Court (1) grant some of Defendants' *Daubert* motions; (2) deny the remainder of

Defendants' *Daubert* motions; and (3) deny all of Plaintiffs' *Daubert* motions. *See McMunn v. Babcock & Wilcox Power Generation Grp.*, Nos. 10-143 et al., 2013 WL 3487560 (W.D. Pa. July 12, 2013). Specifically, the Magistrate Judge recommended excluding the testimony of Plaintiffs' three general causation experts—Dr. Howard Hu, Dr. Joseph Ring, and Mr. Bernd Franke—and Plaintiffs' specific causation expert, Dr. James Melius. Only the rulings with regard to Melius's testimony bear directly on this appeal.

Melius's expert report used the methodology of differential diagnosis. Melius provided a roughly one-page summary of each Plaintiff's background and alleged exposure and then concluded for each Plaintiff: "[I]t is my professional medical opinion that [Plaintiff's] exposures to uranium and other radioactive materials released from the Apollo nuclear facility made a significant contribution to the development of" his or her cancer. *E.g.*, JA3448, 3465, 3490. For most of the Plaintiffs, Melius added language substantially like the following: "This is reinforced by the lack of other risk factors in [her or his] history that would account for the development of this illness." *E.g.*, JA3448.[10]

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[10] For a handful of Plaintiffs—but only some of the Plaintiffs with a history of smoking—Melius identified smoking as the only confounding factor. *E.g.*, JA3451

The Magistrate Judge recommended excluding Melius's testimony because Melius failed to rule out other confounding factors and did not have information about doses of radiation to which each Plaintiff was exposed. With regard to confounding factors, the Magistrate Judge criticized Melius's "differential diagnosis" because Melius "fail[ed] to explain why he did not rule out smoking, obesity, genetic factors, benzene exposure, radon and many other possible and obvious alternative causes in order to conclude in each instance that uranium is the cause of the individual's cancer." *McMunn*, 2013 WL 3487560, at *28. With regard to dose, the Magistrate Judge criticized Melius for failing to make or use any estimate of any Plaintiff's dose "or the maximum or minimum amount to which the person was exposed." *Id.* at *29. Instead, to determine that Plaintiffs' exposures were sufficient to serve as a "significant contribution" to their cancers, Melius relied on general testimony about radiation—Dr. Hu's testimony that radiation from uranium could cause cancer—and the assumption that Plaintiffs were exposed to dangerous levels of radiation because "the Plaintiffs lived or worked within 1.5 miles of the Apollo facility."

("This is reinforced by the lack of other risk factors in his history that would account for the development of this illness other than smoking which also would have made a contribution.").

Id. at *28. The Magistrate Judge's two criticisms dovetailed with a particular flaw in Melius's testimony: Melius "rule[d] out oral contraceptive use if the dose was small and smoking if the person quit 10–15 years ago, thereby taking dose into account." *Id.* at *29. The Magistrate Judge concluded that Melius's methodology "has not been generally accepted in the medical and scientific communities" and was "untestable." *Id.* at *29.

On February 27, 2014, the District Court rejected the Magistrate Judge's report and recommendation to the extent that the Magistrate Judge recommended granting Defendants' *Daubert* motions with regard to Melius and Plaintiffs' general causation experts.[11] With regard to Melius specifically, the District Court placed great weight on (1) this Court's past discussion of differential diagnosis methodology and (2) the fact that Melius did not have access to perfect information. First, the District Court held that Melius "adequately addressed other possible causes of Plaintiffs' cancers, both known and

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[11] The District Court adopted the portion of the report and recommendation in which the Magistrate Judge recommended denying the exclusion of Defendants' experts and denying the exclusion of most of Plaintiffs' experts. *See McMunn v. Babcock & Wilcox Power Generation Grp.*, Nos. 2:10cv143 et al., 2014 WL 814878, at *20 (W.D. Pa. Feb. 27, 2014).

unknown" because Melius reviewed information about the Plaintiffs. *McMunn v. Babcock & Wilcox Power Generation Grp.*, Nos. 2:10cv143 et al., 2014 WL 814878, at *14 (W.D. Pa. Feb. 27, 2014). The District Court also cited and quoted *In re Paoli Railroad Yard PCB Litigation*, 35 F.3d 717 (3d Cir. 1994), and *Heller v. Shaw Industries, Inc.*, 167 F.3d 146 (3d Cir. 1999), for the propositions that a medical expert performing a differential diagnosis does not need to rule out every alternative factor and that medical experts are permitted to exercise their judgments when conducting a differential diagnosis. *See McMunn*, 2014 WL 814878, at *15.

Second, with regard to dose, the District Court held that there was "enough support in the record for the contention that the Plaintiffs' exposure levels exceeded the normal background level" for Melius to use a "qualitative analysis" rather than a "quantitative dose analysis." *Id.* at *14. In particular, Melius could rely on "NUMEC's failure to monitor emissions." *Id.* Because Melius's analysis relied on the absence of data, the District Court agreed with Melius that a "quantitative dose calculation . . . may in fact be far more speculative than a qualitative analysis." *Id.*

The District Court further held that a dose analysis was not necessary for Plaintiffs' claims to succeed. The District Court stated that *In re TMI Litigation*, 193 F.3d 613 (3d Cir. 1999), "did not require a plaintiff prove a

quantified dose in order to prove personal injuries caused by the release of radiation." *McMunn*, 2014 WL 814878, at *13. Then, the District Court cited to other cases that did not require a dose. *Id.* at *13–14 (quoting and citing *Kannankeril v. Terminix Int'l*, 128 F.3d 802, 808–09 (3d Cir. 1997), *Bonner v. ISP Techs., Inc.*, 259 F.3d 924 (8th Cir. 2001), and *Westberry v. Gislaved Gummi AB*, 178 F.3d 257 (4th Cir. 1999)).

At Defendants' request, the District Court certified the *Daubert* order for interlocutory appeal. *See McMunn v. Babcock & Wilcox Power Generation Grp.*, Nos. 2:10cv143 et al., 2014 WL 12530940 (W.D. Pa. May 7, 2014). We denied Defendants' petition for interlocutory appeal. *See McMunn v. Babcock & Wilcox Power Generation Grp.*, No. 14-8074 (3d Cir. June 16, 2014).

C. Summary Judgment

On May 7, 2015, the Magistrate Judge filed a very thorough report recommending that the District Court grant Defendants' motion for summary judgment on Plaintiffs' Price-Anderson public liability claims and Defendants' motion for a judgment on the pleadings on all of Plaintiffs' common-law claims. *See McMunn v. Babcock & Wilcox Power Generation Grp.*, 131 F. Supp.

3d 352, 359–404 (W.D. Pa. Sept. 15, 2015) (republishing the report and recommendation).[12]

The Magistrate Judge recommended that the District Court grant summary judgment because Plaintiffs (1) failed "to raise a genuine issue for trial on breach of duty" and (2) failed "to proffer evidence of exposure and dose." *Id.* at 389, 404.[13] First, with regard to the breach of duty, the Magistrate Judge held that "[t]he regulatory standard applicable to the emission of radionuclides in airborne effluent to off-site areas . . . when the Apollo facility operated . . . was 10 C.F.R. § 20.106"—"not some other regulation, license requirement or other issue." *Id.* at 368–69, 388; *see also In re TMI*, 67 F.3d 1103, 1108 n.10 (3d Cir. 1995)

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[12] Because Plaintiffs did not appeal the District Court's adoption of the Magistrate Judge's recommendation to dismiss Plaintiffs' common-law claims, we need not discuss the common-law claims.

[13] The Magistrate Judge did not reach any other issues regarding Plaintiffs' Price-Anderson public liability claims. As the Magistrate Judge noted, Defendants raised other issues in separate summary judgment motions that the District Court denied as moot or denied without prejudice to refile. *See McMunn*, 131 F. Supp. 3d at 361 & n.3, 404.

(applying "the relevant federal regulations . . . in place at the time" of the radioactive release caused by Three Mile Island accident at issue).

Section 20.106 prohibited a licensee from "releas[ing] to an unrestricted area radioactive material in concentrations which exceed the limits specified in Appendix 'B', Table II of this part." 10 C.F.R. § 20.106(a) (1980). The regulation further states that "the concentration limits in Appendix 'B', Table II of this part shall apply at the boundary of the restricted area." 10 C.F.R. § 20.106(d).

The Magistrate Judge rejected Plaintiffs' argument that the Table II maximum permissible concentration applied directly to the uranium effluent released from the stacks on the roof. First, the Magistrate Judge determined that the roof of the Apollo facility was a restricted area. *McMunn*, 131 F. Supp. 3d at 386–87. Second, the Magistrate Judge held that the measurements of uranium effluent to be compared to the maximum permissible concentration should be those taken "at the roof boundary." *Id.* at 387–88. Because Plaintiffs' only expert testimony about breach applied the concentration limits at the stacks and not at the roof boundaries, the Magistrate Judge held that Plaintiffs failed to proffer expert evidence of a breach that raised a genuine issue of material fact. *See id.* at 389.

With regard to exposure and dose, the Magistrate Judge held that Plaintiffs' causation case failed because

Plaintiffs failed to show that each Plaintiff was exposed to enough radiation to cause his or her cancer. First, the Magistrate Judge granted Defendants' motion to deem certain facts admitted. *See id.* at 394; Plaintiffs' Local Rule 56.C.1 Response, No. 2:10-cv-001343-DSC-RCM (W.D. Pa. filed Dec. 5, 2014), ECF No. 342. Then, the Magistrate Judge explained that, under *In re TMI Litigation*, 193 F.3d 613 (3d Cir. 1999), each Plaintiff had to show that he or she was exposed to "inhaled uranium from the Apollo plant in excess of normal background radiation amounts." *McMunn*, 131 F. Supp. 3d at 396–97, 399. Thus, the Magistrate Judge held that "Plaintiffs must provide . . . an estimate of the dose they received which caused their cancers." *Id.* at 399. As discussed above, Melius relied on Plaintiffs' other experts for exposure, but none of Plaintiffs' other experts calculated exposure or dose for any of the Plaintiffs. *See id.*

Further, the Magistrate Judge rejected Plaintiffs' argument that Defendants were "estopped from contesting [Plaintiffs'] lack of evidence of exposure and dose" because Defendants failed to keep accurate records. *Id.* at 402–04. The Magistrate Judge also rejected Plaintiffs' argument that law of the case required the Magistrate Judge to deny summary judgment on causation because the District Court had ruled that Melius's testimony was admissible in its *Daubert* ruling. *See id.* at 399–402.

On September 15, 2015, the District Court adopted the Magistrate Judge's report and recommendation over Plaintiffs' objections. *See id.* at 357. The District Court stated that it "review[ed] . . . the record of these cases, . . . the Magistrate Judge's Report and Recommendation, and the Objections thereto," but offered no further explanation for its decision. *Id.*

Certain related cases were not consolidated with the main case when the District Court issued its September 15, 2015 Memorandum Order. The District Court ultimately entered orders adopting the reasoning of the September 15, 2015 Memorandum Order in those cases. *See* JA281–92; SJa3–SJa8.

Timely notices of appeal followed in each case before us.[14] Additionally, Defendants cross-appealed many—but not all—of the cases before us, requesting that we reverse the District Court's *Daubert* order.

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[14] Plaintiffs' Notices of Appeal also objected to orders excluding the expert report of Dr. Steve Wing. *See, e.g.*, Ja1. Because Plaintiffs presented no argument regarding Dr. Wing's report, any issues or objections concerning it have been waived.

JURISDICTION

The District Court had subject-matter jurisdiction over these actions under 42 U.S.C. § 2210(n)(2) because this is a public liability action arising out of a nuclear incident in the Western District of Pennsylvania. This Court has jurisdiction over Plaintiffs' appeals under 28 U.S.C. § 1291.

