UNITED STATES DEPARTMENT OF THE INTERIOR
OFFICE OF HEARINGS AND APPEALS
1700 Louisiana NE, Suite 220
Albuquerque, NM 87110

IN THE MATTER OF YATES	)	
PETROLEUM CORP., ET AL.	)	IBLA 92-612, et al.
	)	
Appellants.	)	

ORDER

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APPENDICES

I. Introduction

In Yates Petroleum Corp. et al., 131 IBLA 230 (1994), the Interior Board of Land Appeals (IBLA) set aside and referred for a hearing decisions by the Director of the New Mexico State Office, Bureau of Land Management (BLM), denying applications for permits to drill (APD's) 100 oil and gas wells in Eddy and Lea Counties, New Mexico. In some instances, the State Director affirmed decisions by the Carlsbad Resource Area Manager denying the permits; in most cases, the State Director directly denied the permit. The decisions were predicated on various findings that approval would likely render the mining of potash from the lands unsafe and uneconomic, thereby constituting an undue waste of the potash resources, and violate the rules for oil, gas, and potash development within what has been termed the "Potash Area." Those rules consist of provisions of an October 21, 1986, Order signed by Secretary Donald Paul Hodel, which also identifies the approximately 497,002 acres that are included in the Potash Area (also know as the "designated Potash Area," the "Secretary's Potash Area," and the "Secretary's Oil-Potash Area"). 51 FR 39425 (Oct. 28, 1986), corrections 52 FR 32171 (Aug. 26, 1987). For convenience, the Order is reproduced as Appendix A and will be hereinafter referred to as the "1986 Order."

In ordering a hearing, the IBLA pointed out that the provisions of the 1986 Order "establish the parameters for concurrent operations in the prospecting for and the development and production of oil and gas and potash deposits owned by the United States within that defined area" and that its terms "govern both the factual and legal issues raised by these appeals and circumscribe the scope of the hearing to be held in these cases * * *." Yates Petroleum Corp. et al., supra, at 231. The Board identified the issues to be addressed as follows:

> The primary focus of the hearing will be on whether BLM's denial of the APD's accords with the provisions of the 1986 Order. Resolution of that question hinges on numerous subsidiary determinations. Principal among those ancillary issues are whether the APD's encompass lands within areas qualifying as potash enclaves under the parameters established by section 3.III.D.1.c. of the Order, i.e., whether the lands are currently unmined areas within Federal potash leases "where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics," and whether approving the APD's would result in undue waste of potash deposits or constitute a hazard to or unduly interfere with mining operations being conducted for the extraction of potash deposits. Should the evidence show that the denied APD's seek to drill wells within properly established enclaves, the applicability of the two exceptions to the 1986 Order's stated policy of denying approval of APD's within such enclaves should also be explored.

Id. at 235-36 [footnotes omitted]. Additionally, the Board stated that its delineation of issues "does not preclude the assigned Administrative Law Judge from receiving evidence on and considering all relevant matters arising during the course of the proceedings before him." Id. at 236.

The hearing was held in Albuquerque, New Mexico on various dates between August 15, 1996, and March 27, 1997, for a total of 80 days of testimony and opening and closing arguments. The primary participants were the Appellants, Yates Petroleum Corporation and Pogo Production Company which hold oil and gas leases for lands within the Potash Area, respondent BLM, and the intervenors, IMC Kalium Carlsbad, Inc., which operates mines in the Potash Area, and the Potash Association of New Mexico (PANM). Devon Energy Corporation, whose appeals to the IBLA also were referred for a hearing, did not participate because all of its appeals were either dismissed or remanded to BLM during prehearing proceedings. See Appendix B. Some of the appeals by Yates and Pogo which were referred for a hearing have also been dismissed or stayed and six additional appeals were referred for consolidation by the IBLA. See Appendix C. Fifty-five appeals affecting 72 APD's remain subject to review in this decision. See Appendix D. In addition, the Trona Industry Committee of the Wyoming Mining Association (WMA), the New Mexico Oil and Gas Association (NMOGA), and the Independent Petroleum Association New Mexico (IPANM)have been granted status as amicus curiae.

I. A. The Record

The record to be addressed is massive and complex. The testimony of 37 witnesses has resulted in a transcript of 15,275 pages. Following the practice of the parties, testimony will be cited by identifying the name of the witness and the transcript page number. The few citations to matters in the transcript other than the testimony of witnesses will be identified simply as "Tr.".

The initial witnesses for the Appellants were Jerry Cooper, a vice president and western division manager for Pogo, and Randy G. Patterson, Yates's land manager in Artesia, New Mexico. Cooper: 208; Patterson: 480. Because the Appellants were not allowed to introduce testimony by an attorney as an expert on legal history, in particular the history of Federal multiple mineral development policy, [1/] a number of BLM employees were made available to testify during the Appellants' case in chief. Tr. 1051, 7997-98. They were:

1. Richard Wayne Melton, who holds B.S. and M.S. degrees in geology, worked for the USGS and later as a BLM geologist, the area geologist in Roswell in 1983, and subsequently held supervisory positions, but did not review any of the APD's at issue. Melton: 1143-45, 1155.

2. Armando A. Lopez, who holds a B.S. in civil engineering, was the Roswell district branch chief in charge of oil and gas production and

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[1/] The Appellants requested and were allowed to make an offer of proof. Tr. 1052-57, 1068. They submitted a 365 page affidavit by the witness which was taken by oral deposition at which counsel for Yates and Pogo, but not BLM or the Intervenors, were present. See Tr. 1130-32. They requested permission from the IBLA to file an interlocutory appeal. The request was denied. Yates Petroleum Corp., 136 IBLA 249 (1996). The Appellants have not further argued in their briefs that it was error to exclude the testimony or that the deposition should be accepted as part of the record upon which this decision is based.

drilling, became the assistant district manager for minerals after Joe Lara, and in early 1993 began work as a BLM petroleum engineer. Lopez: 1661-62.

3. Joe Lara, who holds a B.S. in civil engineering, was the assistant district manager for minerals in Roswell from around April of 1985 to January, 1991 and after two years in Washington D.C. returned to work as a petroleum engineer in the Carlsbad office. Lara: 1819-20.

4. Tony Herrell, who holds a bachelor's degree in geological sciences, began work as a staff geologist in the Carlsbad office in 1988 and held the title of supervising geologist as head of the solid minerals section, during which time he supervised the processing of most of the APD's at issue in this proceeding; Herrell: 1864, 1868, 1873-75.

5. Monte G. Jordan, who graduated with a B.S. in geology, began working for BLM in 1962, and was Associate State Director from October, 1982 until September, 1993, which included most of the time the decisions subject to this hearing were issued. Jordan: 2553-55.

6. Francis Roy Cherry, Jr., who obtained a degree in zoology before beginning work for BLM in 1967, later received a master's degree in urban and regional planning, and was the Roswell District Manager from February 1985 to September 1991. Cherry: 3005-06.

7. Craig Clayton Cranston, who holds a B.S. in geology and an M.A. in business and economics, began working for BLM as a mining engineer in 1991, and wrote some of the recommendations for the APD's at issue and reviewed a majority of them. Cranston: 4085, 4093-94, 4102-03, 4293.

8. Richard L. Manus, who holds a B.S. in natural resources, was the area manager in Carlsbad beginning in June of 1987 to the date of the hearing and signed the initial decisions denying APD's which were appealed to the State Director and remain at issue in this proceeding. Manus: 4379, 4383, 4662.

The BLM employees allowed the Appellants to explore the basis of the decisions at issue and provided a means to have BLM documents identified and introduced into the record. In addition, a retired BLM employee, Donald Van Sickle testified as a witness for the Appellants. After graduating with a degree in geology in 1946, he began working in the mineral classification branch of the Conservation Division of the United States Geological Survey (USGS) in 1952 and eventually moved to Roswell in 1967 as the regional geologist (later redesignated, area geologist). Van Sickle: 6913-15, 7016-17.

The Appellants also presented testimony by a number of their technical personnel as well as by consultants and professors. They were:

1. Brent May, who holds B.S. and M.S. degrees in geology and was employed by Yates as a geologist. May: 4670.

2. Gary John Hoose, who holds a B.S. in geology and had worked for Pogo as a geologist, senior geologist, and division geologist, and at the time of the hearing was exploration manager for its western division. Hoose: 5344.

3. Robert Steven Fant, who holds a B.S. in petroleum engineering and was employed by Yates in that capacity. Fant: 5684.

4. Nelson A. Muncy, who holds B.S. degrees in both business management and mining engineering, was a registered professional mining engineer, had previously worked in the mining industry, including the Amax Potash Company, and from 1986 to the date of the hearing was employed by Myco Industries, Inc. ("Myco" being an acronym for the Martin A. Yates Company). Muncy: 7120-27, 7137-38.

5. Gary L. Hutchinson, who holds M.S. degrees in mining engineering and mineral economics from the Colorado School of Mines and since 1981 had been self-employed as a minerals management consultant. Hutchinson: 7496-97, 7508.

6. Dr. Lawrence W. Teufel, who received a Ph.D. in geology from Texas A&M University, had worked from 1979 to the time of the hearing in the geomechanics department at the Sandia National Laboratories and also held an endowed chair in petroleum and chemical engineering at New Mexico Institute of Mining and Technology (New Mexico Tech). Teufel: 8463-66.

7. Bruce Allen Stubbs, who holds a B.S. in mechanical engineering and is a registered petroleum engineer who worked as a consultant through his company, Pecos Petroleum Engineering, of which he was president. Stubbs: 8927.

8. Dr. William Gregory Hazlett, who received B.A., M.S. and Ph.D. degrees in petroleum engineering from Texas A&M University and was an assistant professor in the Department of Petroleum and Chemical Engineering at the New Mexico Institute of Mining and Technology (New Mexico Tech). Hazlett: 9380, 9397, 9618.

9. Bill L. Bessinger, who received an engineer of mines degree from the Colorado School of Mines and had worked for potash mining companies in the Potash Area, including IMC. Bessigner: 9752-53, 9755, 9759.

