

**BEFORE THE SOUTH DAKOTA PUBLIC UTILITIES COMMISSION**

**DOCKET NO. HP22-001**

**IN THE MATTER OF THE APPLICATION BY  
SCS CARBON TRANSPORT LLC  
FOR A PERMIT TO CONSTRUCT A CARBON DIOXIDE TRANSMISSION PIPELINE**

**Direct Testimony of William R. Byrd, P.E.  
On Behalf of the Staff of the South Dakota Public Utilities Commission  
June 23, 2023**



1 **Q: Please state your name and business address.**

2  
3 A: William Randall Byrd  
4 801 Louisiana St., Suite 200, Houston, Texas 77002  
5

6 **Q: Describe your educational background.**

7  
8 A: I hold Bachelors and Masters degrees in Mechanical Engineering from the Georgia  
9 Institute of Technology.  
10

11 **Q: By whom are you now employed?**

12  
13 A: I am President of RCP Inc, a professional engineering and regulatory consulting firm  
14 which offers consulting services to PHMSA-regulated pipeline companies, investors,  
15 legal firms, and governmental agencies on a wide variety of pipeline issues.  
16

17 **Q: What work experience have you had that is relevant to your involvement on this  
18 project?**

19  
20 A: I have over 40 years of experience in the oil, gas, and pipeline industry in positions  
21 ranging from engineer, engineering supervisor, gas coordination manager, regulatory  
22 compliance manager, pipeline company area manager, and consultant. My experience  
23 includes design, construction, operations, maintenance, corrosion control, emergency  
24 response, and risk management. I routinely teach both public and private courses on  
25 pipeline operations, risk management, and regulatory compliance, including classes  
26 funded by PHMSA for government officials and select members of the public. I am very  
27 familiar with the requirements of 49 CFR Parts 190 through 199, including Part 195 -  
28 Transportation of Hazardous Liquids by Pipeline which is applicable to pipelines  
29 carrying supercritical CO<sub>2</sub>, like the subject pipeline.  
30

31 My experience is explained further in my CV and attached to my testimony as  
32 Exhibit\_WB-1.  
33

34 **Q: What Professional Credentials do you hold?**

35  
36 A: I am a Licensed Professional Engineer in the States of Texas (license number 94036);  
37 Louisiana (license number 24058); Mississippi (license number 10881); and Alabama  
38 (license number 18066). I am also a Professional Member of the Association for  
39 Materials Protection and Performance (previously known as NACE).  
40

41 **Q: What is the purpose of your testimony?**

42  
43 A: My testimony is to state my opinions developed from my review of relevant portions of  
44 the application filed by SCS Carbon Transport LLC (Applicant) for a permit to construct  
45 the Midwest Carbon Express Pipeline (subject pipeline) together with related Docket  
46 filings. For purposes of my testimony, I am presuming that the Applicant will also be the

1 ultimate pipeline Operator, as that term is used by PHMSA, although the actual Operator  
 2 of the pipeline system in the future may be some other entity. At any rate, the Applicant  
 3 in this situation is making commitments that will apply to the future Operator, and  
 4 PHMSA holds both the Owner of a pipeline and its Operator responsible for compliance.  
 5

6 I was requested to develop opinions as to whether or not the proposed facilities will meet  
 7 the design, construction, testing, operation and other requirements of Federal Pipeline  
 8 Safety Regulations (49 CFR 195 – all subparts) and other applicable federal and state  
 9 regulations, including:

- 10 a. Compliance with Federal Integrity Management Plan requirements;
- 11 b. The adequacy of proposed pipeline design in Unusually Sensitive Areas (USAs) and  
 12 High Consequence Areas (HCAs);
- 13 c. The proper location and number of valves and pumping stations; and
- 14 d. Determining whether the proposed project will pose a safety risk, particularly for  
 15 leakage, above acceptable industry standards for carbon dioxide pipelines.  
 16

17 I have also been requested to determine, within my areas of expertise, whether the Project  
 18 meets the criteria set forth in SDCL 49-41B-22, as follows:

- 19 a. Project will not pose a threat of serious injury to the environment nor to the social and  
 20 economic condition of inhabitants or expected inhabitants in the siting area;
- 21 b. Project will not substantially impair the health, safety, or welfare of the inhabitants in  
 22 the siting area;
- 23 c. Project will comply with applicable laws and rules as provided by the Commission for  
 24 my review<sup>1</sup>; and
- 25 d. Project will not unduly interfere with the orderly development of the region with due  
 26 consideration being given the views of governing bodies of affected local units of  
 27 government.  
 28

29 **Q: What methodology did you employ?**

30  
 31 A: My methodology included a review of the permit application and exhibits for the subject  
 32 pipeline per SDCL 49-41B, testimony from others, responses to PUC Staff Data Requests  
 33 (DR), and other documents included in Docket No HP 22-001, including some materials  
 34 which were provided to PUC Staff in responses to data requests but are confidential and  
 35 not publicly available. I compared these documents to current PHMSA regulations and  
 36 relevant industry standards and practices, as well as my own knowledge and experience.  
 37

38 **Q: On whose behalf was this testimony prepared?**

39  
 40 A: This testimony was prepared on behalf of the Staff of the South Dakota Public Utilities  
 41 Commission.  
 42

43 **Q: Is the subject pipeline considered an interstate pipeline?**  
 44

<sup>1</sup> I am not an attorney and will not provide any legal opinions.

1 A: Yes, the proposed pipeline is considered to be an inter-state pipeline by PHMSA, because  
 2 it transports CO2 between states and across state boundaries.  
 3

4 **Q: What agency has primary regulatory authority for the safety of the subject**  
 5 **interstate pipeline?**  
 6

7 A: Interstate pipelines are regulated at the Federal level by the US Department of  
 8 Transportation (DOT), and not by the individual states the pipeline operates in. The  
 9 Pipelines and Hazardous Materials Administration (PHMSA) is the agency within DOT  
 10 that enforces the Pipeline Safety Regulations. These regulations are contained in the  
 11 Code of Federal Regulations (CFR) Title 49 Subchapter D – Pipeline Safety, Parts 190  
 12 through 199.  
 13

14 **Q: Is the subject pipeline considered a Hazardous Liquids Pipeline?**  
 15

16 A: Yes, the proposed pipeline is considered to be a Hazardous Liquids pipeline regulated  
 17 under 49 CFR Part 195-Transportation of Hazardous Liquids by Pipeline.  
 18