Plaintiffs argue that we did not have jurisdiction over Defendants' cross-appeal relating to the District Court's denial of their *Daubert* motion regarding Melius because Defendants are not aggrieved by that denial. As the Supreme Court observed in *Deposit Guaranty National Bank v. Roper*, "Ordinarily, only a party aggrieved by a judgment or order of a district court may exercise the statutory right to appeal therefrom. A party who receives all that he has sought generally is not aggrieved by the judgment affording the relief and cannot appeal from it." 445 U.S. 326, 333 (1980); *see also Nanavati v. Burdette Tomlin Mem'l Hosp.*, 857 F.2d 96, 102 (3d Cir. 1988) ("Because they are completely satisfied with the final judgment and object only to interlocutory rulings of the district court, we lack jurisdiction over their appeal.").

We need not determine whether we have jurisdiction. We simply follow Third Circuit practice and dismiss Defendants' cross-appeals as "superfluous." *Smith v. Johnson & Johnson*, 593 F.3d 280, 283 n.2 (3d Cir. 2010) ("Yet a party, without taking a cross-appeal,

may urge in support of an order from which an appeal has been taken any matter appearing in the record, at least if the party relied on it in the district court."). As such, we consider the parties' *Daubert* arguments to concern causation only as an "alternate ground for affirmance." *Nanavati*, 857 F.2d at 102. Accordingly, we have disregarded Defendants' reply brief in support of their cross-appeal.

STANDARD OF REVIEW

The standard of review on summary judgment is well known: "Because we are reviewing a grant of summary judgment, our standard of review is plenary. Summary judgment is appropriate 'if the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law.'" *Constitution Party of Pa. v. Cortes*, 824 F.3d 386, 393 (3d Cir. 2016) (citations omitted) (quoting Fed. R. Civ. P. 56(a)).

DISCUSSION

We will affirm the judgment of the District Court because Plaintiffs failed to raise an issue of fact that would allow a reasonable jury to find that Defendants breached their duty and because Melius's conclusory expert report would not allow a reasonable jury to find that Defendants' radiation was a substantial factor in causing Plaintiffs' cancers.

I. DUTY

The District Court[15] held that Plaintiff failed to establish a genuine issue of material fact as to whether Defendants breached their duty to Plaintiffs. We agree with the District Court that Defendants' duty was defined by § 20.106.

In three different ways, Plaintiffs try to show that Defendants owed a duty other than to prevent the release of uranium effluent that exceeds the maximum permissible concentrations at the boundary of the roof, when the effluent is averaged over a full year. First, Plaintiffs argue that any emission from the roof counts under § 20.106. Second, Plaintiffs argue that more onerous maximum permissible concentrations for roof emissions were created by the 1969 amendment to NUMEC's license. And, third, Plaintiffs argue that they had the option to decline annual averaging, allowing them to find breaches of duty where emissions exceeded

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[15] Because the District Court "adopt[ed] the Report and Recommendation as the Opinion of [the District] Court," *McMunn v. Babcock & Wilcox Power Generation Grp.*, 131 F. Supp. 3d 352, 357 (W.D. Pa. 2015), "we will refer to the adopted opinion as that of the district court," *USX Corp. v. Liberty Mut. Ins. Co.*, 444 F.3d 192, 197 n.8 (3d Cir. 2006).

the maximum permissible concentration over short periods of time. As discussed below, these attempts to redefine the duty fail because they all conflict with § 20.106 and because we owe *Auer* deference to the NRC's interpretation of § 20.106.

A. The Roof Was a Restricted Area

Under § 20.106(d), the maximum permissible concentrations are assessed "at the boundary of the restricted area." 10 C.F.R. § 20.106(d). A "restricted area" is any area where "access . . . is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials." 10 C.F.R. § 20.3(a)(14). Plaintiffs argue that the entire roof was unrestricted[16] such that emissions from anywhere on the roof—including the stacks and fans—should count directly against the limits. Plaintiffs' argument is undermined by a 1995 NRC report that states that the "regulatory limits [are] applicable at the site boundary,

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[16] The definition of "unrestricted area" is merely a mirror of the definition of "restricted area": "'Unrestricted area' means any area access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, and any area used for residential quarters." 10 C.F.R. § 20.3(a)(17).

not at the stack." 60 Fed. Reg. 35,571, 35,573 n.8 (1995).

Plaintiffs present two arguments as to why the roof is unrestricted: (1) an historical argument based on a series of letters between the AEC and NUMEC and (2) a functional argument that questions whether access to the roof was "controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials."

With regard to the historical argument, Plaintiffs' strongest support is a June 5, 1964 letter, in which the Director of the Division of State and Licensee Relations of the AEC stated that the roof would be "unrestricted" if access were not controlled: "[T]he roof area of the NUMEC facility is an unrestricted area unless access to this area is controlled from the radiation safety standpoint." JA5314.

Plaintiffs also rely on other correspondence in which NUMEC and AEC compared stack emissions to the applicable maximum permissible concentration. For instance, in a 1967 report, a NUMEC employee wrote, "[T]he measured stack concentration frequently exceeds permissible levels." JA5201. The AEC similarly expressed concern about releases from stacks, as though the regulations created limitations on the stacks. In a February 5, 1969 letter, the Director of the Division of Compliance of the AEC warned, "Based on your recorded data, the concentrations of radioactive material

released from the facility through exhaust stacks to unrestricted areas exceed the limits specified in Appendix B, Table II of 10 CFR 20, contrary to 10 CFR 20.105(a), 'Concentrations in effluents to unrestricted areas.'" JA4700. Additionally, the fact that NUMEC sought—and the AEC granted in 1969—approval to exceed the maximum permissible concentration by one-hundred times at the stack, *see* JA5112, suggests that there was a pre-existing regulatory limit at the stack.

Plaintiffs' functional argument focuses on the definition of a restricted area in the regulation. The regulation states that a "restricted area" is any area where "access . . . is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials." 10 C.F.R. § 20.3(a)(14). It is uncontested that the roof could only be accessed by locked hatches from ladders located inside the building. *See* JA5035–36 ("There are no outside ladders on NUMEC's property. We have two inside ladders with normally closed and locked hatches at the top."); JA5317 ("The roof hatch is kept locked with keys in the possession of the health and safety technician.").[17]

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[17] Plaintiffs argue that NUMEC conceded that the roof is unrestricted based on the 1966 letter from NUMEC to the AEC that states, "We regard the roof area as an unrestricted area." JA4649. The District Court

Plaintiffs argue that these hatches do not show that the roof was "controlled . . . for purposes of protection . . . from exposure to radiation." Relying on a 1965 NUMEC letter, they argue that certain safety measures—*e.g.*, alpha survey instruments—are required to show why the access is controlled. *See* Pls.' Br. 40–41.

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concluded that "unrestricted" was "a typographical error." *McMunn v. Babcock & Wilcox Generation Grp.*, 131 F. Supp. 3d 352, 378 (W.D. Pa. 2015). At summary judgment, district courts should not determine whether a particular phrasing is a scrivener's error when other possibilities are reasonable. *See, e.g.*, *Coffill v. Coffill*, 656 F.3d 93, 95–96 (1st Cir. 2011) (holding that it was error to rule that a purported scrivener's error existed "without evidentiary hearing and evidentiary basis"). We agree with the District Court that, in the context of the correspondence in the record and the surrounding sentences, it would be unreasonable or absurd to read that sentence in the 1966 letter as a concession that NUMEC considered the roof "unrestricted." The same paragraph explains the unrestricted areas were at the "roof edge": "[T]he roof edge air samplers are measuring directly the concentration being discharged to unrestricted areas." JA5317.

Ultimately, we defer to the expertise of the NRC as to where the restricted area of the Apollo facility ended. In 1995, the NRC issued a report investigating another NUMEC facility in Parks, Pennsylvania. 60 Fed. Reg. 35,571, 35,573 (1995). Even though the report was about the Parks facility, the NRC referred to the 1969 letter that allowed NUMEC to exceed regulatory limits at the Apollo facility's stacks. The NRC stated that, despite a 1969 license amendment setting limits for stack emissions, the regulatory limits were set at the boundary of the roof. "Accordingly, even though NUMEC was authorized to discharge at the stack up to 100 times the value specified in Appendix B, Table II, [under a 1969 license amendment,] NUMEC was still required to meet the limits at the site boundary (see footnote 8)." *Id.* Footnote 8, in turn, stated, "The values set forth in 10 CFR Part 20, Appendix B, Table II, are the regulatory limits applicable at the site boundary, not at the stack." *Id.* at 35,573 n.8.

Under *Auer v. Robbins*, 519 U.S. 452, 461–62 (1997), we defer to the NRC's "fair and considered judgment" of its interpretation of its regulation. One could argue that the NRC should receive less deference to the extent that the NRC's 1995 position conflicts with Plaintiffs' historical evidence. In this case, we believe we still owe full deference. The Supreme Court's main concern with an agency switching positions has been with circumstances in which the new position could cause "unfair surprise." *Long Island Care at Home, Ltd.*

v. Coke, 551 U.S. 158, 170–71 (2007) ("[A]s long as interpretive changes create no unfair surprise[,] . . . the change in interpretation alone presents no separate ground for disregarding the Department's present interpretation."). Here, our *Auer* deference would not harm any reliance interests.

Even if we did not defer to the NRC, Defendants' interpretation of a "restricted area" is more consistent with our precedent than is Plaintiffs' functional argument. In 1995, we held that "[t]he definitions of 'restricted' and 'unrestricted areas' demonstrate that the C.F.R. sections governing persons in 'unrestricted areas' were intended to cover persons outside a nuclear plant's boundaries, i.e., the general public." *In re TMI*, 67 F.3d at 1114 (footnote omitted). Although denial of access to the "general public" alone does not turn a space into a restricted area, our understanding has been focused more on whether a licensee exercises control rather than on the precise safety measures chosen by the licensee. Other than the isolated statements by NUMEC, Plaintiffs give us no reason to believe that more than locked hatches were needed to control access to the roof for purposes of protecting individuals from radiation.

B. The License Did Not Create a Duty

As noted above, in 1969, the AEC approved NUMEC's request to amend its license to allow "the discharge of radioactive material from any stack . . . in concentrations up to one-hundred (100) times the

applicable limits specified in Appendix B, Table II," contingent on satisfactory sampling "at the plant roof perimeter" and "in the neighboring unrestricted areas of [the] plant." JA5112. Plaintiffs argue that this 1969 license amendment now creates a tort duty that Defendants violated by discharging more than 100 times the maximum permissible concentration at the stacks.

In a Price-Anderson public liability claim, "federal law preempts state tort law on the standard of care." *In re TMI*, 67 F.3d at 1107. Our 1995 opinion in *In re TMI* instructs that the duty that survives preemption must be a regulatory requirement meant to protect people like Plaintiffs. Following *In re TMI*, we look to the principles of negligence per se (by analogy) and to other courts' interpretation of duty under the Price-Anderson Act. Because this license requirement was only meant to make it easier to assess whether NUMEC violated 10 C.F.R. § 20.106 at the boundary of the restricted area—not to create an independent obligation—we hold this license requirement does not supply a tort duty.

In the 1995 *TMI* case, plaintiffs argued that the "as low as is reasonably achievable" principle ("ALARA") established the tort duty. This Court held instead that 10 C.F.R. §§ 20.105, 106 established the relevant duty. Two of our major considerations were that (1) §§ 20.105 and 20.106 indicated they should apply to effluent emissions to the public, *In re TMI*, 67 F.3d at 1114, and (2) the ALARA regulation states that it was not "to be construed

as radiation protection standards" but was rather meant to be a discretionary tool for regulatory agencies, *id.* at 1114–15 (internal quotation mark omitted). Thus, we see that our concerns in 1995 reflected (1) whether the regulation was meant to cover the persons allegedly affected and (2) whether the regulation was meant to establish actual standards or operating principles for the agency. These same considerations are not present here. The limitations on the stacks were meant to show levels below which there could not be a violation at the boundary. Thus, they were not directly protective of persons in unrestricted areas and were a discretionary choice by the AEC to make policing NUMEC easier.