10. Thomas B. O'Brien, a drilling and well completion engineer for oil and gas wells who was president of O'Brien Goins Simpson, Inc. O'Brien:

10204.

Apparently because other BLM personnel had already testified, BLM's sole witness was Leslie Cone, who holds a B.S. degree in forestry and outdoor recreation and an M.A. in public administration. Cone: 10475-76. She became the Roswell District Manager in February of 1992. Cone: 10478.

The Intervenors presented a number of witnesses who responded to and addressed the economic and technical issues raised by the Appellants. They were:

1. David Charles Edward Waugh, a Canadian who holds a B.S. in geology and worked as a consultant in the United States under the name D.C.E. Waugh Services, having been employed during his career almost exclusively within the potash industry, including by IMC in Carlsbad. Waugh: 11242-43, 11253-54.

2. Daniel J. Morehouse, who received a bachelor's in mine engineering from the Colorado School of Mines in 1978, held a masters degree in industrial engineering, had worked for IMC for 18 years, and at the time of the hearing was superintendent of mine engineering construction. Morehouse: 12099-105.

3. Walter E. Thayer, who holds a B.S. in mechanical engineering and at the time of the hearing had retired as vice-president and general manager of the IMC Mine. Thayer: 12379.

4. K. Randall Foote, who holds a degree in mining engineering and at the time of the hearing was vice-president of operations for Mississippi Potash. Foote: 121467-66, 12471.

5. Jill Cameron Ivey, who has a B.S. in mining engineering from the Colorado School of Mines and at the time of the hearing was chief mine engineer for Mississippi Potash. Ivey: 12595-96.

6. Norman Gentry Martinez, who holds a degree in accounting and at the time of the hearing was employed as the chief accountant at the IMC Kalium Carlsbad Potash Company. Martinez: 12659.

7. Donald Purvis, who holds a degree in mechanical engineering and at the time of the hearing was the general manager for the IMC Kalium Carlsbad Potash Company. Purvis: 12709-10.

8. Dr. George B. Griswold, who holds a Ph.D. in geological engineering from the University of Arizona and had retired as chairman of the Department of Mining, Environmental, and Geological Engineering at the New Mexico Institute of Mining and Technology and previously had been chairman of the Department of Mining and Petroleum Engineering before

leaving for employment with oil and gas companies and the Sandia National Laboratories. Griswold: 12729-32.

9. Dr. John Forrest Abel, Jr., had received his Ph.D. from the Colorado School of Mines, was a retired professor and professor emeritus at that school, had worked on projects related to the WIPP site, and at the time of the hearing also worked as a consulting mining engineer. Abel: 13125, 13127, 13136-38.

10. Frederick Dexter Schoch, who holds a B.S. in petroleum engineering and worked as a self-employed petroleum consultant under the name Schoch & Company. Schoch: 13599-600.

11. Dr. Billy Joe Mitchell, a retired professor and professor emeritus at the Colorado School of Mines, who received a Ph.D. in petroleum engineering from the University of Oklahoma. Mitchell: 13957.

12. Robert Waldo Newcomer, Jr., who holds B.A. and M.S. degrees in geology and works as a geochemist with Daniel B. Stephens & Associates, an environmental science and engineering firm. Newcomer: 14230-31.

13. James R. Wilcox, who had been employed by IMC Kalium for 30 years and at the time of the hearing was the manager for human resources. Wilcox: 14272-73.

14. Dr. Edward W. Peterson, who holds a Ph.D. in engineering from the University of California at Berkeley and works as manager of the applied technology group for Maxwell Technologies. Peterson: 14330-34.

15. H. John Head, who received a bachelor's degree in mining engineering from the Royal School of Mines, London, England, holds an M.B.A., had been the director of the technical services division for Archibald Mining & Minerals, Inc., and at the time of the hearing was a mining engineering consultant for Harding Lawson Associates. Head: 14584-85.

BLM prepared a record consisting of approximately 10,000 pages [hereinafter cited as "RP"] and released to the Appellants some 58,000 pages of documents. See Patterson: 674-75; Tr. 1099, 3626. In preparation for the hearing, the Appellants, the Intervenors, and BLM created dozens of notebooks containing potential exhibits. Ultimately, over 1200 exhibits were admitted as evidence at the hearing, including numerous scientific and technical studies as well as exhibits in the form of large posters and maps. Many documents and portions of documents, however, appear in the record more than once because they were identified as exhibits by more than one party, were already attached to another document, or had previously been submitted as exhibits to briefs and were already part of the record proper.

Exhibits admitted at the hearing will be identified using the "YP," "INT," and "BLM" labels assigned by the parties, however parallel citations to the multiple locations a document appears in the record are provided in only a few instances. For convenience, most citations are to the Appellants' "YP" exhibits, to the copy of a document discussed by a witness, or to the copy which appears in the record along with related documents which are also discussed. In addition to original page numbers, many of the exhibits bear "RP" page numbers, while others are copies of documents in files maintained by BLM's Carlsbad District Office and bear "BLMCO" numbers. Some documents have "IMC" identification numbers, apparently indicating they are from IMC Kalium's records. Although such identification numbers were unique when assigned to each page of a document, apparently the various files contained more than one copy of some documents and different identifying page numbers were generated for each copy. Identifying page numbers are provided as appropriate to the copy of the document being cited.

Numerous documents are marked "confidential," as are those portions of the transcript which record testimony taken during periods when the hearing was closed to the public. An issue as to the confidentiality of information in the administrative record arose during the appeals to the IBLA. See Yates Petroleum Corp., 131 IBLA 230, 236-40 (1994). By order dated December 8, 1995, BLM was required to disclose to the Appellants the confidential documents upon which it had relied in issuing its decisions. Those documents primarily consist of monthly production reports, ore zone maps, life of mine reserve estimates, potash statistics, yearly progress maps, and income tax returns. Counsel for the parties were requested to sign the stipulated confidentiality agreement which they had prepared, if they had not already done so. The order exempted counsel for BLM, and by extension BLM employees, because protection of confidential and proprietary information from disclosure by government employees is provided by Departmental regulations. See 43 CFR 2.52, 4.31. It appears, however, that counsel for BLM had already signed the agreement.

Due to the confidentiality of information, portions of this decision will be based upon the review of evidence that is not part of the public record but which has been available to the primary parties. Documents which are marked "confidential" will be described as to their nature and content without reporting the specific confidential information they contain. See 43 CFR 4.31(f). Similarly, descriptions of the testimony of witnesses discussing confidential information will omit the specific information considered to be confidential. Such omissions will be made whenever the information provided in a document or discussed by a witness is of the type considered to be confidential, regardless whether the document or transcript page bears the designation "confidential." In some instances it is apparent that a copy of a document should have been marked "confidential" because another copy is so designated.

Most frequently, the confidential information of importance to this decision consists of information from core holes which identifies the location and grades of potash deposits and documents which identify the amounts and grades of potash produced during a period of time or from an area within a mine, the costs of production, and income from sales. Non-confidential information provided by a confidential document or discussed by a witness during closed testimony will be reported in this decision as needed

to address the issues. In a few instances, a specific number which might be regarded as confidential will appear in this decision because it is needed to adequately respond to an argument or address an issue. In such cases, the number will be presented without additional identifying information. For example, in one instance the grade of potash disclosed by a core hole is identified, but the identifying number of the hole is omitted and its location is described only in relation to another core hole. While the parties should be able to identify both core holes by consulting confidential exhibits, others should be unable to locate them except as being somewhere within an area of several square miles. In addition, confidential information will be provided general protection throughout this decision by omitting public land descriptions of the specific locations of the proposed drilling sites which are at issue.

I. B The Task Ahead

Review of the record is complicated by the wide variety of arguments the parties have presented in the numerous and sometimes lengthy briefs which have been filed during the course of the proceedings. The Appellants' post-hearing brief is 200 pages in length and is accompanied by equally lengthy proposed findings of fact and conclusions of law. The Intervenors' post-hearing brief is 300 pages, with a modest 30 pages of proposed findings. BLM has restrained itself to 70 pages of argument and 18 pages of proposed findings. The Appellants filed a 164 page reply to BLM's and the Intervenors' briefs. In addition, the Intervenors' 73 page Sur-reply was accepted along with Yates's response to it, and Pogo was allowed time to file a separate response. The WMA has filed an amicus brief and the NMOGA and IPANM have jointly filed another.

The Appellants also incorporate and rely upon briefs they filed prior to the hearing, including their "Preliminary Statement of Reasons and Brief" filed with the IBLA, their replies to BLM's and the Intervenors' responses to that brief, and three "final" statements of reasons filed by Yates, jointly by Devon and Pogo, and separately by Pogo. In addition, the Appellants have renewed their motions for partial summary judgment which were denied by Orders dated May 3, June 28, and, July 10, 1996, without reaching the merits. Likewise, BLM and the Intervenors refer to arguments presented in their earlier submissions, including the Intervenors' own motion for partial summary judgment.

The numerous briefs not only present a wide range of arguments but, as might be expected in a case which has extended over several years, the focus of some arguments has shifted and additional arguments have been introduced as the parties have refined their positions. This decision responds to arguments raised in briefs filed throughout the proceedings, but does not expressly identify and address every assertion and argument made by the parties. Many are omitted because they have been implicitly rejected as inconsistent with the analysis presented in addressing an issue. Other points presented by the parties are not mentioned because, whether or not correct, they lack consequence given the analysis presented in this decision. Statements and argument not supported by citation to the record are not considered. A list of the briefs which have been filed in this proceeding and the abbreviated names by which they are cited is provided in Appendix E.

The abundant and diverse issues raised by the Appellants, the number and length

of the parties' briefs, the many days of testimony, and the multitude of exhibits combine to preclude, as a practical matter, any attempt to make formal findings of fact prior to substantively addressing the matters at issue. Moreover, to a considerable extent, the factual controversies presented by the case are not so much disputes about the correctness of asserted facts but disputes about the importance of various facts and the extent to which they are determinative of the issues. While the significance of various findings of fact made at the outset might be obvious to the parties, a listing of findings would neither narrow nor illuminate the discussion and analysis which must follow.