19 **Q: What is the PHMSA permitting approval process for a hazardous liquid pipeline?**  
 20

21 A: PHMSA requires advance notification of large pipeline construction projects, such as the  
 22 subject pipeline, which provides PHMSA the opportunity to review and audit the early  
 23 stages of pipeline design and construction. PHMSA regulations do not generally require  
 24 an operator to apply for a permit or get approval from PHMSA for the construction or  
 25 operation of a hazardous liquids pipeline.  
 26

27 **Q: What documents does PHMSA require from the Applicant?**  
 28

29 A: PHMSA requires the pipeline Operator to develop and maintain an extensive set of plans  
 30 and documents for the life of the pipeline. An Operator is required to document, in  
 31 detail, how they will meet PHMSA’s regulatory requirements – and then they must  
 32 follow their own plans and procedures. An Operator’s non-compliance with its own  
 33 procedures and plans is treated as non-compliance with the rule that required those  
 34 procedures and plans.  
 35

36 Specific plans and programs required by PHMSA include:  
 37

- 38 • Comprehensive construction specifications and standards
- 39 • Geospatial and other pipeline data filed with the National Pipeline Mapping  
 40 System (NPMS)
- 41 • Comprehensive Operating and Maintenance Procedures including Corrosion  
 42 Control Procedures and Emergency Response Procedures
- 43 • Operator Qualification Program
- 44 • Damage Prevention Program
- 45 • Continuing Public Education Program
- 46 • Control Room Management Program

- Drug and Alcohol Program
- Integrity Management Program

**Q: Does the subject pipeline require an Oil Spill Response Plan?**

A: The subject pipeline does not contain “oil” and is not required to prepare an Oil Spill Response Plan under 49 CFR Part 194. It does, however, require emergency response procedures under 49 CFR Part 195.

**Q: Where is the subject pipeline in the document development process?**

A: The Applicant states that they are in the process of developing the required plans and procedures required by PHMSA, which will be in place prior to operations. These documents will typically evolve and be finalized as various details of the project are finalized.

**Q: What documents produced by the Applicant must be approved by PHMSA?**

A: While some special activities require advance notice to and perhaps approval from PHMSA, most plans, programs and procedures are not approved in advance by PHMSA. However, PHMSA conducts routine and comprehensive inspections of these documents for adequacy during compliance audits. PHMSA notes deficiencies in the required plans, programs, and procedures, and requires the Operator to address such deficiencies through Notices of Amendment (NOA).

**Q: Are there parts of the Operator’s siting permit application that PHMSA does not review?**

A: The Operator’s application to the PUC is designed to satisfy the PUC’s requirements and may include information that is unrelated to PHMSA’s pipeline safety regulations. For example, documentation of a public need for a pipeline is unrelated to pipeline safety and would be outside of PHMSA’s purview. Likewise, an application to the PUC may not contain all the documentation that PHMSA will require. PHMSA reviews documents that are relevant to its regulations – whether they are contained in the application to the PUC or not.

**Q: What inspections are required during construction of the pipeline?**

A: PHMSA requires construction inspection by personnel trained and qualified in the phase of construction to be inspected, to ensure that the installation of pipe or pipeline systems is in accordance with 49 CFR Part 195 and the construction specifications and standards developed by the operator.

While PHMSA does not currently require it, I recommend that the PUC require the Applicant to use inspectors with API 1169 certification. This certification program was

1 developed by the pipeline industry for large pipeline construction projects and is  
2 appropriate for inspectors on this project.

3  
4 **Q: What is PHMSA's inspection role during construction of the pipeline?**

5  
6 A: PHMSA conducts construction inspections to verify that activities in the field comply  
7 with the construction requirements of Part 195 and follow the operator's written  
8 construction specifications and standards. Field visits will typically focus on areas where  
9 PHMSA has encountered problems with other pipeline construction in the past, such as  
10 the proper execution of welding procedures, pipe handling, pipeline coating, lowering in  
11 and tie-ins.

12  
13 PHMSA typically schedules its inspections in advance and coordinates with the operator  
14 to ensure the appropriate people and documentation will be made available, or that  
15 certain types of activities will be occurring during the inspection. The operator will be  
16 notified of the types of documentation and phases of construction that PHMSA wishes to  
17 inspect and when it plans to do so.

18  
19 While PHMSA's inspections and audits are frequently comprehensive, PHMSA does not  
20 serve as the operator's construction inspectors.

21  
22 **Q: What is PHMSA's inspection role after construction?**

23  
24 A: After the pipeline has been placed into service, PHMSA conducts routine inspections to  
25 ensure that the operator is operating the pipeline in accordance with the operator's own  
26 procedures, plans and programs, and in compliance with regulatory requirements. These  
27 include operating, maintenance and corrosion control procedures and integrity  
28 management activities. A basic inspection will focus on verification that tests,  
29 inspections, patrols, surveys and other routine actions are being performed within the  
30 stipulated time frames and in accordance with the operator's procedures and ensuring that  
31 the individuals performing such tasks are qualified and subject to a compliant drug and  
32 alcohol program in accordance with Part 199. Other specialized inspections are  
33 conducted to examine, in detail, such things as an operator's integrity management and  
34 control room management programs.

35  
36 **Q: What is PHMSA's role in decommissioning the pipeline?**

37  
38 A: PHMSA requires operators to comply with its regulations until a pipeline is officially  
39 abandoned. Abandoned pipelines must be purged of products and isolated but do not  
40 necessarily have to be removed. PHMSA does require that the operator file a report of  
41 the abandonment with the NPMS.

42  
43 **Q: Does PHMSA have authority to grant special permits that waive compliance with  
44 one or more of the Federal pipeline safety regulations under Part 195?**

45

1 A: PHMSA can grant special permits that allow alternative means of compliance with its  
 2 regulations. The terms of these special permits are agreed to in writing and require  
 3 approval from PHMSA on a case-by-case basis. Such special permits include additional  
 4 requirements for testing and other restrictions and conditions to ensure an equivalent  
 5 level of safety as the original requirement, and often include an expiration date.

6  
 7 **Q: Has the subject pipeline requested a special permit as described above?**

8  
 9 A: According to Lawrence Meredith’s testimony on November 1, 2022 (pg 4 of 5), the  
 10 Applicant has not applied for and does not intend to apply for any waivers from PHMSA.

