IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
SOUTHERN DIVISION
No. 7:23-CV-897

IN RE:	)
CAMP LEJEUNE WATER LITIGATION	)
	)
This Pleading Relates to:	)
	)
ALL CASES.	)
	)

MEMORANDUM IN SUPPORT OF PLAINTIFF LEADERSHIP GROUP'S MOTION TO STRIKE DR. JULIE GOODMAN'S UNTIMELY AND IMPROPER SUPPLEMENTAL EXPERT REPORTS

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Plaintiff Leadership Group ("PLG" or "Plaintiffs") moves to strike the untimely and improper supplemental general causation reports submitted by the United States' ("Defendant") expert Dr. Julie Goodman ("Dr. Goodman"). (D.E. 686-2)-(D.E. 686-11). After the due date for serving expert reports, after the PLG took her deposition, and after the PLG moved to exclude her testimony pursuant to Rule 702, Dr. Goodman submitted approximately 300 changes to her expert submission in direct response to PLG's motion to exclude her as an expert. That is a flagrant violation of the federal rules that warrants the relief sought here – the striking of her revised reports.

INTRODUCTION

"[E]xpert disclosures are fixed targets, and not ones movable at will." *EEOC v. Freeman*, 961 F. Supp. 2d 783, 797 (D. Md. 2013), *aff'd in part sub nom. E.E.O.C. v. Freeman*, 778 F.3d 463 (4th Cir. 2015). "Rule 26(e) is not a loophole through which a party ... who wishes to revise her disclosures in light of her opponent's challenges to the analysis and conclusions therein, can add to them to her advantage after the court's deadline for doing so has passed.'" *Id*. (quoting *Luke v. Family Care & Urgent Med. Clinics*, 323 Fed. Appx. 496, 500 (9th Cir. 2009)). But Defendant did just that last week in response to Plaintiffs' motion to exclude Dr. Goodman pursuant to Rule 702 and *Daubert*. (D.E. 621). Dr. Goodman altered the charts that contain the data supporting her reports. The alterations relate to facts in the most important epidemiology studies in this case. Over approximately a thousand pages, Dr. Goodman made ***three hundred edits to the analysis of seventy-five individual epidemiology studies***. *See generally* (D.E. 686-2)-(D.E. 686-11). Many are substantive. For example, there were over ***one hundred instances*** where Dr. Goodman entirely changed her opinion about a fact relating to the quality of a particular study from a "strength" to a "weakness" or vice versa. *See* Ex. A at 1-97 (Dr. Goodman's Diametrically Different Changes In Her Proposed Revisions, attached hereto). This supplementation contravenes this Court's scheduling orders and Federal Rule of Civil Procedure 26.

BACKGROUND

To promote efficient resolution of this consolidated litigation, the Court entered multiple scheduling orders governing phased expert discovery.[1] *See* (D.E. 270); (D.E. 312); (D.E. 414). Expert discovery has proceeded in three phases: Phase I (water contamination), Phase II (general causation), and Phase III (specific causation, damages, and residual issues). *Id*. Defendant disclosed Dr. Goodman as its general causation expert for all five Track I diseases.

On February 7, 2025, pursuant to the Court's scheduling orders, Dr. Goodman submitted five expert reports, one for each Track I disease.[2] Attached to Dr. Goodman's reports are lengthy appendices wherein Dr. Goodman's staff (and purportedly Dr. Goodman) analyzed the "quality [and] characteristics" of studies and evaluated what Dr. Goodman opined were the "study results." (D.E. 686-2 ¶ 8).

On April 29, 2025, Plaintiffs deposed Dr. Goodman. *See generally* Goodman Dep. Tr. (JA Ex. 172, D.E. 471-1). Expert discovery for Phase II experts, including Dr. Goodman, closed on May 14, 2025. (D.E. 312). On June 13, 2025, Dr. Goodman signed an Errata sheet; she did not change any of the errors at issue in this motion and in Dr. Goodman's now-altered charts. Goodman Dep. Err. (JA Ex. 173, D.E. 471-2).

On June 25, 2025, the Court entered a scheduling order setting additional deadlines: the Parties' opening briefs for Phases II and III were due on September 10, 2025, opposition briefs were due on November 10, 2025, and reply briefs are due on December 12, 2025. (D.E. 414).

Pursuant to the schedule, Plaintiffs moved to exclude Dr. Goodman on September 10, 2025 on a number of grounds—including that her testimony was unreliable because her reports were

[1] The court entered the initial Pretrial Scheduling Order on August 7, 2024. (DE-270).
[2] Goodman Rep. (Bladder) (JA Ex. 75, D.E. 463-14); Goodman Rep. (Kidney) (JA Ex. 94, D.E. 464-15); Goodman Rep. (Leukemia) (JA Ex. 102, D.E. 465-7); Goodman Rep. (NHL) (JA Ex. 117, D.E. 466-11); Goodman Rep. (PD) (JA Ex. 134, D.E. 467-17).

self-contradictory. (D.E. 622) at 17-27. For example, in her kidney cancer charts Dr. Goodman stated that it was a "STRENGTH" of Bove (2024b) that the authors considered "negative control diseases" to account for smoking history. Goodman Rep. (Kidney) at C-32 (JA Ex. 94, D.E. 464-15). By contrast, in her bladder cancer and leukemia charts, she stated a "WEAKNESS" of the ***very same study*** was that the authors "[d]id not control for or consider smoking[.]" Goodman Rep. (Bladder) at C-41 (JA Ex. 75, D.E. 463-14); Goodman Rep. (Leukemia) at C-40 (JA Ex. 102, D.E. 465-7). In other words, these are completely different interpretations of the same fact in the same study. At her deposition, Dr. Goodman could not explain the inconsistencies between her charts. Goodman Dep. Tr. at 258:2-13 (JA Ex. 172, D.E. 471-1).

In moving to exclude her, PLG pointed out that one obvious reason for these inconsistencies was Dr. Goodman's admission that her staff (in this case approximately ***sixty*** employees) were the ones who wrote the majority of her reports. (D.E. 622) at 17-27. For example, another epidemiologist also employed by Dr. Goodman's company, Gradient, billed approximately twenty-three hundred (2,300) hours on this case. (D.E. 622) at 18. As PLG noted, if multiple people actually authored the multiple reports, as Dr. Goodman admitted, it is not surprising there are inconsistencies. This evidences the flawed methodology and unreliability of Dr. Goodman's opinions that warrant her exclusion as an expert.

On November 10, 2025, Defendant filed its opposition to PLG's motion, attaching to it the new and revised reports for all five Track I diseases. (D.E. 686-2-686-11). These revised reports consist of re-worked analyses of the same studies disclosed in Dr. Goodman's original reports. (D.E. 686-2-686-11). Defendant framed this new disclosure as a "supplementation." (D.E. 686-2)-(D.E. 686-11). Dr. Goodman did not sign the altered appendices, but instead attached them to a signed Declaration, dated November 10, 2025. The Declaration filed by Dr. Goodman evidences

her bias and the unreliability of her opinions. Dr. Goodman stated under oath that the reason for her need to supplement was because she and her team had made "typographical or inadvertent errors." (D.E. 626-2 at ¶ 10.). A cursory review of the hundreds of revisions show that her changes are not typographical or inadvertent errors.[3] Dr. Goodman went on to state, under oath, that these errors do not "impact any of [her] analyses or opinion" *Id*. That statement, likewise, is not true.

LEGAL STANDARD

Federal Rule of Civil Procedure 26 ("Rule 26") governs general discovery and disclosures, including expert witnesses and their reports. Rule 26(a)(2) requires disclosure of expert reports containing "a complete statement of all opinions the witness will express and the basis and reasons for them," as well as "the facts or data considered." Fed. R. Civ. P. 26(a)(2)(B)(i)–(ii). Rule 26(e) requires supplementation "in a timely manner" when a "party learns that in some material respect the disclosure or response is incomplete or incorrect, and if the additional or corrective information has not otherwise been made known to the other parties during the discovery process or in writing." Fed. R. Civ. Proc. 26(e)(1)(A); *see also Pierce v. N.C. State Bd. of Elections*, No. 4:23-cv-193, 2024 WL 5170738, at *3 (E.D.N.C. Dec. 18, 2024) (J. Dever) ("Rule 26(e) requires a supplemental report when a party 'learns that in some material respect the disclosure or response is incomplete or incorrect.'"). "Rule 26(e) does not, however, create a 'right to produce information in a belated fashion.'" *Pierce*, 2024 WL 5170738, at *3 (quoting *Freeman*, 961 F. Supp. at 797).

[3] Dr. Goodman's statements that these are typographical errors are further belied by the fact that she and her company, Gradient, billed over 4.3 million dollars for the drafting of the original five reports. Approximately sixty Gradient employees spent over 12,000 hours reviewing and preparing the original reports. It is simply not believable that there would be *hundreds* of "typographical" or "inadvertent" errors missed by that many people. The only logical explanation is that Plaintiffs were correct: the reports are inconsistent because they were written, not by Dr. Goodman, but by many different members of her junior staff. Dr. Goodman's attempt to cover this fact up by belatedly "supplementing" her charts should not be accepted by this Court.

Rule 37 governs the failure to make proper disclosures. Courts have broad discretion to determine the propriety of supplemental materials and fashion a remedy for violating Rule 26. *See Silicon Knights, Inc. v. Epic Games, Inc.*, No. 5:07-CV-275-D, 2012 WL 1596722, at *2 (E.D.N.C. May 7, 2012); *Bresler v. Wilmington Tr. Co.*, 855 F.3d 178, 190 (4th Cir. 2017). Rule 37(c)(1) provides that "[a] party that without substantial justification fails to disclose information required by Rule 26(a) or 26(e)(1), or to amend a prior response to discovery as required by Rule 26(e)(2), is not, unless such failure is harmless, permitted to use as evidence at a trial ... any witness or information not so disclosed." Fed. R. Civ. P. 37(c)(1).

ARGUMENT

Dr. Goodman's alteration of her charts does not qualify as true supplementation under Rule 26(e) both because the materials provide new conclusions and analysis and because they are untimely. For both of these reasons, the new reports should be stricken.

I. Dr. Goodman's newly-disclosed materials are not supplements under Rule 26(e).

"Courts distinguish 'true supplementation' (e.g., correcting inadvertent errors or omissions) from gamesmanship." *Gallagher v. S. Source Packaging, LLC*, 568 F. Supp. 2d 624, 631 (E.D.N.C. 2008) (J. Dever). The acceptance of a supplemental report that does not amount to "true supplementation" under Rule 26(e) would "promote gamesmanship and delay." *Id.*; *see also Pierce*, 2024 WL 5170738, at *3 (finding an expert report was not a true supplementation when it contained new expert opinions in response to the opposing parties' criticisms of the expert's original opinions). Moreover, Rule 26(e) is not a "loophole through which a party ... who wishes to revise her disclosures in light of her opponent's challenges to the analysis and conclusions therein, can add to them to her advantage after the court's deadline for doing so has passed." *Freeman*, 961 F. Supp. 2d at 797 (quoting *Luke v. Family Care & Urgent Med. Clinics*, 323 Fed.Appx. 496, 500 (9th Cir. 2009)).

Courts repeatedly reject supplementation of expert reports with untimely "new and improved" expert reports. *See e.g.*, *Petersen v. Midgett*, 140 F. Supp. 3d 490, 502 (E.D.N.C. 2015); *Gallagher*, 586 F. Supp. 2d at 631; *Pierce*, 2024 WL 5170738, at *3; *Beller ex rel. Beller v. United States,* 221 F.R.D. 696, 701 (D.N.M. 2003) ("To rule otherwise would create a system where preliminary reports could be followed by supplementary reports and there would be no finality to expert reports, as each side, in order to buttress its case or position, could 'supplement' existing reports and modify opinions previously given."). Dr. Goodman's newly-disclosed opinions are not proper supplementation under Rule 26(e) and should be stricken.

A. Dr. Goodman's newly-disclosed materials do not correct "typographical or inadvertent errors;" she makes substantive changes to many of her opinions.

"Supplementation under the Rules means correcting inaccuracies, or filling the interstices of an incomplete report based on information that was not available at the time of the initial disclosure." *Keener v. United States,* 181 F.R.D. 639, 640 (D.Mont. 1998); *see also Pierce* 2024 WL 5170738, at *3. "It does not cover failures of omission because the expert did an inadequate or incomplete preparation." *Akeva L.L.C v. Mizuno Corp.,* 212 F.R.D. 306, 310 (M.D.N.C. 2002).

In opposing PLG's motion to exclude Dr. Goodman, Defendant claims that any errors in Dr. Goodman's appendices were "inadvertent" and constituted "typographical" errors. (D.E 686) at 19. This is not accurate. A comparison between Dr. Goodman's initial report and the new materials reveals that the alterations are mostly substantive and address the exact deficiencies and errors that PLG identified in its motion to strike her initial reports.[4]

[4] In contrast, Defendant's other experts Dr. Lisa Bailey and Dr. Michael McCabe timely submitted actual supplemental reports long before the deadline for filing *Daubert* motions. These supplemental reports corrected inadvertent typographical errors. Dr. Bailey corrected ten numerical errors in a table for a single plaintiff's report. Ex. B at 1 (Errata – Expert Rep. of Bailey, attached hereto). Dr. McCabe made a few corrections to typos in each of his reports with four such corrections in his bladder cancer report, seven in his kidney cancer report, and six in his NHL/Leukemia report. McCabe Rep. Err. at 1-2 (JA Ex. 176, D.E. 471-5) (i.e., changing "TCE" to "benzene" or "bladder" to "kidney").

Dr. Goodman made approximately ***three hundred substantive edits*** to her analysis of ***seventy-five individual studies***. *See* (D.E. 686-3)–(D.E. 686-11); *See also generally* Ex. A. The most egregious substantive alterations are outlined in Plaintiffs' Exhibit A. For example, in analyzing Bove 2014b, *Mortality study of civilian employees exposed to contaminated drinking water at USMC Base Camp Lejeune: a retrospective cohort study*, a study that assessed actual Camp Lejeune exposures and disease risk, Dr. Goodman's new materials changed critical facts in terms of the reliability of this study.

Bove *et al.* (2014a)	Civilian employees at CL and CP	T	P	B	V	Strengths • Appropriate comparison groups • ≤ 2% loss to follow-up Weaknesses • Most of the cohort was < 65 yrs old by end of follow-up (> 70% CL, > 60% CP)	Strengths • No missing data • Direct chemical exposure measurement (measured in groundwater) • Internal analyses considered duration of employment and average exposure Weaknesses • Indirect chemical exposure measurement – based on employment at CL (external analyses) ~~or modeling of groundwater contamination (internal analyses)~~ • External analyses did not consider duration of employment and average exposure	Strengths • Deaths identified from SSA, a commercial tracing service, and NDI; cause of death determined from NDI Plus • No missing data Weaknesses • Assessed mortality only	Strengths • Controlled for: age, and sex in US comparison and sex and occupation in CP and internal comparisons • Considered smoking using negative control diseases • Considered but did not control for: age in CP and internal comparisons because adjusted *vs.* unadjusted results differed by < 10% • Collected occupation data quarterly during employment Weaknesses • Did not consider or control for: genetic factors or family history of PD or ~~, alcohol intake, smoking~~ in any analyses, or other potential occupational exposures in US comparison • ~~Unclear whether occupation was analyzed in a time-varying manner, other~~ Covariates only	Strengths • Employment histories collected separately from outcome data • Appropriate consideration of latency Weaknesses • No major weaknesses

Dr. Goodman changed two key facts regarding the reliability of the study from the "Weaknesses" category to the "Strengths" category.[5] *See* Ex. A at 95 & (D.E. 686-12) (Parkinson's Rep. Changes) at C-1. These two changes, from "Weaknesses" to "Strengths," are particularly important because Dr. Goodman entirely discounts the epidemiology studies from Camp Lejeune

[5] Dr. Goodman erroneously mixed up the titles of certain studies. Therefore, when Dr. Goodman refers to the Bove (2014a) civilian mortality study in her Parkinson's report, she is actually referring to the Bove (2014b) civilian mortality study. There are other similar errors in her titles of the Camp Lejeune studies throughout her reports.

as a result of her conclusion that the studies are unreliable. *See* Goodman Rep. (Bladder) at 51 (JA Ex. 75, D.E. 463-14); Goodman Rep. (Kidney) at 50 (JA Ex. 94, D.E. 464-15); Goodman Rep. (Leukemia) at 55 (JA Ex. 102, D.E. 465-7); Goodman Rep. (NHL) at 49 (JA Ex. 117, D.E. 466-11); Goodman Rep. (PD) at 45 (JA Ex. 134, D.E. 467-17). This type of change is widespread. *See e.g.*, Exhibit A at 42 & (D.E. 686-6) (Kidney Cancer Rep. Changes) at C-31; Exhibit A at 20 & (D.E. 686-4) (Bladder Cancer Rep. Changes) at C-48; Ex. A at 54 & (D.E. 686-8) (Leukemia Rep. Changes) at C-22; and Ex. A at 74 & (D.E. 686-10) (NHL Rep. Changes) at C-8.

Such changes are substantive, as they reverse Dr. Goodman's assessments of the strength of a study – specifically, as to the quality of the most important studies in this case. Dr. Goodman herself stated in her original reports that she "evaluated the quality of the epidemiology and animal carcinogenicity studies to determine how valid and reliable the results of individual studies are for addressing causation." Goodman Rep. (Kidney) at 15 (JA Ex. 94, D.E. 464-15). In other words, the quality of the epidemiology determined whether Dr. Goodman found a particular study valid and reliable. To change aspects of a study from weak to strong (or vice versa), therefore, is a new and changed opinion of the same evidence.