It also would be difficult, if not impossible, to describe in neutral terms the issues and arguments which have been raised. To whatever extent the IBLA may have contemplated that the issues to be addressed in this decision would primarily concern factual questions which could be resolved based upon testimony and exhibits, the case has developed into something considerably more complex. The Appellants do not disagree with the IBLA that the Secretary's 1986 Order governs the issues they raise about the administration of the Potash Area; however, they have presented multiple arguments about the meaning and proper application of its various provisions. In particular, the critical "factual dispute as to whether the areas subject to the denied APD's qualify as potash enclaves under the 1986 Order" noted by the IBLA (Yates Petroleum Corp. et al., supra at 235) has become subsumed under arguments about the meaning of the term "enclave" as defined in the Order, the kind of standards for designating a potash enclave the Order requires, and whether BLM has ever properly identified potash enclaves. These disputes have made factual questions about the quantity and quality of potash deposits found within the areas which BLM has designated as potash enclaves secondary to questions about whether the standards which have been used to identify potash enclaves remain valid. Cf. App. Prelim. SOR at 21-22, 28. Indeed, as the Appellants understand the definition of potash enclaves found in the 1986 Order, none of their APD's are for sites within a properly designated potash enclave.

The parties' disagreements over the meaning and application of provisions of the 1986 Order extend so deep that they fundamentally differ about the procedure BLM should follow in reviewing an APD. In addition to disagreeing about the interpretation and application of the portions of the 1986 Order which define and address potash enclaves, the parties differ about the meaning and role of four stipulations which the Order requires be part of every oil and gas lease issued in the Potash Area and another stipulation which is required to be included in all potash leases. Based upon various portions of the Order, The Appellants describe the "methodology for processing APD's" they believe it establishes:

> Upon receipt of an application for a permit to drill a well within the Secretary's Area, the first inquiry must be whether the APD is in an area which is leased for potash. If the area is unleased for potash, the authorized officer must determine the propriety of the APD pursuant to the oil and gas lease stipulations. If the area is unleased for potash, the determination of whether the APD is for a test well or a development well is irrelevant, because areas which are unleased for potash may not be properly included within an enclave. * * *

> Therefore, if the area is unleased for potash, the applicable determinations are those set forth in the oil and gas stipulations, rather than the test well portion of the order. Specifically, the authorized officer must apply the first lease stipulation to determine whether the granting of the APD will interfere with mining and recovery of potash deposits or whether the interest of the United States will best be served by permitting such drilling. Thereafter, the authorized officer must determine the propriety of the APD pursuant to the second oil and gas lease stipulation. The officer must determine whether the APD will result in an undue waste of potash deposits or constitute a hazard to or unduly interfere with mining operations being conducted for the extraction of potash deposits.

App. PH Brief at 75-76 [emphasis in original]. If the area of the proposed wellsite has been leased for potash, the Appellants understand that BLM will "determine the propriety of the APD pursuant to the mutual lease stipulations." Id. at 77. Subsequently, however, they have asserted that the oil and gas lease stipulations apply only "in the event of an actual conflict with mining operations being conducted," and they appear to believe that the stipulations otherwise have no bearing on BLM's decision to approve or disapprove an APD. See App. PH Reply at 109-110. [2/]

Using language from two of the four oil and gas lease stipulations, BLM explains that, in addition to the question whether an APD is for a site within a designated potash enclave, an APD will be approved only if five conditions are met:

> 1) drilling will not interfere with the mining and recovery of potash deposits, 2) the best interest of the United States will best be served by permitting such drilling, 3) drilling would not result in undue waste of potash deposits, 4) drilling will not constitute a hazard to mining operations and 5) drilling will not interfere with mining operations being conducted for the extraction of potash deposits.

BLM PH Brief at 43. Somewhat differently, the Intervenors explain that:

> The scheme for processing APDs is straightforward. When an application is filed, BLM must first ask whether the proposed well site falls within a potash enclave. If it does fall within the enclave, the application

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[2/] The claim that the stipulations apply only to resolve a conflict between operations is inconsistent with the Appellants' previously quoted statement that BLM reviews an APD for an area unleased for potash "pursuant to the oil and gas lease stipulations." Although, as has been indicated, it is to be expected that the legal positions taken by a party may develop and be refined as a case proceeds, at times the Appellants have made claims which appear to be irreconcilable with other assertions they make about the 1986 Order. Because their position entails a complex interpretation of the meaning and interrelationship of various provisions of the Order, and they frequently frame their arguments using the words of the Order with the meanings they understand them to have, the apparent changes in position have complicated the already complex analysis needed to respond to their arguments.

> is presumptively denied, unless it falls within one of two narrowly circumscribed exceptions. If the proposed well site does not fall within the enclave, the APD must be analyzed according to the oil and gas lease stipulations. Under those stipulations, if drilling will tend to impact ore within the enclave, posing a potential safety hazard and resulting in undue waste of ore, the stipulations will balance in favor of protecting potash, and the APD will be denied. In most other circumstances, however, the safety and undue waste factors will balance in favor of the oil and gas lessee, and the APD may be approved for further processing.

Int. PH Brief at 88. In regard to APD's for areas outside of potash enclaves, the Intervenors understand that "application of the oil and gas lease stipulation factors must govern the BLM's approval or denial decisions." Id. at 93.

I. C Overview of this Decision

The next section will provide basic information about potash, potash mining, and factors which give rise to the conflict between potash mining and oil and gas drilling in the Potash Area. The following section will describe the series of decisions by which BLM denied approval of the Appellants' APD's, the grouping of the APD's by geographic area and the similarities of the reasons for denial of the APD's within each group and during different periods of time. Identifying the reasons BLM denied the applications will also serve to introduce a variety of matters which the Appellants have placed in issue.

The first step in addressing the issues will be to review the relevant statutes and regulations under which oil and gas and potash leases are issued and operations conducted as well as other statutes cited by the Appellants. Next, this decision will describe and respond to two sets of arguments about the nature of the review to be undertaken. Although the Intervenors acknowledge that the ultimate question for review is whether BLM abused its discretion, they present a series of incorrect assertions about this tribunal's scope of review and the applicable standards. In effect, they would preclude close examination of BLM's decisions by insulating them under the shields of Secretarial "policy," "permissible interpretation," “reasonable procedures," "agency discretion," and "deference." In contrast, the Appellants seek to broaden the basis for construing the Secretary's 1986 Order by arguing that two "maxims"--"equal footing" and "first in time to develop, first in right"-- are implicit in the 1986 Order and should govern its interpretation. Neither maxim, however, can be justified under provisions of the Order.

Addressing the maxims, however, will both respond to some of the arguments the Appellants have raised about the meaning and application of provisions of the 1986 Order and establish a basis for addressing other claims. As the previous quotation describing the proper "methodology" for reviewing APD's suggests, the Appellants have developed a complex understanding of the interrelationship of provisions of the Order which is decidedly at odds with that of BLM and the Intervenors. Their understanding is based upon their analysis of the history of the administration of the Potash Area and the Secretarial Orders issued in 1951, 1965, and 1975 which preceded the 1986 Order.

Many of the provisions of the 1986 Order which are at issue in this proceeding were part of the 1951 Order and other portions, in particular the section pertaining to potash enclaves, originate with the 1975 revision of the Order. Consequently, this decision will address a number of issues the Appellants raise by discussing a series of interrelated documents which led to issuance of the 1975 Order.

This decision will next turn to the two broad issues which were the primary focus of the hearing and require detailed review of testimony and exhibits. As noted by the IBLA, one concerns the identification of potash enclaves under the 1986 Order. A key provision of the Order is its declaration that: "It is the policy of the Department of the Interior to deny approval of most applications for permits to drill oil and gas test wells from surface locations within the potash enclaves established in accordance with Part D, item 1 of this Order." Appendix A, § 3.III.E.1. The Appellants argue two points that would significantly narrow the application of this policy. First, their motions for partial summary judgment presented a variety of arguments that the 1986 Order, properly interpreted, allows only land which has been leased for potash to be designated a "potash enclave." Because they claim that relatively few of their APD's are for land which has been leased for potash, if they correctly interpret the Order, the declaration of policy would not preclude approval of their other APD's. [3/] Second, the Appellants claim that the term "test wells" in the statement of policy refers to exploratory wells for oil and gas rather than development wells. Because they believe that almost all of their applications are for development wells, if they are correct, the policy would apply to only a few of their APD's.

After addressing these specific claims, this decision will turn to the Appellants' broader argument that BLM, and before it the United States Geological Survey (USGS) when it was responsible for administering the Potash Area, have never properly identified potash enclaves as defined in the 1986 Order. [4/] The "Part D, item 1" referred to in the enclave policy requires potash lessees to annually file a map or maps showing areas with active mining operations, areas where mining operations have been completed, and:

> Those areas that are not presently being mined which are considered to contain a mineable reserve in one or more ore zones, i.e., those areas (enclaves) where

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[3/] APD's for wells within land which has been leased for potash were identified at the hearing (Hutchinson: 7683-85; Foote: 12497-98), including some for sites within the potash lease area at issue in Pogo Producing Co., 138 IBLA 142 (1997), rev'd, IMC Kalium Carlsbad, Inc. v. Babbitt, 32 F. Supp. 2d 1264 (D.N.M. 1999), rev'd, IMC Kalium, Carlsbad, Inc. v. Interior Board of Land Appeals, 206 F.3d 1003 (10th Cir. 2000). See also IMC Fertilizer, Inc., 138 IBLA 160 (1997).

[4/] By Order No. 3071 the Secretary created a Minerals Management Board and a Minerals Management Service (MMS) and assigned to the latter the functions previously administered by the Conservation Division of the USGS 47 FR 4751 (Feb. 2, 1982). By Order No. 3087, as amended, the Secretary abolished the Minerals Management Board, assigned all functions related to royalty and mineral revenue management to MMS, and assigned MMS's onshore minerals management functions to BLM. 48 FR 8983 (Mar. 2, 1983).

potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics.