11  
 12 **Q: What are HCAs?**

13  
 14 A: In the pipeline safety regulations, HCAs are High Consequence Areas. For hazardous  
 15 liquid pipelines, these are defined as

- 16 1. A commercially navigable waterway.
- 17 2. A high population area, which means an urbanized area delineated by the Census  
 18 Bureau as having a population of 50,000 or more people or a population density  
 19 of 1000 people per square mile.
- 20 3. Other populated area with a concentrated population such as an unincorporated  
 21 town or designated commercial area.
- 22 4. An unusually sensitive area (USA), defined as a drinking water or ecological  
 23 resource area that is unusually sensitive to environmental damage from a  
 24 hazardous liquids pipeline such as a community water intake, a source water  
 25 protection area for aquifers, a wellhead protection area, an ecological resource, a  
 26 migratory bird concentration area, an area containing endangered or imperiled  
 27 species, as defined in Part 195 section 195.6.

28  
 29 **Q: What is the relevance of HCAs to pipelines?**

30  
 31 A: PHMSA imposes special “integrity management” requirements on sections of pipelines  
 32 that “could affect” an HCA with a “Worst Case Discharge” (WCD). Per 49 CFR 195.452  
 33 *Pipeline integrity management in high consequence areas:*

34  
 35 *(a) Which pipelines are covered by this section?*  
 36 *This section applies to each hazardous liquid pipeline and carbon dioxide*  
 37 *pipeline that could affect a high consequence area, including any pipeline located*  
 38 *in a high consequence area unless the operator effectively demonstrates by risk*  
 39 *assessment that the pipeline could not affect the area. (Appendix C of this part*  
 40 *provides guidance on determining if a pipeline could affect a high consequence*  
 41 *area.)*

42  
 43 PHMSA’s integrity management regulations require detailed threat and risk analysis of  
 44 the affected pipeline segments, extensive inspections to look for defects, and deadlines to  
 45 address these defects.

1 **Q: Could the subject pipeline affect any HCAs in South Dakota?**

2  
3 A: Inhalation is the main threat from CO<sub>2</sub>. CO<sub>2</sub> in sufficient concentrations can be toxic  
4 and displace oxygen, causing illness or death. A CO<sub>2</sub> release is short-lived (measured in  
5 minutes, not days), and once released it is at atmospheric pressure. A CO<sub>2</sub> release is  
6 unlikely to have a significant impact on drinking water or navigable waters.

7  
8 A large release of CO<sub>2</sub> could travel some distance from the release site, primarily  
9 downhill and downwind. In response to a Staff Data Request, Applicant has provided a  
10 confidential DRAFT Report (February 2023) which states that [BEGIN

11 CONFIDENTIAL] [REDACTED]  
12 [REDACTED] [END CONFIDENTIAL]

13  
14 **Q: The Commission received public comment regarding concerns from inhabitants**  
15 **within the project area about pipeline rupture and distance that carbon dioxide may**  
16 **adversely impact individuals and livestock. Would site-specific dispersion and**  
17 **overland flow modeling help the Commission understand whether or not the subject**  
18 **pipeline will substantially impair the health, safety or welfare of the inhabitants?**

19  
20 A: Site-specific dispersion and overland flow modeling is part of a pipeline's integrity  
21 management program, to determine pipeline segments requiring a higher level of  
22 integrity management / accident prevention / accident mitigation. The net effect is to  
23 minimize or avoid any exceptional risk to the potentially affected areas from these  
24 pipeline segments. Thus, the Commission does not need to delay its approval pending  
25 site-specific dispersion and overland flow modeling, because "the health, safety or  
26 welfare of the inhabitants" should be adequately addressed by the PHMSA-mandated  
27 pipeline integrity management program.

28  
29 **Q: In your opinion, should site-specific dispersion and overland flow modeling for the**  
30 **subject pipeline be used to inform route selection and siting at the state level?**

31  
32 A: Applicant has conducted dispersion modeling using historical weather data along the  
33 planned route and has identified "critical valleys" which would be most likely to channel  
34 CO<sub>2</sub> into a populated area. They have used a combination of dispersion modeling and  
35 overland flow analysis using site-specific terrain to determine the impact of a major CO<sub>2</sub>  
36 release in these areas. The purpose of this modeling is to inform risk management  
37 decisions such as higher integrity pipe or enhanced emergency response. It has not been  
38 used to determine the pipeline's route.

39  
40 **Q: Are main line block valves planned to be installed at the proper locations?**

41  
42 A: PHMSA issued a new valve spacing rule on April 8, 2022 (Amdt. No. 195-105, 87 FR  
43 20987). At 49 CFR 195.260 Valves: Location, paragraph (c), it requires that "newly  
44 constructed or entirely replaced onshore hazardous liquid or carbon dioxide pipeline  
45 segments":  
46



1                   ...valve spacing must not exceed 15 miles for pipeline segments that could affect  
 2 or are in HCAs, as defined in § 195.450, and 20 miles for pipeline segments that  
 3 could not affect HCAs. Valves on pipeline segments that are located in HCAs or  
 4 which could affect HCAs must be installed at locations as determined by the  
 5 operator's process for identifying preventive and mitigative measures established  
 6 pursuant to § 195.452(i) and by using the selection process in section I.B of  
 7 appendix C of part 195, but with a maximum distance that does not exceed 7 1/2  
 8 miles from the endpoints of the HCA segment or the segment that could affect an  
 9 HCA.

10  
 11 The Applicant is aware of and has committed to meet or exceed these new valve spacing  
 12 requirements. A detailed HCA analysis, which depends upon site-specific dispersion /  
 13 overland flow analysis, would be required to verify that every valve location is  
 14 appropriate. I was not provided with the detailed HCA analysis, nor the exact location of  
 15 the proposed valves, and cannot pass judgement on the number of valves or their proper  
 16 location.

17  
 18 **Q: Does Part 195 require that the pipeline be protected from external and internal**  
 19 **corrosion?**

20  
 21 A: Yes, it does. The Applicant intends to use Fusion Bonded Epoxy (FBE) as an external  
 22 coating and cathodic protection to control external corrosion. I have not seen details  
 23 concerning the Applicant's plans to avoid internal corrosion but note that each pipeline  
 24 segment will have pig launchers and receivers, which can be used for maintenance  
 25 pigging if necessary to assist with internal corrosion control.

