BY FIRST CLASS CERTIFIED MAIL AND EMAIL

December 18, 2020

Andrew Wheeler, Administrator
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Dear Administrator Wheeler:

This is a petition to the Environmental Protection Agency (EPA) to reconsider under Clean Air Act (CAA), 42 U.S.C. § 7607(d)(7)(B), the final action EPA took at 85 Federal Register 66,550-66,552 (Oct. 20, 2020) titled Approval of the Request for Other Use of Phosphogypsum by the Fertilizer Institute (PG Approval). The parties submitting this petition are Center for Biological Diversity, Healthy Gulf, ManaSota-88, North America's Building Trade Unions, People for Protecting Peace River, Public Employees for Environmental Responsibility, RISE St. James, and Sierra Club and its Florida Chapter (collectively, the Petitioners).

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The Petitioners request you reconsider the PG Approval. As discussed in detail below, EPA's PG Approval is not an "approval" under 40 C.F.R. § 61.206 as it purports to be, but a revision of EPA's national Clean Air Act regulations for radionuclides. Because it was issued without notice or opportunity for comment, it violates the Administrative Procedure Act (APA), 5 U.S.C. § 553. Had EPA provided an opportunity for comment, as required by law, Petitioners (and likely others) would have pointed out that EPA's decision to allow PG to be used in roads violates 40 C.F.R. § 61.206, required notice and comment, was a time-barred petition to reconsider, is arbitrary and capricious because it failed to fully consider the risks or provide a rational explanation for reversing its previous conclusions that using PG in road construction presents an unreasonable risk to public health, violated the National Environmental Policy Act and/or failed to provide a functional equivalent of an environmental analysis, and was issued without the requisite consultation under the Endangered Species Act for impacts to listed species and their critical habitat.

To the extent that EPA's action is an "approval" under 40 C.F.R. § 61.206 as EPA claims, it is flatly unlawful. That provision allows approvals only for specific "facilit[ies]," and it states that any person seeking approval "must" provide, in writing, facility-specific information, including the location of "each facility" where the use of PG will take place, the quantity of PG to be used at "each facility," and a signed and dated request by the corporate officer or public official responsible for such "facility."[1] The request for approval that EPA purported to grant under 40 C.F.R. § 61.206 did not contain any of these expressly required elements. Indeed, the action EPA has taken could never satisfy the requirements of 40 C.F.R. § 61.206; because it is not actually an approval of a specific use of PG at a specific facility but rather a blanket approval of unidentified future uses of PG for a purpose EPA has already determined presents an unreasonable risk to public health. Neither the party requesting the approval nor EPA can possibly provide the facility-specific information that "must" be provided under 40 C.F.R. § 61.206(b).

Petitioners submit this petition to reconsider as a precaution and as a matter of courtesy. The Clean Air Act § 307(d)(7)(B) requirement that a party petition the EPA to reconsider a rule if it was impracticable to raise its objection during the public comment period or if the grounds arose after the public comment period (while still within the window for judicial review), only applies to actions specified at § 307(d)(1)(a)-(u).[2] EPA's approval here arises under § 112(e)[3] of the pre-1990 amendments to the Clean Air Act, a provision to which § 307(d) does not apply, and instead, the EPA was required to comply with the APA, 5 U.S.C. §§ 553-557, and did not.

Petitioners submit this petition to reconsider to allow EPA an opportunity to correct its violations voluntarily. Assuming *arguendo* that EPA's action arises under § 307(d), where the petition can demonstrate that an objection to the rulemaking is of "central relevance" and could not have

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[1] 40 C.F.R. § 61.206(b).
[2] 42 U.S.C. § 7607(d)(7)(B).
[3] *See* 54 FR 51654 *National Emission Standards for Hazardous Air Pollutants; Radionuclides* (Dec. 15, 1989) (requiring PG be kept in stacks pursuant to § 112(e) of pre-1990 amendments Clean Air Act); 57 FR 23305 *National Emission Standards for Hazardous Air Pollutants; National Emissions Standards for Radon Emissions from PG Stacks* (June 3, 1992) (in response to TFI's petition to reconsider EPA refers to its rulemaking authority re radon emissions from PG stacks as arising under section 112(e) of pre-1990 amendments Clean Air Act regarding "work practice standards.").

been brought during the public comment period either because the grounds for the objection arose after the public comment period or because commenting was otherwise "impracticable," the EPA must reconsider and conduct a new notice and comment rulemaking process.[4] Here, the EPA did not afford a public notice and comment process, and Petitioners have raised numerous objections of central relevance in this petition. Therefore, EPA must reconsider its PG Approval and conduct a rulemaking process on The Fertilizer Institute's (TFI) application for the use of PG in road construction. Petitioners request EPA stay the effectiveness of the PG Approval during the reconsideration pursuant to 42 U.S.C. § 7607 (d)(7)(B).

I. BACKGROUND

The purpose of Clean Air Act § 112(a) is to control air emissions from any hazardous air pollutant which "causes or contributes to air pollution which may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible or incapacitating illness."[5] In 1977, Congress amended the Clean Air Act after finding:

> It is clear that exposure to radioactive materials can cause serious harm to health, including cancer, genetic damage, and birth deformities. Materials that are radioactive may remain so for thousands of years. This longevity poses a special problem for living organisms. Furthermore, exposures to radioactivity are cumulative, that is, each new or additional exposure increases the risk of serious illness.[6]

In 1979, the EPA issued a determination that radionuclides should be regulated as a hazardous air pollutant under § 112 of the CAA because they are a known cause of cancer and genetic damage and present a risk warranting regulation under § 112.[7] Following a lawsuit to enforce § 7412(b)(1)(B) which required EPA to issue proposed regulations within 180 days,[8] in 1983, the EPA proposed standards regulating radionuclide emissions from elemental phosphorous plants,

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[4] *Portland Cement Ass'n v. EPA*, 665 F.3d 177 (D.C. Cir. 2011) (petitioner not jurisdictionally barred from petitioning EPA for reconsideration of a rule where it could not have reasonably anticipated that EPA would base final emission standards on specific data set).
[5] 42 U.S.C. § 7412.
[6] H.R. Rep. No. 95-294, 95th Cong., 1st Sess. 36-37, *reprinted in* (1977) U.S. Code Cong. & Ad. News 1077, 1114-15.
[7] 44 Fed. Reg. 76738, *National Emission Standards for Hazardous Air Pollutants; Addition of Radionuclides to List of Hazardous Air Pollutants*, (Dec. 27, 1979).
[8] *Sierra Club v. Gorsuch*, 551 F. Supp. 785 (N.D. Cal. 1982).

but explicitly not from other sources in the phosphate industry.[9] In 1984, the EPA withdrew the proposed emission standards for elemental phosphorus plants, asserting that the public was already protected from exposure to radionuclides with an ample margin of safety and reaffirmed its decision to not regulate other aspects of the phosphate industry.[10] In 1985,[11] the EPA promulgated standards for radionuclides emissions from phosphorous plants,[12] which was challenged by conservation and industry groups. In 1987, following a U.S. Court of Appeals for the D.C. Circuit decision (*Vinyl Chloride* case) that the EPA improperly considered cost and technological feasibility of regulating vinyl chloride without first making a determination based exclusively on risk to health, the EPA voluntarily remanded its elemental phosphorous plants standards decision.[13]

The *Vinyl Chloride* case established that to make a determination under § 112, the EPA must first determine a "safe" or "acceptable" level of risk considering only health-related factors, and next must set a standard that provides an "ample margin of safety" in which costs, feasibility, and other relevant factors may be considered.[14] In 1989, the EPA again determined that radiation causes cancer, hereditary effects, and developmental effects on fetuses; that numerous studies have demonstrated radiation is a carcinogen; that it is assumed that there is no completely risk-free level of exposure of radiation for cancer; and that its initial evaluation of radionuclides in 1979 was correct. EPA accordingly proposed listing radionuclides for regulation under § 112.[15] Later that year, EPA finalized the rule for emissions of radionuclides from elemental phosphorous plants and phosphogypsum stacks.[16]

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[9] 48 Fed. Reg. 15076, *National Emission Standards for Hazardous Air Pollutants; Standards for Radionuclides*, (Apr. 6, 1983).
[10] 49 Fed. Reg. 43906, *National Emission Standards for Hazardous Air Pollutants; Regulation of Radionuclides*, (Oct. 31, 1984).
[11] *Sierra Club v. Ruckelshaus*, 602 F. Supp. 892 (N.D. Cal. 1984).
[12] 50 Fed. Reg. 7280, *National Emission Standards for Hazardous Air Pollutants; Standard for Radon-222 Emissions from Underground Uranium Mines*, (Feb. 21, 1985).
[13] 54 Fed. Reg. 9612, *National Emission Standards for Hazardous Air Pollutants; Regulation of Radionuclides*, (Mar. 7, 1989).
[14] *NRDC v. EPA*, 824 F.2d 1211 (D.C. Cir. 1987).
[15] 54 Fed. Reg. at 9615.
[16] Phosphogypsum is the waste byproduct of wet-process phosphoric acid production, the intermediate feedstock of granular and liquid ammonium phosphate fertilizers. United States

Phosphogypsum is the radioactive waste from wet-process phosphoric acid production, the intermediate feedstock of granular and liquid ammonium phosphate fertilizers.[17] Phosphogypsum contains high concentrations of radioactive materials, particularly radium and uranium. Calcium phosphate ore is transported to a fertilizer plant for processing by chemically digesting the phosphate ore in sulfuric acid.[18] This reaction results in a slurry of phosphoric acid and phosphogypsum (calcium sulfate dihydrate or calcium sulfate hemihydrate, depending on the type of wet process) as a suspended solid, at a rate of five tons of phosphogypsum waste for every one ton of phosphoric acid.[19] The phosphoric acid solution is filtered from the phosphogypsum and concentrated through evaporation to be sold as merchant-grade phosphoric acid, feed-grade phosphoric acid, and superphosphoric acid, or used as feedstock for finished fertilizer products like diammonium phosphate (DAP) or monoammonium phosphate (MAP).[20] The phosphogypsum waste is then reslurried with process wastewater[21] and pumped via pipeline for disposal in an impoundment atop a waste pile known as a phosphogypsum stack, where the phosphogypsum settles, thereby growing the stack.[22] The settled phosphogypsum is dredged to build up embankments at the sides of the impoundment containing the process wastewater.[23] Cooling ponds containing process wastewater are also situated at or below grade along the perimeter of the stack.[24]

Geological Survey, "Mineral Commodities 2020" https://pubs.usgs.gov/periodicals/mcs2020/pdf.

[17] United States Geological Survey, "Mineral Commodities 2020." https://pubs.usgs.gov/periodicals/mcs2020/mcs2020.pdf.

[18] EPA, *Report to Congress on Special Wastes from Mineral Processing* (1990) at 12-1.

[19] *Id.* at 12-2.

[20] *Id.*

[21] Alternatively called "pond water" by industry and state regulating agencies. *See*, *Typical Pond Water Analysis*, Florida Industrial and Phosphate Research Institute, http://www.fipr.state.fl.us/about-us/phosphate-primer/process-water/ (last visited July 17, 2020). "Process wastewater" also includes phosphogypsum stack runoff, wastewater generated from the uranium recovery step of phosphoric acid production, process wastewater from animal feed production, and process wastewater from superphosphate production. 55 Fed. Reg. 2322 (Jan. 23, 1990). Uranium recovery from phosphate processing became uneconomic in the 1990s. Gerald Steiner et al., *Making Uranium Recovery from Phosphates Great Again?* 54 ENVIRON. SCI. TECHNOL. 1287 (2020). https://pubs.acs.org/doi/pdf/10.1021/acs.est.9b07859.

[22] EPA 1990 Report to Congress at 12-4.

[23] *Id.*

[24] *Id.*

EPA found that in order to control the dispersion of phosphogypsum and the resultant release of radon gas (a decay product of radium-226 found in phosphogypsum) to ambient air, the phosphogypsum, once created, must be disposed in stacks such that the radon emission is limited to a level of 20 pCi/m^2-s (picocuries per square meter per second).[25] The 1989 rule also found that, if dispersed throughout the country, PG would present a public health threat from radon gas emissions that would continue for generations given radium-226's 1,600-year half-life, and that it would be impracticable for EPA to implement regulation of such numerous and diffuse sources.[26]

A. EPA's 1992 rulemaking regarding PG in road construction determined it presents an unacceptable level of risk to public health and declined to authorize its use.