Moreover, Dr. Goodman testified that the charts served as the foundation for the content of her reports. Goodman Dep. Tr. at 212:24-214:15 (JA Ex. 172, D.E. 471-1). A comparison of Dr. Goodman's charts to the body of her reports reveals this to be true: strengths and weaknesses in Dr. Goodman's charts are incorporated directly into the body of her reports. *See, e.g.*, Goodman Rep. (PD) at 34-35, C-1 (JA Ex. 134, D.E. 467-17); Goodman Rep. (Kidney) at 85, C-28 (JA Ex. 94, D.E. 464-15); Goodman Rep. (Bladder) at 74, C-50 (JA Ex. 75, D.E. 463-14); Goodman Rep. (NHL) at 79, C-16 (JA Ex. 117, D.E. 466-11).

Significantly, Dr. Goodman decided not to make the same changes to her underlying reports as she made to her charts.[6] Therefore, if the new materials are allowed, the parties would be left with a situation where Dr. Goodman's ***own reports are internally inconsistent with her altered charts***.[7] Dr. Goodman's alterations create a new irreconcilable inconsistency within her expert opinions. Defendant boldly labels these significant substantive changes as "typographical" errors and "characterizes the new report as a supplementation" in an attempt to sneak in a "new and improved" expert report under Rule 26(e). *Gallagher*, 568 F. Supp. 2d at 631. Such an attempt should be rejected.

B. Dr. Goodman's newly-disclosed materials are not timely.

Dr. Goodman's newly-disclosed materials should also be excluded because they are not timely. Rule 26(e) requires that a party supplement or correct its expert report in a "timely manner" if it learns that the disclosure is incomplete or incorrect. Fed. R. Civ. P. 26(e)(1)(A); *see also* Fed. R. Civ. P. 37(c)(1) ("If a party fails to provide information or identify a witness as required by Rule 26(a) or (e), the party is not allowed to use that information or witness to supply evidence on a motion, at a hearing, or at a trial, unless the failure was substantially justified or is harmless.").

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[6] Dr. Goodman relies on numerous research assistants to inform her on the studies and then bases her opinion on their review. *See* Goodman Dep. Tr. at 212:24-214:15 (JA Ex. 172, D.E. 471-1) (testifying that she had "junior staff review the studies and fill in information about the studies in tables on both the quality study characteristics and results, and these were then checked."). This methodology is clearly flawed and cannot possibly comply with *Daubert*, as Dr. Goodman did not do her own work and did not adequately check the work that others did. The unreliability of such a methodology is highlighted in this motion to strike as evidence by significant changes Dr. Goodman needed to make to her expert report, far beyond typos.

[7] For example, Dr. Goodman attempts to eliminate in her Leukemia charts a "Strength" that Aschengrau (1993) used "Direct chemical exposure measurement (i.e., modeled contaminated drinking water wells)." (D.E. 686-8) (Leukemia Rep. Changes) at C-47. However, in the body of her Leukemia report, she still states "Only ***one study*** that was conducted in Massachusetts had direct chemical measurements. Aschengrau et al. (1993) modeled participants' PCE exposure based on an algorithm of PCE leaching from vinyl-lined cement pipes into water and their residence on streets with vinyl-lined asbestos cement pipes." Goodman Rep. (Leukemia) at 68 (JA Ex. 102, D.E. 465-7) (emphasis added). There are many more examples of these inconsistencies that would be pervasive throughout Dr. Goodman's own reports and charts if these supplementations were allowed by the court.

Dr. Goodman's supplemental materials were hardly made in a "timely manner"— Dr. Goodman submitted her reports on February 7, 2025, she was deposed on April 29, 2025, expert discovery closed on May 14, 2025, and opening briefs for Phase II and III were due on September 10, 2025. *See generally* (D.E. 270); (D.E. 312); (D.E. 414). At no point in these seven months did Defendant supplement Dr. Goodman's reports, or even indicate that there were corrections that needed to be made.

Indeed, even after Plaintiffs cross-examined Dr. Goodman at her deposition in April of 2025 about several errors in her report, she did not supplement her report.[8] Goodman Dep. Tr. at 230:22-258:13 (JA Ex. 172, D.E. 471-1). Moreover, on June 13, 2025, Dr. Goodman signed an Errata sheet and did not change her substantive testimony relating to these inconsistencies, nor did she supplement her reports and charts at that time. Instead, Defendant waited until after Plaintiffs moved to exclude Dr. Goodman's opinions to address deficiencies in Dr. Goodman's reports, which includes substantive charts, for the sole purpose of addressing the issues Plaintiffs' raised in their motion.[9] This can only be seen as a "poorly disguised attempt[] to counter [Plaintiffs'] arguments with new expert analyses"; and such submissions are "clearly not proper supplementation, but instead fall into that category of counterarguments strictly prohibited by

[8] Specifically, Dr. Goodman was questioned about several inconsistencies in her charts. (D.E. 622) at 19-27; Goodman Dep. Tr. at 230:22-258:13 (JA Ex. 172, D.E. 471-1). In short, Dr. Goodman's charts were contradictory. A chart for one Track I disease had opposite conclusions about the quality of the same fact relating to the same epidemiological study as compared to a second Track I disease chart. For example, in her kidney cancer charts Dr. Goodman stated that it was a "STRENGTH" of Bove (2024b) that the authors considered "negative control diseases" to account for smoking history. Goodman Rep. (Kidney) at C-32 (JA Ex. 94, D.E. 464-15). By contrast, in her bladder cancer and leukemia charts, she stated a "WEAKNESS" of the ***very same study*** was that the authors "Did not control for or consider smoking[.]" Goodman Rep. (Bladder) at C-41 (JA Ex. 75, D.E. 463-14); Goodman Rep. (Leukemia) at C-40 (JA Ex. 102, D.E. 465-7). Significantly, Dr. Goodman could not explain the inconsistencies between her charts. Goodman Dep. Tr. at 258:2-13 (JA Ex. 172, D.E. 471-1).

[9] Defendant admits as much, stating in its opposition that "after considering the minor errors identified by Plaintiffs, Dr. Goodman performed a ***comprehensive review*** of the tables in all five reports." (D.E. 686) at 19.

federal courts." *Freeman*, 961 F. Supp. 2d at 797. *See also Pierce*, 2024 WL 5170738, at *3-4; *Lightfoot v. Georgia-Pacific Wood Prods, LLC*, No. 7:16-CV-244, 2018 WL 4517616, at *6-8 (E.D.N.C. Sept. 20, 2018); *Gallagher*, 568 F. Supp. 2d at 630-32; *Western Plastics, Inc. v. DuBose Strapping, Inc.*, 334 F. Supp. 3d 744, 754-55 (E.D.N.C. 2018); *Southern v. Bishoff*, 675 Fed.Appx. 239, 249 (4th Cir. 2016). Accordingly, Dr. Goodman's supplementation should be stricken.

II. The remedy for Defendant's failure to make a supplemental disclosure in accordance with Rule 26(e) is exclusion of Dr. Goodman's new materials.

Under Rule 37(c)(1), "[i]f a supplemental disclosure is not made in accordance with Rule 26(e), the remedy is to exclude the improper disclosure from trial 'unless the failure was substantially justified or is harmless.'" *Lightfoot*, 2018 WL 451616, at *6; *see also Pierce*, 2024 WL 5170738, at *4; *Gallagher*, 568 F. Supp. 2d at 630-32; Fed. R. Civ. P. 37(c)(1) ("[i]f a party fails to provide information . . . as required by Rule 26(a) or (e), the party is not allowed to use that information or witness to supply evidence on a motion, at a hearing, or at a trial, unless the failure was substantially justified or is harmless."). In assessing whether the nondisclosure was "substantially justified or harmless" courts in this Circuit consider:

> (1) the surprise to the party against whom the evidence would be offered; (2) the ability of that party to cure the surprise; (3) the extent to which allowing the evidence would disrupt the trial; (4) the importance of the evidence; and (5) the nondisclosing party's explanation for its failure to disclose the evidence.

S. States Rack & Fixture, Inc. v. Sherwin-Williams Co., 318 F.3d 592, 597 (4th Cir. 2003).

Moreover, courts should only deviate from a scheduling order's clear deadlines upon a showing of good cause. Fed. R. Civ. P. 16(b)(4); *Velasquez v. Salsas & Beer Restaurant, Inc.*, No. 5:15-CV-146, 2016 WL 3339488, at *2 (E.D.N.C. June 13, 2016) ("A trial court's scheduling order 'is not a frivolous piece of paper, idly entered, which can be cavalierly disregarded by counsel without peril'") (quoting *Gestetner Corp. v. Case Equip. Co.*, 107 F.R.D. 138, 141 (D. Me. 1985)).

"If the court finds such a violation without good cause, it has 'broad discretion in employing sanctions.'" *SMD Software, Inc. v. EMove, Inc.,* No. 5:08–CV–403, 2013 WL 5592808, at *12 (E.D.N.C. Oct. 10, 2013) (quoting *Akeva,* 212 F.R.D. at 311). Relevant considerations include "(1) the explanation for the failure to obey the order; (2) the importance of the expert opinion; (3) the prejudice to the opposing party by allowing the disclosures; and (4) the availability of alternative or lesser sanctions .... ([5]) the interest in expeditious resolution of litigation; ([6]) a court's need to manage its docket; and ([7]) public policy favoring disposition of cases on the merits." *Akeva,* 212 F.R.D. at 311. Defendant made no attempt to justify or explain any of these factors.

First, Defendant did not explain why it failed to disclose the evidence in a timely manner or why Dr. Goodman's initial report was incomplete or incorrect as to these substantive changes. *See* Fed. R. Civ. P. 26(e)(1)(A). Instead, as previously outlined, Defendant supplemented Dr. Goodman's report in response to Plaintiffs' motion to exclude the same testimony. Courts routinely find this type of supplementation inappropriate and untimely. *Lightfoot*, 2018 WL 4517616 at *6-8 (finding that supplemental expert reports filed in response to arguments raised by *Daubert* motions were "not timely supplemental disclosures" and ordering sanctions under Rule 37(c)(1)); *Gallagher*, 568 F. Supp. 2d at 630-31 ("Here, [Defendant] did not file the new [expert] report to correct an inadvertent error or omission. It filed the new [expert] report in order to address the numerous problems in the expert report that plaintiffs discussed in moving for summary judgment."). Moreover, while supplemental reports may sometimes be necessary and proper when new information is obtained, Defendant did not identify any new information that serves as the basis for its supplementation, because there is none. *See, e.g., S. States Rack & Fixture, Inc.*, 318 F.3d at 595-96 ("Rule 26(e)(1) requires a party to supplement its experts' reports and deposition testimony when the party learns of new information."); *Freeman,* 961 F. Supp. 2d at 797; *Wilson*

v. Sundstrand Corp., No. 1:99-cv-6944, 2003 WL 22012673, at *7-8 (N.D. Ill. Aug. 25, 2003) (unpublished); *Collier v. Bradley Univ.*, 113 F. Supp. 2d 1235, 1242 (C.D.Ill. 2000).

Second, the supplemental materials caught Plaintiffs by complete surprise. "[Rule 26(e)] does not give license to sandbag one's opponent with claims and issues which should have been included in the expert witness' report ..." *Beller ex rel. Beller*, 221 F.R.D. at 701 (quotation omitted). Plaintiffs had "no reason to expect" that Dr. Goodman would make any changes, never mind hundreds of substantive changes, to her charts. *See Pierce*, 2024 WL 5170738, at *4. To the contrary, Dr. Goodman testified at her deposition that she did not think there would be many additional inconsistencies in her charts. Goodman Dep. Tr. 258:2-13 (JA Ex. 172, D.E. 471-1).

Third, if Dr. Goodman's revised charts were allowed to stand, Plaintiffs would need to conduct significant, additional discovery that would delay this case far into the future. *See e.g., Gallagher*, 568 F. Supp. 2d at 632 (granting motion to strike where "[p]laintiffs cannot cure ... surprise [caused by the untimely expert report] without further delay and further discovery"); *Carteret Inv. Associates, LLC v. Mt. Hawley Ins. Co.*, No. 4:21-CV-157-FL, 2023 WL 9034243, at *5 (E.D.N.C. Dec. 29, 2023) (quoting *Colony Apartments v. Abacus Project Mgmt., Inc.*, 197 F. App'x 217, 233 (4th Cir. 2006)) (noting that the duty to supplement "does not permit a party to make an end-run around the normal timetable for conducting discovery."). What's more, Plaintiffs cannot respond to Dr. Goodman's supplemental expert charts under the current scheduling orders. The deadline for Plaintiffs' rebuttal reports was March 15, 2025, and Plaintiffs have already deposed Dr. Goodman. Given that there are now almost three hundred changes, many about important studies,[10] Plaintiffs would need to re-depose Dr. Goodman, individuals from Dr.

[10] *See, e.g.*, (D.E. 686-4) (Bladder Cancer Rep. Changes) at C-2 (changing "No major weaknesses" to "Unknown number of exclusions"); (D.E. 686-6) (Kidney Cancer Rep. Changes) at C-5 (changing "No consideration of latency" to "No major weaknesses"); (D.E. 686-8) (Leukemia Rep. Changes) at C-16

Goodman's company who assisted in writing her reports, and expert witnesses who relied on Dr. Goodman.[11]

Fourth, it is not possible now to address the new internal inconsistencies created by Dr. Goodman's altered charts. As previously addressed, Dr. Goodman's charts are now directly contradictory to her own reports. *See* Section I(A), *supra*.

Lastly, allowing Dr. Goodman's improper and untimely supplementation would disrupt the current trial schedule and work against the expeditious resolution of this litigation. *See Akeva*, 212 F.R.D. at 310 ("To construe supplementation to apply whenever a party wants to bolster or submit additional expert opinions would [wreak] havoc [on] docket control and amount to unlimited expert opinion preparation."). The extensive additional discovery that would be required to cure these alterations, as previously mentioned, would cause significant further delay. Moreover, if the supplemental materials are allowed, a whole new host of issues would arise because Dr.

(changing "Indirect chemical exposure measurement" to "Direct chemical exposure measurement"); (D.E. 686-10) (NHL Rep. Changes) at C-5 (changing "Unknown number of exclusions to "No major weaknesses"); (D.E. 686-12) (Parkinson's Rep. Changes) at C-1 (changing "Did not consider or control for . . . smoking" to "Considered smoking using negative control diseases").

[11] Plaintiffs would also need to depose select individuals who helped prepare and write Dr. Goodman's charts. *See* (D.E. 622); *see also* Goodman Dep. Tr. at 212:24-214:15 (JA Ex. 172, D.E. 471-1) (testifying that she had "junior staff review the studies and fill in information about the studies in tables on both the quality study characteristics and results, and these were then checked"). This would need to be done relating to both Dr. Goodman's original and supplemental charts. Plaintiffs are therefore unable to "cure th[is] surprise without further delay and further discovery[.]" *Gallagher*, 568 F. Supp. 2d at 632. Plaintiffs also would additionally need to re-depose each expert who purportedly relied upon Dr. Goodman's expert reports, namely specific causation experts from each Track I disease who are relying on Dr. Goodman's reports. *See, e.g.*, Stadler Dep. Tr. at 41:6-10, 90:7-91:3, 148:5-13 (JA Ex. 600, D.E. 508-9); Erba Dep. Tr. at 55:15-56:22; 85:20-88:6 (JA Ex. 608, D.E. 509-6); Ambinder SC (Carter) at 4, 8 (JA Ex. 515, D.E. 501-1); Ambinder Rep. (Davis) at 4, 8, 9-10 (JA Ex. 516, D.E. 501-2); Ambinder Rep. (Howard) at 4, 8, 10 (JA Ex. 517, D.E. 501-3); Ambinder Rep. (Keller) at 4, 8, 10, 16 (JA Ex. 518, D.E. 501-4); Ambinder Rep. (Kidd) at 4, 8, 10, 13 (JA Ex. 519, D.E. 501-5); Ambinder Rep. (Vidana) at 4, 8, 10, 13 (JA Ex. 520, D.E. 501-6). For example, Dr. Kates, a Defense specific causation expert, opines about bladder cancer, and he testified that he relied on Dr. Goodman's bladder cancer report to exclude the Camp Lejeune water as a risk factor for the Plaintiffs' bladder cancers because he believed the report was "more compelling" and "more thorough" than Plaintiffs' experts' reports. Kates Dep. Tr. at 138:5-25 (JA Ex. 586, D.E. 507-7).

Goodman's expert reports would then be contradictory to and inconsistent with the altered charts. *See supra* n. 7 at 10. While the court in *Lightfoot* did allow for discovery to be re-opened on a limited basis in lieu of striking the supplemental reports, such an option is not available here. 2018 WL 4517616 at *8-9. The court in *Lightfoot* found that there would be no disruption of the trial schedule by allowing the defendant to re-depose plaintiff's experts and amend or supplement their own expert reports. *Id*. By contrast, there are *hundreds of thousands* of plaintiffs in this case, twenty-two Bellwether plaintiffs still with pending claims, numerous other experts who rely on Dr. Goodman's opinions, and dispositive motions have already been filed. Accordingly, Dr. Goodman's new materials should be stricken.

CONCLUSION

For the foregoing reasons, this Court should reject Defendant's attempt to cure the defects in Dr. Goodman's report under the guise of supplementation under Rule 26(e) and strike the same under Rule 37(c)(1).

Dated: November 18, 2025.