The 1995 *TMI* case also instructs us to consider principles from negligence per se. In that case, we explained that the duty analysis under the Price-Anderson Act "is analogous to the practice followed by many jurisdictions with negligence per se cases. In such cases, where defendants violated the relevant statute or regulation, courts have held as a matter of law that plaintiffs have satisfied the first two elements of their cause of action: the duty and breach of duty." *In re TMI*, 67 F.3d at 1118.

Plaintiffs' objection that we would nullify the license requirements if we refused to use them as the

standard of care[18] assumes that every legal requirement must be enforceable by a civil plaintiff. That assumption is contrary to fundamental principles of negligence per se, under which courts must ask "whether the policy behind the legislative enactment will be appropriately served by using it to impose and measure civil damage liability." *Frederick L. v. Thomas*, 578 F.2d 513, 517 n.8 (3d Cir. 1978).

Negligence per se only attaches to a statutory or administrative duty when its direct effect is to prevent the harm at issue to the type of person allegedly injured. *See Byrne v. Matczak*, 254 F.2d 525, 528 (3d Cir. 1958) ("[T]he general principle is that the violation of a statute will not create a liability unless it is the efficient cause of the injury."); *Congini ex rel. Congini v. Portersville Valve Co.*, 470 A.2d 515, 518 (Pa. 1983); Restatement (Second) Torts § 286.[19] We have held that "general

[18] "To hold that NUMEC had no duty to obey the AEC's regulatory caps stated in its license would be tantamount to holding that the AEC had no authority to set those limits." Pls.' Br. 35.

[19] When we adopted 10 C.F.R. §§ 20.105 and 20.106 as the standard of care, we cited Restatement (Second) of Torts for the proposition that a court can adopt regulations as the standard of care. *See In re TMI*, 67 F.3d at 1113 n.24.

licensing or permit schemes do not usually establish standards of competence; they do not usually represent judgments that a violation of the licensing scheme will generally constitute the breach of a duty to a particular person rather than to the state." *Beaver Valley Power Co. v. Nat'l Eng'g & Contracting Co.*, 883 F.2d 1210, 1221–22 (3d Cir. 1989); *see also Talley v. Danek Med., Inc.*, 179 F.3d 154, 159 (4th Cir. 1999) ("Even if the regulatory scheme as a whole is designed to protect the public or to promote safety, the licensing duty itself is not a standard of care, but an administrative requirement."); Restatement (Second) of Torts § 288 ("The court will not adopt as the standard of conduct . . . the requirements of . . . administrative regulation whose purpose is found to be exclusively . . . to protect the interests of the state or any subdivision of it as such.").[20]

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[20] Following oral argument, Plaintiffs filed a letter under Rule 28(j) of the Federal Rules of Appellate Procedure with additional cases that showed regulations creating tort duties. None of them is contrary to the reasoning above. Rather, Plaintiffs' 28(j) cases pertain to situations in which statutes explicitly create a duty for license violations, *see* 33 U.S.C. § 1365(a) ("[A]ny citizen may commence a civil action on his own behalf . . . against any person . . . who is alleged to be in violation of . . . . an effluent standard."); 33 U.S.C. § 1365(f) ("[T]he term 'effluent standard or limitation under this chapter'

Finally, as in 1995, we look to other circuits' caselaw as "instructive." *In re TMI*, 67 F.3d at 1113. Here, we see that no other circuit has adopted Plaintiffs' proposed standard. *See Adkins v. Chevron Corp.*, 960 F. Supp. 2d 761, 766, 772–73 (E.D. Tenn. 2012) (holding that license violations do not create duty in a Price-Anderson public liability action).

The history of the license amendment shows that its purpose was not to create an independent duty to minimize discharge from the stacks. On November 13, 1968, Roger D. Caldwell, NUMEC Manager, Health and Safety, sent a letter to Donald A. Nussbaumer at the AEC. The letter requested a change to NUMEC's license that would "permit[] concentrations up to 100 MPC_a in any stack's effluent, providing the concentration at the roof edge is permissible." JA5073. Caldwell justified

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means . . . a permit or condition thereof . . . ."); N.Y. Veh. & Traffic Law § 509(3) ("Whenever a permit or license is required to operate a motor vehicle, no person shall operate any motor vehicle in violation of any restriction contained on, or applicable to, the permit or license."), or situations where preemption of alternative laws is not as complete as here, *see Gomez v. St. Jude Medical Daig Div. Inc.*, 442 F.3d 919, 928–30 (5th Cir. 2006) (discussing the scope of preemption relating to the Medical Device Amendments).

the request by pointing to empirical data relating to diffusion factors at the Apollo facility—that is, by showing that amounts released at the stacks would be much less at the roof edge. *See* JA5074–76.

On February 5, 1969, Lawrence D. Low, AEC, Director, Division of Compliance wrote to Zalman Shapiro, NUMEC President. Low wrote that "the concentrations of radioactive material released from the facility through exhaust stacks to unrestricted areas exceed the limits . . . contrary to 10 CFR 20.106(a)." JA5079–80. In the same section of the letter, Low acknowledged NUMEC's request that its license "be amended to permit use of a dilution factor for stack effluents." JA6080.

On February 25, 1969, Shapiro responded, explaining that a higher concentration limit could be applied at the stacks to determine whether NUMEC violated its maximum permissible concentration at the roof edge:

> We recognize the necessity for an amendment to our license which would reflect appropriately the means of varifying [sic] the effectiveness of atmospheric dilution in reducing concentration in unrestricted areas. In this connection, we submitted on November 13, 1968 a request for an amendment to our license which would place primary reliance on roof

> perimeter sampling in lieu of stack sampling as a means of measuring releases to unrestricted areas. At a meeting on January 17, 1969 with Licensing and Compliance personnel, it was concluded that the off-site environment sampling program should be included as a part of our license amendment application to provide additional assurance with respect to the effectiveness of atmospheric dilution. Accordingly, we are preparing and will submit by March 7, 1969 a revised application which, if approved, should provide an acceptable means of varifying [sic] compliance with Part 20.

JA5083–84.

On March 10, 1969, Caldwell submitted a "revised application to permit concentration to 100 MPC_a in any stack's effluent." JA5087. Again, Caldwell "justified" the proposed limits by pointing to empirical data showing dilution factors at the roof perimeter. *Id.*

On May 26, 1969, Nussbaumer at the AEC wrote to Caldwell at NUMEC granting the amendment to NUMEC's license "to authorize the discharge of radioactive material from any stack effluent . . . in concentrations up to one-hundred . . . times the applicable limits . . . *in accordance with the statements, representations and conditions specified in your application dated March 5, 1969*." JA5112 (emphasis

added). Nussbaumer added, "We consider the environmental sampling program required by Condition 2 above to be a means for providing backup data and *evidence that your roof edge sampling results are adequately representative of the concentrations released to the unrestricted areas*." JA5112–13 (emphasis added). Thus, even at the time, the AEC, via Nussbaumer, accepted NUMEC's "representations" about the relationship between the stack discharges and the roof edge and that the roof edge monitors would be used to determine the concentrations "released to the unrestricted areas."

In 1995, the NRC agreed that NUMEC's purpose in seeking the amendment assumed that all requirements would be met if the emission at the boundaries were below the maximum permissible concentration: "By application dated November 13, 1968, and supplement dated March 5, 1969, and pursuant to 10 CFR 20.106(b), NUMEC requested that License SNM-145 be amended to permit concentrations up to 100 times the limits specified in Part 20, Appendix B, Table II, in any stack effluent, provided that concentrations at the roof edge and in the local environment complied with 10 CFR Part 20 limits." *In re Babcock & Wilcox Co.*, 41 N.R.C. 489, 492–93 (June 26, 1995); *see also* 10 C.F.R. § 20.106(b). Thus, it is clear that the stack-discharge license restriction was created as a threshold to test for emissions at the boundary of the restricted area.

Because the license requirement was only an administrative safe harbor for NUMEC's compliance with the emissions maximum set at the boundary of the restricted area, it does not create a tort duty here.

C. Plaintiffs Had to Show that Maximum Permissible Concentration was Exceeded on Average Over a Full Year

Section 20.106 states, "For purposes of this section[,] concentrations may be averaged over a period not greater than one year." 10 C.F.R. § 20.106(a) (1980). The District Court's holding that Plaintiffs failed to show a genuine issue of material fact regarding duty was based on Plaintiffs' failure to show a violation of § 20.106 when averaged over the course of a year: "Plaintiffs have pointed to no genuine issues of material fact that the annual average concentration of uranium effluent ever exceeded 1.7×10^{-2} microcuries/milliliter during the period 1957–1960, or that it ever exceeded 4.0×10^{-12} microcuries/milliliter during the period 1961–1983." *McMunn*, 131 F. Supp. 3d at 388. On appeal, Plaintiffs continue to argue that they could show a violation based on a discharge that exceeds the maximum permissible concentration over any length of time. Plaintiffs are plainly wrong.

Plaintiffs' argument is based entirely on the word "may" in the phrase "concentrations may be averaged over a period not greater than one year." They argue, "The term *may* is permissive, not mandatory. There is no

requirement to take an average." Pls.' Br. 43 (footnote omitted). We agree with Plaintiffs that "may" is permissive. *See, e.g.*, *Simpson v. Kay Jewelers, Div. of Sterling, Inc.*, 142 F.3d 639, 650–51 (3d Cir. 1998) (comparing "the more flexible and permissive 'may'" to "the mandatory 'must'" (quoting *Torre v. Casio, Inc.*, 42 F.3d 825, 831 n.6 (3d Cir. 1994))).

But Plaintiffs' reliance on a single word in that phrase ignores the fact that it is part of a sentence that speaks in the passive voice. "Phrases constructed in the passive voice use an implied subject or actor who carries out the verb." *Sci. Drilling Int'l, Inc. v. Pathfinder Energy Servs., Inc.*, No. H-06-1634, 2006 WL 2882863, at *3 (S.D. Tex. Oct. 4, 2006). Thus, the question is *who* has the discretion to decide whether to average annually.

Given the context of the regulation, the obvious answer is that such discretion lies in the AEC because it is the entity charged with determining whether a licensee violates its regulatory duties. *Cf. United States v. Brumbaugh*, 909 F.2d 289, 291 (7th Cir. 1990) ("The use of the passive voice in the statutory language requires us to infer a subject; the most logical inference is that the Attorney General, who has been charged with granting credit under section 3568 for over thirty years, is the intended subject of the sentence."). Plaintiffs' unwritten assumption that the AEC intended for tort plaintiffs or district courts to have discretion to use annual averaging is mistaken. Giving tort plaintiffs the power to determine

retroactively the period over which a violation is assessed "would allow [them] to fix the standard case by case and plant by plant. An operator acting in the utmost good faith and diligence could still find itself liable for failing to meet such an elusive and undeterminable standard." *In re TMI*, 67 F.3d at 1115. Under § 20.106, Plaintiffs were required to show a breach using annual averaging. Their data relating to individual moments in time fails to show a breach.

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Plaintiffs' attempts to expand Defendants' duty must fail. The maximum permissible concentration is assessed at the boundary of the roof, the license requirement does not create a duty, and Plaintiffs must show that the maximal permissible concentration was exceeded when the emissions are averaged annually.

II. BREACH

The District Court held that Plaintiffs failed to show there was a dispute of fact as to whether Defendants emitted excessive radiation at the boundary of the roof because Plaintiffs failed to offer appropriate expert testimony.[21] On appeal, Plaintiffs again rely

[21] *See McMunn*, 131 F. Supp. 3d at 389 ("In addition, to establish a breach of duty, Plaintiffs must offer evidence

almost entirely on data from the stacks and roof fans, which, as was established above, are legally irrelevant. *See, e.g.*, Pls.' Reply Br. 15–16 ("NUMEC officials were all too aware of the problem with the roof fans."). Putting aside the stacks and fans data, we agree that Plaintiffs' argument for breach fails for lack of expert evidence in this highly technical area.