Shortly following the 1989 final rule, TFI and others petitioned the EPA under 42 U.S.C. § 7607(d)(7)(B) to reconsider the portion of the regulation (subpart R) that requires disposal of phosphogypsum in stacks, arguing the regulation prevented other uses of PG.[27] Industry argued the rule was adopted without proper notice and comment, was contrary to a national policy favoring recycling, prevented beneficial uses, would cause irreparable harm to farmers, was arbitrary and capricious it prevented the sale of phosphogypsum for industrial processes, and that it was possible to make phosphogypsum radon gas emissions safe.[28] The EPA granted limited reconsideration to receive more information on (1) specific types of proposed alternative uses; (2) current and anticipated feasibility of those uses; (3) research and development of processes which remove radium from phosphogypsum; (4) health risks associated with those uses; (5) the availability, cost, and effectiveness of substitutes for phosphogypsum; and (6) the proper definition of phosphogypsum regarding its radium content.[29] It also established a 60-day public comment period and a public hearing.[30]

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[25] 54 Fed. Reg. 51654, *National Emission Standards for Hazardous Air Pollutants; Radionuclides*, (Dec. 15, 1989).
[26] *Id.*
[27] 55 FR 13480, *NESHAPS for Radionuclides Reconsideration; Phosphogypsum*, (Apr. 10, 1990).
[28] 55 FR at 13480.
[29] 55 FR at 13480; 55 FR at 13482.
[30] *Id.*

In 1992, in response to TFI's petition for reconsideration, EPA finalized National Emission Standards for Radon Emissions from PG stacks approving the use of PG in agriculture at 10 pCi/g and limited research and development with no more than 700 pounds of PG. However, EPA found that "regardless of the radium-226 concentration, the use of phosphogypsum in road construction always resulted in a MIR [(maximum individual risk)] significantly greater than the presumptive safe level….Therefore, *EPA has determined that the use of phosphogypsum in road construction presents an unacceptable level of risk to public health*."[31]

EPA also found that phosphogypsum "contains appreciable quantities of radium-226, uranium, and other uranium decay products…The radionuclides of significance are uranium-238, uranium-234, thorium-230, radon-222, lead-210, polonium-210,"[32] and that these toxins can be resuspended into the air by wind and vehicular traffic.[33] It found that "trace metals may also be leached from phosphogypsum, as are radionuclides, and migrate to nearby surfaces and groundwater resources,[34] that chromium and arsenic may also pose a significant health risk,[35] and that a "number of potential constituents in phosphogypsum from some facilities…may cause adverse effects or restrictions of potential uses of nearby surface and groundwater resources" such as arsenic, lead, cadmium, chromium, fluoride, zinc, antimony, and copper.[36]

EPA concluded that "the level of risk presented by a particular application depends not only upon the radium-226 concentration in the phosphogypsum but also the nature of the application, the exposure scenario, the exposure pathway, the amount of phosphogypsum used, and other factors" and that "for road construction applications, even at radium-226 concentrations 3pCi/g, the risk to the maximum exposed individual is well above the acceptable level."[37] EPA also determined that, besides certain restricted uses for agriculture and research, "other uses of phosphogypsum will be prohibited without prior EPA approval" approval that would be

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[31] 57 Fed. Reg. 23305, *National Emission Standards for Hazardous Air Pollutants; National Emissions Standards for Radon Emissions from Phosphogypsum Stacks* (June 3, 1992) (emphasis added).
[32] Potential Uses of Phosphogypsum and Associated Risk. EPA BID 1992.
[33] *Id*.
[34] *Id*.
[35] *Id*.
[36] *Id*.
[37] 57 Fed. Reg. at 23305.

reviewed on a case-by-case basis "only if EPA finds that the proposed use of phosphogypsum will be at least as protective of public health in the short and long term as disposal in a stack or mine."[38]

EPA established a process to consider other uses of phosphogypsum for approval. It requires an application must include a description of the proposed use, handling, processing, location of the facility; the quantity of phosphogypsum to be used by each facility; average concentration of radium-226 in the phosphogypsum to be used; description of measures to prevent the uncontrolled release of phosphogypsum into the environment; an estimate of the maximum individual risk, risk distribution, incidence associated with proposed use; and intended disposition of any unused phosphogypsum.[39]

B. TFI's 2020 application to the EPA to allow the use of PG in road construction presents no new information to disturb EPA's 1992 rulemaking.

On October 15, 2019, TFI, on behalf of its members that own or operate PG stacks, petitioned the EPA to approve the removal of PG from stacks for use in road construction under 40 C.F.R. § 61.206.[40] On April 7, 2020, TFI submitted a revised request for approval for use of PG in federal, state, and local departments of transportation or public works.[41] Specifically, the request was for EPA to grant a blanket approval, in advance, for the use of PG containing up to an average of 35 pCi/g in road base, paving, and various combinations of road base and paving in any government roadway projects that are (1) authorized by federal, state, or local departments of transportation or public works; and (2) conducted as part of government road project using appropriate road construction standards.

TFI's risk assessment purported to evaluate gamma radiation and PG dust from no more than 50 percent of the roadbed material by weight and no more than 2.25 percent of road surface material

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[38] *Id.*
[39] 57 Fed. Reg. 23305.
[40] Wheeler, Oct. 14, 2020, letter to TFI at 2.
[41] It appears one major difference between the two requests is that the Oct. 2019 petition requested a waiver that PG be placed in stacks, whereas the revised petition's request is narrower asking that PG under 35 pCi/g be used for road construction.

by weight[42] and asserted the risk of fatal cancer in various exposure scenarios for road construction workers to be 0.5 in 10,000, road users 0.1 in 10,000, truck drivers of PG for road construction 0.5 in 10,000, residents 0.08 in 10,000, and utility workers 0.004 in 10,000.[43] It also included an "Extreme Hypothetical 'Reclaimer Exposure Scenario," in which it described the future scenario where a road breaks down or is broken down and a house is constructed on top of it. TFI's "reclaimer exposure scenario" presumed customary construction methods for a house on grade and calculated risk of fatal cancer at 0.4 in 10,000.[44]

In its 1992 rule, the EPA estimated the lifetime risk in the reclaimer scenario from external radiation, dust inhalation, and ingestion of food for 30 years of exposure to be 3.5 in 1,000 (35 in 10,000), far outside the acceptable level of risk.[45] In response to TFI's 2020 request, EPA retained SC&A as its expert reviewer. SC&A determined TFI's consultant, Arcadia's, modeling was inappropriate and recommended that EPA request TFI revise its reclaimer radon exposure dose calculation "using more realistic (i.e., less optimistic) parameter values, or provide additional justification for the values").[46] Instead, the EPA stated that "though likely an underestimation of the dose and risk to a future resident of a house built on a site of an abandoned road built with phosphogypsum, the TFI risk assessment does show that risk to a future resident of the site might be acceptable depending on the methods used to construct the house,"[47] accordingly "to ensure that the risk to members of the public in the future is not above the acceptable risk, the redevelopment of any abandoned roads as anything other than a road

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[42] Arcadis. 2019. Radiological Risk Assessment in Support of Petition for Beneficial Use of Phosphogypsum (App 2) at ES-2; Wheeler Oct. 14, 2020 at 4.
[43] Arcadis. 2019. Radiological Risk Assessment in Support of Petition for Beneficial Use of Phosphogypsum at ES-2; Wheeler Oct. 14, 2020 at 3.
[44] Arcadis. 2019. Radiological Risk Assessment in Support of Petition for Beneficial Use of Phosphogypsum at 3-12; App. 1 at p. 10.
[45] E-Docket: EPA-HQ-OAR-2020-0442. Review of the Radiological Risk Assessment in Support of Petition for Beneficial Use of Phosphogypsum Prepared for The Fertilizer Institute (Oct. 14, 2020) at 17.
[46] SC&A. 2020. Technical Review of the Fertilizer Institute Risk Assessment for Additional Use of Phosphogypsum in Road Base. June 10, 2020 at 45.
[47] *Id.* at 18.

constructed in accordance with this risk assessment should not be undertaken until an additional site-specific risk assessment demonstrates that risks to members of the public are acceptable."[48]

EPA says it "remains concerned" about potential exposure should the road become abandoned, particularly for residences built on road material containing phosphogypsum, and "does not agree that TFI's assumptions in its analysis of this scenario … could be relied upon to limit the potential risks to a future residential individual from such an occurrence."[49] The EPA determined "this risk can be acceptably mitigated by including appropriate terms and conditions in the approval." EPA states that roads constructed with PG may not be abandoned or used for other non-road purposes, and that any PG removed from the stack but not used must be returned to the stack.[50] EPA "questioned some of the modeling assumptions used by TFI to generate the estimate of the reclaimer…but based on new information and analysis in the revised request now concludes that risks associated with the reclaimer scenario can be addressed with conditions."[51]

The request does not include information required by 40 C.F.R. § 61.206(b)(3)-(5) and (10), regarding where the ultimate requested use will take place, including the roads or intermediary locations, or how much PG will be used at each facility.[52] EPA nonetheless concludes that given "the nature of the request and the conditions" imposed, that required information "is not essential to making the determination of whether the proposed use of PG would be at least as protective of public health as stacking."[53] These conditions are (1) average radium-226 content of PG to be used in a road base or pavement must not exceed 35 pCi/g; (b) pavement may contain no more than 2.25% PG by weight; (c) road base may contain no more than 50% PG by weight; (d) road base containing PG may consist of one lift of up to 25cm depth and not extend beyond paved areas of the road; and (e) a minimum 50-foot setback from the edge of the road to inhabited structures.[54]

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[48] *Id.* at 20.
[49] 57 Fed. Reg. at 66552.
[50] *Id.*
[51] Wheeler Oct. 14, 2020 at 5.
[52] Wheeler, Oct. 14, 2020, letter to TFI at 3.
[53] Wheeler Oct. 14, 2020 at 4.
[54] Wheeler Oct. 14, 2020 at 7.

II. GROUNDS FOR OBJECTION TO EPA'S UNLAWFUL APPROVAL OF PG IN ROAD CONSTRUCTION

EPA's approval of PG in road construction was unlawful because it violates 40 C.F.R. § 61.206. The approval required notice and comment, it was a time-barred petition to reconsider, and it is arbitrary and capricious. It failed to fully consider the risks or provide a rational explanation for reversing its previous conclusions that using PG in road construction presents an unreasonable risk to public health. EPA's approval violated the National Environmental Policy Act and/or failed to provide a functional equivalent of an environmental analysis. Additionally, it failed to consult under the Endangered Species Act for impacts to listed species and their critical habitat.

A. EPA's approval of TFI's petition violates 40 C.F.R. § 61.206.

EPA's approval of the TFI's petition, to the extent that it can be interpreted as a request for an approval under 40 C.F.R. § 61.206, was unlawful because TFI failed to meet those requirements.

1. EPA cannot approve TFI's 2020 petition to use PG in roads under 40 C.F.R. § 61 Subpart R. EPA has already determined the use of PG in roads presents an unreasonable risk of harm, and it is not the type of "other purpose" contemplated by the regulation.

TFI's 2020 petition is not properly a request for an "other purpose" of PG within the meaning of 40 C.F.R. 61 Subpart R, because EPA already considered the use of PG in roads in 1992, and it determined it presented an unreasonable risk to public health. EPA's 1992 rule outlined the process for EPA to consider "other" uses of phosphogypsum for approval, which includes an EPA determination that the proposed distribution or use of the phosphogypsum is at least as protective of the public health, on both the short term and the long term, as is disposal of phosphogypsum in a stack or a mine.[55] To the extent the EPA would like to characterize TFI's 2020 petition as a request for an "other purpose," EPA relies on an absurd interpretation of

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[55] In January 2005, EPA promulgated guidelines for using the process which involves asking the applicant to submit a copy of the complete petition to the public library closest to the site of the intended alternative use and another to the library closest to the gypstack. EC/R Incorporated [Under EPA Contract No. EP-D-04-007, Work Assignment 0-2], Applying to the EPA for Approval of Other Uses of Phosphogypsum: Preparing and Submitting a Complete Petition Under 40 CRF 61.206, A Workbook, https://www.epa.gov/sites/production/files/2015-05/documents/wrkbk_sub-r_appl_1105.pdf. Upon information and belief that was not done for the PG Approval.

"other" under 40 C.F.R. § 61.206(c) given that the EPA's 1992 rule explicitly analyzed and rejected the use of PG in road construction. EPA's interpretation would define "other" established in the 1992 rule to mean "other than agricultural and research uses," rather than "other than the uses considered and approved or rejected in the 1992 rule."[56] But this explanation seeks to rewrite EPA's well-documented rulemaking from 1992, which shows that EPA evaluated the use of PG in road construction, and after notice and comment and a petition to reconsider from TFI, determined not to authorize that use.[57] That TFI is now seeking approval to use PG roads constructed by the government, rather than in roads generally, as it did in 1992, is immaterial, in light of the fact that the vast majority of paved roads are constructed by governments.

Moreover, EPA clearly intended that § 61.206 apply to discrete "other purposes," not the categorical use requested by TFI. EPA codified § 61.206 to address case-by-case approvals of the use of PG for other purposes,[58] as is clear from the specific information that provision requires applicants to provide in their request for approval.[59] That TFI did not and cannot meet the requirements of § 61.206(a)(1), (3)-(5), and (9)-(10) as described below, underscores that EPA intended this regulation apply to specific, rather than categorical, uses. Indeed, in approving PG in roads, Administrator Wheeler characterized EPA's 1992 determination as declining to "categorically" authorize the use of PG in road construction.,[60] yet that is precisely what EPA has done here.

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[56] Wheeler Oct. 14, 2020 at 4.
[57] EPA finding For road construction scenarios, use of PG always resulted in MIR greater than the outer bound of the presumptively safe level of 1 in 10,000, therefore EPA has determined that the use of PG in road construction presents an unacceptable level of risk to public health. 57 at 23311.
[58] 57 Fed. Reg. at 23305.
[59] Section § 61.206(b) provides that any person seeking approval "must" supply a facility-specific description of the proposed use – including the handling and processing that PG will undergo, and the location of each originating and destination facility, the average quantity to be used, a description of measures which will be taken to prevent the uncontrolled release of PG into the environment, a description of the intended disposition of any unused PG, and "*shall* be signed and dated by a corporate officer or public official in charge of the facility."
[60] Wheeler Oct. 14, 2020 at 5.

2. TFI's application did not provide the information required by EPA's regulation.

TFI did not provide the information EPA requires in its regulations to approve a request to use PG for an "other purpose." EPA's 1992 rule codified at 40 C.F.R. § 61.206(c) requires EPA to considering approving the use of PG for "other purposes" when they are at least as protective of the public health, in both the short term and the long term, as is disposal of phosphogypsum in a stack or a mine. An application must include a description of the proposed use, handling, processing; location of the facility where the PG is stacked, will be processed or used; the quantity of phosphogypsum to be used by each facility; average concentration of radium-226 in the phosphogypsum to be used; description of measures to prevent the uncontrolled release of phosphogypsum into the environment, an estimate of the maximum individual risk, risk distribution, incidence associated with proposed use; and intended disposition of any unused phosphogypsum. And it "*shall* be signed and dated by a corporate officer or public official in charge of the facility."[61]

Yet, EPA approved TFI's petition even though TFI's request did not supply the information that 40 C.F.R. § 61.206(b) expressly requires it "must" including "any specific location information where the ultimate requested use – road construction – will take place," any intermediary locations between a PG stack and road, or the quantity to be used.[62] By approving a request that lacks this information,[63] EPA violated 40 C.F.R. § 61.206.