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EXHIBIT

A

EXHIBIT 3

Bladder Cancer Report Attachment Revisions

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Garabrant *et al.* (1988)	Aircraft manufacturing workers	T				Strengths ▪ Appropriate study and comparison groups ▪ ~~No exclusions for missing data~~ Weaknesses ▪ ~~No major weaknesses~~Unknown number of exclusions	Strengths ▪ No missing data ▪ Semiquantitative exposure estimate (*i.e.*, considered duration) Weaknesses ▪ Indirect chemical exposure measurement (*i.e.* factory personnel records) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, SSA, California DMV, credit records, death certificates, California Death Tapes) ▪ 25 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for age, sex, and race Weaknesses ▪ Did not control for or consider: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ▪ Race was missing for unspecified number of subjects; assumed to be white	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (*i.e.*, ≥ 4-years employment in duration analysis) Weaknesses ▪ No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Dagg *et al.* (1992)	Employees at oil refineries, US			B		Strengths ▪ Appropriate study and comparison groups ▪ ~~4.8<~~<20% loss to follow-up; <1% excluded from individual refinery analyses (*i.e.*, worked at both refineries under study) Weaknesses ▪ ~~All women excluded (1.8% of total) due too few cases~~No major weaknesses	Strengths ▪ Semiquantitative exposure measurement (*i.e.*, considered duration) ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, based on work history) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, company records, NDI, SSA, California death index, Equifax, and death certificates) ▪ 37 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for or considered: age, sex, and race/ethnicity Weaknesses ▪ Did not control for or consider: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ▪ Amount of missing data unknown	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (*e.g.*, analyses based on 10-19, 20-29, and ≥30 yrs since hire Weaknesses ▪ No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Sinks *et al.* (1992)	Paperboard printing plant workers	T				Strengths ▪ Appropriate study and comparison groups ▪ <2% excluded in SMR analyses and <16% excluded in SIR analyses ▪ 10% loss to follow up Weaknesses ▪ ~~Unknown loss to follow up~~No major weaknesses	Strengths ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, employment at facility) ▪ Qualitative exposure estimate (*i.e.*, ever/never) ▪ Did not assess time-varying nature of exposure	Strengths ▪ All deaths and most incident cases identified and validated using reliable sources (*i.e.*, SSA, mailing address with USPS, death certificates, and local cancer registries) ▪ Assessed disease incidence ▪ 32 yrs of follow-up Weaknesses ▪ Some cases self-reported and not all validated	Strengths ▪ Controlled for: age, sex, and race (SIR analysis) Weaknesses ▪ Did not control for or consider: race/ethnicity (SMR analysis), smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ▪ ~~1~~5% missing race data; assumed white	Strengths ▪ Exposure documented before outcome Weaknesses ▪ No consideration of latency

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Tsai *et al.* (1993)	Male refinery/ petrochemical workers, US			B		Strengths ▪ Appropriate study and comparison groups ▪ No loss to follow-up Weaknesses ▪ No major weaknesses	Strengths ▪ No missing data Weaknesses ▪ Indirect benzene exposure measurement (*i.e.*, job history) ▪ Qualitative exposure estimate (*i.e.*, ever/never employment) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, company records, NDI, and SSA ▪ 17 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for or considered: age, sex, and race/ethnicity Weaknesses ▪ Did not control for or consider: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ▪ Amount of missing data unknown	Strengths ▪ Exposure documented before outcome Weaknesses ▪ No consideration of latency
Axelson *et al.* (1994)	TCE-exposed workers	T				Strengths ▪ Appropriate study and comparison groups ▪ <4% excluded Weaknesses ▪ ~~Unknown loss to follow-up~~No major weaknesses	Strengths ▪ Direct chemical exposure measurement (*i.e.*, U-TCA) ▪ No missing data Weaknesses ▪ Qualitative exposure estimate (*i.e.*, ever exposure) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Cases identified using reliable sources (*i.e.*, Swedish cause-of-death and cancer registries) ▪ Assessed disease incidence ▪ 30 yrs of follow-up Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for: age and sex ▪ No missing data Weaknesses ▪ Did not control for or consider: race/ethnicity, smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure documented before outcome Weaknesses ▪ No consideration of latency

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Anttila *et al.* (1995)	Occupationally exposed workers~~FIGM workers~~	T				Strengths ▪ Appropriate study and comparison groups ▪ No loss to follow-up; 7% excluded Weaknesses ▪ No major weaknesses	Strengths ▪ Direct chemical exposure measurement (U-TCA) ▪ No missing data Weaknesses ▪ Qualitative exposure estimate (*i.e.*, any exposure) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Cases identified using reliable sources (*i.e.*, Population Register Center, Finnish Cancer Registry, and Central Statistical Office of Finland) ▪ Assessed disease incidence ▪ 26 yrs of follow-up Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for: age and sex) ▪ No missing data Weaknesses ▪ Did not control for or consider: race/ethnicity, smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (10 and 20-yr lags) Weaknesses ▪ No major weaknesses
Honda *et al.* (1995)	Employees of a petroleum manufacturing plant, US			B		Strengths ▪ Appropriate study and comparison groups ▪ 3% loss to follow-up ▪ No exclusions Weaknesses ▪ ~~No major weaknesses Unknown number of exclusions~~	Strengths ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, work history at plant) ▪ Qualitative exposure estimate (*i.e.*, ever employment at plant) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, company records, SSA Death Master File, NDI, state DMV records, and death certificates) ▪ 50 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for: age, sex, and race ▪ No missing data Weaknesses ▪ Did not consider or control for: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure documented before outcome Weaknesses ▪ No consideration of latency

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Satin *et al.* (1996)	Workers at an oil refinery, US			B		Strengths ▪ Appropriate study and comparison groups ▪ 5.1% loss to follow-up Weaknesses ▪ Unknown number of exclusions	Strengths ▪ Semiquantitative exposure measurement (*i.e.*, considered duration) ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, work history) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, personnel annuitant record systems, DMV, SSA, and NDI) ▪ 51 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for or considered: age, sex, and race/ethnicity Weaknesses ▪ Did not control for or consider: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ▪ Amount of missing data unknown	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (*i.e.*, analyses of 10-19, 20-29, 30-39 and 40+ yrs since first hired) Weaknesses ▪ No major weaknesses
Lynge *et al.* (1997)	Service station workers in Denmark, Finland, Norway, and Sweden			B		Strengths ▪ Appropriate study and comparison groups ▪ No loss to follow-up ▪ No exclusions Weaknesses ▪ ~~Unknown number of exclusions~~No major weaknesses	Strengths ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, job at time of census) ▪ Qualitative exposure estimate (*i.e.*, employment at service station) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Cases identified using a reliable source (*i.e.*, national cancer registries) ▪ Assessed disease incidence ▪ ≥5 yrs follow-up (Denmark: 18 yrs; Finland: 15 yrs; Norway: 21 yrs; Sweden: 20 yrs) Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for or considered: age and sex ▪ No missing data Weaknesses ▪ Did not control for or consider: race/ethnicity, smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure documented before outcome Weaknesses ▪ No consideration of latency

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Morgan *et al.* (1998)	Aircraft manufacturing workers	T				Strengths ▪ Appropriate study and comparison groups ▪ <0.01% excluded Weaknesses ▪ Unknown loss to follow-up	Strengths ▪ Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, job classification and JEM) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, SSA, NDI, and death certificates) ▪ 44 yrs of follow-up ▪ <5% missing death certificates Weaknesses ▪ Assessed mortality only ~~About 3% of deaths missing death certificates; unclear how this was handled in analysis~~	Strengths ▪ Controlled for or considered: age and sex (RR analyses) Weaknesses ▪ Did not control for or consider: sex (SMR analyses), smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ▪ Considered race but data was "sparse" and was ultimately not used	Strengths ▪ Exposure documented before outcome Weaknesses ▪ Did not consider appropriate latency (6-month lag)

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Hansen *et al.* (2001)	TCE exposed workers	T				Strengths ▪ Appropriate sample and comparison groups Weaknesses ▪ Loss to follow-up unknown; unable to identify individuals for 36% and 48% of urine and air samples, respectively	Strengths ▪ Direct chemical exposure measurement (*i.e.*, U-TCA and occupational air measurements) ~~▪ No missing data~~ Weaknesses ▪ Qualitative exposure estimate (*i.e.*, any exposure) ▪ Did not assess time-varying nature of exposure ▪ Amount of missing data unknown	Strengths ▪ Cases identified using a reliable source (*i.e.*, Danish Cancer Registry) ▪ Assessed disease incidence ▪ 29 yrs of follow-up Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for: age and sex ▪ No missing data Weaknesses ▪ Did not control for or consider: race/ethnicity, smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Appropriate consideration of latency (10- and 20-yr lags) ▪ Exposure documented before outcome Weaknesses ▪ No major weaknesses~~Exposure not necessarily measured before outcome (exposure period overlaps follow-up period)~~

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Wong *et al.* (2001a)	Employees at oil refinery, US			B		Strengths ▪ Appropriate study and comparison groups ▪ 1.1% loss to follow-up Weaknesses ▪ Unknown number of exclusions	Strengths ▪ Semiquantitative exposure measurement (*i.e.*, considered duration) ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, work history from personnel records and payroll files) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, SSA and NDI) ▪ 39 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for or considered: age, sex, and race/ethnicity ▪ ~~No ≤5%~~ missing race data Weaknesses ▪ Did not control for or consider: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ▪ ~~Hispanics and unknown race were considered white~~ ▪ Did not include relevant covariates in a time-varying manner	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (*i.e.*, analyses based on 20-39 and 40+ yrs since first exposure; 10-29 and 30+ yrs of employment) Weaknesses ▪ No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Chang *et al.* (2003)	Electronics factory workers	T	P			Strengths ▪ Appropriate study and comparison groups ▪ No loss to follow-ups or exclusions Weaknesses ▪ Relatively young subjects (mean age 39 yrs at end of follow-up)	Strengths ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, employment status at factory) ▪ Qualitative exposure estimate (*i.e.*, any exposure) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified and validated using a reliable source (*i.e.*, National Mortality Database) ▪ 13 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for: age, and sex ▪ No missing data Weaknesses ▪ Did not control for or consider: race/ethnicity, smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (analyses by duration 5+years) Weaknesses ▪ No ~~consideration of latency~~major weaknesses
Lewis *et al.* (2003)	Canadian refinery/ petrochemical workers			B		Strengths ▪ Appropriate study and comparison groups ~~No loss to follow-up~~ Weaknesses ▪ Young study population at cohort inception (M x̄= 29.1 M; F x̄= 27.5) ▪ Unknown loss to follow-up	Strengths ▪ Semiquantitative exposure measurement (*i.e.*, considered duration) ▪ No missing data Weaknesses ▪ Indirect benzene exposure measurement (*i.e.*, location, department, function, date, and expert review ▪ Did not assess time-varying nature of exposure	Strengths ▪ Cases identified using a reliable source (*i.e.*, Canadian Cancer Data Base) ▪ Deaths identified using a reliable source (*i.e.*, Canadian Mortality Data Base) ▪ Assessed disease incidence ▪ 31 yrs of follow-up Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled: age and sex, ~~smoking~~ ▪ No missing data Weaknesses ▪ Did not control for: race/ethnicity, prior cancer treatment, chronic bladder inflammation, family history of bladder cancer, genetics, smoking, or other potential occupational exposures ~~>5% missing data~~	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (*i.e.*, analyses by 10+ year exposure duration) Weaknesses ▪ No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Raaschou-Nielsen *et al.* (2003)	Blue-collar workers at TCE using companies	T				Strengths ▪ Appropriate study and comparison groups Weaknesses ▪ >75% excluded (including an unspecified number of large companies [200+ employees; 24% of companies]; loss to follow-up unknown	Strengths ▪ No major strengths Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, blue-collar employment) ▪ Qualitative exposure estimate (*i.e.*, any exposure) ▪ 37% of workers with unknown blue- status (only included in sensitivity analyses) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Cases identified using a reliable source (*i.e.*, Danish Cancer Registry) ▪ Assessed disease incidence ▪ 30 yrs of follow-up Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for: age, and sex ▪ No missing data Weaknesses ▪ Did not control for or consider: race/ethnicity, smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure documented before outcome~~No major strengths~~ Weaknesses ▪ No consideration of latency ~~Exposure not necessarily documented before outcome (exposure period overlaps follow-up period)~~
Tsai *et al.* (2003)	Male chemical/ refinery workers US			B		Strengths ▪ Appropriate study and comparison groups ▪ No loss to follow-up Weaknesses ▪ No major weaknesses	Strengths ▪ Semiquantitative exposure measurement (*i.e.*, considered duration) ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, job history) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, company records, NDI, SSA) ▪ 27 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for or considered: age, sex, and race/ethnicity Weaknesses ▪ Did not control for or consider: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ▪ Amount of missing data unknown	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (*i.e.* include analyses of employees with ≥ 10 yrs of employment) Weaknesses ▪ No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Huebner *et al.* (2004)	Employees at two oil refineries and petrochemical facilities, US			B		Strengths ▪ Appropriate study and comparison groups ▪ ≤2% loss to follow-up Weaknesses ▪ Unknown number of exclusions	Strengths ▪ ≤1% missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, company records and work histories) ▪ Qualitative exposure estimate (*i.e.*, employment at plant) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, benefits records, NDI, and SSA) ▪ 28 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for or considered: age, sex, and race/ethnicity ▪ No missing data Weaknesses ▪ Did not control for or consider: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (i.e., analyses considering only employees hired before 1950) Weaknesses ▪ No ~~consideration of latency~~major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Pukkala *et al.* (2009)	General population in Denmark, Finland, Iceland, Norway and Sweden	T	P			Strengths ▪ Appropriate study and comparison groups ▪ No exclusions/loss to follow-up Weaknesses ▪ ~~Amount lost to follow-up unknown~~No major weaknesses	Strengths ▪ No major strengths Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, self-reported occupation in censuses) ▪ Qualitative exposure estimate (*i.e.*, job title) ▪ Unknown number of subjects with missing data ▪ Did not assess time-varying nature of exposure	Strengths ▪ Cases identified using reliable sources (*i.e.*, Central Population Register and national registries) ▪ Assessed disease incidence ▪ 23-45 yrs of follow-up (depending on country) Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for: age and sex ▪ No missing data Weaknesses ▪ Did not control for or consider: race/ethnicity, smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure documented before outcome Weaknesses ▪ No consideration of latency
Calvert *et al.* (2011)	Dry cleaning workers		P			Strengths ▪ Appropriate study and comparison groups ▪ 5% loss to follow-up;< 1% excluded Weaknesses ▪ No major weaknesses	Strengths ▪ Semiquantitative exposure estimate (*i.e.*, considered duration) Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, employment at shops using PCE) ▪ Did not assess time-varying nature of exposure ▪ Solvent history not available for approximately half of shops studied	Strengths ▪ Deaths identified using reliable sources (*i.e.*, SSA, unions, DMV, IRS, postal service, and NDI records) ▪ 65 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for: age, sex, and race ▪ No missing data Weaknesses ▪ Did not consider or control for: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (20 yrs since first employment; duration 5+ yrs) Weaknesses ▪ No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Seldén and Ahlborg Jr. (2010)	Dry cleaning workers in Sweden		P			Strengths ▪ Appropriate comparison group ▪ ~~2.8% loss to follow-up~~ Weaknesses ▪ Low participation rate - 62.1% if companies that received a questionnaire did not respond ▪ Unknown loss to follow-up	Strengths ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, employer reported job history) ▪ Qualitative exposure estimate (*i.e.*, employment in dry-cleaning/laundry) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Cases identified using a reliable source (*i.e.*, national cancer registry) ▪ Assessed disease incidence ▪ 22 yrs of follow-up Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for: age, and sex ▪ No missing data Weaknesses ▪ Did not control for or consider: race/ethnicity, smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (sensitivity analysis included 15-yr lag) Weaknesses ▪ No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Bove *et al.* (2014a)	Civilian employees at CL and CP	T	P	B	V	Strengths ▪ Appropriate study and comparison groups ▪ ≤2% loss to follow-up Weaknesses ▪ Number of participants excluded unknown	Strengths ▪ Direct chemical exposure measurement (measured in groundwater, not used in the analysis) ▪ No missing data Weaknesses ▪ Qualitative exposure estimate (*i.e.*, employed at CL *vs* employed at CP) ~~Did not assess time varying nature of exposure~~	Strengths ▪ Deaths identified using reliable sources (*i.e.*, SSA, a commercial tracing service, and NDI/NDI Plus) ▪ 30 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for or considered: age, sex, race, and occupation (as a proxy for other potential chemical exposures) ▪ Considered smoking using negative control diseases Weaknesses ▪ Did not control for or consider: prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, or genetics ▪ Did not include relevant covariates in a time-varying manner (*i.e.*, occupation) ▪ Amount of missing data is unknown	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (*i.e.*, 10-yr lag) Weaknesses ▪ No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Carreón *et al.* (2014)	Workers at a chemical manufacturing plant				V	Strengths ▪ Appropriate study and comparison groups ▪ 2% loss to follow-up ▪ <1% excluded Weaknesses ▪ No major weaknesses	Strengths ▪ Semiquantitative exposure estimate (*i.e.*, considered duration) ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, employment at facility) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, NDI, NDI Plus, and Florida Department of Health) ▪ 48 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for: age, sex, and race/ethnicity Weaknesses ▪ Did not control for or consider: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ▪ 54.2% missing race/ethnicity; assumed white	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (i.e., 10- and 20-yr lags, results not shown) Weaknesses ▪ ~~No consideration of latency~~No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Silver *et al.* (2014)	Microelectronics and business machine facility employees	T	P			Strengths ▪ Appropriate study and comparison groups Weaknesses ▪ Relatively young cohort (mean age at hire was mid-20s, average follow-up 25.7 yrs) ▪ Amount excluded and lost to follow-up unknown	Strengths ▪ Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) ▪ Assessed time-varying nature of exposure Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, employment at facility and JEM) ▪ Missing, incomplete, and conflicting data regarding work dates, facility location, department, and position (particularly for early yrs) that are not addressed ~~Did not assess time-varying nature of exposure~~	Strengths ▪ Cases identified using reliable sources (*i.e.*, SSA, NDI, IRS, and death certificates) ▪ 41 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for: age, sex, and race (in external analyses) Weaknesses ▪ Did not control for or consider: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures; race (in internal analyses) ▪ 16% missing race data (assumed white)	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (10-yr lag) Weaknesses ▪ No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Callahan *et al.* (2019)	Dry-cleaning union members in St. Louis, MO		P			Strengths ▪ Appropriate study and comparison groups ~~▪ About 2% excluded~~ Weaknesses ▪ Amount lost to follow-up unknown ▪ Unknown number of exclusions ▪ ~9% missing data	Strengths ▪ Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, monitoring studies of the dry-cleaning industry applied to job titles from union records) ▪ Did not assess time-varying nature of exposure	Strengths ▪ Deaths identified using reliable sources (*i.e.*, union records, SSA, DMV, credit bureaus, state bureaus of social services, telephone and street directories, NDI, death certificates) ▪ 67 yrs of follow-up Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for: age, sex, and race Weaknesses ▪ Did not consider or control for: smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ▪ Amount of missing data is unknown	Strengths ▪ Exposure documented before outcome ▪ Appropriate consideration of latency (10- and 20-yr lag) Weaknesses ▪ No major weaknesses