Moreover, Plaintiffs argue that they are "entitled" to "adverse inferences" that allow them to show a breach (and also causation). *See* Pls.' Br. 22. This, too, fails because Plaintiffs did not show that the District Court abused its discretion in denying the adverse inference.

A. Plaintiffs Needed Experts

Plaintiffs failed to provide an expert who could testify that the data upon which they rely (stacks, vents, and readings from outside the facility) could show a violation of the maximum permissible concentration of uranium effluent at the boundary of the roof when averaged annually.

Expert evidence is generally required when an issue is beyond the ken of a lay jury. For instance, in a medical monitoring claim, we explained that the plaintiff

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from a qualified expert that the Apollo facility's emissions exceeded regulatory limits.").

had to prove he or she suffered a "significantly increased risk of contracting a serious latent disease" and other factors "by competent expert testimony." *Redland Soccer Club, Inc. v. Dep't of Army of U.S.*, 55 F.3d 827, 845–46, 852 (3d Cir. 1995).[22] Similarly, then-Judge Sotomayor wrote for the Second Circuit that expert testimony would be "necessary" where "an injury has multiple potential etiologies." *Wills v. Amerada Hess Corp.*, 379 F.3d 32, 46 (2d Cir. 2004).

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[22] *Cf. also Boring v. Kozakiewicz*, 833 F.2d 468, 473 (3d Cir. 1987) ("In some situations in which the seriousness of injury or illness would be apparent to a lay person, expert testimony would not be required, *e.g.*, a gunshot wound. However, those circumstances are not present here." (citation omitted)); *Breidor v. Sears, Roebuck & Co.*, 722 F.2d 1134, 1140–41 (3d Cir. 1983) (stating that expert testimony was necessary to rebut the defendants' contention in a products liability case); *Lentino v. Fringe Emp. Plans, Inc.*, 611 F.2d 474, 480 (3d Cir. 1979) ("Expert testimony is required to establish the relevant standard and whether the defendant complied with that standard, except where the matter under investigation is so simple, and the lack of skill so obvious, as to be within the range of the ordinary experience and comprehension of non-professional persons." (citations omitted) (Pennsylvania medical malpractice case)).

Perhaps recognizing their failure to transmute vent data into roof data, Plaintiffs try to borrow an "average dilution factor of 50" from an isolated 1968 document. *See* Pls.' Br. 45. But these kinds of calculations are best suited to experts—not lawyers or lay factfinders.

B. The District Court Did Not Abuse Its Discretion in Holding That Plaintiffs Were Not Entitled to an Inference Sufficient to Survive Summary Judgment

Objecting to the report and recommendation, Plaintiffs argued that Defendants' poor recordkeeping allowed them to request an inference under which a jury could assume that Defendants had breached the above-described duty. **[*See* Dist. Ct. ECF No. 376, at 50–53.]** By adopting the Magistrate Judge's report and recommendation, the District Court rejected this argument. *See McMunn*, 131 F. Sup. 3d 352.

We review the District Court's denial of the adverse inference for abuse of discretion. *See, e.g.*, *In re Hechinger Inv. Co. of Del., Inc.*, 489 F.3d 568, 574 (3d Cir. 2007) ("We also review the [bankruptcy court's] denial of UFP's motion seeking an evidentiary inference based on spoliation of evidence for abuse of discretion."); *Davis v. White*, 858 F.3d 1155, 1160 (8th Cir. 2017) ("The district court's refusal to sanction the officers with an adverse inference instruction was not an abuse of discretion.").

Plaintiffs have failed to show that the District Court abused its discretion when determining that an adverse inference was not warranted here.[23] Plaintiffs simply have not developed their argument sufficient to show an abuse of discretion. **[*See* Pls.' Br. 21–22.]** In cases where this argument is more developed, an adverse inference may be appropriate. *See United States ex rel. Scutellaro v. Capitol Supply, Inc.*, No. 10-1094 (BAH), 2017 WL 1422364, at *11 (D.D.C. Apr. 19, 2017) (noting several circuits have held that the failure to maintain records allows for an adverse inference). This can be seen by analogy to spoliation cases. In spoliation cases, where there is evidence that one party has destroyed or altered evidence, the opposing party can obtain a "'spoliation inference,' that the destroyed evidence would have been unfavorable to the position of the offending party." *Schmid v. Milwaukee Elec. Tool Corp.*, 13 F.3d 76, 78 (3d Cir. 1994). Here, because

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[23] Plaintiffs' recordkeeping argument also relates to their failure to provide expert evidence relating to any individual Plaintiff's exposure. *See, e.g.*, Pls.' Reply Br. 18 ("NUMEC's failure to collect data makes calculations impossible—and it should not now benefit from its own malfeasances."). Plaintiffs have also failed to show the District Court abused its discretion when it denied an adverse inference with regard to causation. *See McMunn*, 131 F. Supp. 3d at 394–96.

Plaintiffs failed to show an abuse of discretion, we need not analyze further.

III. CAUSATION

The District Court held that Plaintiffs' case also must be dismissed because Plaintiffs' experts failed to provide "evidence of [Plaintiffs'] exposure to inhaled uranium from the Apollo plant and an estimate of the dose they received which caused their cancers." *McMunn*, 131 F. Supp. 3d at 399. On appeal, Plaintiffs argue they showed causation even though they did not show a dose for any individual plaintiff because (1) Plaintiffs needed only to show "frequency, regularity, and proximity"—not dose—and (2) the law of the case requires us to assume that Melius's testimony would be sufficient to show causation because the District Court ruled Melius's testimony was admissible in its *Daubert* motion. These arguments are unpersuasive because Plaintiffs' experts failed to show that any of the individual Plaintiffs had sufficient exposure—looking at the frequency, regularity, and proximity to the radiation—and Plaintiffs were not prejudiced by the District Court's inconsistent reasoning.

A. *Plaintiffs Do Not Show* Sufficient *Frequency, Regularity, and Proximity*

Unlike with duty and breach discussed above, causation for Price-Anderson public liability actions is evaluated under state law. *See In re TMI*, 67 F.3d 1103,

1117 n.33 (3d Cir. 1995) ("As we have noted, the 1988 Amendments retroactively required the applicable law for 'public liability actions' be 'the law of the State in which the nuclear incident involved occurs, unless such law is inconsistent' with federal law."); *see also In re Hanford Nuclear Reservation Litig.*, 534 F.3d 986, 1010 (9th Cir. 2007) ("Under the PAA, Washington state law controls the standard of causation to be used in this case."). Here, that state law is Pennsylvania law.

Pennsylvania requires a plaintiff to show that a defendant's acts were a substantial factor in causing a plaintiff's injury. As the Pennsylvania Supreme Court recently stated, "To establish proximate causation, a plaintiff must adduce evidence to show that the defendant's act was a substantial factor in bringing about the plaintiff's harm." *Rost v. Ford Motor Co.*, 151 A.3d 1032, 1049 (Pa. 2016); *see also Summers v. Certainteed Corp.*, 997 A.2d 1152, 1164–65 (Pa. 2010) ("[T]he requirements of proving substantial-factor causation remain the same.").

Until recently, the Pennsylvania Supreme Court had suggested that proving substantial-factor causation required showing the dose to which plaintiff was exposed because otherwise the "substantiality" of the substantial factor would not be shown to the jury. *See Betz v. Pneumo Abex LLC*, 44 A.3d 27, 58 (Pa. 2012) ("Certainly a complete discounting of the substantiality

in exposure would be fundamentally inconsistent with Pennsylvania law.").

However, following oral argument in the case before us, the Pennsylvania Supreme Court issued its decision in an asbestos case, *Rost v. Ford Motor Co.* In *Rost*, the Pennsylvania Supreme Court retreated from its earlier statements, emphasizing that it had previously "adopted the 'frequency, regularity, and proximity' test, as refined and applied by the United States Court of Appeals for the Seventh Circuit in *Tragarz v. Keene Corp.*, 980 F.2d 411 (7th Cir. 1992)." *Rost*, 151 A.3d at 1043.

It may well be that *Rost* applies only in mesothelioma cases because of unique public policy concerns about mesothelioma.[24] Yet we need not decide

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[24] *See, e.g.*, *Rost*, 151 A.3d at 1042–43 (describing the "test on motions for summary judgment in mesothelioma cases"); *id.* at 1044 n.7 ("It is important to recognize that this Court settled on these principles based on a policy concern: that it is fundamentally unfair to hold a defendant jointly and severally liable for a mesothelioma plaintiff's injuries for a de minimis contribution to the plaintiff's overall exposure."); *id.* at 1052 (stating that the frequency, regularity, and proximity test applied "for all exposures to asbestos"). This makes particular sense to the extent that *Rost* relies on *Tragarz*, which, in turn is

based on an Illinois appellate court's reliance on the nature of asbestos-related diseases:

> Given the various diseases which are associated with asbestos exposure, the medical evidence presented, the types of asbestos involved, the manner in which the products are handled, and the tendency of those asbestos products to release asbestos fibers into the air, the amount of evidence needed to establish the regularity and frequency of exposure will differ from case to case. For example, none of the plaintiffs in this case were diagnosed with mesothelioma, an asbestos-related disease which is caused after only minor exposure to asbestos dust.

Wehmeier v. UNR Indus., Inc., 572 N.E.2d 320, 337 (Ill. App. Ct. 1991) (citation omitted).

Mesothelioma is a "signature" disease relating to asbestos exposure; individuals do not usually develop mesothelioma without asbestos exposure. *See Daley v. A.W. Chesterton*, 37 A.3d 1175, 1177 n.4 (Pa. 2012) ("Moreover, because mesothelioma, in general, is so rare, 'any case occurring after a well attested and substantial asbestos exposure is commonly accepted as being caused

by that exposure.'"); *see also Ford Motor Co. v. Boomer*, 736 S.E.2d 724, 728 (Va. 2013) ("Mesothelioma is a signature disease: it was uncontroverted at trial that the cause of mesothelioma is exposure to asbestos at some point during an individual's lifetime.").

By contrast, the cancers suffered by the Plaintiffs have numerous and sometimes even unknowable causes, as Melius conceded. *See* JA3236 ("We're evaluating a disease that's multi-causal. We don't have any way of testing the cancer to determine what caused it, what specific factor caused it."); JA3237 ("There are many cancers that occur where we don't identify the cause of that cancer or the causes of that cancer."); JA3311 ("In an individual patient I think it's more appropriate to use risk factors because it implies -- otherwise it implies that we know the factor that caused their specific individual cancer and in most cases we probably do not."); *see also Risk Factors for Cancer*, Nat'l Cancer Institute, https://www.cancer.gov/about-cancer/causes-prevention/risk (last visited Oct. 15, 2016) (identifying age, alcohol, cancer-causing substances, chronic inflammation, diet, hormones, immunosuppression, infectious agents, obesity, radiation, sunlight, and tobacco as risk factors for cancer).