26  
 27 **Q: What provisions will be made for detecting leaks on the pipeline?**

28  
 29 A: The Applicant intends to use a Real Time Transient Model (RTTM) for leak detection,  
 30 which should be capable of detecting any rapid release of CO2 from the pipeline and  
 31 provide an alarm to the pipeline control center (Powell testimony pg 16 of 19). Bi-  
 32 monthly patrols can detect longer-term but slow CO2 release locations. The Applicant  
 33 has not committed to install other forms of CO2 leak detection, such as fiber optic cables,  
 34 which may be able to detect smaller releases of CO2 from the pipeline with higher  
 35 precision concerning the leak location than an RTTM. However, I have not seen the  
 36 performance specifications of the RTTM that the applicant intends to use and thus cannot  
 37 compare the expected performance of that system versus other alternatives at this time.

38  
 39 I recommend that the Applicant use direct forms of CO2 detection (external CO2  
 40 sensors) at pump stations, which are the most likely locations for a significant CO2  
 41 release to occur, in addition to the RTTM.

42  
 43 **Q: Will the contents of the pipeline be odorized?**

44  
 45 A: PHMSA does not require odorization of CO2 pipelines, and such odorants may not be  
 46 technically feasible for the subject pipeline. Applicant has not committed to odorization.

1 In my opinion, odorants are helpful in natural gas distribution pipelines because they  
 2 assist with detection of small leaks inside homes, but they are not applicable and should  
 3 not be required for CO2 transmission pipelines. It should be noted that PHMSA does not  
 4 require natural gas transmission pipelines to be odorized in most situations, even though  
 5 the gas they carry must be odorized once it enters a gas distribution system.  
 6

7 **Q: What are PHMSA's emergency response requirements?**

8  
 9 A: PHMSA requires that a pipeline operator develop comprehensive emergency response  
 10 plans, train their personnel on those plans, coordinate and drill those plans with local  
 11 officials, have personnel, equipment, instruments, tools and materials as needed to  
 12 respond to emergencies, and provide immediate and direct notification to public safety  
 13 agencies in the event of an emergency.  
 14

15 **Q: Does PHMSA require the operator consult with state agencies, such as the**  
 16 **Department of Public Safety, on the development and review of emergency response**  
 17 **plans?**

18  
 19 A: PHMSA's regulation require that a pipeline operator communicate with emergency  
 20 officials and local public officials, by incorporating API RP 1162 as part of the federal  
 21 pipeline safety regulations:  
 22

23 *§195.440 Public awareness.*

24 *(a) Each pipeline operator must develop and implement a written continuing*  
 25 *public education program that follows the guidance provided in the American*  
 26 *Petroleum Institute's (API) Recommended Practice (RP) 1162 (incorporated by*  
 27 *reference, see § 195.3).*  
 28

29 PHMSA's regulations require, in §195.440 (d) (4), communication concerning:

30  
 31 *Steps that should be taken for public safety in the event of a hazardous liquid or*  
 32 *carbon dioxide pipeline release*  
 33

34 PHMSA audits a pipeline operator's emergency response plans and requires that relevant  
 35 information be communicated to public officials, but does not require that local officials  
 36 or state agencies review or approve those plans.  
 37

38 **Q: Will the subject pipeline comply with PHMSA's emergency response requirements?**

39  
 40 A: Applicant has committed to develop the emergency response plans required by PHMSA,  
 41 to share their emergency response plan with local responders, to train them on the plan,  
 42 and to conduct drills with them. This should meet PHMSA's requirements. Mr. Dillon's  
 43 testimony (pg 3 of 7) states that he has met with County Emergency Managers  
 44 representing each county through which the project will be located, and that those County  
 45 Emergency Managers are compiling first responder equipment needs.  
 46

1 **Q: The Commission has heard public comment from first responders with concerns**  
2 **about incidents and their ability to respond to those incidents. In order to assess**  
3 **whether or not the subject pipeline has emergency response plans in place that**  
4 **address those concerns, should the operator provide a copy of the emergency**  
5 **response plan to the Commission for review prior to the Commission making its**  
6 **determination on the application? Please explain why or why not.**  
7

8 A: PHMSA inspects pipeline operator emergency response plans on a routine basis.  
9 PHMSA has a “PREPAREDNESS, EMERGENCY SUPPORT, AND SECURITY  
10 DIVISION” within the Office of Pipeline Safety at the headquarters level, with a Director  
11 and 10 employees as of 4/23/2023 (Exhibit\_WB-2). PHMSA’s personnel deal with  
12 pipeline issues as a full-time job and develop a high level of expertise. First responders  
13 should communicate their concerns to the Applicant and to PHMSA – both of whom  
14 have expertise to respond appropriately to those concerns. For these reasons, I believe  
15 the Commission should rely on PHMSA’s pipeline-specific emergency response  
16 expertise for plan review.  
17

18 **Q: Is the subject pipeline following all PHMSA requirements?**  
19

20 A: PHMSA requires that plans, procedures, and specifications be developed either prior to  
21 the start of construction or the start of operations (as appropriate). The documentation  
22 that PHMSA will ultimately require has not been finalized and was not available for my  
23 review. I cannot at this time render an opinion concerning the operator’s final plans and  
24 procedures, but it appears that thus far, the subject pipeline is aware of and intends to  
25 follow all PHMSA requirements.  
26

27 **Q: PHMSA is in the process of updating its regulations for carbon dioxide pipelines.**  
28 **Do you have knowledge as to what PHMSA may require for carbon dioxide**  
29 **pipelines in the rule revision?**  
30

31 A: I am aware of concerns raised by the Pipeline Safety Trust concerning CO2 pipeline  
32 regulation and it is my understanding that the pending regulations will be responsive to  
33 those concerns, but I do not know what those regulations may require.  
34

35 **Q: The Commission has heard public comment that the subject pipeline should not be**  
36 **issued a permit until PHMSA updates its rules for carbon dioxide pipelines. Do you**  
37 **have an opinion as to whether or not the subject pipeline should be delayed until**  
38 **PHMSA’s rulemaking is complete?**  
39

40 A: CO2 pipelines are already regulated by PHMSA. As mentioned earlier, PHMSA has  
41 stated that they intend to amend its regulations specific to CO2 pipelines but the timing  
42 and content of those amendments is unknown. This is not unusual. PHMSA maintains a  
43 permanent schedule of pending / future regulatory changes. PHMSA’s rulemaking  
44 process can be lengthy and is in fact never complete because rules are always subject to  
45 future amendment. I do not believe the Commission should delay its decision pending a  
46 PHMSA rulemaking of unknown content and timing.