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Aschengrau *et al.* (1993)	Residents of five Upper Cape towns, MA		P			Strengths ▪ Appropriate case and control selection ▪ ~~83% participation rate in cases~~ ▪ Characteristics of participants and non-participants were similar Weaknesses ▪ 20.3% of cases did not participate ▪ 74% participation rate in controls	Strengths ▪ Semiquantitative exposure estimate (*i.e.*, considered intensity) Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, exposure modelled based on subjects' residences on streets with vinyl-lined/asbestos cement pipes) ▪ Amount of missing data unknown	Strengths ▪ Cases identified using reliable sources (*i.e.*, Massachusetts Cancer Registry and confirmed by medical professional) ▪ Assessed disease incidence Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for: age, sex, occupational exposure to PCE, benzene, and other solvents, smoking, and history of a cancer-associated job Weaknesses ▪ Did not consider or control for: race/ethnicity (though majority White), prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, or genetics ▪ Amount of missing data unknown	Strengths ▪ Exposure considered prior to diagnosis ▪ Appropriate consideration of latency (15-yr lag) Weaknesses ▪ No major weaknesses
Greenland *et al.* (1994)	Workers at a transformer-assembly facility	T		B		Strengths ▪ Appropriate case and control selection Weaknesses ▪ About 40% of potential study population excluded (36% missing job history)	Strengths ▪ <2% of person-yrs missing exposure level, assigned by imputation Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, work history records and JEM) ▪ Qualitative exposure estimate (*i.e.*, any exposure)	Strengths ▪ Deaths identified using reliable sources (*i.e.*, company pension office and death certificates); subset of cancer diagnoses were validated by medical professional Weaknesses ▪ Assessed mortality only	Strengths ▪ Controlled for: age, sex, and race ▪ No missing data Weaknesses ▪ Did not control for or consider: smoking, prior cancer treatment, personal or family history of bladder cancer, genetics, or other potential occupational exposures	Strengths ▪ Exposure considered prior to death Weaknesses ▪ Insufficient consideration of latency (2-yr lag)

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Gérin *et al.* (1998)	Canadian white males			B		Strengths ▪ Appropriate case selection ▪ 82% participation rate in cases ▪ Non-differential participation rates between cases and controls Weaknesses ▪ Inappropriate control selection (*i.e.*, non-compulsory electoral lists) ▪ 71% participation rate in controls ▪ Case and control participation rates differed	Strengths ▪ Semiquantitative exposure estimate (*i.e.*, considered duration, frequency, and intensity) ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, self-reported occupational history and expert opinion) ▪ Potential for recall bias (*i.e.*, self-reported occupational history after diagnosis)	Strengths ▪ Cases identified using a reliable source (*i.e.*, medical records); vital status for controls confirmed *via* interview ▪ Assessed disease incidence Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for or considered: age, sex, ethnicity, smoking, and co-exposures (toluene, xylene, styrene, and aromatic amines) Weaknesses ▪ Did not control for or consider: prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, or genetics ▪ Amount of missing data unknown	Strengths ▪ Exposure considered prior to diagnosis Weaknesses ▪ No consideration of latency

Citation	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Colt *et al.* (2011)	General population of NH, VT, and ME		P			Strengths ▪ Appropriate case and control selection Weaknesses ▪ 65% response rates in cases and controls	Strengths ▪ <2% missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, self-reported occupational history) ▪ Qualitative exposure estimate (*i.e.*, job title and industry ▪ Potential for recall bias (*i.e.*, self-reported occupational history after diagnosis)	Strengths ▪ Cases identified using reliable sources (*i.e.*, hospital pathology departments, hospital cancer registries, and state cancer registries) and histologically confirmed ▪ Assessed disease incidence Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for: age, sex, race/ethnicity, smoking status, and employment in other high-risk occupations ▪ <2% missing data Weaknesses ▪ Did not control for or consider: prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, or genetics	Strengths ▪ No major strengths Weaknesses ▪ Unclear if exposure period included time after diagnosis ▪ No consideration of latency
Christensen *et al.* (2013)	Male Canadian citizens residents of Montreal	T	P			Strengths ▪ Appropriate case selection ▪ 82% case participation rate Weaknesses ▪ Inappropriate control selection (non-compulsory electoral lists) ▪ 72% control participation rate	Strengths ▪ Semiquantitative exposure estimate (*i.e.*, considered duration, frequency, and intensity) ▪ No missing data Weaknesses ▪ Indirect chemical exposure measurement (*i.e.*, self-reported occupational history and expert opinion) ▪ Potential for recall bias (*i.e.*, self-reported occupational history after diagnosis)	Strengths ▪ Cases identified using a reliable source (*i.e.*, hospital records) and histologically confirmed ▪ Assessed disease incidence Weaknesses ▪ No major weaknesses	Strengths ▪ Controlled for: age, sex, ethnicity, smoking, and aromatic amines exposure Weaknesses ▪ Did not control for or consider: prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, or genetics ▪ Amount of missing data is unknown	Strengths ▪ Appropriate consideration of latency (5-yr lag) ▪ Exposure considered prior to diagnosis Weaknesses ▪ ~~Unclear if exposure period included time after diagnosis~~No major weaknesses

EXHIBIT 5

Kidney Cancer Report Attachment Revisions

Table C.1 Kidney Cancer Epidemiology Study Quality Assessment

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Cohort Studies										
Wong (1987a,b)	Male chemical workers			B		Strengths • Appropriate study and comparison groups • 2.3% loss to follow-up Weaknesses • Unknown number of exclusions	Strengths • Semiquantitative exposure estimate (*i.e.*, considered frequency, duration, and intensity) • No missing data • Assessed time-varying nature of exposure Weaknesses • Indirect chemical exposure measurement (*i.e.*, work location/type of work, and uniform task approach)	Strengths • Deaths identified using reliable sources (*i.e.*, company records, SSA, DMV, and death certificates) • 32 yrs of follow-up Weaknesses • Assessed mortality only • 2.2% of all deaths without death certificate (1.1% in continuously exposed group, 1.3% in intermittently exposed group, and 4.3% in unexposed group)	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • About 8% missing race data; assumed white	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 10-19 and 20 years) Weaknesses • No major weaknesses
Garabrant *et al.* (1988)	Aircraft manufacturing workers	T				Strengths • Appropriate study and comparison groups ~~• No exclusions for missing data~~ Weaknesses • ~~No major weaknesses~~Unknown amount of exclusions	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, factory personnel records) • Qualitative exposure estimate (*i.e.*, ever employment at	Strengths • Deaths identified using reliable sources (*i.e.*, SSA, California DMV, credit records, death certificates, California Death Tapes) • 25 yrs of follow-up Weaknesses • Assessed mortality	Strengths • Controlled for age, sex, and race Weaknesses • Did not control for or consider smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 4-year lag) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
						population) • Unknown number of exclusions	exposure		consumption, or other potential occupational exposures	
Dagg *et al.* (1992)	Employees at oil refineries, US			B		Strengths • Appropriate study and comparison groups • ~~4.8%~~ <20 % loss to follow-up • <1% excluded from individual refinery analyses (*i.e.*, worked at both refineries under study) Weaknesses • ~~All women excluded (4.8% of total) due too few cases~~No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company records, NDI, SSA, California death index, and Equifax) • 37 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race/ethnicity ~~No missing data~~ Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • Amount of missing data unknown	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*e.g.*, analyses based on 10-19, 20-29, and ≥30 yrs since hire) Weaknesses • No major weaknesses
Sinks *et al.* (1992)	Paperboard printing plant workers	T				Strengths • Appropriate study and comparison groups • 10% lost to follow-up • <2% excluded in SMR analyses and <16% excluded in SIR analyses Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at facility) • Qualitative exposure estimate (*i.e.*, any employment) • Did not assess time-varying nature of	Strengths • All deaths and cases identified and validated using reliable sources (*i.e.*, SSA, mailing address with USPS, death certificates, company medical records, and local cancer registries) • Assessed disease incidence • 32 yrs of follow-up	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency in SIR or SMR analyses

Study	Population	Chemical				Study Quality Factors				
Tsai *et al.* (1993)	Male refinery/ petrochemical workers, US			B		Strengths • Appropriate study and comparison groups • No loss to follow-up Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect benzene exposure measurement (*i.e.*, job history) • Qualitative exposure estimate (*i.e.*, ever/never employment) • Did not assess time-varying nature of exposure	Strengths • Deaths identified or using reliable source (*i.e.*, company records, NDI, and SSA) • 17 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, race/ethnicity Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • Amount of missing data unknown	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, worked ≥10 yrs in subanalysis) Weaknesses • ~~No consideration of latency~~No major weaknesses
Wong *et al.* (1993)	Petroleum marketing/ distribution workers			B		Strengths • Appropriate study and comparison groups • No loss to follow up Weaknesses • Unknown ~~loss to follow-up and~~ number of exclusions	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration, frequency and intensity) • Assessed time-varying nature of exposure • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment records, job titles, work history, and JEM)	Strengths • Cases identified using reliable sources (*i.e.*, SSA, DMF, NDI, company records, state vital statistics departments, and death certificates) • 43 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • 40% missing race data (assumed White)	Strengths • Exposure documented before outcome • Appropriate consideration of latency (analyses based on 5-9, 10-19, 20-29, and 30+ yrs since first exposure) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
Henschler *et al.* (1995a)	Cardboard factory workers	T				Strengths • Appropriate study group and comparison groups • About 8% excluded (*i.e.*, refused to participate or not able to participate due to poor physical health) or lost to follow-up Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect exposure measurement (*i.e.*, job location) • Qualitative exposure estimate (*i.e.*, ever exposure) • Did not assess time-varying nature of exposure	Strengths • Cases and deaths identified using reliable sources (*i.e.*, medical, personnel, and pension records) and all renal cell tumors verified by histopathological examination • Assessed disease incidence • 36 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Exposure documented before outcome • All cases occurred 18+ yrs after first exposure Weaknesses • No major weaknesses
Honda *et al.* (1995)	Employees of a petroleum manufacturing plant, US			B		Strengths • Appropriate study and comparison groups • 3% loss to follow-up • No exclusions Weaknesses • ~~Unknown number of exclusions~~ No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at the plant) • Qualitative exposure estimate (*i.e.*, ever employed at plant) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company records, SSA Death Master File, NDI, state DMV records, and death certificates) • 50 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race/ethnicity • No missing data Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
Collingwood *et al.* (1996)	Workers at an oil refinery, US			B		Strengths • Appropriate study and comparison groups • 2% loss to follow-up • No exclusions Weaknesses • No major weaknesses • Unknown number of exclusions	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company's personnel database, PBI, NDI, SSA, and death certificates) • 41 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race • About 3.5% missing race data; classified as White Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, analyses of 20-29 and 30+ yrs since first employment) Weaknesses • No major weaknesses
Satin *et al.* (1996)	Workers at an oil refinery, US			B		Strengths • Appropriate study and comparison groups • 5.1% loss to follow-up Weaknesses • Unknown number of exclusions	Strengths • Semiquantitative exposure measurement (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, personnel annuitant record systems, DMV, SSA, and NDI) • 51 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age, sex, and race/ethnicity Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • Amount of missing data unknown	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, analyses of 10-19, 20-29, 30-39 and 40+ yrs since first hired) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
Lynge *et al.* (1997)	Service station workers in Denmark, Finland, Norway, and Sweden			B		Strengths • Appropriate study and comparison groups • No loss to follow-up Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job at time of census) • Qualitative exposure estimate (*i.e.*, employment at service station) • Did not assess time-varying nature of exposure	Strengths • Cases identified using reliable sources (*i.e.*, cancer registries) • Assessed disease incidence • ≥5 years follow-up (Denmark: 18 yrs; Finland: 16 yrs; Norway: 21 yrs; Sweden: 20 yrs) Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency
Morgan *et al.* (1998)	Aircraft manufacturing workers	T				Strengths • Appropriate study and comparison groups • <0.01% excluded Weaknesses • Unknown loss to follow-up	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job classification and JEM) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, SSA, NDI, and death certificates) • ≥44 yrs of follow-up • <5% missing death certificates Weaknesses • Assessed mortality only ~~About 3% of deaths missing death certificates; unclear how this was handled in analysis~~	Strengths • Controlled for: age and sex Weaknesses • Did not control for or consider: ~~race/ethnicity,~~ smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • Considered race but data was "sparse"	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
									and was ultimately not used	
Pukkala (1998)	Employees of a Finnish oil and chemical enterprise			B		Strengths • Appropriate study and comparison groups • No loss to follow-up/exclusions Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • Assessed time-varying nature of exposure • No missing data Weaknesses • Indirect benzene exposure measurement (*i.e.*, work history and job categories) ~~Did not assess time-varying nature of exposure~~	Strengths • Cases identified using reliable sources (*i.e.*, Finnish Cancer Registry) • Assessed disease incidence • 24 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex, • No missing data Weaknesses • Did not consider or control for: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Exposure data collected prior to outcome • Appropriate consideration of latency (*i.e.*, analyses of 5-14 yrs since first employment) Weaknesses • No major weaknesses
Bulbulyan *et al.* (1999)	Female Russian printing plant employees			B		Strengths • 1.5% loss to follow-up (1.5%) and no exclusions Weaknesses • Inappropriate comparison group (*i.e.*, Moscow reference rates were based on only a single year during follow-up, 1992) • Notable weakness in study population (*i.e.*, benzene use in bookbinding was	Strengths • No missing data Weaknesses • Indirect benzene exposure measurement (*i.e.*, personnel records and job type) • Qualitative exposure estimate (*i.e.*, job type) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using a reliable source (*i.e.*, Moscow Vital Statistics Department) • 15 yrs follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational	Strengths • Exposure documented before outcome • Appropriate consideration of latency (benzene use discontinued 20 yrs prior) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
Lewis *et al.* (2000a)	Active and terminated workers at three oil refineries and petrochemical facilities			B		Strengths • Appropriate study and comparison groups Weaknesses • Unknown loss to follow-up • Unknown number of exclusions	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, company records and work histories) • Qualitative exposure estimate (*i.e.*, employment at plant) • Amount of missing data unknown • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, benefit records, NDI, SSA, and death certificates) • 23 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race • No missing data Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency
Hansen *et al.* (2001)	TCE exposed workers	T				Strengths • Appropriate sample and comparison groups Weaknesses • Loss to follow-up unknown; unable to match individual for 36% and 48% of urine and air samples, respectively	Strengths • Direct chemical exposure measurement (*i.e.*, U-TCA and occupational air measurements) used to form study population ~~• No missing data~~ Weaknesses • Qualitative exposure estimate (*i.e.*, any exposure) • Amount of missing data unknown • Did not assess time-varying nature of exposure	Strengths • Cases identified using a reliable source (*i.e.*, Danish Cancer Registry) • Assessed disease incidence • 29 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Appropriate consideration of latency (10- and 20-yr lags) • Exposure documented before outcome Weaknesses • ~~Exposure period overlaps period of follow-up; unclear how this was handled in analysis~~No major weaknesses