Indeed, in 1999, we explained that establishing causation for a given cancer was extremely difficult. *See In re TMI*

whether *Rost* is limited to mesothelioma cases because Plaintiffs' evidence would not allow a jury to find *sufficient* frequency, proximity, and regularity. *Rost* requires a plaintiff at summary judgment to have propounded "evidence that exposure to defendant's asbestos-containing product was *sufficiently* 'frequent, regular, and proximate' to support a jury's finding that defendant's product was substantially causative of the disease." *Rost*, 151 A.3d at 1044 (emphasis added). For

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Litig., 193 F.3d at 643 ("Consequently, medical evaluation, by itself, can neither prove nor disprove that a specific malignancy was caused by a specific radiation exposure."). Modern secondary sources continue to agree with that assessment. *See, e.g.*, Steve C. Gold, *When Certainty Dissolves into Probability: A Legal Vision of Toxic Causation for the Post-Genomic Era*, 70 Wash. & Lee L. Rev. 237, 279–81 (2013); William D. O'Connell, Note, *Causation's Nuclear Future: Applying Proportional Liability to the Price-Anderson Act*, 64 Duke L.J. 333, 357, 359 (2014) ("Radiation-protection scientists are in agreement that differential diagnosis cannot confidently identify the ultimate source of a plaintiff's cancer."); *cf. Wilcox v. Homestake Mining Co.*, 619 F.3d 1165, 1167 (10th Cir. 2010) ("[N]or do we see a basis for alternative liability where only one potential wrongdoer has been identified and the injury may simply have resulted from natural causes.").

instance, the *Rost* Court noted that the plaintiff's expert testified to more than three months of exposure "while noting studies showing that a single month of regular exposure to asbestos can double one's likelihood of developing mesothelioma." *Id.* at 1046. Even *Lohrmann*—the original frequency, regularity, and proximity case, which stated that the court was creating "a *de minimis* rule" for proving asbestosis causation under Maryland law—explained that "a plaintiff must prove more than a casual or minimum contact with the product." *Lohrmann v. Pittsburgh Corning Corp.*, 782 F.2d 1156, 1162 (4th Cir. 1986). Here, where Plaintiffs (1) simply rely on the existence of *any* frequency, regularity, and proximity and (2) fail to offer any individualized evidence of exposure for any given Plaintiff, they come up short. Even were this evidence substantively permissible under Pennsylvania law, it would fail to be admissible under *Daubert* for three reasons.

First, Melius's testimony is insufficient to create a genuine issue of fact regarding causation because it is nothing more than a radiation version of the impermissible "any breath" theory in *Gregg v. V-J Auto Parts* (the case in which that court first adopted the frequency, regularity, and proximity test in mesothelioma cases). *See Summers*, 997 A.2d at 1161 n.14 ("In *Gregg v. V-J Auto Parts, Co.*, 596 Pa. 274, 943 A.2d 216 (2007), this Court recently rejected the viability of the 'each and every exposure' or 'any breath' theory."). The

Gregg Court explained that, in a so-called "any breath" theory of asbestos exposure, a plaintiff alleges that "any exposure to asbestos, no matter how minimal, is a substantial contributing factor in asbestos disease." *Gregg v. V-J Auto Parts, Co.*, 943 A.2d 216, 226 (Pa. 2007); *see also Howard v. A.W. Chesterton Co.*, 78 A.3d 605, 608 (Pa. 2013) (per curiam) ("Bare proof of some *de minimus* [sic] exposure to a defendant's product is insufficient to establish substantial-factor causation for dose-responsive diseases.").

Melius assumes that anyone who lived in the area of the Apollo facility was exposed to a *sufficient* amount of radiation. In Melius's words, he "estimated that -- that they had a, um, substantial or significant exposure." JA3227. Yet he did not "estimate a specific or associate a specific level of exposure with a -- with those terms." *Id.* When asked about "significant exposure," Melius agreed that "any exposure to a plaintiff that was above that plaintiff's background would be a substantial exposure." JA3315.[25] Similarly, Melius said that,

[25] This is in contradiction to, for instance, his admissions that he relied on different levels of cigarette usage to determine substantiality. *See* JA3300, 3308; *see also* JA3321 ("For cigarette smoking and lung cancer, it is reduced to ten or twenty percent increased risk compared to somebody who has never smoked after a period of say twenty years, maybe even after ten or fifteen years.").

"[d]epending on how you use the meaning of significant," he "would say" one millirem above background was "substantial." JA3315–16.

Second, Melius failed to offer individualized testimony as he was required to do for each Plaintiff. For instance, in *Howard v. A.W. Chesterton Co.*, the Pennsylvania Supreme Court explained, "Relative to the testimony of an expert witness addressing substantial-factor causation in a dose-responsive disease case, some reasoned, individualized assessment of a plaintiff's or decedent's exposure history is necessary." 78 A.3d at 608; *cf. also Black v. M&W Gear Co.*, 269 F.3d 1220, 1237–38 (10th Cir. 2001) (holding that a district court did not abuse its discretion in excluding an expert's testimony when that expert "had not based his conclusion on the results of tests or calculations specific to" the plaintiff). Although Melius describes each Plaintiff's smoking history and a few other features for most Plaintiffs, Melius fails to offer any "reasoned . . . assessment" of any individual's exposure to radiation from uranium effluent. *See, e.g.*, JA4782–84 (relying on reports about radiation released from the facility that do not show exposure to any of the individual Plaintiffs). He merely offers the conclusion that each Plaintiff's "exposures to uranium and other radioactive materials released from the Apollo nuclear facility made a significant contribution to the development of" her or his cancer. *E.g.*, JA3448. Even if such a conclusion were permissibly individualized, it would still be insufficient

to generate a genuine issue of fact because, under the *Lone Pine* order, only exposure to uranium is at issue here.

Although *Rost* stresses that causation is an issue for the jury, we have never hesitated to grant summary judgment where one side fails to establish a genuine issue of fact concerning causation. *See, e.g.*, *In re TMI Litig.*, 193 F.3d 613, 722–23 (3d Cir. 1999) (affirming summary judgment where plaintiff's expert testimony "was insufficient to create a genuine issue of material fact" regarding causation); *Heller v. Shaw Indus., Inc.*, 167 F.3d 146, 150 (3d Cir. 1999) ("[B]ecause the District Court did not abuse its discretion in excluding the key elements of Heller's experts' testimony necessary to prove causation, the grant of summary judgment will be affirmed.").

Finally, the Federal Rules of Evidence impose a duty on a district judge to act as a gatekeeper of expert testimony even when considering elements of a cause of action derived from state law. *See Forrest v. Beloit Corp.*, 424 F.3d 344, 358 n.9 (3d Cir. 2005) (explaining that "evidentiary issues in this case are governed by federal . . . law" while Pennsylvania substantive law affected what facts would be relevant); *see also Hendrix ex rel. G.P. v. Evenflo Co., Inc.*, 609 F.3d 1183, 1193 (11th Cir. 2010) ("Although the standards for finding causation are governed by Florida law, we apply federal law to determine whether the expert testimony proffered

to prove causation is sufficiently reliable to submit it to the jury."); *cf. Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 597 (1993) ("[A] gatekeeping role for the judge . . . is the balance that is struck by Rules of Evidence . . . .").

Thus, even assuming *arguendo* that *Rost* resuscitated "any breath" causation, Melius's testimony would be too insubstantial to survive *Daubert*. Melius's testimony provides only a perfunctory narrative for each Plaintiff, and an unexplained conclusion that radiation was the cause, presumably because each Plaintiff was exposed to *some* radiation. Such conclusory opinions of medical causation, even by qualified experts, are insufficient to establish causation of cancer by exposure to uranium effluent. *See Tamraz v. Lincoln Elec. Co.*, 620 F.3d 665, 671 (6th Cir. 2010) ("Whatever Dr. Carlini understood by 'with a reasonable degree of medical certainty,' the phrase—the conclusion by itself—does not make a causation opinion admissible. The '*ipse dixit* of the expert' alone is not sufficient to permit the admission of an opinion." (quoting *Gen. Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997))).

Although we have held that an expert can offer an opinion "absent hard evidence of the level of exposure to the chemical in question," we have only done so where an expert could rely "on the temporal relationship and the nature of the plaintiff's complaints." *Heller*, 167 F.3d at 157. This, too, does not require a dose. But it requires

more than an assumption about the effect of living within a mile of the Apollo facility.

* * *

Consider how a trial would unfold. Plaintiffs would present a general causation expert who opines that any amount of ionizing radiation could cause cancer. Then, Plaintiffs would present Melius who would state that each of the Plaintiffs lived or worked near the Apollo facility and would therefore be assumed to have been exposed to some radiation from airborne uranium effluent from the Apollo facility. Melius would then presumably testify that he is certain that the additional radiation specifically from the airborne uranium was a substantial factor in causing the cancer of each of the Plaintiffs.[26] Finally, the jury would decide whether more than a dozen different illnesses suffered by more than seventy people were each caused by the radiation from the airborne uranium from the Apollo facility.

How? Without any ability to compare any plaintiff's frequency, proximity, or regularity to any evidence showing that a given frequency, proximity, or regularity is correlated with any particular increase in

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[26] Plaintiffs would also have to ensure they have sufficient testimony relating only to uranium effluent under the *Lone Pine* order.

risk—let alone the ability to perform the ideal comparison between dose and the dose-responsiveness of a given illness—the jury would be engaging in rank speculation.

It is true that demanding more than evidence of "any exposure" makes it more burdensome for most plaintiffs to recover for injuries from radiation. But the evidentiary regime that must apply in these cases necessarily requires that a jury find radiation was a substantial factor in causing a plaintiff's injury—and requires, now, at summary judgment, that we be able to hold that a reasonable jury could so find. *See Gregg*, 943 A.2d at 225–26 ("We appreciate the difficulties facing plaintiffs in this and similar settings, where they have unquestionably suffered harm on account of a disease having a long latency period and must bear a burden of proving specific causation under prevailing Pennsylvania law which may be insurmountable."); *see also* Fed. R. Civ. P. 56(a). We can demand no less.

B. District Court Law of the Case Does Not Bind This Court, and, in Any Event, Plaintiffs Were Not Prejudiced

Pointing to the inconsistency between the District Court's *Daubert* opinion, which suggested Melius's testimony was strong, and the District Court's opinion granting summary judgment to Defendants, which held that Melius's testimony did not create a genuine issue of material fact, Plaintiffs argue that the District Court was

bound to adhere to its *Daubert* opinion at summary judgment. Such concerns are irrelevant where, as here, (a) this Court is not bound by the District Court's *Daubert* opinion and (b) Plaintiff cannot show prejudice.

Plaintiffs are correct that the District Court's *Daubert* opinion appears to be inconsistent with its summary judgment opinion. The *Daubert* opinion strongly implied that Melius's testimony would be enough to get the case to the jury, holding that his testimony should not be excluded because there was "enough support in the record for the contention that the Plaintiffs' exposure levels exceeded the normal background level." *McMunn v. Babcock & Wilcox Power Generation Grp.*, Nos. 2:10cv143 et al., 2014 WL 814878, at *14 (W.D. Pa. Feb. 27, 2014). By contrast, the District Court's summary judgment opinion held that "Plaintiffs must provide . . . an estimate of the dose they received which caused their cancers." *McMunn*, 131 F. Supp. 3d at 399.

But, as a general matter, we fail to see what difference law of the case makes at this stage of the litigation. We are not bound by either of the District Court's rulings, and we have addressed the Plaintiffs' arguments on their own merits.

At all events, Plaintiffs' law-of-the-case argument fails on its own merits. Two values animate law-of-the-case doctrine: judicial economy and unfair prejudice. *See, e.g.*, *Roberts v. Ferman*, 826 F.3d 117, 126 (3d Cir.

2016) ("We also have held that 'the law of the case doctrine does not limit the power of trial judges to reconsider their prior decisions,' but have noted that when a court does so, it must explain on the record why it is doing so and 'take appropriate steps so that the parties are not prejudiced by reliance on the prior ruling.'" (quoting *Williams v. Runyon*, 130 F.3d 568, 573 (3d Cir. 1997))).

Here, Plaintiffs have failed to show any prejudice from the District Court's change in position. Had the District Court ruled against them in its *Daubert* order, Plaintiffs' case would have been dismissed as the Magistrate Judge recommended. Plaintiffs would not have had an opportunity to create new expert reports in response to a *Daubert* ruling that more clearly reflected the District Court's legal rulings on causation at summary judgment.