1  
2 **Q: The Applicant has committed to a minimum burial depth of 4 feet. What is the**  
3 **relationship between burial depth and pipeline safety?**

4  
5 A: Pipeline burial depth is related to surface loading impacts and unsupervised excavation  
6 impacts.

7  
8 Surface loading of buried steel pipelines is normally only of concern under highways and  
9 railroads with high cyclic loads (e.g. tires from heavy trucks or wheels from heavy trains)  
10 over the pipeline. Pipelines are typically buried far deeper beneath highways and  
11 railroads than required to handle surface loads, for a variety of other reasons. In  
12 agricultural areas, pipelines do not normally need to be concerned about surface loading  
13 because farm equipment is designed to minimize surface loading (to avoid getting stuck  
14 in dirt). At any rate, a four foot burial depth is normally adequate for almost every  
15 surface loading condition for modern steel pipelines – especially pipelines such as the  
16 subject pipeline which have thick walls relative to the pipe diameter (known in the  
17 pipeline industry as the d/t ratio).

18  
19 In agricultural areas, pipelines need to be buried below the depth of routine farming  
20 activity (such as plow depth). That is an issue to be addressed on a site-specific basis  
21 between the farmer and the pipeline operator. Installation of drain tiles frequently  
22 exceeds this depth and would require close coordination with the pipeline operator.

23  
24 It is generally assumed that deeper burial depths are safer (4' is better than 3', and 5' is  
25 better than 4', etc.), although there is little hard evidence in the industry incident reports  
26 to support that assumption. The data would indicate that compliance with the One Call  
27 system requirements (or lack of compliance) is much more important than pipeline burial  
28 depth.

29  
30 **Q: What are your conclusions as of the date of this report?**

31  
32 A: The Applicant has selected a pipeline route that is preferentially adjacent to and  
33 parallel with existing utilities. I recommend that the PUC require the Applicant to  
34 comply with API Recommended Practice 1172: *Recommended Practice for Construction*  
35 *Parallel to Existing Underground Transmission Pipelines*, at all locations where the  
36 pipeline will be installed parallel to other underground energy pipelines. While it is not  
37 required by PHMSA, RP 1172 was developed specifically to address the unique damage  
38 prevention needs of parallel construction projects such as anticipated for the proposed  
39 pipeline.

40  
41 Applicant has stated that they do not plan to install warning tape above the pipeline, since  
42 existing requirements for damage prevention are sufficient. While this may be true,  
43 excavation damage is an ongoing and significant threat that cannot be completely  
44 eliminated. I recommend that the PUC require warning tape in areas where future  
45 excavation may be expected, such as urban and agricultural areas, and near road  
46 crossings, since it provides an inexpensive and effective additional layer of protection.

1  
2 Based on the documents reviewed to date, and the claims concerning future activities  
3 made by the applicant, the proposed facilities should meet the design, construction,  
4 testing, operation and other requirements of Federal Pipeline Safety Regulations (49 CFR  
5 195 – all subparts) and other applicable federal and state regulations, should comply with  
6 Federal Integrity Management Plan requirements; be appropriately designed in relation to  
7 Unusually Sensitive Areas (USAs) and High Consequence Areas (HCAs); have the  
8 appropriate location and number of valves and pumping stations; and not pose a safety  
9 risk, particularly for leakage, above acceptable industry standards for carbon dioxide  
10 pipelines.

11  
12 **Q. Does this conclude your testimony?**

13  
14 **A:** Yes.

15



Professional Engineers. Regulatory Experts. Trusted Partners.

## **W.R. (Bill) Byrd, P.E.**

### **President**

#### **Executive Summary**

A Summa Cum Laude graduate of the Georgia Institute of Technology, Mr. Byrd enjoys a solid reputation for working with the public, corporate executives, legal representatives, and regulatory agencies to resolve complex regulatory, integrity management, safety, and compliance management issues. He is a professional engineer and regulatory expert, combining exceptional analytical and communication skills with a broad background in engineering, operations, management, economics, and regulatory affairs, yielding excellent professional judgment and problem-solving capabilities that can be applied to corporate-level issues. He conducts multi-day training sessions on pipeline topics several times a year for both public and private audiences. He is a widely respected public speaker and is routinely called upon to make presentations concerning energy pipeline issues to industry associations and other groups at the national and international level including Canada, Brazil, and India. He is the founder and President of RCP Inc., a professional engineering and regulatory consulting firm serving more than 100 global clients throughout the energy pipeline industry.

#### **Accomplishments/Experience**

Mr. Byrd's accomplishments and experience include:

- Chairing the 2020 International Pipeline Conference, the largest and most prestigious energy pipeline conference of its type in the world, drawing more than 1,400 delegates and 350+ peer-reviewed technical papers presenting cutting-edge research for all aspects of the energy pipeline industry.
- Serving on the Board of Directors of the Pipeline Research Council International (PRCI) and on its Technology Development Center oversight committee.
- Being selected and serving as a technically competent and independent expert Peer Review Panelist for pipeline safety research funded by PHMSA's Pipeline Safety Research and Development (R&D) Program.
- Chairing the executive committee of the Pipeline Systems Division (PSD) of ASME (American Society of Mechanical Engineers), an engineering society that is recognized worldwide and whose standards are incorporated into regulations by countless federal, state, and local jurisdictions. Current serving as a Senator of PSD.
- Chairing the Safety Engineering and Risk Analysis Division (SERAD) of ASME.
- Chairing tracks on Safety Engineering, Risk Assessment, and Reliability Methods at three International Mechanical Engineering Congress and Exhibitions (IMECE), attended by thousands of engineering and risk management professionals from around the world.



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- Serving as the consulting expert to the API / AOPL Pipeline Performance Excellence Team, a permanent team composed of pipeline executives dedicated to improving the safety of the liquid transmission pipeline industry.
- Serving as the consulting expert to the API / AOPL Data Mining Team, a permanent team that analyzes incident root causes and trends in the hazardous liquids pipeline industry and identifies opportunities for further investigation and improvement initiatives.
- Serving on the Interstate Natural Gas Association of America (INGAA) Foundation to identify, prioritize, and fund research projects for the gas transmission industry.
- Serving as a consulting expert during the first criminal prosecution under the Pipeline Safety Act.
- Serving as an expert witness during the first class action lawsuit brought against a pipeline company under the citizen suit provisions of the Pipeline Safety Act.
- Serving as an expert witness / consulting expert on several other pipeline accidents and lawsuits, including those of national significance.
- Chairing the Offshore Corrosion Surveillance Subcommittee for a major pipeline company.
- Facilitating the development and implementation of a corrosion control strategy for oil and gas operations on the North Slope of Alaska, during several congressional investigations.
- Developing solutions for the following: H<sub>2</sub>S contingency planning in large sour oil and gas production areas, produced water toxicity issues on the Outer Continental Shelf, NORM sampling and testing procedures for oil field wastes, and asbestos exposure issues.