Study	Population	Chemical				Study Quality Factors				
Sorahan *et al.* (2002)	Refinery and petroleum distribution workers, UK			B		Strengths • Appropriate study and comparison groups Weaknesses • Unknown loss to follow-up	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement-based on job history • Qualitative exposure estimate (*i.e.*, employment as refinery or distribution worker) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, national registers and death certificates) • 48 years of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, prior cancer treatment, chronic bladder inflammation, personal or family history of bladder cancer, genetics, or other potential occupational exposures ~~Amount of missing data unknown~~	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency
Travier *et al.* (2002)	Dry-cleaning workers	T	P			Strengths • Appropriate study and comparison groups Weaknesses • Loss to follow-up and number of exclusions unknown	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported employment and industrial codes from two decennial censuses) • Qualitative exposure estimate (*i.e.*, job title) • Amount of missing data unknown	Strengths • Cases and death identified from a reliable source (*i.e.*, CERIII) • Assessed disease incidence • 19 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
							• Did not assess time-varying nature of exposure		exposures	
Chang *et al.* (2003)	Electronics factory workers	T	P			Strengths • Appropriate study and comparison groups • No loss to follow-up or exclusions Weaknesses • Relatively young subjects (mean age 39 yrs at end of follow-up)	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, ever employment at factory) • Did not assess time-varying nature of exposure	Strengths • Deaths identified and validated using a reliable source (*i.e.*, National Mortality Database) • 13 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of latency (analyses by duration 5+ yrs) Weaknesses • No major weaknesses
Lewis *et al.* (2003)	Canadian refinery/ petrochemical workers			B		Strengths • Appropriate study and comparison groups ~~• No loss to follow-up~~ Weaknesses • Young study population at cohort inception (Male $\bar{x}$ = 29.1; Female $\bar{x}$ = 27.5) • Unknown loss to follow-up	Strengths • Semiquantitative exposure measurement (*i.e.*, considered duration) • No missing data Weaknesses • Indirect benzene exposure measurement (*i.e.*, location, department, function, date, and expert review) • Did not assess time-varying nature of	Strengths • Cases identified using a reliable source (*i.e.*, Canadian Cancer Data Base); deaths identified using a reliable source (*i.e.*, Canadian Mortality Data Base) • Assessed disease incidence • 31 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex Weaknesses • Did not control for or consider: race/ethnicity, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, smoking, or other potential occupational	Strengths • Exposure documented before outcome • Appropriate consideration of latency (analyses by duration 5+ yrs) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
							exposure		exposures	
Raaschou-Nielsen *et al.* (2003)	Blue-collar workers at TCE using companies	T				Strengths • Appropriate study and comparison groups Weaknesses • >75% excluded (including an unspecified number of large companies [200+ employees; 24% of companies]; loss to follow-up unknown	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment and blue-collar status at companies) • 37% of workers for whom blue- or white-collar status unknown (only included in sensitivity analyses) • Did not assess time-varying nature of exposure	Strengths • Cases identified using a reliable source (*i.e.*, Danish Cancer Registry) • Assessed disease incidence • 30 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Appropriate consideration of latency (20-yr lag) • Exposure documented before outcome Weaknesses • ~~Exposure period overlaps period of follow-up; unclear how this was handled in analysis~~No major weaknesses
Tsai *et al.* (2003)	Male chemical/ refinery workers, US			B		Strengths • Appropriate study and comparison groups • No loss to follow-up Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company records, NDI, and SSA) • 27 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, race/ethnicity, obesity, and hypertension Weaknesses • Did not control for or consider: smoking, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational	Strengths • Exposure documented before outcome • Sufficient consideration of latency (*i.e.*, worked ≥10 yrs in subanalysis~~conducted a sensitivity analysis for cancers with shorter latencies~~) Weaknesses

Study	Population	Chemical				Study Quality Factors				
							varying nature of exposure	Weaknesses • Assessed mortality only	hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • Did not include relevant covariates in a time-varying manner (*i.e.*, hydrazine exposure)	
Gun *et al.* (2006)	Employees of Australian Institute of Petroleum member companies			B		Strengths • Appropriate study and comparison groups • <20% loss to follow-up (1.3% of males and 4.9% of females) Weaknesses • Participation rate declined to 73% at last follow-up; unknown number of exclusions	Strengths • Semiquantitative exposure measurement (*i.e.*, considered duration) ~~No major strengths~~ Weaknesses • Indirect benzene exposure measurement (*i.e.*, survey interviews job codes ranked by industrial hygienists) • ~~Qualitative exposure estimate (i.e., ever exposed and job title)~~ • Did not assess time-varying nature of exposure	Strengths • Deaths identified from reliable sources (*i.e.*, NDI; cancers identified from National Cancer Statistics Clearing House [cancer registries]) • Assessed disease incidence • ≥5 years follow-up (mortality: 20 yrs; incidence: 21 yrs) Weaknesses • No major weaknesses	Strengths • Controlled for age, and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures ~~Did not include relevant covariates in a time-varying manner~~	Strengths • Exposure data collected prior to outcome Weaknesses • No consideration of latency
Tsai *et al.* (2007)	Male petroleum refinery and			B		Strengths • Appropriate study and comparison	Strengths • Semiquantitative exposure estimate	Strengths • Deaths identified using reliable	Strengths • Controlled for: age, sex, and	Strengths • Exposure documented

Study	Population	Chemical				Study Quality Factors				
	population					and comparison groups • <2% excluded (*i.e.*, missing information) Weaknesses • ~~No major weaknesses~~ Unknown loss to follow-up	data Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported job titles from 1960 and 1970 National Population and Housing Censuses) • Qualitative exposure estimate (*i.e.*, job title) • Did not assess time-varying nature of exposure	using a reliable source (*i.e.*, CERIII) • Assessed disease incidence • 19 yrs of follow-up Weaknesses • No major weaknesses	considered: age, sex, and smoking • No missing data Weaknesses • Did not control for or consider: race/ethnicity, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • Did not consider relevant covariates in a time-varying manner (*i.e.*, smoking)	documented before outcome Weaknesses • No consideration of latency
Pukkala *et al.* (2009)	General population in Denmark, Finland, Iceland, Norway and Sweden	T	P			Strengths • Appropriate study and comparison groups • No exclusions/loss to follow up Weaknesses • ~~Amount lost to follow-up unknown~~ • No major weaknesses	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported occupation in censuses) • Qualitative exposure estimate (*i.e.*, job title) • Unknown number of subjects with missing data	Strengths • Cases identified using reliable sources (*i.e.*, Central Population Register and national registries • Assessed disease incidence • 23-45 yrs of follow-up (depending on country) Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
							• Did not assess time-varying nature of exposure		occupational exposures	
Bahr *et al.* (2011)	Paducah Gaseous Diffusion Plant workers	T				Strengths • Appropriate study and comparison groups • No loss to follow-up; excluded <19%(*i.e.*, unusable data [<1%], few female deaths [18.2%]) Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at facility and JEM) • Qualitative exposure estimate (*i.e.*, probability of exposure) • Did not assess time-varying nature of exposure	Strengths • Cases identified using reliable sources (*i.e.*, KY Cancer Registry) • ~~Assessed disease incidence~~ • 51 yrs of follow-up Weaknesses • Not clear how vital status or death data were gathered • Assessed mortality only	Strengths • Controlled for: age, sex, and race • No missing data Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency
Calvert *et al.* (2011)	Dry cleaning workers		P			Strengths • Appropriate study and comparison groups • 5% loss to follow-up; <1% excluded (*i.e.*, missing age) Weaknesses • No major weaknesses	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at shops using PCE) • Qualitative exposure estimate (*i.e.*, ever employment at shop) • Solvent history not available for approximately half of shops studied • Did not assess time-	Strengths • Deaths identified using reliable sources (*i.e.*, SSA, unions, DMV, IRS, postal service, and NDI records) • 65 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race • No missing data Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Exposure documented prior to outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
							varying nature of exposure			
Lipworth *et al.* (2011)	Aircraft manufacturing workers	T	P			Strengths • Appropriate study and comparison groups • <2% lost to follow-up Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job codes/titles, facility files, walk-through visits, and employee interviews) • Did not assess time-varying nature	Strengths • Deaths identified using reliable sources (*i.e.*, CA Death Statistical Master File, NDI, SSA Death Master File, pension and other records, death certificates, and SSA Service to Epidemiologic Researchers and LexisNexis records) • 49 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • Amount of missing race data unknown	Strengths • Exposure document before outcome • Appropriate consideration of latency (analyses by duration 10+ yrs, and 5+ yrs of exposure) Weaknesses • No major weaknesses
Seldén and Ahlborg Jr. (2011)	Dry cleaning workers in Sweden		P			Strengths • Appropriate study and comparison groups • ~~2.8% loss to follow-up~~ Weaknesses • 62.1% of companies excluded for not responding to questionnaire • Unknown loss to follow-up	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employer reported job history) • Qualitative exposure estimate (*i.e.*, employment in dry-cleaning/laundry) • Did not assess time-varying nature of exposure	Strengths • Cases identified using a reliable source (*i.e.*, national cancer registry) • Assessed disease incidence • 22 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational	Strengths • Exposure documented before outcome • Appropriate consideration of latency (sensitivity analysis included 15-yr lag) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
							exposure Weaknesses • No direct chemical exposure measurement in individuals (*e.g.*, no water consumption information)		hypertension, genetic factors, family history of kidney cancer, diabetes, or alcohol consumption • Did not include relevant covariates in a time-varying manner (*i.e.*, occupation) • Amount of missing data is unknown	
Carreón *et al.* (2014)	Workers at a chemical manufacturing plant				V	Strengths • Appropriate study and comparison groups • 2% loss to follow-up • <1% excluded Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at facility) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, NDI, NDI Plus, and Florida Department of Health) • 48 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race/ethnicity Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • 54.2% missing race/ethnicity; assumed white	Strengths • Exposure documented before outcome • Appropriate consideration of latency (i.e., 10- and 20-yr lags, results not shown) Weaknesses • No ~~consideration of latency~~major weaknesses
Silver *et al.* (2014)	Micro-electronics and business machine facility employees	T	P			Strengths • Appropriate study and comparison groups Weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity)	Strengths • Cases identified using reliable sources (*i.e.*, SSA, NDI, IRS, and death certificates	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or	Strengths • Exposure documented before outcome • Appropriate consideration of

Study	Population	Chemical				Study Quality Factors				
						• Relatively young cohort (mean age at hire was mid-20s, average follow-up 25.7 yrs) • Number of subjects excluded and lost to follow-up unknown	• Assessed time-varying nature of exposure Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at facility and JEM) • Missing, incomplete, conflicting data regarding work dates, facility location, department, and position (particularly for early yrs) that are not addressed ~~Did not consider time-varying nature of exposure~~	• 41 yrs of follow-up Weaknesses • Assessed mortality only	consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • Race missing for 16% of cohort; assumed white	latency (10-yr lag) Weaknesses • No major weaknesses
Collins *et al.*, (2015)	Benzene workers			B		Strengths • Appropriate study and comparison groups • <1% loss to follow-up Weaknesses • Unknown number of exclusions	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment in three production areas at facility) • Qualitative exposure estimate (*i.e.*, any exposure) • Did not assess time-varying nature of exposure	Strengths • Deaths identified from company's research database (HR records, NDI, state vital statistics bureaus) • 70 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for age, sex, and race Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of latency (15- and 30-yr lags) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
ATSDR (2018b)	Marines & Navy personnel and civilian employees at CL and CP	T	P	B	V	Strengths • Appropriate study and comparison groups Weaknesses • 70% of CL Marines, 72% CP Marines, 55% CL civilians and 62% CP civilians did not enroll • 10% of those who reported an outcome excluded for not completing HIPAA form	Strengths • Direct chemical exposure measurement (*i.e.*, measured in groundwater) • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) • No missing data • Assessed time-varying nature of exposure Weaknesses • No direct chemical exposure measurement in individuals (*e.g.*, no water consumption information)	Strengths • Deaths validated using reliable sources (*i.e.*, medical records and death certificates) • Assessed disease incidence • 41 yrs of follow-up Weaknesses • Initial case identification relied on self-report	Strengths • Controlled for or considered: age, sex, race, smoking, alcohol consumption, and other potential occupational/chemical exposures Weaknesses • Did not control for or consider: obesity, hypertension, genetic factors, family history of kidney cancer, or diabetes • Did not consider relevant covariates in a time-varying manner (*i.e.*, smoking, alcohol consumption, occupational exposures) • >5% missing data for smoking, alcohol consumption, and other occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, "virtually all" participants developed cancer ≥10 yrs after being stationed or employed at CL) Weaknesses • No major weaknesses
Callahan *et al.* (2019)	Dry-cleaning union members in St. Louis, MO		P			Strengths • Appropriate study and comparison groups • ~~About 7% excluded~~ Weaknesses • Amount lost to follow-up unknown	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) • No missing data Weaknesses	Strengths • Deaths identified using reliable sources (*i.e.*, union records, SSA, DMV, credit bureaus, state bureaus of social services, telephone and street	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 10- and 20-yr lag)

Study	Population	Chemical				Study Quality Factors				
						• ~~Unknown~~Unknown number of exclusions • ~9% missing data	• Indirect chemical exposure measurement (*i.e.*, monitoring studies of the dry-cleaning industry applied to job titles from union records) • Did not assess time-varying nature of exposure	directories, NDI, death certificates) • 67 yrs of follow-up Weaknesses • Assessed mortality only	factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures • Amount of missing data is unknown	Weaknesses • No major weaknesses
Bove *et al.* (2024b)	Marines & Navy personnel and civilian workers at CL and CP	T	P	B	V	Strengths • Appropriate study and comparison groups • <2% excluded Weaknesses • Unknown loss to follow-up	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, assignment or employment at base) • Did not assess time-varying nature of exposure	Strengths • Cases identified and validated using reliable sources (*i.e.*, SSA Data for Epidemiological Researchers, NDI, and cancer registries) • Assessed disease incidence • 22 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age, sex, race, and (for civilians) blue-collar work proxy for other occupational exposures ← ~~Considered quantitative bias from unmeasured smoking "negative control disease"~~ Weaknesses • Did not control for or consider: smoking, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or (for Marines & Navy) other potential occupational exposures • 5.2% of CP Marines &	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, follow-up began 10 yrs after last exposure of interest) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
						participation rates differed >15%	self-reported occupational history)	Weaknesses • No major weaknesses	variables Weaknesses • Did not control for or consider: genetic factors, diabetes, alcohol consumption, or other potential occupational exposures	after diagnosis
Christensen *et al.* (2013)	Male Canadian citizens living in Montreal	T	P			Strengths • Appropriate case selection • High participation rate in cases (82%) Weaknesses • Inappropriate control selection (non-compulsory electoral lists) • Low participation rate in controls (72%)	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration, frequency, and intensity) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported occupational history and expert opinion) • Potential for recall bias (*i.e.*, self-reported occupational history after diagnosis)	Strengths • Cases identified using a reliable source (*i.e.*, hospital records) and histologically confirmed • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for: age, sex, ethnicity, smoking, and alcohol consumption Weaknesses • Did not control for or consider: obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, and other potential occupational exposures • Amount of missing data is unknown	Strengths • Appropriate consideration of latency (5-yr lag) • Exposure considered prior to diagnosis Weaknesses • ~~Unclear if exposure period included time after diagnosis~~No major weaknesses
Vlaanderen *et al.* (2013)	General population in Nordic Countries	T	P			Strengths • Appropriate case and control selection • Nested case-control design; no issues with participation/enroll	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) • Assessed time-varying nature of	Strengths • Cases identified using reliable sources (*i.e.*, national population and cancer registries) • Assessed disease	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider:	Strengths • Exposure considered prior to diagnosis • Considered appropriate latency (5-, 10-, and 20-yr lags)

Study	Population	Chemical				Study Quality Factors				
						ment Weaknesses • No major weaknesses	exposure (updated with each census) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported census data and JEMs) ~~Occupations and industries based on decennial censuses~~	incidence Weaknesses • No major weaknesses	race/ethnicity, obesity, hypertension, genetic factors, family history of kidney cancer, diabetes, alcohol consumption, or other potential occupational exposures	Weaknesses • No major weaknesses
Purdue *et al.* (2017)	General populations of Detroit MI, and Chicago, IL	T	P			Strengths • Appropriate case and control selection Weaknesses • Low participation rates among cases (77%) and controls (54%) • Case and control participation rates differed >15%	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration, frequency, and intensity) Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported occupational history and chemical exposure) • Amount of missing data unknown	Strengths • Cases identified using a reliable source (*i.e.*, Metropolitan Detroit Cancer Surveillance System) and histologically confirmed • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for: age, sex, race, smoking, obesity, and hypertension • <2% missing obesity or hypertension data; no missing data for other variables Weaknesses • Did not control for or consider: genetic factors, family history of kidney cancer, diabetes, alcohol consumption or other potential occupational exposures	Strengths • Appropriate consideration of latency (5- and 15-yr lags) Weaknesses • Unclear if occupational history considered after diagnosis
Michalek *et al.* (2019)	General populations of Finland, Iceland, and Sweden	T				Strengths • Appropriate case selection • Participation in censuses was	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and	Strengths • Cases identified using reliable sources (*i.e.*, national cancer	Strengths • Controlled for: age, sex, and other potential occupational	Strengths • Exposure considered prior to diagnosis • Appropriate