Appendix A, § 3.III.D.1.c. [5/] The Appellants contend that the enclave maps which BLM and the USGS have produced have not identified areas containing potash ore "minable under existing technology and economics" as called for by the 1975 and 1986 Orders, but were developed using standards for identifying lands containing valuable deposits of potash which by statute must be leased through competitive bidding. See 30 U.S.C. § 283 (1994).

After addressing the Appellants' arguments concerning the proper identification of potash enclaves, this decision will turn to the testimony of their witness Gary L. Hutchinson. An initial section will describe his analysis of the manner in which the 1986 Order requires BLM to identify potash enclaves based upon their definition as areas where potash ore is "known to exist in sufficient thickness and quality to be mineable under existing technology and economics." A subsequent series of sections will examine critical aspects of his analysis as he applied them to the Potash Area, along with testimony by the Intervenor's witness who discussed the same topic, David Waugh. This decision will then address other evidence and arguments concerning the issue whether the standards which BLM used to prepare its potash enclave maps continued to define, as of the time of the hearing, the thickness and quality of potash ore which is "minable under existing technology and economics." In particular, the Appellants have argued that BLM cannot determine both that the potash which underlies potash leases is not economically recoverable for the purpose of granting royalty reductions and that it is "known to exist in sufficient thickness and quality to be mineable under existing technology and economics." On the other hand, David Waugh testified that IMC mines ore at approximately the same standards as applied by BLM in issuing its potash enclave maps.

The second broad issue which was the subject of extensive testimony at the hearing is whether oil and gas wells pose a danger to ongoing and future potash mining operations. As quoted above, in referring the case for a hearing, the IBLA identified the issue of "whether approving the APD's would result in undue waste of potash deposits or constitute a hazard to or unduly interfere with mining operations being conducted for the extraction of potash deposits." Yates Petroleum Corp. et al., supra, at 235-36. As addressed at the hearing, the issue concerns three basic factual questions. The first is whether the drilling technology to be used to drill the wells at issue, in particular the casing and cementing, is sufficient to preclude oil, natural gas, and other substances from escaping the well bores. The second is whether, if substances escape, they could migrate to open mine workings. The third is whether the subsidence which will occur when

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[5/] The 1975 Order stated the requirement in a slightly different manner: "The presently unmined areas which are considered to contain a mineable reserve in one or more ore zones, i.e., those areas (enclaves) where potash ore is known to exist in sufficient thickness and quality to be mineable under present day technology and economics." Although "minable" seems to be the preferred spelling within the mining industry, consistent with the 1986 Order, this decision will use "minable" except when quoting a document.

mining has removed sufficient material will create subsurface forces that can crush, shear, or otherwise damage well casing and allow oil, gas, or other substances to escape.

After the broad issues have been addressed, a final section will address and rule upon the specific grounds on which BLM denied each of the Appellants' APD's.

I. D. Understanding the Conflict

The term "potash" refers to various compounds of the chemical element potassium (K). Commercial grade potash was discovered in southeastern New Mexico in 1925 when it was found in cuttings from drilling the Snowden-McSweeney No. 1 McNutt oil and gas well. YP 361, ex. J at 1 (BLMCO42543). Mining, however, did not begin until the first access shaft was sunk in 1931 at what later became the Mississippi Chemical Corporation mine. Id. at 2 (BLMCO42544); INT 170 at 154.

Although there are industrial uses for potash, 90 to 95% of the potash consumed in North America is used for fertilizer. Waugh: 11280; Hutchinson: 7755-56; INT 108; INT 459; YP 741. Some potash is produced in California, Utah, and Michigan, but the Potash Area accounts for 84% of domestic production and is the only current source of langbeinite in the world, providing 80% of the world's supply of potassium magnesium sulfate. Waugh: 11278, 11300-02; INT 451; INT 454. Domestic production, however, supplies only 20% of domestic consumption, with 73% coming from Canada. Hutchinson: 7755; YP 741. At the same time, a large percentage of domestic production is exported, primarily to Mexico and Japan. Waugh: 11306 (28%); Hutchinson: 7755; YP 741.

Two forms of potash are mined within the Potash Area. Sylvite, which is potassium chloride (KCl), is the more common and is used for fertilizer, in drilling and fracturing fluids, and as feed stock for other potassium chemicals. Langbeinite, which is potassium magnesium sulfate ($2MgSO_4K_2SO_4$), is rarer and more valuable and has been found in the United States only in the Potash Area. Waugh: 11262-63; INT 458. In addition, IMC has manufactured potassium sulfate (K_2SO_4) from concentrated sylvite and langbeinite brines. Waugh: 11262; INT PH Brief at 117.

Potash deposits occur within the McNutt portion of the Salado Formation in 11 ore zones (numbered from the bottom up) separated by "marker beds" (numbered from the top down). See YP 352; YP 361, ex. J at 12 (BLMCO42556); INT 463. The McNutt ranges from 300 to 500 feet thick; above it lies the Upper Salado, which averages 500 feet thick; and below it is the Lower Salado, which varies from 400 to 1500 feet thick. INT 170 at 155-56 (BLMCO53316-17). Although both the Upper and Lower Salado also contain marker beds, each consists almost entirely of halite (NaCl), more ordinarily known as table salt, which is not commercially mined in the Potash Area. Id. at 156 (BLMCO53317). The potash ore zones vary in thickness, some containing very low grades of potash that make them economically unmineable, and the quality of the potash within a zone can also vary. YP 361, ex. J at 13 (BLMCO42557). Although both the potash beds and the marker beds tend to have a consistent thickness, they dip toward the southeast, so that the potash deposits on the western side of the Potash Area may be only

600-700 feet below the surface, while those to the east are around 1800 feet deep. May: 4762; Foote: 12520. In the areas at issue in this proceeding, mining occurs in the 4th and 10th ore zones at depths of about 1600 to 1900 feet. Elsewhere within the Potash Area, the first, third, fifth, and seventh ore zones have been mined, although the first, which produced the richest ore, is considered to be mostly depleted. Hutchinson: 7614-15; Waugh: 11381-82; Foote: 12545.

At the time of the hearing, five mines owned by two companies were operating in the Potash Area. Herrell: 3755; Waugh: 11381. Mississippi Potash, a wholly-owned subsidiary of the Mississippi Chemical Corporation, operates its original Mississippi Potash mine (formerly operated by U.S. Potash, U.S. Borax, and Teledyne) under the name Mississippi West. Foote: 12469, 12480, 12560. In 1996 Mississippi Potash purchased the New Mexico Potash mine (formerly Kerr McGee), which it has renamed Mississippi East, and also purchased the Eddy Potash mine that at one time was owned by the Potash Corporation of America. Herrell: 2060, 3952; Cranston: 4090; Foote: 12492, 12494, 12559-60. In addition, Mississippi Potash owns the old National Potash mine, which it refers to as Mississippi North, but it was not in operation at the time of the hearing. Foote: 12487, 12490, 12562. IMC Kalium operates its original mine and in 1997 purchased the Western Ag mine, which had previously been the Duval mine. Cranston: 4233-34; Foote: 12564.

As described by Waugh, potash mining is conducted using basically two different methods. IMC and Western Ag mines continue to use conventional "drill-and-blast" mining with a conventional room-and-pillar operation. Waugh: 11383-84. Ore is mined along a panel of up to 20 rooms, leaving roughly square pillars of ore behind as support for the "back" or roof of the mine, resulting in an underground checkerboard pattern. Waugh: 11393-95; INT 471. Long bolts are driven into the roof at intersections between rooms because, as Waugh explained, "the blast induces a certain amount of breaks, fractures, and microfracturing in the roof" and there also may be "partings" which "over time, will separate, and that roof will come down." Waugh: 11388. A "cutting arm loader" gathers up the broken rock and loads it onto a shuttle car or other vehicle for transport to the "breaker" which crushes it down to a maximum size and loads it onto a conveyor belt. Waugh: 11396-97. The conveyor belt takes the ore to the mine shaft, where it can be hoisted to the surface and sent to the processing plant, although usually ore is stored in underground bins which have been cut into the rock and drawn from as needed to mix with other ore in order to send a particular grade to the plant. Waugh: 11410-11. Between 60% to 70% of the ore is removed during "first mining" and the remaining ore in the pillars is removed when "second mining" occurs, but that may not happen for many years. Herrell: 1899; Waugh: 11795. Once sufficient support is removed by mining the pillars, "convergence" of the space begins with the remaining pillars shrinking, the floor rising, and the roof collapsing. More recently IMC began using continuous mining machines in addition to drill and blast mining. Waugh: 11406.

Mining at IMC Kalium and Mississippi East is conducted using continuous mining machines which operate in a chevron pattern. Waugh: 11398. Mobile bridge conveyors are connected to a continuous miner for the transfer of ore to a conveyor belt without use of a rock crusher. Waugh: 11399-400; INT 470. Using this method, the miner can

extract above 40% of the ore as it moves into an area and another 40% as it pulls out, giving an overall extraction rate of about 80%, without any need to return to the area. Waugh: 11415, 11797-98.

Mississippi Potash (Mississippi West) mines sylvite in the seventh ore zone using continuous miners and shuttle cars and a mining method that it calls “modified longwall” which allows it to mine some areas at approximately a 90% extraction rate without second mining. Foote: 12476-79; Abel: 13132, 13140; Waugh: 11408-09, 11798; INT 469. Several parallel entries are made into an area, breakthroughs are cut from one entry to the next, and, working from the rear, rooms are cut to the right and left of the entries, leaving small pillars which may collapse in a relatively short time. New Mexico Potash (Mississippi East) also first mines at a high extraction ratio without conducting second mining. Foote: 12558.