### **Associations/Affiliations**

- American Gas Association
- American Petroleum Institute
- American Society of Mechanical Engineers
- Houston Pipeliners Association
- Association for Materials Protection and Performance (previously NACE)
- Southern Gas Association
- Texas Gas Association

### **Education**

M.S., Mechanical Engineering – Honors, Georgia Institute of Technology, 1982

B.S., Mechanical Engineering – Summa Cum Laude, Georgia Institute of Technology, 1981

### **Professional Registrations**

- Professional Engineer, State of Texas
- Professional Engineer, State of Louisiana
- Professional Engineer, State of Mississippi



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- Professional Engineer, State of Alabama
- Professional Member – Association for Materials Protection and Performance

### **Honors and Awards**

- Graduate Fellowship – Georgia Power Research Laboratory
- Pi Tau Sigma
- Tau Beta Pi
- Gamma Beta Phi
- Phi Kappa Phi
- Certificate of Appreciation – U. S. Coast Guard

### **Presentations and Publications** (excluding in-house training sessions)

Byrd, W. R., “PSMS Beginning the Journey: How to get started” presented at the API Webinar on May 21, 2019

Byrd, W. R., “Management Systems and Goldilocks: How Much Process Rigor Is Just Right for Your PSMS?” presented at the AGA Operations Conference in Nashville, TN on April 2, 2019

Byrd, W. R., “Current trends in pipeline industry performance data” presented at the API Pipeline Conference in Phoenix, AZ on April 10, 2019

Byrd, W. R., “Teaching and Engaging with the ‘unpersuadables’ - an experiment – Houston Public Training” presented at the Pipeline Safety Trust Conference in New Orleans, LA on October 18, 2018

Byrd, W. R., “API RP 1173 Evaluation Tool” presented at the Pipeline SMS Evaluation Tool webinar hosted by API on June 26, 2018

Byrd, W. R., “API RP 1173 Implementation Tools” presented at the Pipeline SMS Tools webinar hosted by API on February 27, 2018

Byrd, W. R., “Implementation Tools for API RP 1173” presented at the American Gas Association Pipeline Safety Management Systems workshop in San Diego, CA February 1, 2018

Byrd, W. R., “PSMS Conformance Audit Tool” presented at the API / AOPL Liquid Operators Pipeline Safety Management System Conformance Workshop in Houston, TX June 13, 2017

Byrd, W. R., “Implementation Solutions for Pipeline Safety Management Systems”, presented at the American Gas Association Pipeline Safety Management Systems Workshop in Jacksonville, FL April 12, 2017

Byrd, W. R., “Trends in Incidents, and Food for Thought”, presented at the API / AOPL Pipeline Information Exchange (PIX) meeting in Houston, TX October 11, 2016





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## Presentations and Publications Cont'd

Byrd, W. R., "Excavation Damage and Near Misses: What Do the Data Tell Us?", presented at the API Damage Prevention Workshop in Houston, TX, May 26, 2016

Byrd, W. R., "Liquid Transmission Data and Strategic Initiatives", presented at the API Pipeline Conference in Carlsbad, CA, April 6, 2016

Byrd, W. R., "Industry Implementation of Pipeline SMS – Industry's Journey", Panel at the API Pipeline Conference in Carlsbad, CA, April 5, 2016

Byrd, W. R., "Pipeline Safety Management System Implementation Tools", presented at the API Pipeline SMS workshop in Houston February 16, 2016 and April 26, 2016

Byrd, W. R., "Cost / Benefit Analysis: A Skeptic's Perspective" presented to the Pipeline Safety Trust annual meeting in New Orleans, LA, November 20, 2015.

Byrd, W. R., "Introduction to API RP 1173: Pipeline Safety Management Systems" presented to the Texas Gas Association in Galveston, TX, June 8, 2015.

Byrd, W. R., Brunt, D.J., "Changes to PHMSA Rules Affect Wide Range of Inspections, Reports" Pipeline & Gas Journal, Vol. No. 242, Number 6, p. 51, June 2015.

Byrd, W. R., Wylie, M.G., "Site-Specific Quantitative Pipeline Risk Analysis Using Monte Carlo Methods" Proceedings of the 2014 10<sup>th</sup> International Pipeline Conference, Calgary, Alberta, Canada, Paper IPC2014-33171.

Byrd, W. R., "PHMSA Shifts Emphasis Toward Preventing Highest Risk Events" Pipeline & Gas Journal, Vol. No. 241, Number 6, p. 55, June 2014.

Byrd, W. R., "Site Risk Analysis Using Monte Carlo Methods" presented to the Interstate Natural Gas Association of America, Safety Committee; Colorado Springs, CO, May 7, 2014.

Byrd, W. R., Decker, L., "Pipeline Pressure Testing" course for the ASME International Petroleum Technology Institute, Denver, CO, April 14, 2014.

Byrd, W. R., "The problems that come from people focusing too much on Consequences" presented at the Pipeline Safety Trust Conference; New Orleans, LA, November 21, 2013.

Byrd, W. R., "Introduction to Pipeline Regulations in the USA" presented at the Rio Pipeline Conference 2013; Rio de Janeiro, Brazil, September 26, 2013.

Keynote Speaker, "Extreme Value Risk Analysis" ASME Indian Oil and Gas Pipeline Conference 2013, Jaipur, India, February 1, 2013.

Byrd, W. R., Instructor for the Introduction to DOT 192 & 195 Pipeline Regulations, presented at the DOT Pipeline Compliance Workshop, Houston, TX, November 6 – 8, 2012.

Chair, ASME Pipeline Systems Division Awards Ceremony in Calgary, Alberta, Canada, September 25, 2012.



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## Presentations and Publications Cont'd

Byrd, W. R., "Improving System Integrity for Energy Pipelines in the 21st Century" presented at the Chevron NDE & Pipeline Forum, Houston, TX, March 5, 2012; the NACE Tulsa Section Meeting, Tulsa, OK, April 23, 2012; and the NACE Western Area Conference in Chicago, IL, August 29, 2012.