Although apparently aware that EPA is violating its own regulations, EPA Administrator Wheeler sought to dismiss this problem by claiming the "information required as part of a request under 40 C.F.R § 61.206(b) - especially information on specific address locations where the PG may be used - is not essential to making the determination of whether the proposed use of PG would be at least as protective of public health as stacking."[64] Instead, at TFI's request, EPA approved the categorical use of PG in road construction and conditioned removal of PG from stacks upon receipt of the very information EPA regulations required TFI to submit in order to

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[61] 57 Fed. Reg. 23305.
[62] Wheeler Memo p. 2-3 "The Revised Request essentially acknowledges that it has not provided the information required by 40 C.F.R. § 61.206(b)(3)-(5) and (10).
[63] Wheeler at 6-7.
[64] Wheeler at 4.

evaluate the safety of the use of PG in roads to begin with.[65] In so doing, Administrator Wheeler acted unlawfully and exceeded his authority.[66] If EPA wished to change its requirements for an approval under 40 C.F.R. § 61.206, the agency needed to revise its regulations through the normal, required notice-and-comment rulemaking procedures. It cannot simply disregard its own regulations as Administrator Wheeler has done here.

3. EPA applied the incorrect legal risk factor for its risk assessment.

The correct legal standard for EPA to consider in approving the use of PG for "other purposes" under 40 C.F.R. § 61.206(c) is that "the proposed distribution and/or use is at least as protective of public health, in both the short term and long term, as disposal of phosphogypsum in a stack or a mine." The EPA established in 1989 and reiterated in 1992 that the "maximum individual risk of fatal cancer from radon from phosphogypsum stacks is $9x10^{-5}$."[67] Therefore, the correct scientific standard for determining whether a proposed use is as protective as leaving PG in a stack is that the maximum individual risk to any individual not exceed $9x10^{-5}$ (a risk of 9 in 100,000 or 0.9 in 10,000). However, the EPA and TFI appear to have instead based their risk analysis on "a lifetime risk of excess mortality no greater than 3 in 10,000 ($3x10^{-4}$),"[68] which is more than three times higher (or less protective) than the risk EPA established as the risk from stacks.

EPA's consultants determined that the use of PG for roads as proposed by TFI could result in radiation doses far in excess of even the inflated risk level it used for comparison, $3x10^{-4}$.[69] For

[65] Wheeler at 6-7.
[66] "It is axiomatic ... that an agency is bound by its own regulations." *Nat'l Env't Dev. Ass'n Clear Air Project v. EPA*, 752 F.3d 999, 1009 (D.C. Cir. 2014) (quoting *Panhandle E. Pipe Line Co. v. FERC*, 613 F.2d 1120, 1135 (D.C. Cir. 1979)).
[67] 57 Fed. Reg. at 23306; 54 Fed. Reg. at 51675.
[68] Wheeler at 5 and TFI Apr. 2020 at 7.
[69] See SC&A, *Technical Review of The Fertilizer Institute Risk Assessment for Additional Use of Phosphogypsum in Road Base,* Prepared for USEPA, June 10, 2020, Table 4-10, at p. 36, which estimates radiation doses from just one pathway alone (inhalation of radon gas) as 623 millirem/year, and still 73.8 millirem/year even if there were a 10 cm cover. SC&A asserts that any dose over 19 millirem/year is presumptively outside the outer limits of EPA's acceptable risk range. p. 42, fn. 5. While we do not agree with the assertion that 19 millirem/year is in fact within the risk range, EPA's consultant is nonetheless making clear that the doses far exceed even what it characterizes as the upper limit of the risk range.

example, the estimated radiation doses from just one pathway alone (inhalation of radon gas) is 623 millirem/year, and 73.8 millirem/year with a 10 cm road cover. The EPA's consultant SC&A asserts that any dose over 19 millirem/year is presumptively outside the outer limits of EPA's acceptable risk range.[70] Millirems are units of radiation dose or exposure: a chest X-ray is about 2 millirem.[71] EPA, based on the most recent research by the National Academy of Science, estimates 1.16 excess cancers are produced per 1,000 rem of exposure.[72] TFI uses 5 fatal cancers per 10,000 rem; SC&A uses 6 per 10,000 rem.[73] SC&A estimates that 19 millirem/year over 26 years amounts to 3×10^{-4} risk. Therefore, where SC&A estimated 623 millirem/year as the annual dose, with 19 millirem/year amounting to 3×10^{-4} risk, this in effect estimates a risk of 9.8×10^{-3} (approximately one in every hundred people at risk of fatal cancer from exposure to PG), a risk more than 30 times the purported 3×10^{-4} limit and more than one hundred times the actual regulatory limit. Even EPA concluded this scenario "could potentially still present lifetime risks above the Agency's defined threshold."[74]

Additionally, EPA's analysis using TFI's own numbers and scaling to the 35 pCi/g radium concentration allowed under the PG Approval shows a road construction worker would face an excess fatal cancer risk of 1.3×10^{-4}—44% higher than the risk EPA estimates for disposal in a stack.[75] EPA's analysis of TFI's calculations at a concentration of PG below that allowed in the PG Approval, shows both construction workers and truck drivers face even higher risks, as high

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[70] *Id.* at 42, fn. 5.
[71] EPA, "How much radiation am I exposed to when I get a medical x-ray procedure?" https://www.epa.gov/radiation/how-much-radiation-am-i-exposed-when-i-get-medical-x-ray-procedure. EPA states that a single chest x-ray is equal to 2 millirem.
[72] The 1.16×10^{-3} cancers/rem coefficient is from USEPA, *EPA Radiogenic Cancer Risk Models and Projections for the U.S. Population*, EPA 402-R-11-001, April 2011 (https://www.epa.gov/sites/production/files/2015-05/documents/bbfinalversion.pdf), which in turn is derived from the National Academy of Sciences/National Research Council, *Health Effects from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2,* 2006, https://www.nap.edu/catalog/11340/health-risks-from-exposure-to-low-levels-of-ionizing-radiation.
[73] SC&A, p. 38.
[74] Radiation Protection Division, Office of Radiation and Indoor Air, US Environmental Protection Agency, *Review of the Radiological Risk Assessment in Support of Petition for Beneficial Use of Phosphogypsum Prepared for The Fertilizer Institute*, October 14, 2020, p. 2.
[75] EPA. 2020. PG Risk Tech. Summary. Oct. 14, 2020, at 3 Table 1. TFI's analysis was based on 27 pCi/g, whereas the requested approval was for 35 pCi/g, so EPA staff scaled the TFI numbers to the levels requested under the TFI petition.

as $2x10^{-4}$, more than double the allowable regulatory risk for approval of other uses of PG.[76] At the concentration requested in the TFI petition and allowed in the EPA approval, the risks would be even greater, as high as $2.6x10^{-4}$, just correcting for the higher concentration, nearly triple the 40 C.F.R. § 61.206(c) limit which is based on EPA's estimate of the risk from PG stacks. EPA's analysis summarizing its 1992 calculations from EPA 402-R-92-002, *Potential Uses of Phosphogypsum and Associated Risks, Background Information Document*, estimates risks of up to $3x10^{-4}$ for construction workers, 3.3 times higher than the 40 C.F.R. §61.206(c) limit.[77] Indeed, this analysis makes clear how astronomically in excess of the correct legal and scientific standard the abandoned road scenario is—as much as $43.4x10^{-4}$ (4.34×10^{-3}), 48 times the standard.

EPA's consultant analysis identified a number of other scenarios that could produce risks in excess of EPA's estimates for risk from PG in stacks. For example, SC&A estimates a backhoe driver could be exposed to radiation producing a risk of 3 in 10,000, which is 3.3 times the limit based on the risk from PG stacks.[78] Working just a little more than 2 ½ years at such work would expose the backhoe driver to a greater risk than the regulatory limit set in 40 C.F.R. § 61.206(c).

B. TFI's request is either an untimely petition to reconsider or a petition for a rule revision, for which the APA required notice and comment opportunity.

In 1992, at TFI's request, the EPA evaluated uses of PG other than disposal in stacks, including use in constructing roads, and after notice and comment, determined that "regardless of the radium-226 concentration, the use of phosphogypsum in road construction always resulted in a MIR [(maximum individual risk)] significantly greater than the presumptive safe level….Therefore, EPA has determined that the use of phosphogypsum in road construction presents an unacceptable level of risk to public health."[79] EPA also determined that "[a]ll other uses of phosphogypsum will be permitted *on a case by case basis* with prior EPA approval. EPA approval will be granted only if EPA finds that the proposed use of phosphogypsum will be at

[76] EPA. 2020. PG Risk Tech. Summary. Oct. 14, 2020, at 5 Table 2.
[77] EPA. 2020. PG Risk Tech. Summary. Oct. 14, 2020, at 6 Table 3.
[78] SC&A. 2020. PG Risk Assessment Review. June 6, 2020 at 38.
[79] 57 Fed. Reg. 23305, *National Emission Standards for Hazardous Air Pollutants; National Emissions Standards for Radon Emissions from Phosphogypsum Stacks* (June 3, 1992).

least as protective of public health in the short and long term as disposal in a stack or mine."[80] EPA codified that rule at 40 C.F.R. § 61.206. In now seeking a different decision on the same question.

1. A petition for reconsideration is untimely.

The Clean Air Act allows parties to petition the EPA for reconsideration of a rule "if it was impracticable to raise such objection within such time or if the grounds for such objection arose after the period for public comment (but within the time specified for judicial review)."[81] The 1992 rule states that under § 7607(b)(1) "judicial review of decision under section 112 is available only by filing a petition for review in the United States Court of Appeals for the District of Columbia Circuit within 60 days of" the publication of the rule,[82] meaning that the time specified for judicial review was 60 days, and therefore, an objection must have been raised in that 60 days. Viewing TFI's 2020 request to allow PG in circumstances EPA rejected in 1992 as a petition for reconsideration, it is untimely, and the EPA should have denied it for falling 28 years outside of the Clean Air Act's 60-day deadline for judicial review provided by § 7607(b)(1).[83]

2. EPA unlawfully failed to conduct notice and comment rulemaking in revising its 1992 rule.

TFI's request may also be viewed as a petition for a rule revision, under which EPA would be required by both the CAA at 42 U.S.C. § 7607(d)(3) and APA at 5 U.S.C. § 553(b) to provide notice of proposed rulemaking in the federal register.[84] EPA did not provide public notice and

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[80] *Id.* (emphasis added).
[81] 42 U.S.C. § 7607(d)(7)(B).
[82] 57 Fed. Reg. at 23305. TFI availed itself of its right to timely petition EPA for reconsideration of the June 3, 1992 rule in August 1992. *See* 59 FR 5993 (Mar. 24, 1994) National Emission Standards for Hazardous Air Pollutants and Radon Emissions from Phosphogypsum Stacks; Final Rule (EPA declining to reconsider its decision to not allow PG in road construction).
[83] *See North Carolina v. EPA*, 614 Fed. Appx. 517, 519 (D.C. Cir. 2015) (holding EPA did not abuse its discretion in determining that a petition for reconsideration submitted more than 60 days after the rule was untimely).
[84] § 7407(d)(3) requires notice be published as provided by 5 U.S.C. § 553(b).

opportunity for comment on its PG Approval, therefore, the PG Approval is unlawful under the CAA and/or APA.[85]

Clean Air Act § 7607(d)(3) requires that notice of proposed rulemaking shall be published in the federal register as provided under 5 U.S.C. § 553(b) and be made open for public comment and include data, methodology, and legal interpretations. Section 7607(d)(3) only applies to actions taken under § 7607(d)(1)(a)-(u). The PG Approval arises under § 112(e) of the pre-1990 Clean Air Act,[86] or § 112 more broadly as a rulemaking under 40 C.F.R. 61.206, which are not enumerated actions under § 7607(d)(1)(a)-(u), therefore § 7607(d)(3) does not apply. Instead, the EPA was required to comply with the APA, 5 U.S.C. §§ 553-557.

The APA requires that agencies provide adequate notice and meaningful opportunity for comment for proposed rulemaking which the EPA here failed to do.[87] The APA describes rulemaking as the "agency process for formulating, amending, or repealing a rule."[88] A "rule" is defined expansively to include any "agency statement of general or practical applicability and future effect designed to implement, interpret, or prescribe law or policy or describing the organization, procedure, or practice requirements of the agency."[89] Agency rulemakings are actions which (1) affect people broadly and equally, rather than a small number of people being

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[85] Additionally, in January 2005, EPA promulgated guidelines for using the process requiring the applicant to submit a copy of the complete petition for "other use" to the public library closest to the site of the intended alternative use and another to the library closest to the gypstack. EC/R Incorporated [Under EPA Contract No. EP-D-04-007, Work Assignment 0-2], Applying to the EPA for Approval of Other Uses of Phosphogypsum: Preparing and Submitting a Complete Petition Under 40 CRF 61.206, A Workbook, https://www.epa.gov/sites/production/files/2015-05/documents/wrkbk_sub-r_appl_1105.pdf. The EPA is also required to publish a notice of its pending approval in the local newspaper "near the site(s) and stack informing the public of our pending approval" along with the location of the libraries where the petition is available for review, and provide 30 days for public comment. EPA 2006 at 6. Upon information and belief, neither TFI nor EPA complied with these requirements.
[86] *See* 57 FR 23305 *National Emission Standards for Hazardous Air Pollutants; National Emissions Standards for Radon Emissions from PG Stacks* (June 3, 1992) where EPA evaluated using PG in roads and determined it presented an unacceptable level of risk to public health and determined its rule arose under section 112(e) regarding work practice standards. *See also* 54 FR 51654 *National Emission Standards for Hazardous Air Pollutants; Radionuclides* (Dec. 15, 1989) (requiring PG be kept in stacks pursuant to § 112(e)).
[87] 5 U.S.C. § 553.
[88] 5 U.S.C. § 551(5).
[89] *Id*. at § 551(4); *Id*. at § 553.

exceptionally affected; (2) are based off of general grounds instead of specific/individual grounds; (3) many people are affected, rather than a few or a small number; and often (4) rulemakings are policy-setting for the future, looking forward, as opposed to resolving/tweaking something that has happened, backward-looking.[90] As the EPA's approval is forward-looking and will affect many people, living and working around the phosphogypsum stacks and road constructed with phosphogypsum, it is a rulemaking rather than a specific adjudication.