The conflict underlying the hearing arises because the Appellants seek to drill below the potash beds to the base of the Delaware Mountain Group of formations which extend from 4,500 to approximately 8,300 feet underground. The wells would generally be drilled some 9,000 feet into the underlying Bone Spring formation and produce from higher "pay" zones ranging in some cases up to 7,000 feet. See Cooper: 226-27, 316, 390; May, 4745, 4790; Hoose, 5404, 5407, 5500; Fant: 6006.

As explained by the Appellants' witnesses, although the wells they propose to drill will primarily produce oil, all oil wells also produce some amount of gas, so that whether a well is classified as an oil well or a gas well is a matter of the ratio of the substances produced. See Cooper: 227; May: 4708; Fant: 5714-16, 6567. The Appellants’ witnesses also explained that the term "gas" refers to natural gas, which can consist of a number of naturally-occurring compounds, primarily methane but also ethane, propanes, and butanes, and that almost all gas in the Delaware Formation is dissolved within oil as "solution gas" rather than "free" gas. May: 4730; Fant: 5709, 5718-19; Stubbs: 8998-99. In turn, the production occurs from what has been termed "solution gas drive" reservoirs because, as a well begins to produce, pressure is reduced and gas is able to expand, migrating toward the well and carrying with it the oil in which it is dissolved. Fant: 5695, 5725-26, 5795; Hazlett: 9497; see Peterson: 14473. Oil, and the dissolved gas, moves toward the well because the pressure within the well is lower than in the surrounding strata. Fant: 5727-28; Hazlett: 9497. The lower pressure in the upper portion of a well draws the oil and gas higher, and when the pressure is insufficient to move oil, pumps are used which have the effect of lowering the pressure in the well bore. Fant: 5745-46, 5795, 6096-103.

As has been described elsewhere, the discovery of potash gave rise to an ongoing tension between potash mining companies and oil and gas companies which seek to drill wells in areas containing, or potentially containing, mineable potash deposits in order to reach underlying oil and gas bearing formations. [6/] The points of disagreement do not

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[6/] See Lear, "Multiple Mineral Development Conflicts: An Armageddon in Simultaneous Mineral Operations?" 28 Rocky Mt. Min. L. Inst., 79, 86-87, 97-98 (1982); Croft, "Conflicts

seem to have changed over the years. As stated by one court:

> The inherent conflict lies here: although it makes economic sense to extract oil and gas before the potash is mined, oil and gas drilling through potash may create safety hazards when the potash is eventually mined, may increase the costs required to mine the potash, and may reduce the ultimate amount of potash that is recovered if the potash is mined. Potash interests wish to restrict or prevent oil and gas drilling near potash leases, while oil and gas interests seek drilling permits near potash leases.

IMC Kalium Carlsbad, Inc. v. Babbitt, 32 F. Supp. 2d 1264, 1266 (D.N.M. 1999), rev'd, IMC Kalium, Carlsbad, Inc. v. Interior Board of Land Appeals, 206 F.3d 1003 (10th Cir. 2000). As reflected in the issues in this case, potash mining companies are concerned not only that oil and gas drilling will allow oil, gas, or water to reach and contaminate mineable potash deposits but that methane or other gas will migrate to their operating mines and cause them to be subject to the "gassy mine" regulations of the Mine Safety and Health Administration (MSHA), potentially necessitating large expenditures for required mining equipment and ventilation systems as well as increased operating costs. INT 178 at 17-19; see Thayer: 12397; Foote: 12500; Head: 14626-28.

Other than directly encountering and damaging well casing while mining, the prime danger potash mining poses for oil and gas production is the possibility that subsidence due to mining may result in well casing being sheared, crushed, or otherwise damaged. The danger posed by subsidence depends not only upon the amount of material removed and the support provided by any pillars which remain, but whether wells are protected by a surrounding buffer pillar and the extent to which well casing and cement can withstand the forces generated by subsidence. Of course, a breach of well casing which allows oil or gas to escape could also allow the substances to reach potash deposits or mines.

Complicating the conflict between the two industries are the time frames and cost structures in which each operates. An oil and gas well may be drilled in a relatively short time, measured in days or weeks, and, if a discovery is made, the company, or others holding leases in the area, will seek to drill additional wells, as limited by the spacing requirements established by the state regulatory authority. Testimony indicated that it would cost an estimated $550,000 to $600,000 to drill each of the wells at issue in this case, although a variety of other costs would have been incurred before drilling them, including the costs of obtaining a lease or operating rights. See Cooper: 255, 459-60; Patterson: 491-92, 498, 506, 513-14, 522-23, 527-28. A successful well may produce for only a short time or for decades, but its life also may be extended by secondary and tertiary recovery techniques as well as by recompleting the well in another oil or gas bearing zone. Patterson: 818-19; May: 4803-04, 5192. Once drained, the well will be

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Between Potash and Oil and Gas Developments," 10 Rocky Mt. Min. L. Inst., 29, 42-52 (1965); 6 American Law of Mining, § 200.04[2][b]. Evidence of the ongoing conflict can also be seen in the statements submitted to the Department by representatives of the oil and gas and potash mining industries prior to issuance of the 1975 Order. YP 234, YP 235; see also INT 5.

plugged and abandoned, although it may still be reentered. Patterson: 821-23; May 4717-18.

In contrast, an underground potash mine requires a very large initial investment to sink a main production shaft for hoisting ore, to develop secondary shafts for ventilation and access, and to construct a processing plant. The production shaft alone may cost $10 million to develop. Waugh: 11411-13, 11558, 11588; Cranston: 4308-10. The time required to plan a mine, the costs of developing it, and the time and labor required to mine the potash deposit preclude quick extraction of ore. Thayer: 12419. Once production begins, it will continue at a fairly sustained rate for decades, given proper market conditions, until the deposit is exhausted. The life of the mine may be extended by driving a new drift to develop additional deposits, generally less expensive than sinking a new shaft and installing additional equipment. Waugh: 11329-30, 11341.

An obvious approach that would allow both minerals to be fully extracted would be to preclude oil and gas drilling until mining has been completed and subsidence has occurred. A maximum amount of potash could be extracted and wells would not pose any danger to mining operations. Nor could wells be damaged by mining equipment or unexpected subsidence. Such delay, however, could indefinitely preclude the development of oil and gas resources in large portions of the Potash Area which are underlain by potash deposits that will not be mined for many decades, if ever. For this reason, delay is not a satisfactory solution for oil and gas companies whose business it is to seek and develop new resources, particularly the Appellants who have been issued leases for lands within the Potash Area. See Patterson: 512. Minimizing delay of oil and gas drilling until mining has been completed could necessitate changes in the manner in which mining companies have conducted their operations. As presented at the hearing, mines have tended to operate by moving their equipment from area to area within a mine to meet changing needs for types of ore, frequently returning to expand areas mined many years before. Consequently, mines in the Potash Area usually do not close off areas where mining has ceased. IMC's mine workings extend approximately 20 miles north to south and eight to ten miles east to west, with most of the area remaining accessible. Morehouse: 12109. In order for oil and gas drilling to occur after mining, areas would need to be closed to future mining operations and subsidence allowed to occur.

Although the conflict between oil and gas companies and potash mining companies is long standing and, as evidenced at the hearing, intense, some perspective is provided by remembering that potash mining has managed to continue for some 70 years and numerous wells have been drilled throughout the Potash Area. See YP 214. As of 1983, there were 780 oil and gas leases in the Potash Area, 1,080 wells had been drilled, and 238 APD's had been approved under the 1975 Order. YP 248. In 1992, BLM approved 166 APD's and denied 79 for a 67% approval rate and in 1993, BLM denied 67 APD's and approved 277, 50 of them in measured potash reserves, for an 80% approval rate. Cone: 11183; see BLM 7, RP 006290. As stated to the IBLA in responding to the initial appeals, BLM had allowed 452 wells to be drilled within areas of measured ore as of December 1, 1993. Supp. Resp. to Prelim. SOR at 2 (RP006014); Cone: 11184.

I. E. The Decisions at Issue

The earliest decisions at issue were issued by the Carlsbad Resource Area Manager, Richard L. Manus, who, by separate letters dated January 10, 1992, denied approval of three APD's filed by Pogo and one filed by Yates. As the basis for his decisions, each of the letters stated:

> The physical characteristics of the ore body and the fact that these same ore bodies are currently being mined to the north, west, and south of the area in question, leads us to conclude that the fourth and tenth ore zones constitute a "Potash Enclave". Therefore the drilling of this well may result in undue waste of potash. In accordance with the 1986 Secretary's Order, the APD cannot be approved at this time.

YP 64, RP 001046; YP 65, RP 001395; YP 66, RP 001423; YP 78, RP 001108. [7/] Five days later, the Area Manager provided the same explanation when rejecting three additional APD's filed by Yates and nine filed by Pogo. YP 67, RP 001460; YP 68, RP 001489; YP 69, RP 001526; YP 70, RP 001558; YP 71, RP 000568; YP 72, RP 000586; YP 73, RP 000622; YP 74, RP 000658; YP 75, RP 000685; YP 76, RP 001060; YP 77a, RP 001080; YP 79, RP 001131.

Pogo's applications were for sites known as the "Federal 23" wells, numbers 4 and 6 through 16, and Yates's APD's were for sites known as the "Martha" wells numbers 7 through 9 and the "Dolores" number 4 well. [8/] Along with five additional "Martha" wells, they are known as the "Livingston Ridge" sites. The drill sites lie in the eastern half of T. 22 S., R. 32 E., N.M.P.M., near the eastern boundary of the southern portion of the Potash Area. They are to the east and northeast of an area of sixteen sections of land set aside for the Waste Isolation Pilot Plant (WIPP), generally referred to as the "WIPP site." Congress created the WIPP site, and within it the WIPP facility which is administered by the Department of Energy, "for the express purpose of providing a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from

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[7/] The decisions denying approval of the APD's and documents related to them are cited to the Appellants' exhibits, which are copies of pages from BLM's RP volumes. The exhibits are in two series. One includes the Appellants' Form 3160-3 application (but not the additional documentation submitted with it) and BLM's decision. In a few instances, the copy of a decision is not signed or lacks a date. The other series of exhibits contains the decision rationale or other document prepared in reviewing the APD and maps BLM prepared at the time.