Byrd, W. R., "Regulatory Developments for Pipeline Recordkeeping" presented at the PODS (Pipeline Open Data Standard) User Conference, Houston, TX, October 12, 2011.

Moderator, "Moving the Industry Forward" panel at the Pipeline Opportunities Conference, Houston, TX, April 19, 2011, with the Executive Director of the Pipeline Safety Trust, the Director of Program Development for PHMSA, the Executive Director of the INGAA Foundation, and the Sr. VP / COO of AGA.

Byrd, W. R., "Common Challenges in Preparing for an Integrated Inspection" presented at the API Pipeline Conference, San Antonio, TX, April 12, 2011.

Byrd, W. R., "Potential Sources of Error in GPS Use for One Call Purposes" Damage Prevention Professional Magazine, p. 26, Vol. 2, No. 2, Spring 2011.

Byrd, W. R., "SPCC and OPA-90 Requirements for Liquid Pipelines" presented at the TGA / PHMSA Liquid Pipeline Workshop, Corpus Christi, TX, June 17, 2010.

Byrd, W. R., "EPA Issues New Spill Prevention Regulations" American Gas Magazine, p.14, May 2010.

Byrd, W. R., "Control Room Management for DOT Pipeline Operators" presented at the MASH Conference, San Antonio, TX, April 28, 2010.

Byrd, W. R., "Oil Spill Prevention Control and Countermeasure (SPCC) Requirements for Gas Pipeline Operators" webinar sponsored by the American Gas Association, March 9, 2010; also presented to the Southern Gas Association; Kansas City, KS, June 10, 2010; also presented to the Texas Gas Association; Corpus Christi, TX, June 15, 2010; also presented at the US DOT / PHMSA regulations workshop; Corpus Christi, TX, June 17, 2010.

Byrd, W. R., "Avoiding Pitfalls Using GPS Data for Damage Prevention" presented at the CGA Excavation Safety Conference & Expo; San Diego, CA, March 4, 2010.

Byrd, W. R., "SPCC Rule Revisions Affect Gas Processing Facilities" Gas Processors Report, Vol. 28 Issue 8, p.1, February 25, 2010.

Byrd, W. R., "DOT Existing Regulations for Leak Detection" presented at the Siemens Technology Conference, Houston, TX, February 23, 2010.

Byrd, W. R., "The New SPCC Rule: Are You In or Out?" The TIPRO Target, Vol. 13. No. 04, p.6, February 19, 2010.

Byrd, W. R., "New Control Room Management Regulations Require Structured Management Approach" Pipeline & Gas Journal, February, 2010.



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### Presentations and Publications Cont'd

Byrd, W. R., "Offshore Pipeline Construction and Operation" presented to the Select Policy Council on Strategic & Economic Planning of the Florida House of Representatives, Tallahassee, FL, February 4, 2010.

Byrd, W. R., "API, AOPL Working to Standardize GPS System" Oil & Gas Journal, November 9, 2009.

Byrd, W. R., "Methods for Complying with Pipeline Leak Detection and Monitoring Regulations" presented at the Pipeline Leak Detection & Monitoring Conference, Houston, TX, October 28, 2009.

Byrd, W. R., "Pipeline Integrity Management Rules Affecting Gathering, Transmission, and Distribution Pipelines" presented at the GITA Oil & Gas Conference, End to End: Risk and Integrity Management seminar, Houston, TX, September 14, 2009.

Byrd, W. R., "New and Proposed Pipeline Regulations 2-2009" presented at the OQSG User Conference, Houston, TX, February 26, 2009.

Byrd, W. R., Palmer, K., Garrett, J., "One-call System Addresses Offshore Damage Prevention" Oil & Gas Journal, May 4, 2009.

Byrd, W. R., "Best Practices in Damage Prevention for Parallel Construction Projects" presented at the API Pipeline Conference, Fort Worth, TX, April 21, 2009.

Byrd, W. R., Palmer, K., "Company Name Change Requires Diligent Execution" Oil & Gas Journal, March 16, 2009.

Byrd, W. R., "Overview of Shale-Gas Pipeline Development Activities" presented at the Barnett Shale Expo, Fort Worth, TX, March 11, 2009 and the Haynesville Shale Expo, Shreveport, LA, November 21, 2008.

Byrd, W. R., "Best Practices in Damage Prevention for Parallel Construction Projects" presented at the 7<sup>th</sup> International Pipeline Conference, Calgary, Alberta, Canada, October 1, 2008.

Byrd, W. R., "Risk Factors for Urban Shale Gas Pipeline Development" presented to the Mayor's Shale Gas Development Task Force, Fort Worth, TX, August 7, 2008.

Byrd, W. R., "Damage Prevention Workshop Findings and Recommendations" presented at the API Pipeline Conference, Orlando, FL, April 8, 2008.

Byrd, W. R., "Management Systems and Safety Culture Survey Findings and Recommendations" presented at the Liquid Pipeline Leadership meeting, Squaw Valley, CA, June 25, 2007.

Byrd, W. R., "GIS Applications for DOT Regulatory Compliance" presented at [GeoGathering 2007](#), Estes Park, CO, May 2007.

Byrd, W. R., "Risk Management and Integrity Regulations for Gas and Liquid Pipelines" presented at the GITA Oil & Gas Conference, Houston, TX, September 18, 2006.



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### **Presentations and Publications Cont'd**

Byrd, W. R., "Overview of the new Gas Gathering Regulations" presented at the DOT Pipeline Compliance Workshop, Houston, TX, May 10, 2006.

Byrd, W. R., "Introduction to DOT Pipeline Regulations" presented at the DOT Pipeline Compliance Workshop, Houston, TX, February 22, 2006.

Byrd, W. R., "Regulatory Developments for Pipeline Integrity Management" presented at the Geospatial Information Technology Association's 14th Annual GIS for Oil & Gas Conference, JW Marriott Hotel, Houston, TX, September 19, 2005.

Byrd, W. R., "Introduction to DOT Pipeline Regulations; Texas State Pipeline Regulations; Louisiana State Pipeline Regulations" presented at the DOT Pipeline Compliance Workshop, Houston, TX, February 22 – 24, 2005.

Byrd, W. R., McCoy, R.G., Wint, D., "A Success Guide for Pipeline Integrity Management" Pipeline Gas & Journal, November 2004.