Even if the PG Approval qualifies as an action enumerated at § 7607(d)(1)(a)-(u) and § 7607(d)(3) applies, that provision requires notice and comment as provided in 5 U.S.C. § 553(b). Therefore, either way, EPA was required to provide the public with notice of the proposed approval and the opportunity to comment, but it did not.[91]

C. EPA's approval of TFI's petition is arbitrary because EPA failed to fully consider the risks or provide a rational explanation for reversing its previous conclusion that using PG for road construction presents an unreasonable risk to public health.

For the reasons explained above, Petitioners do not agree that 42 U.S.C. § 7607(d) applies to the PG Approval; however, regardless of whether the PG Approval implicates the Clean Air Act's jurisdictional and standard of review provisions, the general arbitrary/capricious framework applies. Section 7607(d)(1)(C),(V) states that 5 U.S.C. § 706 shall not apply to actions to which this subsection applies, specifically that this subsection shall not apply in the case of any rule or circumstance referred to in 5 U.S.C. § 553(b) (A) or (B). However, 42 U.S.C. § 7607 (d)(9)(A)-(D) state that the court may reverse such action found to be

(A) arbitrary, capricious, an abuse of discretion, or otherwise no in accordance with law;
(B) contrary to constitutional right, power, privilege, or immunity;
(C) in excess of statutory jurisdiction, authority, or limitations, or short of statutory right; or

[90] *Bi-Metallic Inv. Co. v. State Bd. of Equalization*, 239 U.S. 441 (1915); *Londoner v. Denver*, 210 U.S. 373 (1908).
[91] To the extent TFI attempts to characterize its petition for reconsideration as a request for approval to use PG in road construction "in light of the new scientific and factual information," that too fails. Clean Air Act § 7607(b)(1) allows the 60-day clock to reset where a "petition is based solely on grounds arising after such sixtieth day," then a petition "shall be filed within sixty days after such grounds arise." However, TFI petition does not present new scientific or factual information.

(D) without observance of procedure required by law, if (i) such failure to observe such procedure is arbitrary or capricious, (ii) the requirement of paragraph (7)(B) has been met, and (iii) the condition of the last sentence of paragraph (8) is met.

Therefore, regardless of whether 5 U.S.C. § 706 or 42 U.S.C. § 7607(d)(9) applies, the EPA must make decisions that comport with the norms and expectations of rulemakings established by the APA and CAA, i.e. not be arbitrary or capricious.[92]

1. *EPA failed to use the best available scientific information.*

TFI used RESRAD as its primary model. EPA has its own model, the Preliminary Remediation Goal Calculator, and a variant of it, the Preliminary Remediation Goal Calculator for Outdoor Surfaces (hereafter "PRG Calculators").[93] EPA's Superfund office, which created and is responsible for the PRG Calculators, generally prohibits the use of RESRAD, unless its use in specific circumstances can be demonstrated to be consistent with the PRG Calculators.[94]

Moreover, EPA accepted TFI's risk assessment which was based on several errors and flawed assumptions. For example, the residential exposure scenario considers only direct gamma shine from a nearby road and ignores entirely inhalation and ingestion risks, including the exposure pathways of backyard gardens and consumption of contaminated well/groundwater.[95] The non-occupational (e.g., residential) exposures are assumed to be limited to 26 years, even though for purposes of the CAA and the PG requirements, 70 years is required to be assumed.[96] As EPA noted in its review, TFI itself estimates a resident living 20 feet from the radioactive road would face, from gamma radiation alone, an excess cancer risk of 0.5×10^{-4} (5×10^{-5}) from just 26 years exposure, whereas a 70-year analysis is required. Thus, even if TFI had calculated the gamma dose correctly, and even ignoring all the other pathways it left out (inhalation, ingestion, garden,

[92] *Util. Air Regul. Grp. v. EPA*, 744 F.3d 741, 748 (D.C. Cir. 2014) ("to determine whether a rule is arbitrary or capricious, we apply the same standard of review that we apply under the Administrative Procedure Act.").
[93] https://epa-prgs.ornl.gov/radionuclides/
[94] USEPA, OSWER, *Radiation Risk Assessment at CERCLA Sites: Q&A,* OSWER 9285.6-20, June 13, 2014, p. 28, https://semspub.epa.gov/work/HQ/176329.pdf.
[95] Inhalation risks are considered only for the first few weeks, during construction, and ignored for the rest of the nearly 26 years of potential exposure assumed.
[96] See 57 Fed. Reg. at 23306.

water), its own calculations produce a risk of 1.35×10^{-4} [i.e., $70/26 \times 0.5 \times 10^{-4}$], or 50% higher than the risk EPA estimates for PG stacks, which is the limit for approval of other uses.

The analysis is also based on pristine conditions for the road at installation and does not adequately take into account what happens as the road ages, cracks, crumbles, develops potholes, sinkholes, is eroded by weather like storm surge, high tide, and rain, and otherwise degrades, increasing radioactive particulates being kicked into the air by passing vehicles whereby it can be inhaled by people nearby and be deposited on soil near residents, as well as leaching out of the degraded road and migrating into groundwater and surface water. Relatedly, the analysis fails to consider impacts of any sort on either groundwater or surface water, merely restating an indefensible claim that it would take 10,000 years for any contaminant to migrate to groundwater and 100,000 years to migrate to surface water.[97] Meanwhile, there are real-world examples of radioactive contaminants migrating such distances and contaminated such water bodies in periods of a few decades. For example, similar claims were made that it would take 10,000 years for the plutonium to migrate out of the trenches at the Maxey Flats, Kentucky "low level radioactive waste" disposal site, but it migrated in ten years, and the site became a Superfund site.[98]

The analysis for the reclaimer scenario is predicated on fully intact concrete with a liner to prevent radon entry into the house.[99] Both EPA in its review and SC&A in its analysis say these assumptions are improper. SC&A indicates its estimate of the radon concentration for this scenario is 169 pCi/m^3 whereas TFI claimed it to be only 13 pCi/m^3, thus underestimating the exposure.

EPA contracted with SC&A to perform a detailed review of the TFI proposal and risk assessment, and SC&A identified numerous serious problems with the TFI analysis and made a series of recommendations for revisions, which EPA appears to have ignored.

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[97] TFI Apr. 2020 at 46.
[98] EPA. 1991. Record of Decision Summary of Remedial Alternative Selection Maxey Flat Disposal Site, Fleming County, Kentucky at 12-14.
[99] SC&A at 35.

EPA, in failing to request additional information from TFI or make decisions based on its expert evaluation, instead states that the "final approval limits phosphogypsum to a single 25 cm layer, and requires that all phosphogypsum be covered by pavement," and this supposedly would prevent any migration of the radioactivity.[100] However, the actual approval is expressly for phosphogypsum to be allowed to be used both in the road base and in the pavement.[101] Furthermore, as the road degrades over time e.g., due to cracks, potholes, subsidence, etc.— water will be able to penetrate and carry with it the radioactivity in the PG. Contracting with SC&A to analyze potential deficiencies in the TFI analysis and then throwing out the SC&A review when it identifies numerous problems further reinforces the arbitrary, capricious, and rushed nature of the PG Approval.

Among the issues raised by SC&A, is the consumption of crayfish that could concentrate radioactivity. SC&A estimates doses as high as 110,000 millirem per year from that pathway, a pathway not considered by TFI.[102] That dose would be the equivalent of 55,000 chest x-rays, and about 5,800 times higher than the already inflated, unlawful upper-risk level TFI and EPA used as an acceptable level for the PG Approval. Moreover, SC&A also found that while the calculated conservative, upper bound crayfish ingestion annual dose is unacceptably large, "the dose is due primarily to Po-210, but Pb-210 and Ra-226 also result in significant crayfish ingestion doses."[103] SC&A "believes that the Table 5-4 crayfish ingestion doses are so large that TFI should be requested to further investigate this potential exposure pathway, as well as the crayfish-to-meat/poultry-to-man food chain."[104] It warned EPA "[b]ecause the ingestion dose estimated...is so large, it is recommended that TFI be requested to further investigate this potential exposure pathway."[105] SC&A's calculated total mrem/yr measurements range from 450 - 110,000 mrem/yr in combined dose.[106] According to SC&A, the acceptable annual dose is 19 mrem/yr, so the doses could be as much as ~5,800 times higher than the value TFI and EPA assert is acceptable. EPA states it ignored the SC&A crayfish pathway because it assumes

[100] Wheeler at 7.
[101] Wheeler approval, October 14, 2020, p. 7.
[102] SC&A at 42.
[103] SC&A at 42.
[104] SC&A at 44.
[105] SC&A at 46.
[106] Table 5-4. SC&A Calculated Conservative, Upper Bound Crayfish Ingestion Dose at 42.

radioactivity has migrated into the water in which the crayfish live, and that such migration is not expected to occur.[107] But again, that is based on the erroneous assertion that PG is not allowed in the paving and that the roads will not develop cracks, potholes, etc.

EPA appears to have ignored additional key findings and recommendations by SC&A. For example, SC&A raised possible contamination of groundwater due to the leaching of radionuclides through soil.[108] SC&A found that the potential exposure risk associated with the groundwater pathway *could* be within the 3 in 10,000 level. However, it states that "there is much uncertainty in the values assumed for many parameters involved in evaluating the groundwater pathway, and further evaluation...may be necessary."[109] It found "because the radionuclides of concern are long-lived...TFI should include in their risk assessment a demonstration that the groundwater pathway does not present an exposure pathway that could result in a greater-than-3- in-10,000 risk to the population."[110] "TFI's risk assessment lifetime dose was calculated by assuming that the individual lived at that location for 26 years,[111] but EPA requires 70 years exposure for PG risk estimates.[112] SC&A raised the concern that TFI's report makes no mention of groundwater as an exposure pathway, even to explain why they did not analyze it.[113]

SC&A also warned that road construction workers (RCWs) may spend more years exposed to PG than assumed by TFI. TFI asserts only 20% of a RCW's presumed 25-year career would be spent handling PG material, assuming they were involved in a single, 5-year project, but SC&A observed "no detail was provided on how many construction companies and subcontractors were involved in placement of subgrade materials or pavement. Road construction by smaller county and city governments may use fewer earthwork and pavement contractors or have smaller construction budgets than FDOT."[114] Likewise, SC&A raised concerns that backhoe operators

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[107] EPA. 2020. Review of the Radiological Risk Assessment in Support of Petition for Beneficial Use of Phosphogypsum Prepared for the Fertilizer Institute at 19.
[108] SC&A at 38.
[109] SC&A at 46.
[110] SC&A at 39.
[111] SC&A at 40.
[112] 57 Fed. Reg. at 23305.
[113] SC&A at 46.
[114] SC&A at 17.

would be exposed to undiluted PG during construction activities.[115] The backhoe operator's exposure pathways were assumed to be the same as those analyzed by TFI for the Road "Construction Worker – Road Base No Cover_Center," except the backhoe operator would be exposed to undiluted PG.[116] Therefore, the backhoe operator's dose would be twice the Road Construction Worker's dose.[117] If the backhoe operator "were to perform this task for 8.7 years, his/her LCF risk would be at SC&A's reference risk of 3 in 10,000."[118] Regarding occupational road users, SC&A noted they spend more time on the road than the average driver,[119] but only average road user exposure doses were considered. Using a 2003 Nationwide Truck Survey, the SC&A found that "heavy-duty truckers" spent approximately 3,000 hrs/yr on the road versus the 500 hrs/yr estimate provided by TFI.[120]

SC&A also cautioned EPA road base width was calculated inaccurately. "TFI's model assumed that the road surface extended over the entire width of the road base, leaving none exposed…[this] is inconsistent with information from the FHWA [Federal Highway Administration] (2017), which indicates that road bases 'are typically extended 3 to 4 feet beyond the edge of the pavement.'"[121] It found that "[e]xtending the road base beyond the road surface would increase the ground shine dose for a number of TFI's evaluated scenarios."[122] SC&A recommended that TFI reevaluate "all affected scenarios, assuming a road base that

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[115] SC&A at 38.
[116] SC&A at 38.
[117] SC&A at 46.
[118] *Id*.
[119] *Id*.
[120] *Id*..
[121] SC&A at 44. The Wheeler letter merely says the road base may not extend beyond paved areas of the road, with no enforcement mechanism, and there no definition of what they mean by "paved," as it does not expressly refer to areas with zero pavement, as opposed to areas where the road base has compacted to make a shoulder. SC&A indicates it is unlikely that in the real world of road construction the road base would not extend beyond the area with pavement out to the shoulder, as the FHWA says the road base is typically extended beyond the pavement to make up the shoulders. There is no realistic mechanism for enforcement of such a condition, and in the real world of day-to-day road construction, it seems unlikely that such an abnormal practice would be followed in the field. As SC&A notes at 44, "the road base normally extends 3 to 4 feet on either side of the road."
[122] SC&A at 44.

extends 4 feet from the edge of the road surface."[123] EPA does not appear to have meaningfully addressed that concern.