The originals of the APD's, decisions, and other documents are contained in the case files which BLM sent to the IBLA when the appeals were filed. They were forwarded to the Hearings Division when the cases were referred to it and are part of the record in this case. The documents in those files have been reviewed and are quoted in describing the decisions at issue. Because they lack RP page numbers, the Appellants' exhibits are cited for the convenience of the parties.

[8/] The caseful for the Dolores number 4 well includes a "Notice of Staking" and map showing the location of the Dolores number 3 well.

the defense activities and programs of the United States exempted from regulation by the Nuclear Regulatory Commission." Pub. L. No. 96-164, § 213, 93 Stat. 1259, 1265 (1979). The WIPP site is withdrawn for use as a permanent repository for underground storage of transuranic waste and is withdrawn from operation of the mining and mineral leasing laws. 57 FR 55,277 (Nov. 24, 1992); see Pub. L. No. 102-579, §§ 3-4, 106 Stat. 4777, 4779-81 (1992), as amended by Pub L. No. 104-201, §§ 3181-91, 110 Stat. 2422, 2851-54 (1996).

The presence of the WIPP site within the Potash Area does not directly affect the legal and factual issues addressed in this decision, but is a convenient reference point for describing the location of the proposed wells and other places within the Potash Area. The WIPP site, however, is of considerable importance in relation to factual issues related to the hazards oil and gas drilling may pose to mining operations because numerous studies of the Salado Formation, within which both it and the Intervenors' mines operate, were conducted prior to opening the facility. A number of those studies have been made part of the record and several of the Appellants' witnesses who addressed technical issues relied upon data developed at the WIPP site in preparing the studies they discussed at the hearing.

Both Yates and Pogo sought State Director review of the Carlsbad Resource Area Manager's decisions denying their APD's. After oral presentations by the parties, the New Mexico State Director, Larry L. Woodard, issued a separate decision to each company, dated July 20, 1992, upholding the Area Manager's decisions. He concluded that the wells "have the potential to make the mining of potash unsafe and ultimately uneconomic, therefore constituting undue waste of potash." YP 80 at RP 001050; YP 81 at RP 009615. In addition, he stated that he agreed with the area manager’s estimate that mining would begin within the area in 10 years and "drilling would create a situation where active mining and oil and gas operations would exist in the same space simultaneously" and that “this is an unsafe condition, creating unnecessary hazards to both industries." YP 80, RP 001050. The State Director also concluded "that there are economical potash reserves in the subject area." Id. Yates and Pogo appealed the decisions to the IBLA (IBLA 92-612, 92-615).

In the interim between the Area Manager's and the State Director's decisions, both Yates and Pogo (as well as other oil and gas companies) filed additional APD's. Beginning in early February, however, the State Director had imposed a moratorium on processing them. Cone: 10501. It lasted until April 27, 1992, when he sponsored a meeting in Albuquerque to address the issues which had arisen between the oil and gas and potash industries at which some of the attorneys involved in the present proceeding were present and spoke, apparently as representatives of the oil and gas and potash industries. BLM 26; Cone: 10501; 10575. At the conclusion of the meeting, the State Director announced that he was moving authority to review APD's to his office. BLM 26 at 13; Cone: 10606; see YP 496. He also announced the formation of a working group that would attempt to clarify not only the procedures for reviewing APD's but also "LMR implementation and the buffer zone concept." BLM 26 at 14; see BLM 29.

Since 1951 the New Mexico Oil Conservation Commission (NMOCC) has issued a

series of orders which have defined a state administered “Potash-Oil” area and set forth provisions governing the casing, cementing, and plugging of wells. [9/] YP 219, YP 220. Its initial order was numbered R-111 and its applicable order as of the time of the hearing, numbered R-111-P, had been adopted in 1988. YP 262. [10/] Order R-111-P uses the term "LMR," which stands for "life of mine reserves," to refer to areas identified by potash lessees as containing "potash ore in sufficient thickness and grade to be mineable using current day mining methods, equipment and technology." YP 262 at 10. As explained at the hearing, a buffer zone is the area adjacent to an LMR within which drilling a well to a target above the base of the Delaware Formation or above a depth of 5,000 feet, whichever is less, is not allowed for a distance of one-quarter mile and drilling a well to below the base of the Delaware Formation or below 5,000 feet is not allowed for a distance of one-half mile. Cone: 10585; see YP 262 at 6, 12. Neither LMR’s nor buffer zones are part of the Secretary’s 1986 Order, but they were included in a proposed revision of it published in the Federal Register in 1991. 56 FR 5697 (Feb. 12, 1991).

Leslie Cone, who had become the Roswell District Manager on February 2, 1992, chaired the working committee meetings, which included representatives of both industries as well as the New Mexico Conservation Division and the New Mexico Commission of Public Lands. Cone: 10482, 10577-79; BLM 29 at BLMR000383. Meetings were held on May 21, July 9, and August 25, 1992, the last attended by BLM Director Cy Jamison. BLM 29 at BLMR000404. Although there seems to have been agreement among the committee members on some minor issues, no formal document was issued due to disagreements about provisions of the proposed revision of the 1986 Order. Cone: 10584-85.

In the meantime, the State Director continued to issue decisions on APD's and the Appellants continued to appeal those denying approval of theirs. Although the State Director had reserved authority over APD's and issued the letters sent to the Appellants, the substantive work of reviewing applications continued to be performed within the Carlsbad Resource Area Office, which prepared a “decision rationale" document for each application and forwarded it along with other documents to the district and state offices

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[9/] As currently constituted, the NMOCC is a three member board composed of designees selected by the New Mexico Commissioner of Public Lands and the Secretary of the New Mexico Department of Energy, Minerals, and Natural Resources and also the Director of the Oil Conservation Division (OCD) of that Department (who is also designated as the state petroleum engineer). N.M. Stat. Ann. §§ 70-2-4, 70-2-5 (1978, 1995 Replacement). To the extent its duties require, the NMOCC has concurrent jurisdiction with the OCD and has de novo review authority over decisions by OCD hearing examiners. Id. §§ 70-2-6, 70-2-11, 70-2-13.

[10/] Similar to the Secretary's 1951 Order, Order R-111 identified a large "potash-oil area" and a within it a smaller area, but the designated areas differed from those in the Secretary's Order. In 1955 the order was revised and reissued as Order R-111-A. YP 220. After further revisions, R-111-P was issued in 1988. YP 262. Apparently, the lands listed in appendix A as included within the “Know Potash Leasing Area” were for the first time coextensive with those included in the Secretary’s Potash Area.

for review and approval. See Herrell: 1907-24; Cone: 10686. [11/] The decision rationale documents, which set forth recommended reasons for denying approval of the APD's, were not sent to the Appellants with the State Director's letters informing them of his decisions, but were later provided to them as part of the record of the decisions at issue in this proceeding. Tr. 7808-09.

On June 29, 1992, the State Director denied approval of two APD's filed by Pogo for the "Mobil Federal" wells numbers 2 and 3 (IBLA 92-614), stating as before that:

> The physical characteristics of the ore body and the feasibility of economically mining potash in the subject area have been evaluated. The ore zone in the vicinity of the proposed well site is currently being mined to the northwest of the area in question. This, combined with a mineralogical evaluation of the ore zone, leads us to conclude that the fourth ore zone constitutes a "Potash Enclave." Therefore the drilling of this well may result in undue waste of potash.

YP 1, RP 001166; YP 2, RP 001308. The decision for the Mobil Federal well number 3 also noted that "an alternative vertical location may be available in the northeast quarter of this section" and that a well "could possibly" be directionally drilled "from one of the existing producing oil and gas well locations in the area." YP 1, RP 001166. The decision for the Mobil Federal well number 4 similarly stated that a vertical well might be drilled 1300 feet to the east and that a directional well could possibly be drilled from an existing well. YP 2, RP 001308.

The decision rationales noted that the proposed drill sites were on land which had been leased to the International Minerals and Chemical Corporation, were 4.5 miles from its mining operations, and were within one-quarter mile of the area the company had designated as its LMR. YP 82, RP001279; YP 83, RP 001325. Referring to attached maps, the decision rationales also stated that "several ore zones exist in the area which meet the BLM potash leasing criteria these are the first, second, and fourth ore zones." Id. The rationales recommended denying the APD's because potash reserves would be impacted, the proposed wells were within the quarter mile buffer, and "could increase the risk of methane gas contaminating the mine and will limit the mining operations to first mining only in the radius of influence of the proposed wells." Id.

The two Mobil Federal drill sites are about five miles south of the WIPP site and are part of a group of 23 wells within T. 23 S., R. 31 E., N.M.P.M., which the Appellants denominate the "Sand Dunes" wells. Other decisions denying approval of APD's for wells in the group identified a different ore zone. Between March 2 and June 18, 1993, the State Director issued decisions which denied approval of the APD's for Pogo's "Pure Gold" number 9, 10, 13, and 14 wells in the adjoining section to the east (IBLA 93-273, 93-333,

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[11]/ By order dated March 28, 1995, the Interior Board of Land Appeals set aside BLM's decisions on the five APD's, along with its decision on the APD for Yates's Glow Worm number 8 well (IBLA 95-193), and referred the case files for consolidation with those previously referred. Accordingly, the cases are hereby consolidated for review.

93-432, 93-465). They state:

> The Second ore zone is the important potassium bearing formation in this area which meets the leasing criteria of 4 feet of 10% K_2O as sylvite or 4 feet of 4% K_2O as langbeinite. This combined with a mineralogical evaluation of the ore zone leads us to conclude that the Second ore zone constitutes a "Potash Enclave". Therefore, the drilling of this well may result in undue waste of potash.