Perhaps Plaintiffs could have argued that they were prejudiced because they were lulled into failing to challenge Defendants' uncontested facts. But, because we do not rely on any of those uncontested facts when we hold that Plaintiffs fail to show a genuine dispute of material fact with regard to causation, not even the admission of the uncontested facts demonstrates prejudice.

* * *

Because Plaintiffs failed to offer evidence from which a jury could find that each plaintiff was exposed to radiation from Defendants' uranium effluent sufficiently frequently, regularly, and proximately to substantially cause their illnesses, and further because the law-of-the-case doctrine does not require us to conclude otherwise, we hold that Defendants have failed to demonstrate issues of material fact on causation.

CONCLUSION

Defendants are entitled to judgment as a matter of law because Plaintiffs failed to show a genuine issue of material fact with regard to duty, breach, and causation. Therefore, we will affirm the judgment of the District Court.

McMunn, et al. v. Babcock & Wilcox Power Generation Group, Inc., et al., No. 15-3506

MCKEE, *Circuit Judge*, concurring, joined by RESTREPO, *Circuit Judge*.

While I agree that summary judgment is appropriate here, I write to stress that the law in this area is simply inadequate to address claims arising under the Price-Anderson Act based on exposure to excess radiation.

As the Majority explains, this is a Public Liability Action under the Price-Anderson Act.[1] Federal law therefore controls our inquiry into whether Defendants owed Plaintiffs a duty, and if so, whether the duty was breached. State law controls the inquiry into whether the breach, if proven, caused Plaintiffs' injuries.[2] As I will explain, existing law places an almost insurmountable burden on plaintiffs who try to recover under the Price-Anderson Act. Under the existing law, Plaintiffs cannot establish causation, even if they have established that Defendants owed them a duty that was breached.

Suits for injuries allegedly resulting from radiation exposure have no analogous counterpart in traditional tort law, and existing law ignores the unique problems inherent in claims based on exposure to "manmade" radiation. As a result, plaintiffs will rarely, if ever, recover in these types of actions, and this will continue unless states (or Congress) recognize the unique problems endemic in proving that a plaintiff's illness was proximately caused by exposure to radiation from a given facility or event.

I. BREACH OF DUTY

I believe that Plaintiffs' submissions (as itemized in the Majority Opinion) are more than adequate to survive Defendants' motion for summary judgment as to breach of duty.[3] For example, an internal memorandum, dated

[1] Maj. Op. at 5.
[2] *See In re TMI*, 67 F.3d 1103, 1117 n.33 (3d Cir. 1995).
[3] *See* Maj. Op. at 10-12.

November 29, 1972, regarding NUMEC's meeting with AEC Compliance stated:

> P. Nelson [AEC personnel] opened by explaining the purpose of the meeting. He stated that Compliance was concerned about the recurring nature and seriousness of NUMEC violations. He explained that the AEC could now impose civil penalties for those types of violations. . . . **NUMEC has been the worst offender of AEC regulations over the years**. . . . AEC had given NUMEC a grace period after the B&W takeover, but that little improvement was evident. The AEC is strongly considering imposing civil penalties against NUMEC.[4]

Another letter from the AEC stated: "It appears that certain of your activities were not conducted in full compliance with . . . and the requirements of the AEC's 'Standards for Protection Against Radiation,' Part 20, and 'Special Nuclear Material' . . . ."[5] Based on this, there could be enough evidence to support Plaintiffs' claimed breach of duty.

The Majority affirms the District Court's conclusion that much of Plaintiffs' evidence is of either limited value or irrelevant because the only expert whose testimony survived the *Daubert* motion (Dr. Melius) primarily focused on radiation levels at the stacks or vents and not at the roof top boundary.[6] Although I agree that Plaintiffs must establish the levels of radiation at the roof boundary rather than levels at the vents or stacks, levels at the vents or stacks *could* nevertheless be very relevant to establishing levels at the boundary if that evidence had been properly developed. This follows from the fact that different radioactive substances have different half-lives. I will not wade into the quantum mechanical weeds of half-lives here as that was discussed in some detail in our 1999 opinion in *In re TMI Litigation* (*TMI II*).[7] Rather, I will merely note that half-lives vary from as short as less than a second to as long as many billions of

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[4] JA4439-40 (emphasis added).
[5] JA4693.
[6] *See* Maj. Op. at 23, 29-34.
[7] 193 F.3d 613 (3d Cir. 1999).

years, depending on the substance involved.[8] Accordingly, if byproducts of the uranium produced at Defendants' facility included substances with sufficiently long half-lives, their levels at the stacks and vents would be very relevant to determining exposure at the roof boundary and beyond. A fact finder could readily conclude that the levels at the vents and stacks persisted with no discernable diminution (even after allowing for dilution as they dispersed into the surrounding community) long enough for residents of the community to be exposed to those levels. The probative value of this evidence could be particularly compelling if the effluents that comprise the byproducts of uranium production are not otherwise found in the environment. They would thus become much more analogous to toxins that cause diseases such as mesothelioma which I discuss in more detail below.

However, we do not know the extent to which byproducts of uranium production have an exceedingly short half-life or whether they have exceptionally low energies. If they have a momentary short half-life or exceptionally low energies, their presence at the stacks and vents would be irrelevant to determining levels at the roof boundary. This is because they would have disintegrated into sub particles before reaching the roof boundary and would likely not have had enough energy to cause any damage even if they reached the roof's perimeter and beyond into the community. Plaintiffs did not offer any evidence that would allow a fact finder to conclude that the levels at vents and stacks persisted at the roof boundary. Accordingly, evidence of the levels at the stacks and vents cannot satisfy their burden of establishing a breach at the relevant point—the roof boundary.

I also have reservations about the Majority's conclusion that 10 C.F.R. § 20.106(a) *requires* averaging as opposed to merely *allowing* Plaintiffs to average exposure over a year.[9] However, here again, Plaintiffs' proof is deficient because they did not attempt to introduce any evidence about the actual content of the uranium effluent that was discharged. If that effluent contained substances that

[8] *See id.* at 632.

[9] *See* Maj. Op. at 41-43.

were particularly toxic (such as plutonium), exposure to a given amount for a few days (perhaps even for a matter of hours) could cause cancer even though the exposure would appear minimal when averaged out over a year.[10] There is an even more fundamental problem with Plaintiffs' case that prevents them from surviving summary judgment, and that is why I feel compelled to write separately.

In order for Plaintiffs to succeed, they must do more than show a breach of a duty resulting in exposure to excess radiation. They must show that the breach resulted in an exposure that proximately caused their injuries. It is here that Plaintiffs' claims fail regardless of the quality of all of their other proof. Thus, even assuming a genuine issue of fact as to the exposure levels and Defendants' breach, the evidence is still not sufficient to defeat summary judgment under the Price-Anderson Act because causation is lacking.

II. CAUSATION

A. The Problems of Radiation Toxicity

The Majority thoroughly and correctly explains causation as it applies to "toxic torts" under Pennsylvania law. However, the legal principle of causation has evolved from suits arising from exposure to manmade toxic substances such as asbestos. As the Majority notes, mesothelioma is caused by exposure to asbestos, and it is therefore a "signature" disease. The disease almost never occurs absent exposure to asbestos.[11] The problems of proof in such cases are quite similar to problems of causation in cases involving polychlorinated biphenyls (PCBs)[12] or

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[10] *See* George L. Voelz, *Plutonium and Health: How Great is the Risk?*, Los Alamos Sci. 83 (2000), https://fas.org/sgp/othergov/doe/lanl/pubs/00818013.pdf; Katherine Harmon, *Health Risk Fears Escalate as Japan Nuclear Plant's Radioactive Release Remains Uncertain*, Sci. Am. (Mar. 18, 2011), https://www.scientificamerican.com/article/health-risk-fukushima/ ("Plutonium is of graver concern because of its exceptionally long half-life (about 24,000 years) and its propensity to cause lung cancer if inhaled.").

[11] Maj. Op. at 50-51.

[12] *See In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717 (3d Cir. 1994).

pneumoconiosis (black lung disease),[13] to name but a few of the pathological byproducts of modernization. In such cases, a pathology is caused by contact (usually ingestion) with a foreign substance that the injured person would not have otherwise been exposed to, or would have been exposed to only in relatively insignificant quantities, and that pathology almost never occurs in the absence of exposure to that toxic substance. Accordingly, causation can be established by showing that defendant made (or controlled) a substance, plaintiff has a disease that almost never occurs absent contact with defendant's substance, and plaintiff had sufficient contact with defendant's product (i.e. "frequency, regularity, and proximity of exposure") to allow a fact finder to conclude that the defendant's product was a substantial factor in the plaintiff's death or injury.[14] Radiation is different.

In *TMI II*, we discussed the "scientific principles regarding the relationship between radiation and cancer." [15] As the Majority explains, "[m]anmade ionizing radiation can damage human cells."[16] An ion is nothing more than an electron that has been displaced from its orbit.[17] Unlike with

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[13] *See Mancia v. Dir., Office of Workers' Comp. Programs, U.S. Dep't of Labor*, 130 F.3d 579 (3d Cir. 1997).

[14] *See Rost v. Ford Motor Co.*, 151 A.3d 1032 (Pa. 2016).

[15] Maj. Op. at 13-15; *see TMI II*, 193 F.3d 613.

[16] Maj. Op. at 13 (citing *TMI II*, 193 F.3d at 639-40). Although we used the term "manmade" in *TMI II*, it is actually a misnomer that obscures some of the very important distinctions between environmental radiation naturally occurring and radiation from substances that are, in fact, manmade. The latter radiation is not actually "manmade." It consists of natural elementary particles that are transformed by human activity. The resulting radiation is nevertheless the result of quantum mechanical processes. However, for the sake of convenience, we will also refer to this radiation as "manmade" as we did in *TMI II*.

[17] *TMI II*, 193 F.3d at 639 ("[A]n atom is ionized when an electron is ejected from its orbit and expelled from the atom."). It is actually a sweeping generalization to refer to all ionizing radiation as resulting from a single displaced electron. A very detailed description of the process of

PCBs, asbestos or tobacco byproducts, we are constantly exposed to radiation on a daily basis. We are exposed from numerous natural sources including the sun,[18] or naturally occurring radioactive elements such as radon in the ground surrounding our homes.[19]

It is now beyond dispute that radiation can cause various types of cancer. However, unlike with asbestos and diseases, such as mesothelioma, radiation wreaks havoc with our bodies, not because it is a foreign substance (it is not), but because it transfers extra energy to our cells. This energy can, in turn, damage our DNA in numerous ways that are described in detail in *TMI II*.[20]

Asbestos fibers cause mesothelioma by damaging the "mesothelial cells that control cell reproduction. Some damaged cells die and tumor suppressor genes stop others

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ionization (including the all important Columb Force) can be found at *TMI II*, 193 F.3d at 632-38.

However, the complex distinctions are not important for purposes of this discussion. Therefore, rather than attempt more precision by distinguishing between the different types of ionizing particles and ionizing energy as we did in *TMI II*, we will refer to all ions as if they only consisted of electrons without attempting to distinguish between alpha, beta or gamma radiation or between orbital electrons and electrons created through nuclear reactions. The important thing for purposes of this discussion is that "[w]hen a charged particle passes through matter, it excites and ionizes atoms in its path." *Id.* at 635. This is what happens to human tissue that is exposed to radiation.

[18] *Id.* at 644-47.

[19] *See Natural background radiation*, Am. Cancer Soc'y, https://www.cancer.org/cancer/cancer-causes/radiation-exposure/x-rays-gamma-rays/natural-background-radiation.html (last revised Feb. 24, 2015) (explaining that radon is but one source of the background radiation that we are potentially exposed to on a daily basis and is listed only for purposes of illustration).