SC&A identified four issues with the Nearest Resident Scenario. It found RESRAD runs specify a mixing depth of 15 cm, which would bring road base material to the surface for release into the air, affecting inhalation and soil ingestion pathways calculations. TFI assumes 0.15 m mixing depth, which SC&A determined "results in inconsistencies between the ground shine and the inhalation and ingestion exposure pathways"[124] SC&A recommended that TFI redo the RESRAD runs with "the appropriate DMs for the two RCW- RB_SS and two RCW-RS [Road Construction Worker] scenarios."[125] SC&A found "[t]he ground shine calculation assumes that the PG-contaminated road base is covered with a non-PG containing layer of paving. This is inconsistent with the any of the three road construction scenarios definitions identified by TFI."[126] It again recommended the analysis be recalculated using one of the identified PG road construction scenarios:[127] PG in road base during construction with no surface material present; PG in road base (mixed with soil and compacted) and PG in the concrete paving on the road surface; Road base without PG and PG in the concrete paving on the road surface.[128] It further found that if the road base was extended 3-4 feet beyond the edge of the pavement as the FHWA says is the typical practice, this would introduce a new source of exposure to the "Nearest Resident" that was not considered in TFI's analysis.[129] SC&A again recommended that TFI "reevaluate all affected scenarios, assuming a road base that extends 4 feet from the edge of the road surface."[130] It found "the approach used to evaluate the dose rate at the Nearest Resident locations (i.e., 20 and 50 feet from the edge of the road) was inappropriate,"[131] and that "TFI's

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[123] *Id.*
[124] SC&A at 44.
[125] *Id.*
[126] SC&A at 45.
[127] *Id.*
[128] SC&A at ix.
[129] SC&A at 45.
[130] SC&A at 44.
[131] SC&A at 45.

evaluation of the Nearest Resident exposure pathways needs to be revised to address these concerns."[132]

Regarding Reclaimer Radon exposure, SC&A found that "Arcadis (2019) selected values that are representative of intact solid concrete. SC&A believes that it is not appropriate to model either the PG or the home's foundation as intact solid (i.e., without cracks) concrete."[133] SC&A also warned that "sewer pipes can become a conduit for bring sewer gas, volatile organic compounds, and radon into a building."[134] It also cautioned that TFI failed to include in its risk evaluation ingestion of home-grown produce and a number of other exposure pathways: "No other reclaimer exposure pathways were analyzed, e.g., ground shin [sic] from time spent in the yard, inhalation and soil ingestion from working in the garden, consumption of vegetables grown in the garden, consuming water from an onsite well."[135] SC&A recommended that TFI revise their reclaimer radon exposure dose calculation using "more realistic (i.e., less optimistic) parameter values."[136]

In short, EPA hired consultants with radiological expertise. The experts raised numerous concerns and made multiple recommendations that EPA failed to meaningfully address or require of TFI. Therefore, EPA's PG Approval is arbitrary and capricious and its failure to follow the recommendations of its experts suggests it relied on factors other than science in approving the use of phosphogypsum in roads.

2. *EPA's so-called condition that roads constructed with PG not be abandoned does not actually prevent harm from abandonment as it is fictional and unenforceable.*

EPA rejected the use of PG in roads in 1992 because of the risk posed by a PG road if it were to be abandoned and a home were to be built on it. In its 2020 approval, EPA accepted the risk because it supposedly conditions approval of PG use in roads on the roads not being

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132 *Id.*
133 *Id.*
134 SC&A at 36.
135 *Id.*
136 SC&A at 45.

abandoned.[137] Nothing that TFI has now proposed—use in road construction of radioactive waste from phosphate mining—differs substantively from what EPA considered and rejected in its 1992 rulemaking. Indeed, EPA has again concluded, as it did in 1992, that radiation exposures resulting from subsequent abandonment of such radioactive roads would exceed the upper limit of any acceptable risk range.

EPA's 1992 rulemaking concluded: "regardless of the radium-226 concentration in phosphogypsum, *the use of phosphogypsum in road construction always resulted in a MIR [Maximum Individual Risk] significantly greater than the presumptively safe level*."[138] EPA's expert consultant similarly concluded in June 2020 that the use of PG for roads as proposed by TFI could result in radiation doses far in excess of any acceptable risk level.[139] EPA staff, in its October 14, 2020 review of the TFI proposal, also concluded this scenario "could potentially still present lifetime risks above the Agency's defined threshold."[140]

EPA states that it "remains concerned" about potential exposure should the road become abandoned, particularly for residences built on road material containing phosphogypsum, and that "[t]he EPA does not agree that TFI's assumptions in its analysis of this scenario … could be relied upon to limit the potential risks to a future residential individual from such an occurrence."[141] The EPA nonetheless determined "this risk can be acceptably mitigated by including appropriate terms and conditions in the approval," *i.e.,* that roads constructed with PG

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[137] Wheeler Oct. 14, 2020 at 5. EPA questioned some of the modeling assumptions used by TFI to generate the estimate of the reclaimer "but based on new information and analysis in the revised request now concludes that risks associated with the reclaimer scenario can be addressed with conditions."

[138] 57 Fed. Reg. at 23311 (emphasis added).

[139] See SC&A, *Technical Review of The Fertilizer Institute Risk Assessment for Additional Use of Phosphogypsum in Road Base,* Prepared for USEPA, June 10, 2020, Table 4-10, at 36, which estimates radiation doses from just one pathway alone (inhalation of radon gas) as 623 millirem/year, and still 73.8 millirem/year even if there were a 10 cm cover. SC&A asserts that any dose over 19 millirem/year is presumptively outside the outer limits of EPA's acceptable risk range. At 42, fn. 5. While we do not agree with the assertion that 19 millirem/year is in fact within the risk range, EPA's consultant nonetheless makes clear that the doses far exceed even what it characterizes as the upper limit of the risk range.

[140] Radiation Protection Division, Office of Radiation and Indoor Air, US Environmental Protection Agency, *Review of the Radiological Risk Assessment in Support of Petition for Beneficial Use of Phosphogypsum Prepared for The Fertilizer Institute*, October 14, 2020, p. 2

[141] 85 Fed. Reg. at 66552.

may not be abandoned or used for other non-road purposes, and that any PG removed from the stack but not used must be returned to the stack.[142]

The 1992 decision presumed that roads could and would be abandoned. The 2020 approval does not provide any new or different analysis, but now incorporates a new, unwarranted assumption: that a road-builder can reliably commit to never abandoning a road. Thus, the approval requires the owner or operator of the stack from which the phosphogypsum is to be distributed or the governmental entity responsible for building and maintaining the road to submit to the EPA all information required by 40 CRF § 61.2016(b), including "conditions related to" continued control, maintenance, and use of the road.

The radium in phosphogypsum has a half-life of 1,600 years, meaning that in the year 3620, there would still be half of it. It is generally assumed 20 half-lives for a radionuclide to decay away, therefore radionuclide from PG in roads will continue to present risk of harm for the next 32,000 years. Uranium in PG has an even longer half-life. Thus, there is no credible way such a "condition" that roads be forever maintained. Indeed, EPA appeared to recognize the illusory nature of the condition in acknowledging that roads have a finite life, thereby undermining the notion that they would not be abandoned.[143] And while EPA acknowledges that any use of PG not consistent with the condition of non-abandonment "shall be construed as unauthorized distribution of PG" it only goes so far to say that this "may" constitute a violation of 40 C.F.R. Part 61, Subpart R.[144] There is no mechanism whatsoever for enforcing such a fictional condition: no deed restrictions required; no continued inspection by EPA; nothing to actually make such a condition anything other than a fig-leaf for approving a reversal of the 1992 rule.

3. *EPA's analysis does not take into account risk of harm from roads destroyed by sea-level rise, floods, and storm surge.*

There appears to be no analysis of how roads may be eroded or abandoned due to sea-level rise, floods, storms, and changes in temperatures and precipitation. The PG Approval notes that TFI purported that PG was only economically viable within 200 miles of gypstacks. For roads within

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[142] Wheeler Oct. 14, 2020 at 7.
[143] Wheeler Oct. 14, 2020 at 7 requiring that records be maintained by the end user "for the life of the road."
[144] *Id.* At 7-8.

200 miles of the gypstacks in Florida, Mississippi, and Louisiana, many will likely be in coastal areas subject to inundation by sea level rise in the foreseeable future. Inland locales will be impacted by changes in precipitation, temperature, and inland flooding.

Global average sea level rose by seven to eight inches over the past century as the oceans have warmed and land-based ice has melted. Sea level rise is accelerating in pace with almost half of recorded sea-level rise occurring since 1993. The Fourth National Climate Assessment estimated that global sea level is very likely to rise by 0.3 to 0.6 feet by 2030, 0.5 to 1.2 feet by 2050, and 1.0 to 4.0 feet by the end of the century relative to the year 2000, with sea-level rise in excess of 8 feet possible.[145] The impacts of sea-level rise will be long-lived: under all emissions scenarios, sea levels will continue to rise for many centuries.[146]

Unfortunately, the sea level rise projected for the southeast reflects the global outlook, with sea-level rise projections of between 2 and 6 feet within this century. For example, the projections by the Climate Change Compact for south Florida suggest a sea-level rise in excess of the expected global average: 0.6 to 1.0 feet by 2030; 1.1 to 1.9 feet by 2050; and 2.7 to 6.1 feet by 2100. These projections are considered most likely, but less conservative estimates indicate that sea-level rise could go as high as 1.2, 2.5, and 8.6 feet in 2030, 2050, and 2100, respectively.[147]

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[145] Hayhoe, K., D.J. Wuebbles, D.R. Easterling, D.W. Fahey, S. Doherty, J. Kossin, W. Sweet, R. Vose, and M. Wehner. 2018. Our Changing Climate. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 72–144. doi: 10.7930/NCA4.2018.CH2.

[146] Walsh, J., D. Wuebbles, K. Hayhoe, J. Kossin, K. Kunkel, G. Stephens, P. Thorne, R. Vose, M. Wehner, J. Willis, D. Anderson, S. Doney, R. Feely, P. Hennon, V. Kharin, T. Knutson, F. Landerer, T. Lenton, J. Kennedy, and R. Somerville. 2014. Ch. 2: Our Changing Climate. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 19-67. doi:10.7930/J0KW5CXT; U.S. Global Change Research Program (USGCRP). 2017. Climate Science Special Report: Fourth National Climate Assessment, Vol. I. Available at: https://science2017.globalchange.gov/.

[147] Southeast Florida Regional Climate Change Compact Sea Level Rise Work Group. 2019. Unified Sea Level Rise Projection for Southeast Florida. A document prepared for the Southeast

Coastal flooding is becoming more damaging as Atlantic hurricanes and hurricane-generated storm surges grow more severe due to climate change.[148] Projections anticipate an increase in the acceleration of sea-level rise in Florida,[149] which when combined with intensifying hurricanes and storm surge, is greatly increasing the flooding risk.[150] Under a lower emissions RCP 4.5 scenario, storm surge is projected to increase by 25 to 47 percent along the U.S. Gulf and Florida coasts due to the combined effects of sea-level rise and growing hurricane intensity.[151] The increasing frequency of extreme precipitation events is also compounding coastal flooding risk when storm surge and heavy rainfall occur together.[152]

Flooding concerns extend to those associated with high tide. Since the 1960s, sea-level rise has increased the frequency of high tide flooding by a factor of 5 to 10 for several U.S. coastal communities, and flooding rates are accelerating in many Atlantic and Gulf Coast cities.[153] For much of the U.S. Atlantic coastline, a local sea-level rise of 1.0 to 2.3 feet would be sufficient to turn nuisance high tide events into major destructive floods.[154] In Florida specifically, which could have over 6 feet of sea-level rise by the end of the century, nuisance flooding due to sea-level rise has already resulted in severe property damage and social disruption.[155] The frequency, depth, and extent of tidal flooding are expected to continue to increase in the future.[156] As the sea

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Florida Regional Climate Change Compact Climate Leadership Committee. 36 p. Available at http://southeastfloridaclimatecompact.org/.

148 Hayhoe et al. 2018.

149 Southeast Florida Regional Climate Change Compact Sea Level Rise Work Group 2019.

150 Little, C. M., R. M. Horton, R. E. Kopp, M. Oppenheimer, G. A. Vecchi, and G. Villarini. 2015. Joint projections of US East Coast sea level and storm surge. Nature Climate Change 5:1114-1121.

151 Balaguru, K., D. R. Judi, and L. R. Leung. 2016. Future hurricane storm surge risk for the U.S. gulf and Florida coasts based on projections of thermodynamic potential intensity. Climatic Change 138:99-110.

152 Wahl, T., S. Jain, J. Bender, S. D. Meyers, and M. E. Luther. 2015. Increasing risk of compound flooding from storm surge and rainfall for major US cities. Nature Climate Change 5:1093-1098.

153 Hayhoe et al. 2018.

154 Hayhoe et al. 2018.

155 Wdowinski, S., R. Bray, B. P. Kirtman, and Z. Wu. 2016. Increasing flood hazard in coastal communities due to rising sea level: Case study of Miami Beach, Florida. Ocean & Coastal Management 126:1-8.