YP 19a, RP 002798; YP 20a, RP 003123; YP 21a, RP 003145; YP 22a, RP 003172. In contrast to the Mobil Federal wells, the decision rationales reported that the land was not leased for potash. YP 100, RP 002800; YP 101, RP 003124; YP 102, RP 003147; YP 103, RP 003190. They also gave somewhat more expansive reasons for recommending denial of the APD's. In addition to noting that the well sites are within measured ore, they state that "drilling would increase the risk of methane gas contaminating future workings" and that "[i]f the well casing is ruptured, sheared, or deteriorated by corrosion, the mines could be inundated with oil or gas." YP 100, RP 002881; YP 101, RP 003125; YP 102, RP 003148; YP 103, RP 003191.

On July 13, 1992, the State Director issued a decision to Yates denying approval of its APD for the "Lusk" number 8 well, the first of a group of five wells located near the northern border of the Potash Area approximately 14 miles north of the WIPP site (IBLA 92-622). The decision noted that the well site was within an area which had been leased to the Noranda Exploration Company (Noranda) for potash and stated:

> The ore zone in the vicinity of the proposed well site is currently approximately five miles south of the proposed well site. This, combined with a mineralogical evaluation of the ore zone, leads us to conclude that the fourth ore zone constitutes a "Potash Enclave." Therefore the drilling of this well may result in undue waste of potash.

YP 3, RP 001779. The decision advised Yates that "an alternative vertical location may be available approximately 2600 feet north of the proposed location" and that a well could possibly be directionally drilled from an existing well on state land in the adjoining section to the south. Id.

The decision was in error as to both the distance to the ore zone and the reference to the fourth ore zone. Herrell: 2162-63. The decision rationale noted that the proposed well site was on land which had been leased for potash to Noranda and that "[t]he tenth ore zone is the primary ore zone in the area which meets the four feet of 10% K_2O as sylvite leasing criteria." YP 84, RP 001782. It recommended denial of the APD due to its impact on potash reserves, that the "proposed well site falls within Noranda's LMR," and that "the well could increase the risk of methane gas contaminating the mine and will limit the mining operations to first mining only in the radius of influence of the proposed well." YP 84, RP 001783. It explained that sylvite is mined using a modified longwall method and "is not conducive to room and pillar mining methods necessary to protect and oil and gas well from ground subsidence." Id.

The APD's for four additional Lusk wells were filed after the decision denying the first had been issued and were denied by decisions of the State Director dated July 7, 1993. Three of the decisions addressing the Lusk numbers 15, 16, and 17 wells (IBLA 93-571, 93-572, 93-573) stated that:

> The Tenth ore zone is the important potassium bearing formation in this area. The Tenth ore zone meets the leasing criteria of 4 feet of 10% sylvite or 4 feet of 4% langbeinite. This combined with a mineralogical evaluation of the ore zone leads us to conclude that the Tenth ore zone constitutes a "Potash Enclave". Therefore, the drilling of this well may result in undue waste of potash.

YP 31a, RP 003651; YP 32a, RP 003711; YP 33a, RP 003773. As in other decisions, the State Director identified alternatives sites from which a well could be directionally drilled. Two of them identified the site as "the location of the Drill Island established for the Lusk 'AHB' Federal No. 14." YP 31a, RP 003651; YP 32a, RP 003711. The other simply noted that an alternative site was available approximately 2,250 feet to the north. YP 33a, RP 003773. The decision rationales explicitly stated that the proposed well sites are within measured ore and within either Noranda's LMR or its quarter mile buffer zone. YP 112, RP 003653-54; YP 113, RP 003713-14; YP 114, RP 003775-76.

The additional decision on the Lusk number 12 well (IBLA 93-596) did not mention the tenth ore zone, but stated that "[a] mineralogical evaluation of the various ore zones in the area leads us to conclude that the well site is located adjacent to a 'Potash Enclave'." YP 44a, RP 004432. It also stated that "the well could be obtained by drilling from a location 800 feet to the north. This would be located at approximately 1/4 mile from the potash enclave." Id.

Yates proposed to drill another group of seven wells, known as the "Belco" wells, about three miles south of the Lusk wells and approximately 11 miles north of the WIPP site. By separate decisions dated August 12, 13, 21, and 28, 1992, the State Director informed Yates that the APD's for the Belco number 2, 3, 4, 8, and 9 wells were being denied (IBLA 92-623, 92-624, 93-34), stating that "[t]he ore zone in the vicinity of the proposed well site is currently being mined to the southwest," that BLM had concluded the well site was located within a "Potash Enclave," and that drilling the well "may result in undue waste of potash." YP 4a, RP 001830; YP 5a, RP 001854; YP 6a, RP 001877; YP 7a, RP 001910; YP 8a, RP 002088. In each case, the State Director advised that "a well could possibly be obtained by drilling directionally from an existing producing well located on the same lease, the Belco AIA Well No. 1."

As with the Lusk wells, the decision rationales noted that the proposed well sites were on land which had been leased for potash to Noranda. YP 85, RP 001833; YP 86, RP 001857; YP 87, RP 001880; YP 88, RP 001913; YP 89, RP 002092. They recommended that the APD's also be denied because potash reserves would be impacted, the wells were within the 1/4 mile buffer zone, drilling "could increase the risk of methane gas contaminating a mine which will eventually mine the area," and mining would be limited to first mining "in order to protect the well bore." YP 85, RP 001834;

YP 86, RP 001858; YP 87, RP 001881; YP 88, RP 001914; YP 89, RP 002093.

The APD for the Belco number 6 well was denied by a decision dated July 6, 1993 (IBLA 93-568). It stated:

> The Tenth ore zone is the important potassium bearing formation in this area and meets the leasing criteria of 4 feet of 10% sylvite or 4 feet of 4% langbeinite. This combined with a mineralogical evaluation of the ore zone leads us to conclude that the Tenth ore zone constitutes a "Potash Enclave". Therefore, the drilling of this well may result in undue waste of potash.

YP 30a, RP 003460. The decision rationale, however, noted that the third ore zone also met the "leasing criteria." YP 111, RP 003462.

On August 21 and 28, 1992, the State Director issued decisions denying Yates's APD's for the Martha number 10 and 11 wells(IBLA 93-44, 93-53). The explanation was more specific than in the previous decisions on the three Martha wells. They stated:

> Considerable time has been spent evaluating the physical characteristics of the ore body and the feasibility of economically mining potash in the subject area. The Fourth and Tenth ore zones are important potassium bearing formations in this area. Both meet the leasing criteria of 4 feet of 10% K_2O as sylvite or 4 feet of 4% K_2O as langbeinite. This area is scheduled for a competitive potassium lease sale in August, 1992. This combined with a mineralogical evaluation of the ore zone, leads us to conclude that the Fourth and Tenth ore zones constitute a "Potash Enclave". Therefore, the drilling of this well may result in undue waste of potash.

YP 9a, RP 002138; YP 12a, RP 002249. The decision on the APD for the Martha number 10 well went on to inform Yates that "an alternative vertical location may be available approximately 1,600 feet east of the proposed location" and that "[a] directionally drilled well could be completed from that location and bottom in the original location." YP 9a, RP 002138. The decision on the APD for the Martha number 11 well similarly stated that an alternative location for directionally drilling a well might be available 1,900 feet to the east. YP 12a, RP 002249.

The decision rationales recommended that the APD's be denied because the well sites were within potash enclave, because potash reserves would be impacted due to protective barriers needed around well casing and only first mining would be allowed, and because drilling would "increase the risk of methane gas contaminating the mine." YP 90, RP 002142; YP 93, RP 002255. They explained that:

> Langbeinite can only be mined with conventional mining techniques and room and pillar mining. This becomes a problem when oil well barriers are encountered. It is difficult or impossible to maintain mine production

> when oil well barriers cut off all the advancing faces on the far side of the mine.

Id. They also stated that: "Conventional mining consists of drilling and blasting the ore from the faces. This creates fractures in the surrounding formations which could transport petroleum products into the mine if the well casing is breached." Id.

Subsequent decisions on the Martha number 12 through 14 wells issued on November 6, 1992 (IBLA 93-90, 93-92, 93-94) also identified the fourth and tenth ore zones as meeting "the leasing criteria" and as constituting a "Potash Enclave." YP 14a, RP 002232; YP 16a, RP 002395; YP 18a, RP 002493. Like the decisions on the Martha wells numbers 10 and 11, they noted that alternative locations for directional drilling were available to the east. In contrast to the decision rationales which had been prepared for the August decisions, those for the later decisions noted that "[t]he area is leased for potassium by Yates Petroleum Corporation." YP 95, RP 002335; YP 97, RP 002398; YP 99, RP 002496; see YP 90, RP 002141; YP 93, RP 002254.

On October 20, 1992, the State Director issued decisions addressing the APD's for Yates's "Wolf" wells numbers 3 (IBLA 93-51) and 10 (IBLA 93-52). The wells are part of a group of seventeen wells called the "Livingston Ridge" sites which are located approximately four miles northeast of the WIPP site along the boundary between T. 21 S., R. 31. E. and T. 21 S., R. 32 E., N.M.P.M. Each decision stated that:

> The Tenth ore zone is an important potassium bearing formation in this area. The Tenth ore zone meets the leasing criteria of 4 feet of 10% sylvite or 4 feet of 4% langeinite. This combined with a mineralogical evaluation of the ore zone, leads us to conclude that the Tenth ore zone constitutes a "Potash Enclave". Therefore, the drilling of this well may result in undue waste of potash.

YP 10a, RP 002172; YP 11a, RP 002206. The decisions suggested an alternative of directionally drilling from a location 1,720 feet to the east near two of Yates's "Bonneville" wells. Id. The decision rationales stated that the proposed wells would be located on land leased for potash to the New Mexico Potash Corporation and within its LMR. YP 91, RP 002175; YP 92, RP 002209. They recommended that the APD's be denied for many of the same reasons as have been described for other APD's, in particular because the well sites were within an area of potash enclave. YP 91, RP 002176; YP 92, RP 002210.