Byrd, W. R., Swanstrom, B., "Midstream M&A Transactions: What you don't know about regulatory due-diligence CAN hurt you!" Locke, Liddell, and Sapp LLP presentation for CLE credits, September 23, 2004.

Byrd, W. R., "Associated Regulatory Compliance Issues for Integrity Management" presented at the DOT Pipeline Compliance Workshop, Houston, TX, September 22, 2004.

Byrd, W. R., "Introduction to DOT Pipeline Regulations" presented at the DOT Pipeline Compliance Workshop, Houston, TX, April 6, 2004.

Byrd, W. R., "Current Regulatory Challenges for DOT Pipeline Operators" presented at the 9th annual River City Safety, Health, Security, and Environmental Conference and Exposition, Baton Rouge, LA, August 20, 2003.

Byrd, W. R., "Introduction to DOT Pipeline Regulations" presented at the DOT Pipeline Compliance Workshop, Houston, TX, July 30-31, 2003.

Byrd, W. R., "Learnings from the Olympic Pipeline Incident" in-house training for Portland Pipeline, Portland, ME, April 2, 2003.

Byrd, W. R., "DOT Pipeline Regulatory Developments" presented at the US Oil and Gas Association Conference, Jackson, MS, October 30, 2002.

Byrd, W. R., "DOT Pipeline Training Regulations" presented at the API Training and Development Conference, Galveston, TX, October 25, 2002.

Byrd, W. R., "Introduction to DOT Pipeline Regulations" presented at the DOT Pipeline Compliance Workshop, March 21-22, 2002.

Byrd, W. R., "State Pipeline Regulatory Initiatives" presented at the US Oil and Gas Association annual meeting, Jackson, MS, October 10, 2001.



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### **Presentations and Publications Cont'd**

Byrd, W. R., "State Pipeline Regulatory Initiatives" presented at the Southwest Gas Association annual meeting, Phoenix, AZ, August 29, 2001.

Byrd, W. R., "OPA 90 Planning Requirements for US Coast Guard Regulated Facilities" presented at the US Coast Guard compliance workshop; New Orleans, LA, August 16, 2001.

Byrd, W. R., "Operator Qualification Program Requirements / Overview" presented at the Greater Baton Rouge Industrial Managers Association, March 28, 2001, and the Lake Area Industry Alliance, May 8, 2001.

Byrd, W. R., "Pipeline Integrity Management Program Development / Risk Analysis" presented at the Pipeline Integrity Management Workshop, March 6-8, 2001.

Byrd, W. R., "Operator Qualification - Program Management Issues" presented at the DOT Pipeline Operator Qualification Workshop, November 14-15, 2000.

Byrd, W. R., "U.S. Regulatory Scheme for Pipeline Safety" presented to members of the Russian Duma during a state visit, June 22, 2000.

Byrd, W. R., "Operator Qualification Issues and Industry Resources" presented at the DOT Pipeline Compliance Workshop, May 18, 2000.

Byrd, W. R., "New and Proposed Rule Changes for DOT Pipelines" presented at the DOT Pipeline Compliance Workshop, May 17, 2000.

Byrd, W. R., "Introduction to DOT Pipeline Regulations" presented at the DOT Pipeline Compliance Workshop, May 16, 2000.

Byrd, W. R., "Electronic Contingency Plan Team Status, Findings, and Path Forward" presented at the EPA / USCG Region VI Response Team meeting, January 19, 2000.

Byrd, W. R., "Pipeline Legal / Regulatory Requirements for Community Relations" presented at the 1999 API Pipeline Conference, April 21, 1999.

Byrd, W. R., Kasper, S.H., "Proposed USCG Hazmat Spill Planning Rule" presented at the ILTA Southern Region Spring Meeting, April 27, 1999.

Byrd, W. R., "DOT Inspections - Current Expectations" Presented at the DOT Pipeline Compliance Workshops, September, 1998.

Byrd, W. R., "Plan Integration Subcommittee: Objectives and Plans" Presented at the New Orleans Area Committee Meeting, July 30, 1998.

Byrd, W. R., "Relief Settings and Maintenance Activities" Presented at the Coast Guard Compliance Workshops, May, 1998.

Byrd, W. R., "...And Now a Word from Washington" Presented at the Louisiana Pipeliners Association Meeting, September 9, 1997.



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### **Presentations and Publications Cont'd**

Byrd, W. R., Brunell, R.A., "Person in Charge' Training: Current Compliance Issues" presented at the Independent Liquid Terminals Association Conference, June 10, 1997.

Byrd, W. R., "Compliance Guidance for U.S. Department of Transportation Pipeline Regulations" CMA No. 601001F, Chemical Manufacturers Association.

Byrd, W. R., "Training Module for U.S. Department of Transportation Pipeline Regulations" CMA No. 601002F, Chemical Manufacturers Association.

Byrd, W. R., "Natural Resource Damage Assessments: Texas Overview, Louisiana Outlook" presented at SPE Environmental Issues Forum, February 17, 1997 and the ELIRT Regional Training Workshop, November 20-21, 1996.

Hall, S.E., Byrd, W. R., Singh, S., "National Response Team's 'One Plan' Guidance: A Preferable Alternative?" November 1996.

Byrd, W. R., Brunell, R.A., "New Developments in USCG Regulations for Dock Facilities" presented at RCP's U.S. Coast Guard Regulatory Seminar, August 8, 1996.

Byrd, W. R., Shelton, T.C., "DOT Pipelines: Preparing for the Post-Accident Investigation" January 9, 1997.

Byrd, W. R., "Pipeline Risk Management Programs" June 20-21, 1996.

Byrd, W. R., Felder, R.B., "How OPS Regulations Affect the Chemical Industry" presented at Chemical Manufacturers Association Pipeline Compliance Forum, October 24, 1996.

Byrd, W. R., Frey, D., Bertges, W., "DOT Pipeline Spill Planning Requirements" presented at Regulated Pipeline Compliance Seminar, February 29, 1996.

Byrd, W. R., Wheeler, W.H., "Emergency Planning for H<sub>2</sub>S Releases: Utilizing Shelter in Place and Interagency Drills" SPE # 25979, presented at SPE/EPA Exploration & Production Environmental Conference, 1993.

Byrd, W. R., South, B.C., Herries, P.E., "Shelter in Place: The Technical Basis for Its Use in Emergency Planning" SPE # 25980, presented at SPE/EPA Exploration & Production Environmental Conference, 1993.

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