[20] *See TMI II*, 193 F.3d at 640.

from reproducing."[21] However, "[w]here suppressor genes do not stop the reproduction process, . . . the damaged cells divide, replicating the damage in the sister cells."[22] Over decades of continued growth of these cells, tumors develop. "This explains why mesothelioma has an extremely long latency period, as mesothelial cells have a very slow growth rate."[23] As expert testimony in a recent case from the Supreme Court of Pennsylvania established, "it is not scientifically possible to identify the particular exposure or exposures that caused a patient's mesothelioma[.] . . . [I]nstead, the causative agent is 'the series of exposures.'"[24] However, even though it is not possible to identify a particular exposure as causing a given occurrence of the disease, there is now no dispute that asbestos is responsible for mesothelioma.

Although the disease process described above for mesothelioma is quite similar to that which is triggered by radiation after the cell is irradiated, there is a key difference that is very relevant to our discussion. As noted above, we do not normally develop diseases such as mesothelioma in the absence of exposure to the manmade carcinogens that can cause it. Thus, if a plaintiff can produce evidence of sufficient frequency, regularity, and proximity of exposure to asbestos to establish that it is more likely than not that that exposure was a substantial cause of subsequent disease, the plaintiff then need only prove that defendant manufactured or controlled the substance that plaintiff had been exposed to in order to recover. The same is true with any other "signature" disease.

Unlike products such as asbestos and PCBs, radiation is not a foreign substance. All of us are exposed to it every second of every day both inside of buildings and outdoors. Yet, radiation can "damage structures within the human body as cells are disrupted or killed by the ionizing radiation [energy] itself, and as energy is transferred to cells triggering

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[21] *Rost*, 151 A.3d at 1039 (citations omitted).
[22] *Id.*
[23] *Id.*
[24] *Id.*

second-order chemical changes."[25] "Unlike a chemical product, which may be traceable to a particular manufacturer, different sources of radiation are not distinguishable, nor is there any noticeable difference between cancers caused by nuclear-power production and those caused by other sources of radiation."[26]

> [M]edical evaluation, by itself, can neither prove nor disprove that a specific malignancy was caused by a specific radiation exposure [or series of exposures]. Therefore, the primary basis to link specific cancers with specific radiation exposures is data that has been collected regarding the increased frequency of malignancies following exposure to ionizing radiation. In other words, causation can only be established (if at all) from epidemiological studies of populations exposed to ionizing radiation.[27]

However, epidemiological studies of exposed populations can only establish the percentage by which the incidence of given cancers in that population exceeds the rate for those same cancers in similar populations not exposed to the source of radiation. No study can determine whether the cancer of a given member of that population was the result of exposure to a defendant's product or to radiation released from a defendant's facility. As we explained in *TMI II*, "the task of establishing causation is greatly complicated by the reality that a given percentage of a defined population will contract cancer even absent any exposure to ionizing

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[25] William D. O'Connell, *Causation's Nuclear Future: Applying Proportional Liability to the Price-Anderson Act*, 64 Duke L.J. 333, 348 (2014) [hereinafter *O'Connell*] (citing James E. Turner, Atoms, Radiation, and Radiation Protection 421 (3d ed. 2007) [hereinafter *Turner*], *available at* http://nuclear.dababneh.com/Radiation-Undergrad-2/Atoms,%20Radiation,%20and%20Radiation%20Protection.pdf.

[26] *Id.* at 350 (citing *Turner* at 468).

[27] *TMI II*, 193 F.3d at 643 (citations omitted).

radiation."[28] This probability conundrum is even more of an issue when we try to compare members of a population who have only been exposed to natural radiation with members of the same population who have been exposed to that radiation plus radiation emanating from a defendant's product or facility.

Plaintiffs who must prove that exposure to a particular source of radiation was a substantial cause of their injuries therefore face an insurmountable task that the law has yet to satisfactorily address. The task is further complicated by the fact that radiation includes different kinds of particles (i.e. alpha, gamma, beta), each with different properties including different levels of energy and thus having a different capability of damaging human cells.[29] As the NRC has explained:

> [N]atural radiation . . . is always present in the environment. It includes cosmic radiation which comes from the sun and stars, terrestrial radiation which comes from the Earth, and internal radiation which exists in all living things. The typical average individual exposure in the United States from natural background sources is about 300 millirems per year.[30]

Yet, although there is general scientific agreement that radiation can cause cancer, we are still at the rudimentary stages of understanding the etiology of cancers. [31]

As if this does not make plaintiffs' task in such cases difficult enough, two additional considerations further complicate inquiries into causation. First, as has already been mentioned, not all radiation has the same energy level. Some radiation can be filtered out by barriers no more substantial

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[28] *Id*. at 643-44. For a detailed explanation of the two major sources of natural radiation and average doses, *see id.* at 644-48.

[29] For a detailed discussion of this, *see id.*

[30] U.S. Nuclear Regulatory Comm'n, *Background radiation*, https://www.nrc.gov/reading-rm/basic-ref/glossary/background-radiation.html.

[31] *See TMI II*, 193 F.3d at 644-48.

than sunscreen, or surface tissue, yet some radiation is capable of penetrating lead.[32] Thus, mere proximity to a source of radiation does not necessarily establish a sufficient "absorbed dose" to link an individual's illness to that proximity.[33] This point is illustrated in the extreme by the fact that "[c]rews of nuclear submarines have possibly the lowest radiation exposure of anyone, despite living within a few meters of a nuclear reactor, since they are exposed to less natural background radiation than the rest of us [(the ocean shelters them)], and the reactor compartment is well shielded."[34]

Second, the difficulty of linking a potentially radiation-related pathology to a defendant instead of to background radiation is made exponentially more difficult by the fact that some people have a genetic predisposition to diseases associated with radiation exposure, while others have a genetic composition that seems to protect them from the otherwise harmful effects of radiation. Indeed, more than one physician has counseled that the best way to guard against contracting cancer is to "choose your parents carefully."[35] Genetic research has even led researchers to conclude that:

> [P]erhaps a fortunate genetic endowment protects some lifelong smokers from lung cancer, while a genetic mischance induces lung cancer in some non-smokers. Both environmental and genetic differences between individuals appear responsible for at least some

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[32] *See id.* at 637 n.36.

[33] *Id.* at 637 ("The absorbed energy per unit mass of material is termed the 'absorbed dose.'").

[34] World Nuclear Ass'n, *Nuclear Radiation and Health Effects*, http://www.world-nuclear.org/information-library/safety-and-security/radiation-and-health/nuclear-radiation-and-health-effects.aspx.

[35] *See, e.g.*, Huber R. Warner, *If You Wish to Live a Long Time in Good Health, Choose Your Parents Carefully*, 62A J. of Gerontology: Biological Scis. 575 (2007), *available at* https://www.ncbi.nlm.nih.gov/pubmed/17595411; *see also* Steve C. Gold, *When Certainty Dissolves into Probability: A Legal Vision of Toxic Causation for the Post-Genomic Era*, 70 Wash. & Lee L. Rev. 237, 259 (2013) [hereinafter *Gold*].

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> of the variation in individuals' responses to toxic exposures. For the most part, it has been impossible (or at least impractical) to identify, quantify, and tease apart these possibilities using the investigatory tools of toxicology, environmental epidemiology, conventional biochemistry, and classical genetics.[36]

Yet, Plaintiffs such as those here, must produce evidence that will establish that their injuries are more likely than not caused by effluents from Defendants' uranium plant. I simply do not see any way they can do that given the current state of the law.

B. Congress's Response to Causation Issues

Congress has recognized the problems inherent in attempting to prove causation in Public Liability Actions almost from the very beginning of our attempts to harness the power of the atom. The Atomic Energy Act of 1946 created the Joint Committee on Atomic Energy to correct the deficiencies of the Price-Anderson Act, including the stringent burden of establishing causation.[37] The Committee

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[36] *Gold* at 258-59.

[37] Taylor Meehan, *Lessons from the Price-Anderson Nuclear Industry Indemnity Act for Future Clean Energy Compensatory Models*, 18 Conn. Ins. L.J. 339, 346 (2012) [hereinafter *Meehan*]; *see also* Michael Flynn, *A Debt Long Overdue*, Bulletin of the Atomic Scientists 41-42 (2001) (The Energy Employees Occupational Illness Compensation Act acknowledged that "nuclear weapons workers were put at risk building the country's arsenal." Acknowledging the difficulties associated with establishing causation, and "[b]ecause the government failed to adequately track exposures at these sites, [the Act] assumes that workers' cancers are work related, thus relieving the workers of the near-impossible task of having to prove the connection." Further, the Act "establishes the possibility that other sites and illnesses may be added to the cohort at a later date."); *see also* David Rocchio, *The Price-Anderson Act: Allocation of the Extraordinary Risk of Nuclear Generated Electricity: A Model Punitive Damage Provision*, 14 B.C. Envtl. Aff. L.

was also concerned with state statutes of limitation that could nullify meritorious claims because of the latency of injuries caused by radiation.[38] Consequently, the 1966 amendments to the Act included a provision for the waiver of various defenses under state tort law in the event of an "extraordinary nuclear occurrence."[39] An "extraordinary nuclear occurrence" was defined as:

> [A]ny event causing a discharge or dispersal of . . . byproduct material from its intended place of confinement in amounts offsite, . . . which the Nuclear Regulatory Commission or the Secretary of Energy. . . determines to be substantial, and which the Nuclear Regulatory Commission or the Secretary of Energy. . . determines has resulted or will probably result in substantial damages to persons offsite . . ..[40]

"This provision was enacted in order to assure that the victim's entitlement to compensation would be determined under a strict liability standard, instead of the negligence standard that most state courts require."[41] The amendments also included a provision that waived state statutes of limitation that were more limited than the three-year limit established under the Price-Anderson Act.[42] However, the overarching problem of causation was not impacted by attempts to augment statutes of limitation or impose strict

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Rev. 521, 538-39 (1987) [hereinafter *Rocchio*] (citing *Hearings Before the Joint Committee on Atomic Energy on Proposed Amendments to the Price-Anderson Act Relating to Waiver of Defenses*, 89th Cong., 2d Sess. 105-07 (1966), *available at* https://www.loc.gov/resource/conghear08.00170174379/?sp=10).

[38] *Rocchio* at 539.

[39] 42 U.S.C. § 2014(j).

[40] *Id.*

[41] *Meehan* at 347.

[42] *Id.*; *see* 42 U.S.C. § 2210(n)(1)(F)(iii) (The Act allows "any issue or defense based on any statute of limitations if suit is instituted within three years from the date on which the claimant first knew, or reasonably could have known, of his injury or damage and the cause thereof.").

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liability. In either case, a plaintiff would still have to establish that a given pathology was *caused* by exposure to a defendant's radiation rather than background radiation, heredity or some other factor. Accordingly, this legislative effort was only helpful in the exceedingly rare cases where that evidentiary gap could be bridged.

In 1988, Congress created the Presidential Commission on Catastrophic Nuclear Accidents to "conduct a comprehensive study of appropriate means of fully compensating victims of a catastrophic nuclear accident that exceeds the aggregate public liability . . . in the statute . . . ."[43] In its final report to Congress, the Commission "sought to identify the 'next best' approach, since attaining the 'best' solution, compensating only those whose cancers or other latent illnesses were caused by the accident, is not currently possible."[44] The options included:

> Option A, relaxing traditional notions of proof of causation and paying something to everyone who gets cancer; Option B, retaining and rigorously applying traditional standards, which would result in paying few, if any, claims; and Option C, adopting some proxy for direct proof of causation, such as imputing group risk to individuals who actually develop cancer and paying those claims where the association between radiation exposure and a particular cancer is the strongest (or at least at some minimum level), with the option, where a strong association is required for a "full" award, of also paying lesser

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[43] Presidential Comm'n on Catastrophic Nuclear Accidents, *Report to the Congress from the Presidential Commission on Catastrophic Nuclear Accidents*, Letter to the Senate (August 1990) [hereinafter *Report*], *available at* http://www.state.nv.us/nucwaste/news/rpccna/pcrcna02.htm.