EXHIBIT 7

Leukemia Report Attachment Revisions

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Schnatter *et al.* (1993)	Male Petroleum marketing/ distribution workers			B		Strengths • Appropriate study and comparison groups Weaknesses • Unknown loss to follow-up	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration)~~No major strengths~~ Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • ~~Qualitative exposure estimate (e.g., ever employment in petroleum industry)~~ • Did not assess time-varying nature of exposure • Unknown amount of missing data	Strengths • Deaths identified using reliable source (*i.e.*, company records, Statistics Canada, and NDI) • 20 yrs of follow-up Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections Did not include relevant covariates in a time-varying manner	Strengths • Exposure documented before outcome • Appropriate consideration of disease latency (*i.e.*, 10 and 20 yr lags) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Honda *et al.* (1995)	White male workers at a petroleum manufacturing plant, US			B		Strengths • Appropriate study and comparison groups • 3% loss to follow-up • No exclusions Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at the plant) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, state and company records) • Assessed leukemia types • 5048 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race/ethnicity • No missing data Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, duration of employment ≥0.5 yrs) Weaknesses • No major weaknesses
Collingwood *et al.* (1996)	Workers at an oil refinery, US			B		Strengths • Appropriate study and comparison groups • 2% loss to follow-up • No exclusions Weaknesses • No major weaknesses • Unknown number of exclusions	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company's personnel database, PBI, NDI, SSA, and death certificates) • Assessed leukemia types • 41 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race • About 3.5% missing race data; classified as white Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, analyses of 20-29 and 30+ yrs since first employment) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Morgan *et al.* (1998)	Aircraft manufacturing workers	T				Strengths • Appropriate study and comparison groups • <0.01% excluded (missing information) Weaknesses • Unknown loss to follow-up	Strengths • No missing data • Semiquantitative exposure estimate (*i.e.*, considered duration x intensity and peaks) Weaknesses • Indirect chemical exposure measurement (*i.e.*, job classification and JEM) • Did not consider time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, SSA or NDI and death certificates) Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age and, sex, and race • No missing data Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections • Considered race but data were "sparse" and not used	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency
Pukkala (1998)	Employees of an oil and chemical enterprise			B		Strengths • Appropriate study and comparison groups • No loss to follow-up Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data • Assessed time-varying nature of exposure Weaknesses • Indirect chemical exposure measurement (*i.e.*, job categories) ~~Did not assess time-varying nature of exposure~~	Strengths • Cases identified using a reliable source (*i.e.*, Finnish Cancer Registry) • Assessed disease incidence • 24 yrs of follow-up Weaknesses • Assessed aggregated leukemia types	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, results for employees with at least 5 yrs of employment) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Bulbulyan *et al.* (1999)	Female Russian printing plant employees			B		Strengths • Appropriate study and comparison groups • No loss to follow-up Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job type) • Qualitative exposure estimate (*i.e.*, job title) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using a reliable source (*i.e.*, Moscow Vital Statistics Department) • 15 yrs follow-up Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections • Did not include relevant covariates in a time-varying manner	Strengths • Exposure measured or documented before outcome • Appropriate consideration of latency (*i.e.*, ≥2 yrs of employment at baseline) Weaknesses • No major weaknesses
Consonni *et al.* (1999)	Italian oil refinery workers			B		Strengths • Appropriate study and comparison groups • ~4.3% loss to follow-up Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect exposure measurement (*i.e.*, job histories) • Did not assess time-varying nature of exposure ~~Amount of missing data unknown~~	Strengths • Deaths identified using reliable sources (*i.e.*, Population Statistics Offices and death certificates) • 43 yrs of follow-up Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 10 yr lag) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Hansen *et al.* (2001)	TCE-exposed workers	T				Strengths • Appropriate sample and comparison groups Weaknesses • Unable to identify individual for 36% and 48% of urine and air samples, respectively	Strengths • Direct chemical exposure measurement (*i.e.*, U-TCA and occupational air measurements)~~No major strengths~~ Weaknesses ~~• Indirect chemical exposure measurement (i.e., employment history)~~ • Qualitative exposure estimate (*i.e.*, ever exposed) • Amount of missing data unknown • Did not assess time-varying nature of exposure	Strengths • Cases identified using a reliable source (*i.e.*, Danish Cancer Registry) • Assessed disease incidence • 29 yrs follow-up Weaknesses • Assessed aggregated leukemia	Strengths • Considered age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome • Appropriate consideration of latency in sensitivity analyses (*i.e.*, 10 and 20 yr lags) Weaknesses • No major weaknesses
Ward *et al.* (2001)	Workers in the vinyl chloride industry				V	Strengths • Appropriate study and comparison groups • ≤3% loss to follow-up Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, facility records and JEM) • Qualitative exposure measurement (*i.e.*, employment in vinyl chloride industry) • Did not assess time-varying nature of exposure	Strengths • Deaths identified from using reliable sources (*i.e.*, death certificates, cancer registry records, and medical records) • Assessed disease incidence • 43 yrs follow-up Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not consider or control for: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Wong *et al.* (2001a)	Employees at oil refinery, US			B		Strengths • Appropriate study and comparison groups • 1.1% loss to follow-up Weaknesses • Unknown number of exclusions	Strengths • Semiquantitative exposure measurement (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, SSA and NDI) • Assessed leukemia types • 39 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race/ethnicity • ≤5% missing race Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections • ~~>5% were assumed white (Hispanics and unknown race)~~ • Did not include relevant covariates in a time-varying manner	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, analyses based on 20-39 and 40+ yrs since first exposure; 10-29 and 30+ yrs of employment) Weaknesses • No major weaknesses
Wong *et al.* (2001b)	Employees at oil refinery, US			B		Strengths • Appropriate study and comparison groups • 1.7% loss to follow-up Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure measurement (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, SSA and NDI) • 51 yrs of follow-up • Assessed leukemia types Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race/ethnicity • No missing data Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, ≥1 yr of employment at baseline) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Rinsky *et al.* (2002)	Pliofilm manufacturing workers			B		Strengths • Appropriate study and comparison groups • No loss to follow-up Weaknesses • No major weaknesses	Strengths • Direct chemical exposure measurement (*i.e.*, incorporated some air monitoring data linked to occupational records used to model exposure data) • Semiquantitative exposure measurement (*i.e.*, considered duration and intensity) • No missing data • Assessed time-varying nature of exposure Weaknesses • ~~Indirect chemical exposure measurement (i.e., job histories, job titles, industrial hygiene data, some air sampling data, and JEM)~~No major weaknesses	Strengths • Deaths identified and validated using reliable sources (*i.e.*, SSA, DMV, death certificates, and NDI) • 47 yrs of follow-up • Assessed leukemia types Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections • Amount of missing race data unknown	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, reported a result for cumulative exposure based on 2.5 yr lag) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Lewis *et al.* (2003)	Canadian refinery/ petrochemical workers			B		Strengths • Appropriate study and comparison groups • ~~No loss to follow-up~~ Weaknesses • Young study population at cohort inception ($\bar{x}$ = 29.1 [M]; $\bar{x}$ = 27.5 [F]) • Unknown loss to follow-up	Strengths • Semiquantitative exposure measurement (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, location, department, function, date and expert review) • Did not assess time-varying nature of exposure	Strengths • Cases and deaths identified using reliable sources (*i.e.*, Canadian Cancer Data Base and Canadian Mortality Data Base) • Assessed leukemia types • Assessed disease incidence • 31 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure or documented before outcome • Appropriate consideration of latency (*i.e.*, employees all had ≥1 yr of employment at baseline) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Raaschou-Nielsen *et al.* (2003)	Blue-collar workers at TCE using companies	T				Strengths • Appropriate study and comparison groups Weaknesses • Excluded large companies that reported TCE use (200+ employees; 24% of TCE-using companies)	Strengths • ~~Semiquantitative exposure estimate (i.e., considered duration)~~No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment history and job title/blue-collar status at companies) • Qualitative exposure estimate (i.e., any exposure) • ~37% of workers with unknown blue- or white-collar status (this group was assessed in sensitivity analyses) • Did not assess time-varying nature of exposure	Strengths • Cases identified using a reliable source (*i.e.*, Danish Cancer Registry) • Assessed disease incidence • 30 yrs follow-up Weaknesses • Assessed aggregated leukemia types	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome • ~~Appropriate consideration of latency (i.e., result based on at least 1 yr of employment)~~ Weaknesses • No ~~major weaknesses~~consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Tsai *et al.* (2003)	Male chemical/ refinery workers US			B		Strengths • Appropriate study and comparison groups • No loss to follow-up Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company records, NDI, SSA) • 27 yrs of follow-up Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for or considered: age, sex, and race/ethnicity Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections • Amount of missing data unknown	Strengths • Exposure documented before outcome • Appropriate consideration of latency (results for employees with minimum 10 yrs of employment) Weaknesses • No major weaknesses
Bloemen *et al.* (2004)	Employees in benzene exposed jobs, US			B		Strengths • Appropriate study and comparison groups Weaknesses • Amount lost to follow-up unknown	Strengths • Direct chemical exposure measurement (*i.e.*, industrial hygiene air measurements) • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) • No missing data Weaknesses ~~• No direct chemical exposure measurement in individuals (i.e., no personal air monitors)~~ • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company records and state registers) • Assessed leukemia types • 57 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age, sex, and race/ethnicity • No missing data Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure measured before outcome • Appropriate consideration of latency (*i.e.*, 15 yr lag) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Pukkala *et al.* (2009)	General population in Denmark, Finland, Iceland, Norway and Sweden	T	P			Strengths • Appropriate study and comparison groups • No ~~loss to follow-up or~~ exclusions • Very large dataset (~14.9 million subjects) Weaknesses • Unknown loss to follow-up~~No major weaknesses~~	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported occupation in censuses) • Qualitative exposure (*i.e.*, job title) • Amount of missing data unknown • Did not assess time-varying nature of exposure	Strengths • Cases identified using reliable sources (*i.e.*, Central Population Register and national cancer registries) • Assessed leukemia types • Assessed disease incidence • ≥5 yrs of follow-up: Denmark (33 yrs), Finland (35 yrs), Iceland (23 yrs), Norway (43 yrs), Sweden (45 yrs) Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Bahr *et al.* (2011)	Paducah Gaseous Diffusion Plant workers	T				Strengths • Appropriate study and comparison groups • <1~~9~~7% excluded for unusable data, female Weaknesses • No major weaknesses	Strengths • ~~Semiquantitative exposure assessment (i.e., level of likelihood of exposure)~~ • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at facility and JEM) • Qualitative exposure estimate (i.e., probability of exposure) • Did not assess time-varying nature of exposure	Strengths • Cases identified using reliable sources (*i.e.*, KY Cancer Registry and death certificates) • 5~~1~~2 yrs of follow-up Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age, sex, and race • No missing data Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections ~~Amount of missing data unknown~~	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Koh *et al.* (2011)	Male South Korean workers in a refinery and petrochemical complex			B		Strengths • Appropriate study and comparison groups • ~~No loss to follow-up~~ Weaknesses • No major weaknesses • Unknown number of participants lost to follow-up	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work department) • Qualitative exposure estimate (*i.e.*, job title) • Did not assess time-varying nature of exposure	Strengths • Cases and deaths identified using reliable sources (*i.e.*, Korea National Statistics Office and Korea National Cancer Registry) • Assessed disease incidence • ≥5 yrs follow-up (mortality: 16 yrs; incidence: 9 yrs) Weaknesses • Assessed aggregated leukemia types	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders and chemotherapy treatment, and certain viral infections	Strengths • Exposure measured or documented before outcome Weaknesses • No consideration of latency
Lipworth *et al.* (2011)	Aircraft manufacturing workers	T	P			Strengths • Appropriate sample and comparison groups • <2% loss to follow-up • <2% excluded for incomplete work information Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job codes/titles, facility files, walk-through visits, and interviews with employees) • Qualitative exposure estimate (*i.e.*, all exposed workers) • Did not consider time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, California Death Statistical Master File, NDI, SSA Death Master File, pension, and other records, SSA Service to Epidemiologic Researchers, and LexisNexis records) • 49 yrs of follow-up Weaknesses • Only assessed mortality • Assessed aggregated leukemia types	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome • Appropriate consideration of latency (1-yr lag) Weaknesses • ~~No consideration of latency~~No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Carreón *et al.* (2014)	Workers at a chemical manufacturing plant				V	Strengths • Appropriate study and comparison groups • 2% loss to follow-up • <1% excluded Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at facility) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, NDI, NDI Plus, and Florida Department of Health) • 48 yrs of follow-up Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age, sex, and race/ethnicity Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections • 54.2% missing race/ethnicity; assumed white	Strengths • Exposure documented before outcome • Appropriate consideration of latency (i.e., 10- and 20-yr lags, results not shown) Weaknesses • No consideration of latency major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Koh *et al.* (2014)	Korean petrochemical plant maintenance workers			B		Strengths • Appropriate study and comparison groups • No loss to follow up Weakness • No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, union membership) • Qualitative exposure estimate (*i.e.*, job title) • Did not assess time-varying nature of exposure	Strengths • Cases and deaths identified using reliable source (*i.e.*, Korea National Statistics Office and Korea National Cancer Registry) • Assessed disease incidence • 6 yrs of follow up for mortality Weaknesses • Assessed aggregated leukemia types • ~~0~~-3 yrs of follow-up for incidence~~, 0-6 yrs of follow-up for mortality~~	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • No major strengths Weaknesses • No consideration of latency • Exposure not documented before outcome

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Silver *et al.* (2014)	Microelectronics facility workers and business machine facility employees	T	P			Strengths • Appropriate study and comparison groups Weaknesses • Number of subjects excluded and lost to follow-up unknown • Relatively young cohort (x̄ = at hire was mid-20s, average follow-up 25.7 yrs)	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) • Assessed time-varying nature of exposure Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at facility and department-exposure matrix) • Amount of missing/ incomplete/conflicting data regarding work dates, facility location, department, and position (particularly for early yrs) unknown ~~Did not assess time-varying nature of exposure~~	Strengths • Cases identified using reliable sources (*i.e.*, SSA, NDI, and IRS records, and death certificates) • 410 yrs of follow-up Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age and sex ~~• No missing data~~ Weaknesses • Did not control for or consider: race/ ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections • 16% missing race data	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 2 yr lag) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Bassig *et al.* (2015)	Women living in urban Shanghai, China			B		Strengths • Appropriate study and comparison groups • 92.7% of eligible women participated Weaknesses • Unknown loss to follow-up	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration x intensity) • Assessed time-varying nature Weaknesses • Indirect chemical exposure measurement (*i.e.*, lifetime occupational history from interviews/ questionnaires and JEMs) • Amount of missing data unknown • Did not assess time-varying nature of exposure	Strengths • Cases identified using reliable sources (*i.e.*, local cancer and vital statistics registries and medical charts from hospitals) • Assessed disease incidence • 13 yrs of follow-up Weaknesses • Assessed aggregated leukemia types	Strengths • Controlled for: age, sex, and smoking • Only 1 subject missing smoking data Weaknesses • Did not control for or consider: race/ ethnicity, other chemical exposures, family history, genetics, blood disorders, chemotherapy treatment, and certain viral infections • Did not include relevant covariates in a time-varying manner	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency (though all cases occurred 18+ yrs after first exposure)
Collins *et al.* (2015)	Benzene-exposed chemical workers			B		Strengths • Appropriate study and comparison groups • No loss to follow-up Weaknesses • Unknown number of exclusions	Strengths • Direct chemical exposure measurement (*i.e.*, occupational air measurements) • Semiquantitative exposure estimate (*i.e.*, considered duration × intensity) • No missing data Weaknesses • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, HR records, NDI, and state vital statistics bureaus) • Assessed leukemia types • 70 yrs follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections • Amount of missing data is unknown	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 15 and 30 yr lags) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Linet *et al.* (2015)	NCI-CAPM cohort			B		Strengths • Appropriate study and comparison groups • <2% loss to follow-up Weaknesses • No major weaknesses	Strengths • No missing data • Direct chemical exposure measurement (i.e., air monitoring data linked to occupational records and JEM used to model exposure data) Weaknesses • ~~Indirect chemical exposure measurement (i.e., factory records and job title)~~ • Qualitative exposure estimate (*i.e.*, ever exposed) • Did not assess time-varying nature of exposure	Strengths • Cases identified and validated using reliable sources (*i.e.*, facility and medical records, death certificates, and expert validation) • Assessed disease incidence • Assessed leukemia types • 28 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 2 yr lag) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Stenehjem *et al.* (2015)	Male offshore oil workers in Norway			B		Strengths • Appropriate study and comparison groups • ≤1% loss to follow-up Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration, intensity, and peak exposure) • ≤5% missing data • Assessed time-varying nature of exposure Weaknesses • Indirect chemical exposure measurement (*i.e.*, JEM)	Strengths • Cases identified using reliable source (*i.e.*, registry) • Assessed disease incidence • Assessed leukemia types • 12 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age, sex, and smoking • ≤5% missing data Weaknesses • Did not control for or consider: race/ethnicity, family history, genetics, blood disorders, other potential chemical/occupational exposures, chemotherapy treatment and certain viral infections	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, analyses based on 5.5+ yrs of exposure) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Callahan *et al.* (2019)	Dry-cleaning workers		P			Strengths • Appropriate study and comparison groups Weaknesses • Unknown loss to follow-up and exclusions	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) Weaknesses • Indirect chemical exposure measurement (*i.e.*, job titles from union records, and expert opinion) • ~9% missing data that are not addressed • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, death certificates, NDI, and SSA DMF) • 67 yrs of follow-up Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections • Amount of missing data unknown	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 10 and 20 yr lags) Weaknesses • No major weaknesses
Fedeli *et al.* (2019)	Vinyl chloride production and polymerization facility workers				V	Strengths • Appropriate study and comparison groups • <1% lost to follow-up Weaknesses • Unknown number of exclusions	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, JEM and work histories) • Qualitative exposure estimate (*i.e.*, ever employed in a vinyl chloride production and polymerization facility) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using a reliable source (*i.e.*, regional mortality register) • 45 yrs of follow-up Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age, sex • No missing data Weaknesses • Did not consider or control for: ~~sex,~~ other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Case-Control Studies										
Bernard *et al.* (1984)	Male patients from the Yorkshire Health Region, UK			B		Strengths • Appropriate case selection Weaknesses • Unknown participation/ enrollment rates in controls or cases • Inappropriate control selection (*i.e.*, hospital-based)	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported exposure from questionnaire and interview) • Qualitative exposure estimate (*i.e.*, ever occupational benzene exposure) • Amount of missing data unknown • Potential for recall bias (*i.e.*, self-reported occupational history reported after diagnosis)	Strengths • Cases identified confirmed using reliable sources (*i.e.*, registry, hospital records and histologically confirmed) • Assessed leukemia types • Assessed disease incidence Weaknesses • Assessed aggregated leukemia types	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ ethnicity, other chemical exposures, family history, genetics, and certain viral infections ~~Amount of missing data unknown~~	Strengths • Exposure considered prior to diagnosis Weaknesses • No consideration of latency
Wilcosky *et al.* (1984)	White male rubber workers in OH	T	P	B		Strengths • Appropriate case and control selection • 100% participation rates in cases and controls (nested case-control study) • Nondifferential (≤15%) participation rates Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history records linked to solvent usage) • Qualitative exposure estimate (*i.e.*, ever worked in process area with chemical exposure)	Strengths • Deaths confirmed using a reliable source (*i.e.*, company records) Weaknesses • Assessed mortality only • Assessed aggregated leukemia types	Strengths • Controlled for: age, sex, and race • No missing data Weaknesses • Did not control for or consider: other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure considered prior to diagnosis Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Aschengrau *et al.* (1993)	Residents of five Upper Cape towns, MA		P			Strengths • Appropriate case and control selection • Characteristics of participants and non-participants were similar • Nondifferential (≤15%) participation rates Weaknesses • ~24% of eligible controls did not participate; 20.5% of cases did not participate	Strengths • ~~Direct chemical exposure measurement (i.e., modeled contaminated drinking water wells)~~ • Semiquantitative exposure estimate (*i.e.*, considered intensity) Weaknesses • No direct chemical exposure measurement in individuals (*e.g.*, no water consumption information) • Amount of missing data unknown	Strengths • Cases identified and validated using a reliable source (*i.e.*, MA Cancer Registry; confirmed by medical professional) • Assessed disease incidence Weaknesses • Assessed aggregated leukemia subtypes	Strengths • Controlled for: age, sex, other chemical exposures, smoking, and medical treatment with irradiation Weaknesses • Did not control for or consider: race/ethnicity (>96% white), family history, genetics, blood disorders, chemotherapy treatment, and certain viral infections • Amount of missing data unknown	Strengths • Exposure considered prior to diagnosis • Appropriate consideration of latency (*i.e.*, 5 yr lag) Weaknesses • No major weaknesses
Ciccone *et al.* (1993)	MDS cases in Torino, Italy			B		Strengths • Appropriate case selection • 91% participation among cases, and 99 and 82% participation rates for hospital and population-based controls, respectively • Nondifferential (≤15%) participation rates Weaknesses • Inappropriate control selection (*i.e.*, hospital-based)	Strengths • Semiquantitative exposure estimate (*i.e.*, considered exposure likelihood) Weaknesses • Indirect chemical exposure measurement (*i.e.*, job history) • Amount of missing data unknown • Potential for recall bias (*i.e.*, self-reported occupational history reported after diagnosis)	Strengths • Cases identified using reliable source (*i.e.*, hospital records) • Assessed disease incidence • Assessed leukemia types Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age, sex, genetics, and smoking Weaknesses • Did not control for or consider: race/ethnicity, other chemical exposures, family history, blood disorders, and chemotherapy treatment • Amount of missing data unknown	Strengths • Exposure considered prior to diagnosis. Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Linet *et al.* (2020)	NCI-CAPM cohort			B		Strengths • Appropriate case and control selection • 100% participation rates in cases and controls (case-cohort) • Nondifferential (≤15%) participation rates Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration x intensity) • No missing data • Direct chemical exposure measurement (i.e., air monitoring data linked to occupational records and JEM used to model exposure data) Weaknesses • ~~Indirect exposure measurement (i.e., modeled exposure data from monitoring data and occupation records)~~ No major weaknesses	Strengths • Cases were identified using reliable sources (*i.e.*, medical records, pathology reports, and death reports) • Assessed leukemia types • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, other chemical exposures, family history, genetics, smoking, blood disorders, chemotherapy treatment, and certain viral infections	Strengths • Exposure considered prior to diagnosis • Appropriate consideration of latency (*i.e.*, considered lags of 2, 2-10, and ≥10 yrs) Weaknesses • No major weaknesses
Yarosh *et al.* (2021)	MDS patients in MN			B		Strengths • Appropriate case and control selection • Nondifferential (≤15%) participation rates Weaknesses • 64% participation rate among cases and 49% participation rate among controls	Strengths • ≤4% of cases missing exposure data Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported exposure) • Qualitative exposure estimate (*i.e.*, ever exposure) • Potential for recall bias (*i.e.*, self-reported exposure history reported after diagnosis)	Strengths • Cases identified using a reliable source (*i.e.*, MN Cancer Reporting System) • Assessed leukemia types • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age, sex, other chemical exposures, family history, smoking, and chemotherapy treatment • <4% missing data Weaknesses • Did not control for or consider: race/ethnicity, genetics, and blood disorders	Strengths • Exposure considered prior to diagnosis • Appropriate consideration of latency (*i.e.*, 2 yr lag) Weaknesses • No major weaknesses