156 Hayhoe et al. 2018.

level rises, storm surge and tidal flooding will occur on an increasingly higher sea surface which will push water further inland and create more flooding of coastal habitats.[157]

Storms, which are increasing in intensity as a result of the climate crisis, cause erosion and changes to coastlines, with associated damage to roadways.[158] Sea level rise is already progressively making coastal roads and bridges more vulnerable with more than 60,000 miles of U.S. roads and bridges in coastal floodplains vulnerable to extreme storms and hurricanes.[159] Many coastal cities are already experiencing an increase in local flooding that is reducing the functional performance of low-elevation roads.[160] On the east coast alone, more than 7,500 miles of roadway are in high tide flood zones.[161] From 1996-2005 and 2006-2015, there was a 90% increase in tidal flooding and is expected to increase.[162] Even roads that are not inundated are vulnerable as sea-level rise can weaken roadway base materials.[163]

Some models estimate the temperature and precipitation-related damage to paved roads will be up to $20 billion.[164] Elevated temperatures and increased salinity and humidity accelerate deterioration in roads constructed with concrete.[165] For example, in the southeast 5.8 million paved roads are susceptible to increased rutting, cracking, and buckling when sustained temperatures exceed 90F.[166] Inland flooding, which is projected to increase threatens 2,500-4,600 bridges and is anticipated to result in $1.2-1.4 billion in annual damages.[167]

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[157] Tebaldi, C., B. H. Strauss, and C. E. Zervas. 2012. Modelling sea level rise impacts on storm surges along US coasts. Environmental Research Letters 7:014032. doi: 10.1088/1748-9326/7/1/014032.
[158] Culp, M. et al. 2018. Transportation. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment*, Vol. II at 485.
[159] *Id.* at 486.
[160] *Id.* at 487.
[161] *Id.*
[162] Jacobs, J. et al. 2018. Recent and Future Outlooks for Nuisance Flooding Impacts on Roadways on the U.S. East Coast. Transportation Research Record Vo. 2672(2) 1-10.
[163] *Id.*
[164] *Id.* at 485.
[165] *Id.* at 489.
[166] *Id.*
[167] *Id.* at 485.

Roads that are degraded or eroded by "weather," especially the extreme climate-crisis weather already experienced in many areas and projected to worsen, could result in the release of the radioactive waste into the environment, posing an unreasonable risk to public health.

4. *EPA's analysis does not take into account risk of harm from roads destroyed by sinkholes.*

There appears to be no analysis of the very likely scenario of a sinkhole collapse. Sinkholes occur when the sand, clay, shells, or other near-surface rock subsides or collapses into fissure and cavities in the underlying carbonic rock.[168] This happens when the carbonic rock that forms karst geography dissolves after coming into contact with acidic rainwater, surface water, or groundwater.[169] Soluble rock underlies nearly 18% of the total area of the United States,[170] but Florida – which has the most PG stacks of any state – is also the most prone to sinkholes. For example, in 2012 Florida experienced a massive sinkhole event leading to hundreds of collapse sinkholes across the state following record rainfall.[171] Sinkholes are of particular concern in Florida for their direct role effect on aquifer vulnerability and Florida's dependence on groundwater for its water needs.[172]

There have been three reported major sinkholes underneath phosphogypsum stacks in Florida in the last few decades, releasing millions of gallons of untreated process wastewater and an undetermined amount of phosphogypsum into the Floridan aquifer: the 1994 sinkhole beneath a stack in Mulberry, FL releasing 80 million gallons of process wastewater;[173] the 2009 sinkhole beneath a phosphogypsum stack in White Springs, Florida releasing 84 million gallons of process wastewater;[174] and most recently, the 2016 sinkhole beneath a phosphogypsum stack just 1.25 miles away from the 1994 original sinkhole in Mulberry, FL, releasing 215 million gallons

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[168] FDEP. 2017. The Favorability of Florida's Geology to Sinkhole Formation at 4.
[169] FDEP 2017 at 7.
[170] Subedi, P et al. 2019. Sinkhole susceptibility mapping in Marion County, Florida: Evaluation and comparison between analytical hierarchy process and logistic regression based approaches. Scientific Reports.
[171] *Id.* at 5.
[172] *Id.*
[173] James Marshall, *Mountains of Waste Menace Florida's 'Swiss Cheese' Aquifers,* E&E NEWS (Apr. 9, 2020), https://www.eenews.net/stories/1062576963.
[174] *Id.*

of process wastewater and an unknown amount of phosphogypsum into the Floridan aquifer.[175] Remediation of contamination in the Floridan aquifer is likely not possible, as one study found "there is uncertainty in the fate of the contaminant waste after the sinkhole collapse."[176] Another study called for an improved understanding of karst processes and characterization of fast-moving conduit flow patterns.[177] While these sinkholes released an alarming amount of PG into subsurface waters, at least they were in known, discrete, isolated locations where a well-funded, and technologically-equipped company was responsible for mitigating the damage. No such outcome would be likely in the event of a sinkhole in a road containing PG.

5. *EPA violated Section 112 of the Clean Air Act by failing to perform an ample margin of safety analysis in its PG Approval.*

Pursuant to the *Vinyl Chloride* case, EPA was required to set a standard for PG in road construction at a level which may be lower but not higher than the "safe" or "acceptable" level, but it failed to in its PG Approval. The D.C. Circuit in *Vinyl Chloride* set out a two-step decision process for EPA to follow in setting NESHAPs under § 112: (1) determine a "safe" or "acceptable" health risk level; and (2) set the standard at the level – which may be lower but not higher than the "safe" or acceptable" level – that protects public health with an ample margin of safety.[178] The D.C. Circuit held the EPA "cannot consider cost and technological feasibility in determining what is 'safe.' This determination must be based solely upon the risk to health."[179]

EPA, based on an analysis of certain benzene sources, established a presumption of acceptability for a risk posed by a hazardous air pollutant analyzed under § 112 of 1 in 10,000 to the maximally exposed individual and a goal to protect the greatest number of persons possible to a lifetime risk level no higher than approximately 1 in 1,000,000.[180] EPA was then to consider

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[175] *Id.*
[176] Daljit Sandu et. al., *Fate and transport of radioactive gypsum stack water entering the Floridan aquifer due to a sinkhole collapse*, SCIENTIFIC REPORTS (2018), https://www.nature.com/articles/s41598-018-29541-0
[177] Daljit Sandu, *Implications of Groundwater Plume Transport and Analysis of Karst Aquifer Characteristics in Central Florida*, UNIVERSITY OF CENTRAL FLORIDA (2019), https://stars.library.ucf.edu/etd/6575/.
[178] 57 Fed. Reg. at 23306.
[179] *NRDC v. EPA*, 824 F.2d 1146.
[180] 54 Fed. Reg. at 38044; 57 Fed. Reg. at 23306.

"other information, including economic costs and technical feasibility, along with all of the health-related factors previously used to determine the 'safe' level, to set a standard which protects public health with an ample margin of safety."[181] Like vinyl chloride and benzene, radon is "an apparent non-threshold pollutant" meaning that "it appears to create a risk to health at all non-zero levels of emissions."[182]

TFI's application falsely stated in its revised application that EPA in its 1992 rulemaking "determined that the 3 in 10,000 risk level provided 'an amply margin of safety, considering the cost, scientific uncertainty, and technological feasibility of control technologies needed to further reduce the radon emissions from [the PG] stacks.'"[183] But EPA did not make that determination. Instead, it found in its earlier radionuclide rulemakings implementing criteria for benzene, that in some instances emissions resulting in a risk of 3 in 10,000 were acceptable. Given all of the information available about potential exposures and risks, as well as uncertainties inherent in driving risk estimates, EPA concluded that certain uses of PG may be considered acceptable, as long as those uses are restricted to limit the estimated lifetime risk to any individual to no more than 3 in 10,000.[184]

In its final rule on radon emissions from PG stacks, EPA analyzed whether PG could be used in road construction and considered scenarios to identify the greatest maximum lifetime risk of fatal cancer from several exposed groups, members of the general public, people living on contaminated land, and workers. The EPA determined that the largest increase in maximum individual risk associated with gamma radiation and indoor radon inhalation exposure pathways for people living in a house constructed on land where roads built using PG once existed at 7.5 in 10,000 to 9.3 in 1,000,[185] and therefore determined that "regardless of the radium-226 concentration in PG, the use of PG in road construction always resulted in a MIR significantly greater than the presumptively safe level." Because the EPA determined that the use of PG in

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[181] 57 Fed. Reg. at 23306.
[182] 824 F.2d at 1148.
[183] TFI. Oct. 2019. App 2 Radiological Risk Assessment in Support of Petition for Beneficial Use of Phosphogypsum at ES-1; TFI. Apr. 7, 2020. Revised Request for Approval of Additional Uses of Phosphogypsum Pursuant to 40 C.F.R. § 61.206 at 36.
[184] 57 Fed. Reg. at 23311-23312.
[185] 57 Fed. Reg. at 23310-23311.

road construction always resulted in MIR greater than the outer bound of the presumptively safe level of 1 in 10,000 and therefore present an unacceptable level of risk to public health, the EPA did not perform the second step of determining the "amply margin of safety" as required by *Vinyl Chloride.*[186] EPA does not appear to have ever completed the second step of determining PG emissions for roads under *Vinyl Chloride* by establishing or even analyzing an ample margin of safety for PG in road construction.

By swapping the ceiling ($3x10^{-4}$) for the floor, EPA has lost any margin of safety, and has failed to comply with its legal obligation to provide an amply margin of safety.

D. EPA violated the National Environmental Policy Act and Clean Air Act by failing to prepare an environmental assessment on the approval of PG to be used in road construction.

The D.C. Circuit has held that "section 111 of the Clean Air Act, properly construed, requires the functional equivalent of a NEPA impact statement." *Portland Cement Ass'n v. Ruckelshaus*, 486 F.2d 375, 384-385 (D.C. Cir. 1973)). Courts applying other sections of the Clean Air Act and other statutes the EPA implements have likewise held that while the EPA is not required to comply with NEPA as an "environmentally protective regulatory agency," it is required to provide the functional equivalent to NEPA. Here, EPA has not provided a functional equivalent of a NEPA analysis examining the impacts to the human environment.

E. EPA violated the Endangered Species Act in failing to consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service for impacts to listed species and their habitat from the PG Approval.

The EPA has failed to consult with the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA) regarding whether the PG Approval may affect the 451 listed species found within 200 miles of the 71 gypstacks.[187] The Supreme Court has called the ESA "the most comprehensive legislation for the preservation of endangered species ever enacted by any nation."[188] "The plain intent of Congress in enacting

[186] 57 Fed. Reg. at 23312 ("because the MIRs for the use of phosphogypsum in road construction always exceed the upper limit of the presumptively safe level of approximately 1X10-4, the Agency concluded it was not necessary to perform any additional analysis for this use pattern.").
[187] See attached Exhibit 1 for a complete list of impacted species.
[188] *TVA v. Hill*, 437 U.S. 153, 180 (1978).

[the ESA] was to halt and reverse the trend toward species extinction, whatever the cost."[189] The Court specifically noted that the ESA reflects "a conscious decision by Congress to give endangered species priority over the 'primary missions' of federal agencies."[190] To accomplish this goal, the ESA includes a variety of substantive and procedural provisions designed to protect and recover imperiled species.[191]

The heart of the ESA for federal actions is Section 7, which requires that every federal agency ensure that its actions are not likely to "jeopardize" a listed species or "adversely modify" its critical habitat.[192] Each Federal agency shall, in consultation with and with the assistance of the Secretary, ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat. In fulfilling the requirements of this paragraph each agency is required to use the best scientific and commercial data available.[193]

EPA's Technical Review of Fertilizer Institute Risk Assessment for Additional Use of Phosphogypsum in Road Base prepared by SC&A June 10, 2020 found that "in crayfish (i.e., crustacea) the conservative, upper bound crayfish ingestion annual dose is unacceptably large, and would greatly exceed EPA's 3 in 10,000 reference risk" and that it "recommends that further study of the crayfish ingestion potential exposure pathway be performed."[194] EPA's reviewing consultant determined that "[a]mong other things, these further studies would determine: 1) is this a viable exposure pathway (e.g., do crayfish live in the vicinity of PG stacks?; if so, do people

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[189] *Id*. at 184.
[190] *Id*. at 185.
[191] The substantive protections imposed by Section 7 only come into play once a species has been listed as either threatened or endangered under Section 4 of the Act. 16 U.S.C. § 1533(a) (2006) (which sets forth the process for listing threatened or endangered species).
[192] 16 U.S.C. § 1536(a)(2) (2006). The ESA's prohibition on jeopardy to listed species, and its prohibition on adverse modification of critical habitat, are distinct legal duties with distinct standards.
[193] 16 U.S.C. § 1536(a)(2).
[194] SC&A at xi.

regularly harvest the crayfish?) and 2) is it appropriate to utilize equilibrium Kds to calculate the pond water radionuclide concentrations."[195]

The consultant warns that the crayfish's bioaccumulation factor is "80 and 200 times larger than the Ra-226 and Pb-210 bioaccumulation factors, respectively," and notes that "Crayfish are part of nature's food chain. They can be eaten by owls, fox, raccoons, snakes, muskrats, turtles, yellow perch, and bluegills, as well as people. Additionally, crayfish carcasses are being studied as an alternative source for the protein and minerals necessary to raise chickens."[196] The consultant pleas that "crayfish ingestion doses are so large that TFI should be requested to further investigate this potential exposure pathway, as well as the crayfish-to-meat/poultry-to-man food chain."[197]

Instead of following its expert consultant's recommendation, EPA found that:[198]

> *The potential for bioaccumulation of radium progeny, particularly by crustaceans, is noteworthy*. Although SC&A was able to calculate risks far in excess of the established limits for this approval, they were contingent on an extreme conceptual model in which surface water infiltrates phosphogypsum and dissolves radionuclides. Crayfish are assumed to live in this undiluted water and are harvested and ingested by humans, resulting in projected exposures above the risk threshold. *Given that extensive contact between phosphogypsum and ground and surface water is not expected to occur given the generic road design proposed by TFI, further investigation is not necessary at this time*. Should a different road design or use of a previous road site be proposed involving significant interaction between phosphogypsum and surface or ground water, further analysis should be conducted to fully rule out the possibility of the bioaccumulation of radionuclides

In addition to the harms from radioactive materials found in PG – like uranium, uranium-238, uranium-234, thorium-230, radon-222, lead-210, polonium-210 – other constituents in PG – like cadmium and lead, as well as chromium, arsenic, fluoride, zinc, antimony, and copper – can impact species.