[44] *Id.* at ch. 4.IV.B.

> amounts on those claims with a somewhat weaker association.[45]

The Commission ultimately recommended Option C[46] and provided three possible ways to implement that Option, while noting that better techniques can be developed in the future: [47]

> The first would pay the full amount for any diagnosed cancer where the probability of causation (PC) is .5 or greater, and a declining amount down to a cutoff of PC = .2, at which compensation would be 20 percent of the full award, determined in accordance with Chapter 3.
>
> The second variation would pay the full amount for any diagnosed cancer where the PC is .5 or greater, and a declining amount down to a PC of .2, at which compensation would be 30 percent of a full award.
>
> The third variation, which is most like Option A, above, would simply pay a benefit to anyone in the affected area with a diagnosed cancer whose radiation exposure indicated a PC of 20 percent or greater. Congress might elect to make this a full award determined in accordance with Chapter 3, or a fixed dollar amount, or reimbursement for actual medical expenses.[48]

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[45] *Id.*

[46] This option is known as the "probability of causation" rule.

[47] *Report* at ch. 4.II.

[48] *Id.* at ch. 4.IV.B. (citation omitted).

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Courts have adopted variations of these and other options as discussed below. However, despite these efforts, the problem of establishing causation in these suits remains because we continue to approach such claims the same way we approach injuries resulting from asbestos, defective brakes, holes in pavement, and falls in the aisles of the neighborhood supermarket.

C. Evolving Case Law: Relaxing Standards

Some courts have responded by implementing a more relaxed analytical framework for these suits. None of these approaches has yet won general acceptance, and each contains certain flaws.[49]

1. The Preponderance Rule

The preponderance rule is very similar to the typical preponderance of the evidence burden. It requires a plaintiff to prove that the defendant's activity was more likely than not either the but-for causation or a substantial factor in causing the plaintiff's injuries.[50] Courts have equated the "more

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[49] The following discussion of evolving law is not intended as an exhaustive survey. Rather, I mention it only to offer additional examples of the problem and some solutions that have been suggested.

[50] Shelly Brinker, *Opening the Door to the Indeterminate Plaintiff: An Analysis of the Causation Barriers Facing Environmental Toxic Tort Plaintiffs*, 46 UCLA L. Rev. 1289, 1303-04 (1999) [hereinafter *Brinker*]; *see Sterling v. Velsicol Chemical Corp.*, 855 F.2d 1188, 1201 (6th Cir. 1988) ("Whereas numerous jurisdictions have rejected medical experts' conclusions based upon a 'probability,' a 'likelihood,' and an opinion that something is 'more likely than not' as insufficient medical proof, the Tennessee courts have adopted a far less stringent standard of proof and have required only that the plaintiffs prove a causal connection between their injuries and the defendant's tortious conduct by a preponderance of the evidence. While, in accordance with Tennessee common law, plaintiffs' proof by a reasonable medical certainty requires them only to establish that their particular injuries more likely than not were caused by

likely than not" element of this rule to a level of certainty greater than 50%.[51] The preponderance rule does not reduce a plaintiff's burden of showing cause-in-fact, it allows the plaintiff to present individualized and statistical evidence to establish that the defendant's activities were likely a substantial contributor to plaintiff's injury.[52]

Because of the 50% threshold requirement, plaintiffs who cannot demonstrate a greater than 50% likelihood that the defendant caused their injuries do not recover anything. However, if plaintiffs are able to show, for example, that defendant is responsible for causing injuries to 51% of the exposed population, every plaintiff recovers even though the evidence only proved that 51% of the individuals in the exposed population suffered injuries because of defendant's activities.

This is basically the way causation is now determined in Pennsylvania, as explained in the Majority's discussion of *Rost v. Ford Motor Co.*,[53] except that it allows group recovery if any group member of the group is successful in showing his/her disease was proximately caused (i.e. by a 51% probability) by a defendant.

There are several obvious problems with this approach. As we have explained above, because everyone in

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ingesting the contaminated water, their proofs may be neither speculative nor conjectural.").

[51] *In re Agent Orange Prod. Liab. Litig.*, 597 F. Supp. 740, 835-37 (E.D.N.Y. 1984), *aff'd sub nom. In re Agent Orange Prod. Liab. Litig. MDL No. 381*, 818 F.2d 145 (2d Cir. 1987) (quoting *Jackson v. Johns-Manville Sales Corp.*, 727 F.2d 506, 516 (5th Cir. 1984), *on reh'g*, 750 F.2d 1314 (5th Cir. 1985)) (The rule provides an "'all or nothing' approach, whereby [assuming all other elements of the cause of action are proven], the plaintiff becomes entitled to full compensation for those . . . damages that are proved to be 'probable' (a greater than 50 percent chance), but is not entitled to any compensation if the proof does not establish a greater than 50 percent chance.").

[52] *Id.* at 835.

[53] *See* Maj. Op. at 49-52 (citing *Rost*, 151 A.3d 1032).

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the population will have been exposed to radiation during their lifetime, and since it is not yet possible to isolate the effect of radiation from a particular source, the same problems of causation remain. This approach merely suspends proof of causation for everyone else if anyone in the group can prove causation. All recover based on the showing that someone should recover. However the nearly impossible burden of proving causation remains. Moreover, if the burden can somehow be satisfied by any one plaintiff or a subset of plaintiffs, the result imposes "crushing liability" on defendants that could negatively impact some efforts to find alternative energy sources.[54] In addition, this approach allows plaintiffs whose injury is probably genetic or due to background radiation to recover along with those who can trace their injury to the disputed source. But, the fact that one or more plaintiffs in a given population have been injured by exposure to a given source certainly does not mean that everyone in that population has been. Yet, everyone would ride along on the claims of those who can show a defendant proximately caused his/her injury.

2. The Proportionality Rule

Alternatively, some courts have used the proportionality rule. This rule presumes causation when a plaintiff presents statistical evidence showing that it is likely that a defendant's activities caused an injury to a proportion of the individuals in the exposed population.[55] This approach may, at first, also appear to resemble Pennsylvania's "frequency, regularity and proximity" test. However, under a pure implementation of this proportionality rule, *plaintiffs are not required to present individualized proof.* For example, if 100 plaintiffs alleged that defendant's disposal of hazardous wastes caused their injury and the risk of developing such injury in the exposed population is 55%, then every plaintiff will recover 55%.[56] However, plaintiffs will likely never

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[54] *Brinker* at 1309-10.

[55] *Id.* at 1313.

[56] *Sindell v. Abbott Labs.*, 607 P.2d 924, 937 (Cal. 1980); *see Cottle v. Superior Court*, 5 Cal. Rptr. 2d 882, 905 (Ct. App. 1992) (Johnson, J., dissenting) ("Instead of choosing between the extremes of overcompensation and no compensation at all

obtain complete recovery under such a tort regime.[57] In addition, this rule still allows plaintiffs whose injuries or deaths were likely attributable primarily to background radiation or genetics (or a combination of the two) to recover.

3. The *Allen* Rule

The United States District Court for the District of Utah presented another option in *Allen v. United States*, which involved a dispute arising from atmospheric testing. That court resorted to burden shifting. A rebuttable presumption of liability arises if a plaintiff can show a *correlation* between his or her injuries and the increased risk resulting from a defendant's negligent release of radiation. The problem here is that correlation is not the same as causation.[58] Yet, using this approach, *Allen* held that

> [w]here a defendant who negligently creates a radiological hazard which puts an identifiable population group at increased risk, and a member of that group at risk develops a biological condition which is consistent with having been caused by the hazard to which he has been negligently subjected, such consistency having been demonstrated by

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this solution allows plaintiffs to recover a *percentage* of their damages from those responsible for their exposure to the toxic. Under this formula defendants responsible for the toxic exposure are liable to all those who were exposed and later suffered injury—*including those who may have suffered the injury even if they had never come near the toxic substance.* But defendants are only liable for a percentage of plaintiffs' damages equal to the degree this exposure increased plaintiffs' risk of injury. For example, assume a chemical increases the risk of cancer by 15 percent among those exposed to the toxin. All exposed to this chemical who later came down with cancer would be entitled to recover 15 percent of their total damages from those responsible for the exposure.").

[57] *Brinker* at 1318 (citation omitted).

[58] For example, the height of males and females correlates to whether they play professional basketball. However, playing professional basketball does not cause players to grow taller.

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> substantial, appropriate, persuasive and connecting factors, a fact finder *may* reasonably conclude that the hazard caused the condition absent persuasive proof to the contrary offered by the defendant.[59]

In undertaking this inquiry, the fact finder considers the following non-exhaustive list of factors:

> (1) the probability that plaintiff was exposed to ionizing radiation due to nuclear fallout from atmospheric testing at the . . . Test Site at rates in excess of natural background radiation; (2) that plaintiff's injury is of a type consistent with those known to be caused by exposure to radiation; and (3) that plaintiff resided in geographical proximity to the . . . Test Site . . . . Other factual connections may include but are not limited to such things as time and extent of exposure to fallout, radiation sensitivity factors such as age or special sensitivities of the afflicted organ or tissue, retroactive internal or external dose estimation by current researchers, a latency period consistent with a radiation etiology, or an observed statistical incidence of the alleged injury greater than the expected incidence in the same population.[60]

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[59] *Allen v. United States*, 588 F. Supp. 247, 415 (D. Utah 1984), *rev'd on other grounds,* 816 F.2d 1417 (10th Cir. 1987).

[60] *Id.*; *see also* Restatement (Second) of Torts § 433 (1965) ("The following considerations are in themselves or in combination with one another important in determining whether the [defendant's] conduct is a substantial factor in bringing about harm to another: (a) the number of other factors which contribute in producing the harm and the extent of the effect which they have in producing it; (b) whether the actor's conduct has created a force or series of forces which are in continuous and active operation up to the time of the harm, or has created a situation harmless unless acted upon by other forces for which the actor is not responsible; (c) lapse of time."); *see also O'Connell* (proposing a species of proportionality tests that allows compensation based upon

The problem here is that because this rule presents several factors that courts can consider, consistency may be elusive and courts addressing substantially identical circumstances may reach different results. Nevertheless, this approach appears to be the most promising and the most consistent with the realities of the risk created by an activity that can expose a population to radiation. It may be that the only realistic approach is to compensate an identified population for the increased risk occasioned by a given activity. I do not, however, suggest that such nagging questions as the amount of that compensation, identifying the population that is at increased risk, or countless other factors lend themselves to easy or equitable resolution.

None of these approaches have yet gained wide acceptance and, as should be evident from this discussion, none of these approaches is close to perfect. Rather, they are sorely needed attempts to adopt (or augment) the traditional rules requiring a direct and linear cause-in-fact relationship with no intervening causes, to the reality of exposure to ionizing radiation resulting from human activities.

III. CONCLUSION

For reasons I have explained, my concerns about some of the District Court's rulings are not sufficient to cause me to conclude that the court erred in granting summary judgment against these Plaintiffs and dismissing the complaint. Problems with the Plaintiffs' proof (and lack thereof) and the Herculean task of trying to produce enough evidence to get to a fact finder on the issue of causation are simply too formidable for these claims to survive.

As I have explained, this will almost always be the case until state supreme courts, state legislatures and/or Congress devise a way to more fairly address the very real and substantial dangers posed by activities that increase the risk of exposing communities to ionizing radiation. However,

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increased risk once that risk exceeds a certain threshold. The threshold is, of course, a policy matter and can be determined by legislatures after hearings on this issue.).

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since that day is not yet here, I agree that Defendants were entitled to summary judgment. I can only hope that the dues that we pay for the comforts of living in the atomic age will one day not require us to forego remedies for the harmful effects of the nuclear byproducts of that modernization, which we are still trying to understand.