EXHIBIT 9

Non-Hodgkin's Lymphoma Report Attachment Revisions

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Dagg *et al.* (1992)	Employees at US oil refineries			B		Strengths • Appropriate study and comparison groups • ~~4.8≤~~<20~~%~~% loss to follow-up • <1% excluded from individual refinery analyses (*i.e.*, worked at both refineries under study) Weaknesses • ~~All women excluded (4.8% of total) due too few cases~~No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company records, NDI, SSA, CA death index, and Equifax) • 37 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age, sex, and race • ~~No missing data~~ Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures • Amount of missing data unknown	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*e.g.*, analyses based on 10-19, 20-29, and ≥30 yrs since hired) Weaknesses • No major weaknesses
Schnatter *et al.* (1993)	Male petroleum marketing/ distribution workers			B		Strengths • Appropriate study and comparison groups Weaknesses • Unknown loss to follow-up	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure • Unknown amount of missing data	Strengths • Deaths identified using reliable sources (*i.e.*, company records, Statistics Canada, and NDI) • 20 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age and sex. • ≤5% missing data Weaknesses • Did not consider or control for: race/ ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of disease latency (*i.e.*, 10- and 20-yr lags) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Anttila *et al.* (1995)	Occupationally exposed workers	T	P			Strengths • Appropriate study and comparison groups • About 7% of samples not matched; no loss to follow-up Weaknesses • No major weaknesses	Strengths • Direct chemical exposure measurement (*i.e.*, U-TCA for TCE and B-Per for PCE) • No missing data • Quantitative exposure assessment (*i.e.*, mean U-TCA for TCE) Weaknesses • Qualitative exposure estimate (*i.e.*, all PCE-exposed workers for PCE) • Did not assess time-varying nature of exposure	Strengths • Cases identified using reliable sources (*i.e.*, Population Register Center, Finnish Cancer Registry, and Central Statistical Office of Finland) • Assessed disease incidence • 26 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not consider or control for: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 10- and 20-yr lags) Weaknesses • No major weaknesses
Honda *et al.* (1995)	Employees of a US petroleum manufacturing plant			B		Strengths • Appropriate study and comparison groups • 3% loss to follow-up • No exclusions Weaknesses • ~~Unknown number of exclusions~~No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at plant) • Qualitative exposure estimate (*i.e.*, ever employed at plant) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company records, SSA DMF, NDI, state DMV records, and death certificates) • 50 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race • No missing data Weaknesses • Did not consider or control for: family history of NHL or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Collingwood *et al.* (1996)	Workers at a US oil refinery			B		Strengths • Appropriate study and comparison groups • 2% loss to follow-up ~~• No exclusions~~ Weaknesses • No major weaknesses • Unknown number of exclusions	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company's personnel database, PBI, NDI, SSA and death certificates • 41 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age, sex, and race • About 3.5% missing race data; classified as White Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, analyses of 20-29 and 30+ yrs since first employment) Weaknesses • No major weaknesses
Fu *et al.* (1996)	Shoe manufacturing workers			B		Strengths • Appropriate study and comparison groups • ≤20% loss to follow-up/excluded Weaknesses • No major weaknesses	Strengths • No missing data • Semiquantitative exposure assessment (*i.e.*, considered intensity of exposure) Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history and job titles) • Did not assess time-varying nature of exposure	Strengths • 53 and 41 yrs of follow-up for English and Italian populations, respectively Weaknesses • Assessed mortality only • Unclear how deaths were identified (other than "mortality records" for English cohort)	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not consider or control for: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Lynge *et al.* (1997)	Service station workers in Denmark, Finland, Norway, and Sweden			B		Strengths • Appropriate study and comparison groups • No loss to follow-up Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job at time of census) • Qualitative exposure estimate (*i.e.*, employment at service station) • Did not assess time-varying nature of exposure	Strengths • Cases identified using a reliable source (*i.e.*, national cancer registries) • Assessed disease incidence • ≥5 yrs follow-up (Denmark: 18 yrs, Finland: 16 yrs, Norway: 21 yrs, Sweden: 20 yrs) Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency
Morgan *et al.* (1998)	Aircraft manufacturing workers	T				Strengths • Appropriate study and comparison groups • <0.01% excluded Weaknesses • Unknown loss to follow-up	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration x intensity and peaks) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job classification and JEM) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, SSA, NDI, and death certificates • 44 yrs of follow-up • <5% missing death certificates Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age and sex~~, and race~~ Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures • Considered race but data were "sparse" and not used	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Pukkala (1998)	Oil and chemical company workers			B		Strengths • Appropriate study and comparison groups • No loss to follow up or exclusions Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data • Assessed time-varying nature of exposure Weaknesses • Indirect chemical exposure measurement (*i.e.*, based on job categories)	Strengths • Cases identified using a reliable source (*i.e.*, Finnish Cancer Registry) • Assessed disease incidence • 24 yrs follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex Weaknesses • Did not control for or consider: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome Weaknesses • Insufficient consideration of latency (*i.e.*, first 3 mos of employment excluded)
Consonni *et al.* (1999)	Italian oil refinery workers			B		Strengths • Appropriate study and comparison groups • ~4.3% loss to follow-up Weaknesses • No major weaknesses	Strengths • No major strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job histories) • Qualitative exposure measure (*i.e.*, employment at an oil refinery) • Did not assess time-varying nature of exposure ~~Unknown amount of missing data~~	Strengths • Deaths identified using reliable sources (*i.e.*, Population Statistics Offices and death certificates) • 43 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures ~~Unknown amount of missing data~~	Strengths • Exposure documented before outcome ~~• Appropriate consideration of latency (i.e., 30 yr lag)~~ Weaknesses • No ~~major weaknesses~~consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Wong *et al.* (2001a)	Employees at a US oil refinery			B		Strengths • Appropriate study and comparison groups • 1.1% loss to follow-up Weaknesses • Unknown number of exclusions	Strengths • Semiquantitative exposure measurement (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, SSA and NDI) • 39 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age, sex, and race/ethnicity • ≤5% missing race, Hispanics and unknown race were considered white Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, analyses based on 20-39 and 40+ yrs since first exposure; 10-29 and 30+ yrs of employment) Weaknesses • No major weaknesses
Wong *et al.* (2001b)	Employees at a US oil refinery			B		Strengths • Appropriate study and comparison groups • 1.7% loss to follow-up Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure measurement (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, work history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, SSA and NDI) • 51 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age, sex, and race/ethnicity • No missing data Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome • ~~Insufficient~~ Sufficient consideration of latency (*i.e.*, workers had to have worked ≥1 yr) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Rinsky *et al.* (2002)	Pliofilm workers			B		Strengths • Appropriate study and comparison groups • No loss to follow-up or exclusions Weaknesses • No major weaknesses	Strengths • Direct chemical exposure measurement (*i.e.*, air monitoring data linked to occupational records used to model exposure data and occupation records) • ~~Assessed the time-varying nature of exposure (i.e., incorporated measurements overtime)~~ • No missing data Weaknesses • Qualitative exposure estimate (*i.e.*, employment in a rubber hydrochloride department) • Did not assess the time-varying nature of exposure (*i.e.*, incorporated measurements over time)	Strengths • Deaths identified and validated using reliable sources (*i.e.*, SSA, DMV, death certificates, and NDI) • 47 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures • Amount of missing race data unknown	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Raaschou-Nielsen *et al.* (2003)	Blue-collar workers at TCE-using companies	T				Strengths • Appropriate study and comparison groups Weaknesses • Excluded large companies that reported TCE use (200+ employees; ~24% of TCE-using companies)	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment history and job title/ blue-collar status at companies) • ~37% of workers with unknown blue- or white-collar status (this group was assessed in sensitivity analyses) • Did not assess time-varying nature of exposure	Strengths • Cases identified using reliable source (*i.e.*, Danish Cancer Registry) • Assessed disease incidence 30 yrs follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not consider or control for: race/ ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Appropriate consideration of latency (*i.e.*, lag of ≥20 yrs) • Exposure documented before outcome Weaknesses • ~~Exposure period overlaps period of follow-up; unclear how this was handled in analysis~~No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Bloemen *et al.* (2004)	US chemical workers exposed to benzene			B		Strengths • Appropriate study and comparison groups Weaknesses • Unknown loss to follow-up • Unknown number of exclusions	Strengths • Direct chemical exposure measurement (i.e., industrial hygiene air measurements • Semiquantitative exposure estimate (i.e., considered duration and intensity) • No missing data Weaknesses ~~• Indirect exposure measurement in individuals (i.e., employment in benzene-exposed job ≥1 mo based on work history and IH expert opinion)~~ ~~• Qualitative exposure estimate (i.e., ever employed)~~ • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company research database *via* HR records, NDI, state vital statistics bureaus, and other sources) • 57 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race • No missing data Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures	Strengths • Exposure measured before outcome • Appropriate consideration of latency (i.e., 15 yr lag) ~~• No major strengths~~ Weaknesses • No consideration of latency ~~Unclear if exposure measured before outcome~~
Huebner *et al.* (2004)	Employees at two US oil refineries and petrochemical facilities			B		Strengths • Appropriate study and comparison groups • ≤2% loss to follow-up Weaknesses • Unknown number of exclusions	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • ≤1% missing data Weaknesses • Indirect chemical exposure measurement	Strengths • Deaths identified using reliable sources (*i.e.*, benefits records, NDI, and SSA) • 28 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age, sex, and race/ethnicity • No missing data Weaknesses • Did not control for or consider: family history of NHL or other potential	Strengths • Exposure documented before outcome • Appropriate consideration of latency (i.e., analyses considering only employees hired before 1950 or with 15+ yrs of employment)

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
							(*i.e.*, company records and work histories) • Did not assess time-varying nature of exposure		chemical/occupational exposures	Weaknesses • No ~~consideration of latency~~major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Tsai *et al.* (2007)	Male US petroleum refinery and chemical workers			B		Strengths • Appropriate study and comparison groups • 0.87% loss to follow-up Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, job history) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, company records, NDI, SSA) • 56 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age, sex, and race/ethnicity Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures • Amount of missing data unknown	Strengths • Exposure measured or documented before outcome • Appropriate consideration of latency (i.e., analyses by ≥10yrs of employment) Weaknesses • No major weaknesses~~Insufficient consideration of latency~~
Kirkeleit *et al.* (2008)	Norwegian upstream petroleum industry workers			B		Strengths • Appropriate study and comparison groups • ~~Assumed no loss to follow-up as exclusions (based on mandatory reporting to the Norwegian Registry of Employers and Employees)~~ Weaknesses • ~~No major weaknesses~~Unknown loss to follow up	Strengths • Assumed no missing data (based on mandatory reporting to the Norwegian Registry of Employers and Employees) Weaknesses • Indirect chemical exposure measurement (*i.e.*, based on work history) • Qualitative exposure estimate (*i.e.*, job category) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable source (*i.e.*, Cancer Registry of Norway) • Assessed disease incidence • 23 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Radican *et al.* (2008)	Aircraft maintenance employees	T	P			Strengths • Appropriate study and comparison groups Weaknesses • Unknown number of subjects lost to follow-up or excluded	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration, frequency, and intensity) Weaknesses • Indirect chemical exposure measurement (*i.e.*, facility files, walk-through surveys and interviews of long-term employees) • Amount of missing data unknown • Did not assess time-varying nature of exposure	Strengths • Deaths identified and validated using reliable sources (*i.e.*, NDI and NDI Plus) • 22 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race Weaknesses • Did not consider or control for: family history of NHL, or other potential chemical/occupational exposures • About 11% had unknown race (assumed white)	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency
Pukkala *et al.* (2009)	General population in Denmark, Finland, Iceland, Norway and Sweden	T	P			Strengths • Appropriate study and comparison groups • No ~~loss to follow-up or~~ exclusions • Very large dataset (~14.9 million subjects) Weaknesses • Unknown loss to follow-up~~No major weaknesses~~	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported occupation in censuses) • Qualitative exposure (*i.e.*, job title) • Amount of missing data unknown • Did not assess time-varying nature of exposure	Strengths • Cases identified from reliable sources (*i.e.*, Central Population Register and national cancer registries) • Assessed disease incidence • ≥5 yrs of follow-up: Denmark: 33 yrs, Finland: 35 yrs, Iceland: 23 yrs, Norway: 43 yrs, Sweden: 45 yrs Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Bahr *et al.* (2011)	Paducah Gaseous Diffusion Plant workers (KY, US)	T				Strengths • Appropriate study and comparison groups • <19% excluded Weaknesses • No major weaknesses	Strengths • No missing data • ~~Semiquantitative exposure assessment (i.e., level of likelihood of exposure)~~ Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at facility and JEM) • Qualitative exposure estimate (i.e., probability of exposure) • Did not assess time-varying nature of exposure	Strengths • Cases identified using a reliable source (*i.e.*, KY Cancer Registry and death certificates) • 5~~1~~2 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race Weaknesses • Did not consider or control for: family history of NHL or other potential chemical/occupational exposures • Amount of missing data unknown	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency
Calvert *et al.* (2011)	Dry-cleaning workers		P			Strengths • Appropriate study and comparison groups • 3% of males and 6% of females lost to follow-up Weaknesses • No major weaknesses	Strengths • No ~~missing data~~major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, dry-cleaning union records and shop solvent use histories) • Qualitative exposure estimate (*i.e.*, ever worked in a dry-cleaning establishment)	Strengths • Deaths identified or validated using reliable sources (*i.e.*, pre-1979: cases identified using SSA, unions records, DMV records, IRS, and postal service records, with copies of death certificates obtained; 1979 and after: deaths identified from NDI) • 65 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for or considered: age, sex, and race/ethnicity • No missing data Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
							• Did not assess time-varying nature of exposure • Solvent history not available for approximately half of shops studied			