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[195] Technical Review of Fertilizer Institute Risk Assessment for Additional Use of Phosphogypsum in Road Base prepared by SC&A June 10, 2020 at xi.
[196] *Id.*
[197] Technical Review of Fertilizer Institute Risk Assessment for Additional Use of Phosphogypsum in Road Base prepared by SC&A June 10, 2020 at 43.
[198] E-Docket: EPA-HQ-OAR-2020-0442 by EPA on Oct. 14, 2020 at 19

Cadmium

While cadmium can enter waterways due to erosion, in unpolluted freshwaters, cadmium concentrations are typically very low and are frequently below analytical detection limits.[199] Cadmium is toxic and has no biological function in living organisms.[200] Cadmium causes both acute and sublethal effects, and is toxic at low concentrations to plants, fish, birds, mammals (including humans), and microorganisms.[201] Cadmium causes a range of impacts on aquatic organisms. Cadmium is a teratogen, meaning that it causes malformations of embryos, and is also a carcinogen.[202] Exposure results in adverse effects on growth, reproduction, immune and endocrine systems, development, and behavior.[203] In a 2005 study that compared acute toxicity of 63 heavy metals to a widespread crustacean found in both fresh and brackish water (*Hyalella Azteca)*, cadmium was the most toxic.[204] Cadmium bioaccumulates in all levels of the food chain in both aquatic and terrestrial organisms.[205] In both freshwater and marine animals, cadmium concentrates to concentrations hundreds to thousands of times higher than in the water.[206] Bioconcentration factors range from 3 to 4,190 in freshwater organisms and from 5 to 3,160 in saltwater organisms.[207] A 1985 Department of the Interior study examined concentrations of cadmium in a variety of aquatic and terrestrial flora and fauna and identified the following trends relevant here: (1) in general, marine organisms contain "significantly higher cadmium residues" than freshwater organisms; (2) cadmium tends to concentrate in the liver and kidneys of vertebrates; (3) cadmium concentrations are higher in older organisms, especially in marine

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[199] EPA, EPA-820-R-16-002, *Aquatic Life Ambient Water Quality Criteria – Cadmium* 6 (2016) at 8.
[200] Levit, Stuart M., A Literature Review of Effects of Cadmium on Fish 2 (2010), *available at* https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/alaska/sw/cpa/Documents/L2010CadmiumLR122010.pdf.
[201] *Id.*
[202] EPA, EPA-820-R-16-002, *Aquatic Life Ambient Water Quality Criteria – Cadmium* 10 (2016).
[203] *Id.*
[204] Borgmann, U., et al., 24 *Toxicity of sixty-three metals and metalloids to Hyalella azteca at two levels of water hardness, Environmental Toxicology and Chemistry* 641–52 (2005).
[205] U.S. Department of Health and Human Services, Public Health Service Agency for Toxic Substances and Disease Registry, Toxicological Profile for Cadmium 293 (2012), *available at* https://www.atsdr.cdc.gov/toxprofiles/tp5.pdf.
[206] *Id.*
[207] *Id.*

vertebrates; and (4) cadmium concentrations are dependent upon the species analyzed, the season of collection, ambient cadmium levels, and the sex of the organism.[208]

Cadmium causes a range of impacts in fish, including sturgeon. For example, cadmium competes with calcium uptake because the two chemicals are similar, which can cause skeletal malformations and acute hypocalcemia, the latter of which is characterized by cadmium accumulation in tissues and decreased calcium concentrations in plasma.[209] Cadmium also causes disease of the gill, liver, and kidneys in fish, renal tubular damage, alterations of free radical production and the antioxidant defense system, immunosuppression, and structural effects on invertebrate gills.[210] Cadmium pollution also negatively impacts the shortnose sturgeon's physiological processes and ability to swim.[211] Cadmium is also known to disrupt the endocrine functions of Atlantic salmon, other listed salmonids in the Pacific Northwest, and is negatively impacting the reproductive capabilities of these endangered species.[212]

While not as much is known about the impact of cadmium on sea turtles, numerous studies have identified elevated levels. A 2017 paper review of the available scientific literature on metals contamination in sea turtles found that of the most toxic metals (lead, mercury, and cadmium), the concentration of cadmium in sea turtle blood was the highest.[213] Among the non-essential metals, cadmium was found in all reported tissues, with the highest concentrations found in the kidneys.[214] Similarly, a 2018 study of 137 specimens of green sea turtles collected from around the world identified cadmium in all of the samples, with the highest bioconcentration in the kidneys.[215] Specimens from the Pacific Ocean had higher cadmium concentrations in the liver than samples from the Atlantic Ocean.[216] Cadmium concentrations measured in tissues were

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[208] *Id.* at 304.
[209] EPA, EPA-820-R-16-002, *Aquatic Life Ambient Water Quality Criteria – Cadmium* 6 (2016).
[210] EPA, EPA-820-R-16-002, *Aquatic Life Ambient Water Quality Criteria – Cadmium* 10 (2016).
[211] FWS, *Shortnose Sturgeon Recovery Plan* 49 (1998).
[212] FWS, *Atlantic Salmon Recovery Plan* 1-39 (2005).
[213] Cortes-Gomez, A.A. et al., *The Current Situation of Inorganic Metals in Marine Turtles: A General Review and Meta-Analysis*, 229 Env. Pollution, 567, 575-76
[214] *Id.* at 582.
[215] Fraga, N.S., et al., *Cadmium in tissues of green turtles (Chelonia mydas): A global perspective for marine biota*, 637-38 Science of the Total Environment 389, 392-93 (2018).
[216] *Id.* at 396.

generally greater than concentrations found in other marine organisms, including dolphins.[217] The study identified a global trend in cadmium contamination in turtles suggesting that global factors may be more important than regional factors.[218]

The widespread decline in species diversity and population density of freshwater mussels in North America is partly related to chronic, low-level exposure to toxic measures like cadmium and zinc.[219] Mussels bioaccumulate certain metals to such concentrations that greatly exceed those in dissolved water and can alter growth and development.[220] The recovery plan for the Cumberland and Tennessee River mussels explains that many endangered freshwater mussels are "among the most intolerant organisms to heavy metals," and "[c]admium appears to be the heavy metal most toxic to mussels."[221] Cadmium has been directly correlated with the decline of the dwarf Wedgemussel,[222] and the FWS has identified cadmium as "acutely toxic" to the Mapleleaf mussel.[223] Alarmingly, the FWS has noted that "[v]irtually nothing is known about the sublethal impacts in mussels to long-term exposure to metals at low concentration…Sublethal effects are frequently observed at concentrations only one-half the lethal concentration, which indicates that freshwater mussels become stressed at metal concentrations much lower than those reported in acute toxicity tests."[224] Thus, even small amounts of cadmium may have disproportionately adverse effects for endangered species — for example like the Alabama cave shrimp — as they tend to bioaccumulate contaminants rather than metabolizing and releasing them.[225]

To date, at least thirty-six recovery plans identify cadmium as potentially toxic or harmful to freshwater dependent threatened or endangered species. Some of the species harmed by

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217 *Id.*
218 *Id.* at 395-96.
219 Naimo, T. 1995. A review of the effects of heavy metals on freshwater mussels. Ecotoxicology 4, 341-362.
220 *Id.*
221 FWS, *Cumberland and Tennessee River Mussel Recovery Plan 37 (2004); see also FWS, Scaleshell Mussel Draft Recovery Plan* 9 (2004); *see also* FWS, *Recovery Plan for Endangered Fat Threeridge, Shinyrayed Pocketbook, Gulf Moccasinshell, Ochlockonee Moccasinshell, Oval Pigtoe and Threatened Chipola Slabshell, and Purple Bankclimber* (2003).
222 FWS, *Dwarf Wedge Mussel Recovery Plan* 14 (1993).
223 FWS, *Winged Mapeleaf mussel Recovery Plan* 9 (1997).
224 FWS, *Higgens Eye Pearlymussel Recovery Plan* 12 (2004).
225 FWS, *Alabama Cave Shrimp Recovery Plan* 11 (1997).

cadmium pollution include the San Francisco lessingia, Raven's Manzanita, fine-rayed pigtoe pearly mussel, shiny pigtoe pearlymussel, tan riffle shell mussel, roseate tern, Short-tailed Albatross, Alabama cave shrimp, Atlantic salmon, Snake River salmon, Barton Springs salamander, Chriricahua Leopard Frog, clubshell, Northern Riffleshell, Cui-ui, Cumberland River Mussel, Tennessee River Mussel, Devil's River Minnow, Scaleshell Mussel, Dwarf Wedgemussel, Florida Manatee, Gulf Sturgeon, Higgins Eye Pearly Mussel, Illinois Cave Amphipod, Killer Whale, Ozark Cavefish, Pallid Sturgeon, Pecos Bluntnose Shiner, Puget Sound Salmon, River Minnow, Shortnose Sturgeon, Delta Smelt, Sacramento Splittail, Spectacled Eider, the Beluga Whale, and the Winged Mapleleaf Mussel.[226]

Lead

Lead has long been recognized as a poison to living organisms,[227] with negative effects on general health, reproduction, and behavior.[228] Lead was highlighted as an important cause of mortality in wildlife populations in the late 1950s when ingestion of spent hunting lead pellets was recognized to cause death in a wide range of wild waterfowl.[229] Reports of poisoned wildlife have continued frequently since that time.[230] Various authors have attempted to define tissue concentrations in birds indicative of excessive lead exposure, sub-lethal poisoning, and acute

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[226] See attached recovery plans in Appendix A.
[227] Grinnell, G.B. 1894. Lead-poisoning. Forest and Stream 42(6):117-118; Engstad, J.E. 1932. Foreign bodies in the appendix. Minnesota Med. 15:603-6xx; Horton, B.T. 1933. Bird shot in verminform appendix: a cause of chronic appendicitis. Surgical Clinics of North America 13:1005-1006.
[228] Ris, M. D., K.N. Dietrich, P.A. Succop, O.G. Berger and R.L. Bornschein. 2004. Early exposure to lead and neuropsychological outcome in Adolescence. Journal International Neuropsychological Society 10: 261-270.
[229] Bellrose, F.C. 1959. Lead Poisoning as a Mortality Factor in Waterfowl Populations. Ill. Nat. Hist. Surv. Bull. 27:2335-288.
[230] Bates, F.Y., D.M. Barnes, and J.M. Higbee. 1968. Lead Toxicosis in Mallard Ducks. Bull. Wildl. Dis. Assoc. 4:116-125; Sanderson, G.C. and F.C. Bellrose. 1986. A Review of the Problem of Lead Poisoning in Waterfowl. Ill. Nat. Hist. Surv. Spec. Publ. 4; Irwin, J.C. and L.H. Karstad. 1972. The toxicity for Ducks of Disintegrated Lead Shot in a Stimulated Marsh Environment. J. Wildl. Dis. 8:149-154; Kramer, J.L. and P.T. Redig. 1997. Sixteen Years of Lead Poisoning in Eagles, 1980-1995: An Epizootiologic View. J.E. Cooper and A.G. Greenwood (eds.). Journal of Raptor Research 31:327-332; Scheuhammer, A.M. and S.L. Norris. 1996. The Ecotoxicology of Lead Shot and Lead Fishing Weights. Ecotoxicology 5:279-295.

poisoning,[231] but there is no definitive consensus on "background" lead levels for wild birds. Lead is a non-specific poison affecting all body systems. Birds can suffer from both acute and chronic lead poisoning.[232] Birds with acute lead poisoning can appear normal, but they experience massive tissue destruction to internal organs and death within a few days.[233]

Birds with chronic lead poisoning may develop appetite loss, anemia, anorexia, reproductive or neurological impairment, immune suppression, weakness, and susceptibility to predation and starvation.[234] The effects of lead toxicosis in birds commonly include distension of the proventriculus, green watery feces, weight loss, anemia, and drooping posture.[235] Sub-lethal toxic effects are exerted on the nervous system, kidneys, and circulatory system, resulting in

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[231] Franson, J.C., N.J. Thomas, M.R. Smith, A.H. Robbins, S. Newman, and P.C. McCartin. 1996. A Retrospective Study of Post-Mortem Findings in Red-Tailed Hawks, J. Raptor Res. 30, 7-14; Pain, D.J. 1996. Lead in Waterfowl. *Environmental Contaminants in Wildlife: Interpreting Tissue Concentrations*. W.M. Beyer, G.H. Heinz, and A.W. Redman-Norwood (eds.), pp. 251-262.

[232] Bellrose 1995; Redig, P. T. 1985. A report on lead toxicosis studies in bald eagles. Final Report, U. S. Dept. of Interior, Fish and Wildlife Service Project No. BPO #30181-0906; Sanderson and Bellrose 1986.

[233] Sanderson and Bellrose 1986.

[234] Grandy, J.W. IV, L.N. Locke, and G.E. Bagley. 1968. Relative Toxicity of Lead and Five Proposed Substitute Shot Types to Pen-Reared Mallards. Journal of Wildlife Management 32:483-488; Kimball, W. H. and Z. A. Munir. 1971. The corrosion of lead shot in a simulated waterfowl gizzard. Journal of Wildlife Management 35(2):360-365; Finley, M.T., and M.P. Dieter. 1978. Influence of laying on lead accumulation in bone of mallard ducks. Journal of Toxicology and Environmental Health 4:123-129; Hohman, W. L., J. L. Moore, and J. C. Franson. 1995. "Winter survival of immature Canvasbacks in inland Louisiana." Journal of Wildlife Management 59(2):384-392.

[235] Sanderson and Bellrose 1986; Hanzlik, P. J. 1923. Experimental plumbism in pigeons from the administration of metallic lead. Archiv für experimentelle Pathologie und Pharmakologie 97:183-201; Quortrup, E.R. and J.E. Shillinger. 1941. 3,000 wild bird autopsies on western lake areas. American Veterinary Medical Association Journal; Redig et al. 1980; Reiser, M.H. and S.A. Temple. 1981. Effects of Chronic Lead Intoxication on Birds of Prey. Recent advances in the study of raptor diseases, 21-25. J.E. Cooper and A.G. Greenwood (eds.), pp. 21-25; Franson, J.C., L. Sileo, O.H. Pattee, and J.F. Moore. 1983. Effects of Chronic Dietary Lead in American Kestrels (*Falco spaverius*). J. Wildlife Dis. 19,110-113; Custer, T.W., J.C. Franson, and O.H. Pattee. 1984. Tissue Lead Distribution and Hematologic Effects in American Kestrels (*Falco sparverius*) Fed Biologically Incorporated Lead. J. Wildlife Dis. 20, 39-43; Mateo, R. 1998. La Intoxicacion Por Ingestion de Objtos de Polmo en Aves: Una Revision de Los Aspectos Epidemiologicos y Clinicos. La Intoxicacion por Ingestion de Perdigones de Plomo en Aves Silvestres: Aspectos Epidemiologicos y Propuestas para su Prevencion en Espana, Doctoral Thesis, Univertat Autonoma de Barcelona, Barcelona, pp. 5-44.

physiological, biochemical and behavioral changes.[236] Vitamin metabolism can be affected and birds can go blind.[237] Lead toxicosis depresses the activity of certain blood enzymes, such as delta-aminolevulinic acid dehydratase, essential for cellular energy and hemoglobin production, and may impair immune function.[238] Over longer periods, hematocrit and hemoglobin levels are often reduced. Finkelstein et al. (2010) found that sub-lethal concentrations of lead in blood (20 µg/dL), resulted in a 60% decrease in the levels of aminolevulinic acid dehydratase in condors.[239] As a result of physiological and behavioral changes, birds may become increasingly susceptible to predation, starvation, and infection by disease, increasing the probability of death from other causes.[240] Lead can also affect reproductive success.[241] Grandjean (1976) showed a correlation between thin eggshells and high concentrations of lead in European kestrels (*Falco tinnunculus*).[242] Lead poisoning significantly decreased egg production in captive Japanese quail, *Coturnix japonica*.[243] In ringed turtle doves (*Streptopelia risoria*), significant testicular degeneration has been reported in adults following shot ingestion and seminiferous tubules may

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[236] Scheuhammer, A. M. 1987. The chronic toxicity of aluminum, cadmium, mercury, and lead in birds: a review. Environmental Pollution 46:263-295.
[237] Baksi, S.N. and A.D. Kenny. 1978. Effect of Lead Ingestion on Vitamin D3 Metabolism in Japanese Quail, Res. Commun. Chem. Path. Pharmacol. 21, 375-378; Pattee, O.H., S.N. Wiemeyer, B. Mulhern, L. Sileo, and J.W. Carpenter. 1981. Experimental Leadshot Poisoning in Bald Eagles. J. Wildl. Manage. 45:806-810.
[238] Redig et al. 1991; Grasman, K.A., and P.F. Scanlon. 1995. Effects of acute lead ingestion and diet on antibody and T-cell-mediated immunity in Japanese quail. Arch. Environ. Contam. Toxicol. 28, 161–167.
[239] Finkelstein, M.E., D. George, S. Scherbinski, R. Gwiazda, M. Johnson, J. Burnett, J. Brandt, S. Lawrey, A.P. Pessier, M. Clark, J. Wynne, J. Grantham, and D.R. Smith. 2010. Feather Lead Concentrations and $^{207}Pb/^{206}Pb$ Ratios Reveal Lead Exposure History of California Condors (*Gymnogyps californianus*). Environ. Sci. Technol. 2010, 44, 2639–2647.
[240] Scheuhammer and Norris 1996.
[241] Cheatum, E.L., and D. Benson. 1945. Effects of lead poisoning on reproduction of mallard drakes. Journal of Wildlife Management 9(1):26-29; Elder, W.H. 1954. The effect of lead poisoning on the fertility and fecundity of domestic mallard ducks. Journal of Wildlife Management 18(3):315-323; Buerger, T. 1984. Effect of lead shot ingestion on captive mourning dove survivability and reproduction. M.S. thesis. Auburn University, Auburn, Alabama. 39 pp.; Buerger, T., R.E. Mirarchi, and M.E. Lisano. 1986. Effects of lead shot ingestion on captive mourning dove survivability and reproduction. Journal of Wildlife Management 50(1):1-8.
[242] Grandjean, P. 1976. Possible effect of lead on egg-shell thickness in kestrels 1874-1974. Bulletin of Environmental Contamination and Toxicology 16(1):101-106.
[243] Edens, F.W. and J.D. Garlich. 1983. Lead-Induced Egg Production Decrease in Leghorn and Japene Quail Hens, Poultry Sci. 62, 1757-1763.

be devoid of sperm.[244] Experimental studies on Cooper's hawks (*Accipiter cooperii*) showed detectable amounts of lead in eggs when adults had high levels in their blood.[245] In nestlings of altricial species, such as the American kestrel (*Falco sparverius*), body length, brain, liver, and kidney weights can be depressed,[246] along with reduced survival and disrupted brain, liver, and kidney function.[247] Under some circumstances, there may be sex differences in the probability of exposure to or poisoning by lead, at least in western marsh harriers (*Circus aeruginosus*), as significantly more females than males trapped had elevated lead concentrations, for unexplained reasons.[248] Lead exposure may also reduce the likelihood of birds returning to an area to breed.[249] Burger and Gochfeld (2000) found that chronic lead exposure resulted in delayed behavioral response time in both laboratory and wild herring gulls (*Larus argentatus*).[250] Kelly and Kelly (2005) documented moderately elevated blood lead levels increased the risk of collision with overhead power lines for mute swans (*Cygnus olor*).[251] Mallards (*Anas platyrhynchos*) experimentally fed lead exhibited hemolytic anemia during the first week of exposure and neurological impairment during the second week.[252] In experimentally fed turkey

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[244] Kendall, R.J. and P.F. Scanlon. 1981. Effects of Chronic Lead Ingestion on Reproductive Characteristics of Ringed Turtle Doves (*Streptopelia risoria*) and on Tissue Lead Concentrations of Adults and Their Progeny. Environ. Pollut. Series A 26, 203-214; Veit, H.P., R.J. Kendall, and P.F. Scanlon. 1982. The Effect of Lead Shot Ingestion on the Testes of Adult Ringed Turtle Doves (*Streptophelia risoria*). Avian Dis. 27, 442-452.
[245] Snyder, N.F., H.A. Snyder, J.L. Lincer, and R.T. Reynolds. 1973. Organochlorines, Heavy Metals, and the Biology of North American Accipiters. Bioscience 23, 300-305.
[246] Hoffman, D.J., J.C. Franson, O.H. Pattee, C.M. Bunck, and A. Anderson. 1985. Survival, Growth and Accumulation of Ingested Lead in Nestling American Kestrels (*Falco sparverius*). Arch. Environ. Contam. Toxicol. 14, 89-94.
[247] Hoffman, D.J., J.C. Franson, O.H. Pattee, C.M. Bunck, and H.C. Murray. 1985. Biochemical and Hematological Effects of Lead Ingestion in Nestling American Kestrels (*Falco sparverius*). Comp. Biochem. Physiol. 80C, 431-439.
[248] Pain, D. J., and C. Amiard-Triquet. 1993. Lead poisoning of raptors in France and elsewhere. Ecotoxicology and Environmental Safety 25:183-192.
[249] Mateo, R. J. Estrada, J.Y. Paquet, X. Riera, L. Domingues, R. Guitart, and A. Martinez-Vilata. 1999. Lead Shot Ingestión by Marsh Harriers (*Circus aeruginosus*) From the Ebro Delta, Spain. Environ. Pollut. 104, 435-440.
[250] Burger, J. and M. Gochfeld. 2000. Metals in Albatross Feathers From Midway Atoll: Influence of Species, Age, and Nest Location. Environ. Res. 82(3): 207-21.
[251] Kelly, A. and S. Kelly. 2000. Are Mute Swans With Elevated Blood Levels More Likely to Collide With Overhead Powerlines? Waterbirds 28:331-334.
[252] Mateo, R., M. Taggard, and A.A. Meharg. 2003. Lead and Arsenic in Bones of Birds of Prey From Spain, Env. Poll. 126:107-114.

vultures (*Cathares aura*) and bald eagles (*Haliaeetus luecocephalus*), lead ingestion decreased weight and muscle mass and caused blindness.[253] Blood pressure increases and renal damage have also been observed in rodents after experimental lead exposure.[254] Bagchi and Preuss (2005) found that acute lead exposure had lasting effects including lowered bone density and increased blood pressure one year after exposure in laboratory rats.[255]

Sub-lethal lead poisoning may weaken raptors and leave them unable to hunt, or make them more susceptible to mortality from vehicles, power lines, and steel traps.[256] It has also been suggested that raptors intoxicated with lead may suffer impaired hunting ability and may scavenge to a greater extent or be less selective in their choice of prey.[257] Sampling methods to determine the exposure to lead intoxication in wildlife have inherent biases as does any wildlife health assessment in the field. Long-lived species are particularly susceptible to bioaccumulation of lead in bone tissues, and repeated lead ingestion and accumulation in long-lived species can reduce bone mineralization, which could mean an increase in bone fragility.[258] Gangoso et al. (2009) found an unusually high level of frequency of fractures and even leg amputations in an

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[253] Pattee, O.H., S.N. Wiemeyer, B. Mulhern, L. Sileo, and J.W. Carpenter. 1981. Experimental Leadshot Poisoning in Bald Eagles. J. Wildl. Manage. 45:806-810; Pattee, O.H. and D.J. Pain. 2003. Lead in the Environment. Handbook of Ecotoxicology, D.J. Hoffman, B.A. Rattner, G.A. Burton, and J. Cairns (eds.), pp. 373-408.
[254] Victery, W. 1988. Evidence for Effects of Chronic Lead Exposure on Blood Pressure in Experimental Animals: An Overview, Environmental Health Perspectives 78:71-76; Staessen, J.A., R.R. Lauwerys, C.J. Bulpitt, R. Fagard, P. Linjen, H. Roels, L. Thijs, and A. Amery. 1994. Is a Positive Association Between Lead Exposure and Blood Pressure Supported by Animal Experiments? Current Opinion in Nephrology and Hypertension 3:257-263.
[255] Bagchi, D. and H.G. Preuss. 2005. Effects of Acute and Chronic Oval Exposure of Lead on Blood Pressure and Bone Mineral Density in Rats. Journal of Inorganic Biochemistry 99:1155-1164.
[256] Redig, P.T., C.M. Stowe, D.M. Barnes, and T.D. Arent. 1980. Lead Toxicosis in Raptors. J. Am. Vet. Assoc. 177:941-943; Fry, D.M. 2003. Assessment of Lead Contamination Sources Exposing California Condors. Species conservation and recovery report 2003, California Department of Fish and Game: San Diego, Calif.
[257] Pain et al. 1993.
[258] Gangoso, L., P. Alvarez-Lloret, A.A.B. Rodriguez-Navarro, R. Mateo, F. Hiraldo, and J.A. Donazar. 2009. Long-Term Effects of Lead Poisoning on Bone Mineralization in Vultures Exposed to Ammunition Sources. Environmental Pollution 157 569-574.

Egyptian vulture (*Neophron percnopterus*) population with high exposure to ingestion of lead ammunition.[259]

EPA ignored its own best available scientific information indicating that PG in roads may affect listed species, and despite the ESA's mandate to consult with FWS/NMFS, EPA did not take any formal steps to satisfy its ESA Section 7 consultation.[260]

III. RECONSIDERATION REQUIRED

As explained above, EPA unlawfully approved TFI's request to use PG in road construction. As such, the EPA should immediately reconsider the approval. EPA must immediately convene proceedings to reconsider the PG Approval and provide the public an opportunity to comment.[261] The objections raised above go directly to EPA's authority to issue the approval and EPA's authority for doing so. They are therefore of "central relevance," and Petitioners and the public are legally entitled an opportunity to present them and have them considered by the EPA.[262] Petitioners request EPA stay the effectiveness of the PG Approval during the reconsideration pursuant to 42 U.S.C. § 7607 (d)(7)(B).

Although EPA's failure to allow for public comment and its rationale for the PG Approval requires the EPA to convene reconsideration proceedings, the Petitioners reserve the right to seek immediate judicial review of the PG Approval without having to wait for EPA's decision on reconsideration.

We look forward to your prompt reply.

Sincerely,

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[259] *Id.*

[260] EPA, Approval of Other Uses of Phosphogypsum: Supporting Documents, https://www.epa.gov/radiation/approval-other-uses-phosphogypsum-supporting-documents. *Am. Fuel & Petrochemical Mfrs. V. EPA*, 937 F.3d 559, 598 (D.C. Cir. 2019) (holding "by failing to make an effects determination, the EPA did not comply with its obligations under the EPA").

[261] 42 U.S.C. § 7607(d)(7)(B).

[262] *Id.*

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