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Lipworth *et al.* (2011)	Aircraft manufacturing workers	T	P			Strengths • Appropriate sample and comparison groups • <2% loss to follow-up (contributed person-yrs until date last known alive) Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • <2% excluded for incomplete work information Weaknesses • Indirect chemical exposure measurement (*i.e.*, job codes/titles, facility files, walk-through visits and interviews with employees) • Did not consider time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, CA Death Statistical Master File, NDI, SSA DMF, death certificates, pension and other records, and SSA Service to Epidemiologic Researchers and LexisNexis records) • 49 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of latency (1-yr lag) Weaknesses • No ~~consideration of latency~~major weaknesses
Seldén and Ahlborg (2011)	Dry-cleaning workers in Sweden		P			Strengths • Appropriate study and comparison groups • ~2.6% of subjects excluded for missing data or "other" reasons Weaknesses • Unknown loss to follow-up; excluded 62.1% of "washing establishments" due to non-response	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • ~2% of workers with unclassifiable PCE exposure Weaknesses • Indirect chemical exposure measurement (*i.e.*, employer reported job history from questionnaire) • Did not assess time-varying nature of exposure	Strengths • Cases identified using a reliable source (*i.e.*, national cancer registry) • Assessed disease incidence • 2~~0~~ yrs follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure measured or documented before outcome • Appropriate consideration of latency (*i.e.*, built in; 1-12 yrs) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Silver *et al.* (2014)	Microelectronics facility workers and business machine facility employees	T	P			Strengths • Appropriate study and comparison groups Weaknesses • Number of subjects excluded and lost to follow-up unknown	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) • ~~Assessed time-varying nature of exposure~~ • Weaknesses • Indirect chemical exposure measurement (*i.e.*, employment at facility and department exposure matrix) • Amount of missing, incomplete, and conflicting data regarding work dates, facility location, department, and position (particularly for early yrs) unknown ~~Did not assess time-varying nature of exposure~~	Strengths • Cases identified using reliable sources (*i.e.*, SSA, NDI, IRS, and death certificates) • 410 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age and sex • ~~No missing data~~ Weaknesses • Did not control for or consider: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures • 16% missing race data	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 10-yr lag) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Linet *et al.* (2015)	NCI-CAPM cohort			B		Strengths • Appropriate study and comparison groups • <2% loss to follow-up Weaknesses • No major weaknesses	Strengths • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, factory records and job title) • Qualitative exposure estimate (*i.e.*, ever exposed) • Did not assess time-varying nature of exposure	Strengths • Cases identified and validated using reliable sources (*i.e.*, facility and medical records, death certificates, and expert validation) • Assessed disease incidence • 28 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 2-yr lag) Weaknesses • No major weaknesses
Stenehjem *et al.* (2015)	Offshore oil workers			B		Strengths • Appropriate study and comparison groups • ≤1% loss to follow-up Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration, frequency, and intensity) • ≤5% missing data • Assessed time-varying nature of exposure Weaknesses • Indirect chemical exposure measurement (*i.e.*, work histories, self-reported surveys, and JEM)	Strengths • Cases identified using reliable sources (*i.e.*, Cancer Registry of Norway and the Norwegian National Population Register) • Assessed disease incidence • 12 yrs of follow-up Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age and sex • ≤5% missing data Weaknesses • Did not control for or consider: race/ethnicity and family history of NHL, or other potential chemical/occupational exposures	Strengths • Appropriate consideration of latency (*i.e.*, analyses based on exposure durations ≥5.5 yrs) • Exposure documented before outcome Weaknesses • ~~Exposure not documented before outcome~~No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Mundt *et al.* (2017)	VC or PVC resin manufacturing workers				V	Strengths • Appropriate study and comparison groups • <3% loss to follow-up; <2% excluded Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) • No missing data Weaknesses • Indirect chemical exposure assessment (*i.e.*, job history linked to JEM) • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, SSA, NDI, and death certificates) • 72 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age and sex • No missing data Weaknesses • Did not control for or consider: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure documented before outcome • Appropriate consideration of latency (employment of duration >5 years) Weaknesses • No ~~consideration of latency~~major weaknesses
Callahan *et al.* (2019)	Dry-cleaning workers		P			Strengths • Appropriate study and comparison groups Weaknesses • Unknown loss to follow-up and exclusions	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) Weaknesses • Indirect chemical exposure measurement (*i.e.*, job titles from union records, and expert opinion) • ~9% missing data that are not addressed • Did not assess time-varying nature of exposure	Strengths • Deaths identified using reliable sources (*i.e.*, death certificates, NDI, and SSA DMF) • 67 yrs follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, and race Weaknesses • Did not consider or control for: family history of NHL or other potential chemical/occupational exposures • Amount of missing data unknown	Strengths • Exposure documented before outcome • Appropriate consideration of latency (*i.e.*, 10- and 20-yr lags) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Bove *et al.* (2024b)	Marines & Navy personnel and civilian workers at CL and CP					Strengths • Appropriate study and comparison groups • <1% loss to follow-up • No exclusions Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, assignment or employment at base) • Did not assess time-varying nature of exposure	Strengths • Cases identified and validated using reliable sources (*i.e.*, SSA Data for Epidemiological Researchers and NDI) • 40 yrs of follow-up Weaknesses • Assessed mortality only	Strengths • Controlled for: age, sex, race, and (for civilians) occupation (blue *vs.* white collar as a proxy for other potential occupational exposures) Weaknesses • Did not control for or consider: family history of NHL or (for Marines/Navy personnel) other potential occupational exposures • 5.2% of CP Marines & Navy personnel and 14.7% of CP civilians had other/unknown race	Strengths • Exposure documented before outcome Weaknesses • No consideration of latency (though, 75% of the deaths occurred >10 yrs after the water contamination ended)
Case-Control Studies										
Bernard *et al.* (1984)	Male patients from the Yorkshire Health Region (UK)			B		Strengths • Appropriate case selection Weaknesses • Unknown participation/ enrollment rates in controls or cases • Inappropriate control selection (*i.e.*, hospital based)	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported exposure from interview and questionnaire) • Qualitative exposure estimate (*i.e.*, ever had occupational benzene exposure) • Amount of missing data unknown	Strengths • Cases identified and confirmed using reliable sources (*i.e.*, registry, hospital records, and histologically confirmed) • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age, sex • No missing data Weaknesses • Did not control for or consider: ~~age,~~ race/ethnicity, family history of NHL, or other potential chemical/occupational exposures ~~Amount of missing data unknown~~	Strengths • Exposure considered prior to diagnosis Weaknesses • Insufficient consideration of latency (*i.e.*, <0.5 yrs)

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Gérin *et al.* (1998)	Canadian males			B		Strengths • Appropriate case selection • 82% participation rate among cases • Non-differential participation rates between cases and controls Weaknesses • Inappropriate control selection (*i.e.*, noncompulsory electoral lists~~pooled population based and cancer controls~~) • 71% participation rate among controls • ~~Unclear how included cases and controls might differ from those excluded~~	Strengths • Semiquantitative exposure measurement (*i.e.*, considered duration, frequency, and intensity) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported occupational history and expert opinion) • Potential for recall bias (*i.e.*, self-reported occupational history after diagnosis)	Strengths • Cases identified using a reliable source (*i.e.*, hospital records) • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age, sex, and ethnicity Weaknesses • Did not consider or control: family history of NHL or other potential chemical/ occupational exposures • Amount of missing data unknown	Strengths • Exposure considered prior to diagnosis Weaknesses • No consideration of latency
Nilsson *et al.* (1998)	Seamen from Sweden			B		Strengths • Appropriate case and control selection • 100% participation rates among cases and controls Weaknesses • No major weaknesses	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, occupational categories) • Qualitative exposure estimate (*i.e.*, job title) • Amount of missing data unknown	Strengths • Cases identified using a reliable source (*i.e.*, registry) • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age and sex Weaknesses • Did not control for or consider: race/ ethnicity, family history of NHL, or other potential chemical/occupational exposures • Amount of missing data unknown	Strengths • Exposure considered prior to diagnosis Weaknesses • Insufficient consideration of latency (*i.e.*, >1 mo)

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Mao *et al.* (2000)	Residents of eight provinces in Canada			B	V	Strengths • Appropriate case and control selection Weaknesses • Low participation rates among cases (75%) and controls (67%)	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported exposure) • Qualitative exposure estimate (*i.e.*, ever occupational exposure) • Amount of missing data unknown • Potential for recall bias (*i.e.*, self-reported occupational exposure after diagnosis)	Strengths • Cases identified using a reliable source (*i.e.*, National Enhanced Cancer Surveillance System) • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for: age and sex • ≤1% missing age data Weaknesses • Did not control for or consider: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures	Strengths • Exposure considered prior to diagnosis Weaknesses • No consideration of latency
Blair *et al.* (2001)	Residents of IA and MN (US)			B		Strengths • Appropriate case and control selection • 86% participation rate in cases Weaknesses • Low participation rate in controls	Strengths • Semiquantitative exposure estimate (*i.e.*, considered intensity) Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported occupational history and JEM) • Potential for recall bias (*i.e.*, self-reported occupational history after diagnosis)	Strengths • Cases identified using reliable sources (*i.e.*, Cancer Registry of IA and a surveillance network of hospitals in MN; all cases confirmed by pathologist) Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age, family history, sex, race Weaknesses • Did not control for or consider: ~~sex, race/ethnicity, or~~ other potential chemical/occupational exposures • Unknown missing data	Strengths • Exposure considered prior to diagnosis Weaknesses • No consideration of latency

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Guenel *et al.* (2002)	Gas and electric utility workers in France			B		Strengths • Appropriate case and control selection • 100 and 99% participation rate among cases and controls, respectively Weaknesses • No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration, and intensity) • Occupational history extracted from work records • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, occupational records and JEM)	Strengths • Cases identified using reliable source (*i.e.*, company cancer register) • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for: age, sex, and other chemical exposures • No missing data Weaknesses • Did not control for or consider: race/ ethnicity or family history of NHL	Strengths • Exposure considered prior to diagnosis • Appropriate consideration of latency (*i.e.*, 2-, 5-, and 10-yr lags) Weaknesses • No major weaknesses
Glass *et al.* (2003)	Australian males from the Health Watch cohort study			B		Strengths • Appropriate case and control selection • High participation rates in cases Weaknesses • ~~Unknown participation rates in controls~~No major weaknesses	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration and intensity) • ≤5% missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, task-based algorithm) • Potential for recall bias (*i.e.*, self-reported data on jobs and tasks)	Strengths • Cases confirmed using reliable sources (*i.e.*, registry, pathology reports, hospital records, or death certificates) • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age and sex • ≤5% missing data Weaknesses • Did not control for or consider: race/ ethnicity, family history of NHL, other potential chemical/ occupational exposures	Strengths • Exposure considered prior to diagnosis • Appropriate consideration of latency (*i.e.*, analyses based on ≥11 yrs of employment) Weaknesses • No ~~consideration of latency~~major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Lynge *et al.* (2006)	Laundry and dry-cleaning workers in Denmark, Finland, Norway, and Sweden		P			Strengths • Appropriate case and control selection Weaknesses • Low participation rates for interviews (Norway = 57% of eligible cases and 64% of eligible controls, and Sweden = 63% of eligible cases and 60% of eligible controls) • Missing pension scheme data (Denmark = 9% and Finland = 25%)	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration) Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported census data, interviews [Finland, Norway and Sweden, some with next-of-kin], pension data [Denmark and Finland], and industry and telephone books [Denmark]) • Unclassifiable exposure records (Finland = 41%, and Sweden = 35%)	Strengths • Cases identified using reliable sources (*i.e.*, national population, death and cancer registries) • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for or considered: age and sex Weaknesses • Did not control for or consider: race/ethnicity, family history of NHL, or other potential chemical/occupational exposures • Amount of missing data is unknown	Strengths • Exposure considered prior to diagnosis • Appropriate consideration of latency (employment of duration >5 years) Weaknesses • ~~No consideration of latency~~No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Christensen *et al.* (2013)	Male Canadian citizens living in Montreal	T	P			Strengths • Appropriate case selection • 82% participation rate among cases Weaknesses • Inappropriate control selection (*i.e.*, based on electoral rolls) • 72% participation rate among controls	Strengths • Semiquantitative exposure estimate (*i.e.*, considered duration, frequency, and intensity) • No missing data Weaknesses • Indirect chemical exposure measurement (*i.e.*, self-reported occupational history from interviews/ questionnaires, and expert opinion) • ~~Amount of missing data unknown~~ • Potential for recall bias (*i.e.*, self-reported occupational history after diagnosis)	Strengths • Cases identified and validated using a reliable source (*i.e.*, hospital records) • Assessed disease incidence Weaknesses • No major weaknesses	Strengths • Controlled for: age, sex, and ethnicity • No missing data Weaknesses • Did not control for or consider: family history of NHL or other potential chemical/occupational exposures	Strengths • Exposure considered prior to diagnosis • Appropriate consideration of latency (*i.e.*, 5-yr lag) Weaknesses • No major weaknesses

EXHIBIT 11

Parkinson's Disease Report Attachment Revisions

Table C.1 PD Epidemiology Study Quality Assessment

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
Cohort Studies										
Bove *et al.* (2014a)	Civilian employees at CL and CP	T	P	B	V	Strengths • Appropriate comparison groups • ≤ 2% loss to follow-up Weaknesses • Most of the cohort was < 65 yrs old by end of follow-up (> 70% CL, > 60% CP)	Strengths • No missing data • Direct chemical exposure measurement (measured in groundwater) • Internal analyses considered duration of employment and average exposure Weaknesses • Indirect chemical exposure measurement – based on employment at CL (external analyses) ~~– modeling of groundwater contamination (internal analyses)~~ • External analyses did not consider duration of employment and average exposure	Strengths • Deaths identified from SSA, a commercial tracing service, and NDI; cause of death determined from NDI Plus • No missing data Weaknesses • Assessed mortality only	Strengths • Controlled for: age, and sex in US comparison and sex and occupation in CP and internal comparisons • Considered smoking using negative control diseases • Considered but did not control for: age in CP and internal comparisons because adjusted *vs.* unadjusted results differed by < 10% • Collected occupation data quarterly during employment Weaknesses • Did not consider or control for: genetic factors or family history of PD or, alcohol intake, ~~smoking~~ in any analyses, or other potential occupational exposures in US comparison • ~~Unclear whether occupation was analyzed in a time-varying manner, other~~ Covariates only	Strengths • Employment histories collected separately from outcome data • Appropriate consideration of latency Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
									considered at a single time point • Amount of missing data is unknown	
Silver *et al.* (2014)	Microelectronics and business machine facility employees	T	P			Strengths • Appropriate comparison groups Weaknesses • Relatively young cohort (mean age at hire was mid-20s, average follow-up was 25.7 yrs)	Strengths • No major strengths Weaknesses • Indirect chemical exposure measurement – based on ever employment at facility • Missing/incomplete/ conflicting data regarding work dates, facility location, department, and position (particularly for early yrs) • Sparse data during periods of highest chemical use (before 1974)	Strengths • Cases identified from SSA, NDI, and IRS; cause of death determined from NDI and death certificates • No missing data Weaknesses • Assessed mortality only	Strengths • Controlled for: age, race, and sex Weaknesses • Did not consider or control for: genetic factors/family history of PD, heavy alcohol intake, or smoking • Only considered covariates at a single time point • 16% missing race data ~~Amount of missing data is unknown~~	Strengths • Occupational histories collected separately from outcome data • Appropriate consideration of latency (10-yr lag) Weaknesses • No major weaknesses

Study	Population	Chemical				Study Quality Factors				
		T	P	B	V	Study Population	Exposure Assessment	Outcome Assessment	Covariates Considered	Temporality
ATSDR (2018b)	Marines & Navy personnel and civilian employees at CL and CP	T	P	B	V	Strengths • Appropriate comparison groups Weaknesses • < 25% of CL sample completed health survey • 10% of those who reported an outcome excluded for not completing HIPAA form	Strengths • Direct chemical exposure measurement (i.e., measured in groundwater) • Some analyses examined cumulative, average, maximum, and duration of exposure • No missing data Weaknesses • Indirect individual chemical exposure measurement – based on being stationed or employed at CL (external analyses), or modeling of groundwater contamination with no water consumption data (internal analyses) • Some external analyses did not examine cumulative, average, maximum, and duration of exposure	Strengths • Self-reported diagnoses confirmed with medical records or death certificates • Assessed PD incidence • ~~No missing data~~ Weaknesses • Initial case identification relied on self-report • Unknown amount of missing data	Strengths • Controlled for sex in some analyses • Considered but did not control for: age, smoking, alcohol, or other potential occupational exposures/ other chemical exposures (in any analysis), and sex (in some analyses) because adjusted *vs.* unadjusted results differed by < 10% Weaknesses • Information on most covariates was self-reported • Did not consider or control for: genetic factors or family history of PD • Only considered covariates at a single time point • Smoking, alcohol, and other occupational exposures missing for > 5% of participants	Strengths • Up to 410 yrs of follow-up • Exposure documented before outcome Weaknesses • Did not consider latency period ~~Exposure period overlaps period of follow-up for PD, unclear how this was handled in analysis~~

EXHIBIT

B

ERRATA – Expert Report of Lisa Bailey, PhD

The lower end range of the Margin of Exposure value on page 44 of the McElhiney report should be 50 instead of 48.

In addition, the POD and MoE columns in Table D.3 of the McElhiney report should be as follows:

Corrected last three columns in Table D.3

Analyte	POD	MoE[b]	Exposure Exceeds POD? (Y/N)
Benzene	5.8E+03	1.2E+04	N
trans-1,2-Dichloroethylene	1.1E+05	1.9E+03	N
Tetrachloroethylene	1.5E+04	2.0E+04	N
Trichloroethylene	6.4E+04	1.3E+03	N
Vinyl Chloride	1.5E+03	6.0E+02	N