Decisions denying APD's for the Wolf wells numbers 1 (IBLA 93-91), 2 (IBLA 93-93), and 8 (IBLA 93-89) were issued October 28 and November 6, 1992. They differed from the first two addressing Wolf wells by identifying the third ore zone, as well as the tenth, as a potassium bearing formations, as meeting the leasing criteria, and as constituting a potash enclave. YP 13a, RP 002290; YP 15a, RP 002358; YP 17a, RP 002440. The decisions indicated that alternative sites for directional drilling were available, including the site of another of Yates's Wolf wells. YP 13a, RP 002290. In apparent contrast to the decisions, the decision rationales stated that "[t]he area is

classified as indicated ore since the core holes do not meet the measured ore criteria of three data points no more than 1 ½ miles apart," but went on to explain that "economic mineralization" had been found in core holes in the area. YP 94, RP 002293; YP 96, RP 002361; YP 98, RP 002442. They also stated that "[t]he tenth ore zone is present in the area at mineable grades; however, depending on the interpretation of the information, the APD may fall in a subeconomic zone." YP 94, RP 002293-94; YP 96, RP 002361; YP 98, RP 002442-43. Correspondingly, the decision rationales recommended that the APD's not be approved because, among other reasons, "the proposed well site falls within the indicated potash reserves." YP 94, RP 002294; YP 96, RP 002362; YP 98, RP 002443. In addition, they noted that the proposed well sites were on a section of land leased for potassium by the New Mexico Potash Corporation and they recommended denial of the APD's because the sites were within "the designated LMR 1/4 mile buffer zone." YP 94, RP 002293, 002295; YP 96, RP 002361, 002363; YP 98, RP 002442, 002444.

Decisions denying approval of APD's for a third group of Wolf wells, the numbers 11 (IBLA 93-574), 14 (IBLA 93-576), 15 (IBLA 93-577), 16 (IBLA 93-575), 17 (IBLA 93-578), 18 (IBLA 93-579), 19 (IBLA 93-580), and 20 (IBLA 93-581), were issued July 9, 1993. Except for the Wolf number 11, which identified only the tenth ore zone, the decisions stated that both the tenth and third ore zones "meet the leasing criteria in this area" and constitute a "Potash Enclave" and that drilling "may result in undue waste of potash." YP 34a, RP 003836; YP 35a, RP 003898; YP 36a, RP 003964; YP 37a, RP 004027; YP 38a, RP 004096; YP 39a, RP 004174; YP 40a, RP 004238; YP 41a, RP 004297. Again, the decisions identified several of Yates's Bonneville and Wolf wells as alternative drilling sites. The decision rationales noted that the proposed wells were on a section which had been leased to the New Mexico Potash Corporation and that the well sites were within its LMR. YP 115, RP 003837-38; YP 116, RP 003900-3902; YP 117, RP 003066-68; YP 118, RP 004029-31; YP 119, RP 004098-4100; YP 120, RP 004176-78; YP 121, RP 004240-42; YP 122, RP 004299-4301. In addition, except for the Wolf number 11, the decision rationales stated that "[t]he area is classified as indicated ore since the core holes do not meet the measured ore criteria of three data points no more than 1 ½ miles apart," but that "economic mineralization" had been found in "core holes in the area."

The APD's for a final group of Wolf wells were denied by decisions dated July 16, 1993. Like the previous group, the decisions for the Wolf well number 6 (IBLA 93-601), states that both the tenth and third ore zones "meet the leasing criteria in this area" and constitute a "Potash Enclave" and that drilling "may result in undue waste of potash." YP 49a, RP 004710. The decisions for the Wolf wells numbers 12 (IBLA 93-603) and 13 (IBLA 93-604) identify only the tenth ore zone. YP 51a, RP 004835; YP 52a, RP 004889. The decision rationales noted that the proposed well sites were on a section which had been leased to the New Mexico Potash Corporation and recommended that they be denied because, among other reasons, the well sites were within potash enclave and within the company's LMR or the associated buffer zone. YP 130, RP 004711-13; YP 132, RP 004836-37; YP 133, RP 004890-91.

The case files include one additional Wolf well (IBLA 93-602). By letter dated July 22, 1993, the State Director informed Yates that BLM had previously received an

APD for the same location as Yates proposed to drill the Wolf number 9 well and had denied the application by a decision dated October 9, 1992, "because drilling of the well may result in undue waste of potash." YP 50, RP 004748. He also informed Yates that "[s]ince an APD for the referenced well location had been previously denied and since the reason for denial is still valid, all copies of the APD are being returned to you unprocessed." Id.

During the summer of 1993, BLM began using a different approach to review APD's. Due to interest in drilling to the Delaware Formation, the number of APD's filed yearly had increased from less than 30 to several hundred. Herrell: 2283. There is no indication that the BLM received increased resources to handle the increased workload. A backlog of applications developed due not only to the increased number of filings, but also to the moratorium and time lost because of the relocation and consolidation of BLM's offices. Cone: 10698. After State Director Woodard left in April of 1993, Monte Jordan became Acting State Director and, with his assistance, Cone developed a "Backlog Elimination Plan" to address 305 APD's which had accumulated in the Carlsbad Office. Jordan: 2581-83; Cone: 10698; YP 330. About a third of them were for sites within the Potash Area. Cone: 10705. The key features of the plan seem to have been decisions to develop and use standard short forms to approve (category I) and deny (category II) APD's instead of preparing a decision rationale document for each one and, if the APD was to be denied, not to review other aspects of the application such as casing design. See Cone: 10710-14. A copy of the form was not sent to the applicant with the decision, but the Appellants have obtained them as part of the records made available for the hearing.

There appears to have been a transition period during which BLM reviewed many of the APD's already described by preparing a decision rationale while others were reviewed using an early version of the category II form. It had blank spaces for the reviewer to provide information about the depth and formation to which the well would be drilled, the distance of the well site to open mine workings, the distance to an LMR, the type of area of ore, and the relation of the proposed well to the nearest economically mineable ore zone. Based upon review using the form, the State Director denied approval of Pogo's "Federal 29" numbers 1 and 5 wells by decisions dated June 24, 1993 (IBLA 93-488, 93-489). The wells are part the Sand Dunes group of wells which include the previously discussed Mobil Federal wells. Like the decisions on those wells, those for the Federal 29 wells identified the fourth ore zone as meeting the "leasing criteria" and constituting a "Potash Enclave" and stated that drilling "may result in undue waste of potash." YP 23, RP 003210; YP 24, RP 003253. The category II forms noted that the well sites were within an LMR and within measured ore, and that the 4th ore zone was mineable at the well site. YP 104, RP 003213; YP 105, RP 003255.

The same reasons were provided in decisions issued July 1 and 6, 1993, for Pogo's Mobil Federal number 5 well (IBLA 93-534) and the Federal 29 wells numbers 2 (IBLA 93-535), 3 (IBLA 93-537), 6 (IBLA 93-538), and 7 (IBLA 93-536), and the same notes appear on the category II forms, except that the second ore zone is also named for the Federal 29 wells numbers 3 and 7. YP 25, RP 003291; YP 26a, RP 003325; YP 27a, RP 003353; YP 28a, RP 003417; YP 29a, RP 003448; YP 106, RP 003292; YP 107, RP

003326; YP 108, RP 003354; YP 109, RP 003418; YP 110, RP 003449.

By separate decisions dated July 16, 19, and 22, 1993, the State Director denied approval of the APD's for Yates's "Okerlund" wells numbers 1 through 4 which are located about a mile north of its Wolf wells (IBLA 93-597 through 93-600). The decisions do not identify an ore zone, but state that: "Drilling at the proposed location would likely interfere with potash mining and result in undue waste of known enclave reserves. It could also prove hazardous to the health and safety of potash miners." YP 45a, RP 004518; YP 46a, RP 004567; YP 47a, RP 004622; YP 48a, RP 004669. The category II form used to review the applications is also different. It identifies three reasons for denying an APD, but does not have blank spaces for information to be provided by the reviewer. Instead, a comment section is provided at the bottom of the page. The three criteria are:

1. The distance from the proposed well to mine workings is not greater than ½ mile (2,640 feet) and/or not greater than depth of mine workings below the surface plus 10%.

2. The proposed well is in the measured ore potash enclave.

3. For a proposed gas well, or proposed oil well deeper than the Delaware Mountain Group base into strata with potentially more hazardous gas concentrations, the well to LMR distance is not greater than ½ mile (2,640 feet). For a proposed oil well shallower than the Delaware Mountain Group base into strata with potentially less hazardous gas concentrations, the well to LMR distance is not greater than 1/4 mile (1,320 feet). Total depth applies irrespective of plugging considerations.

The second item is underlined on the form for the Okerlund number 1 well and the word "oil" is circled in the second sentence of item 3. YP 126, RP 004519. None of the three criteria are marked on the forms for the Okerlund wells numbers 2 through 4, but the comment sections each state that the "New Mexico Potash LMR extends into inferred ore" in the section where the wells would be drilled. YP 127, RP 004568; YP 128, RP 004623; YP 129, RP 004670.

The statement found in the decisions denying approval of APD's for the Okerlund wells also appears as the reason for denying APD's in two decisions issued July 27, 1993. One addresses the APD for Yates's single "Anise" well which is located on the north side of the Potash Area about two miles east of its Lusk and Belco APD's (IBLA 93-594). YP 42a, RP 004361. The second item on the category II form for the APD is underlined and a handwritten note in the comment section states: "The proposed well is in the measured 10th ore zone sylvite reserves." YP 123, RP 004362. Likewise, the statement in the decisions on the Okerlund wells appears in the decision denying approval of the APD for Yates's Belco no. 5 well (IBLA 93-595). YP 43a, RP 004398. The second item on the category II form is underlined and the note in the comment section states in part: "The

proposed well is within an area bounded by drill holes (exploration) with measured 10th ore zone sylvinite ore." YP 124, RP 004399.

The statement found in the decisions addressing the Okerlund wells was also used by the State Director in his September 3, 1993, decision denying approval of Yates's APD for its single "Nancy" well, located in the same area as its Wolf wells (IBLA 93-680). YP 55a, RP 005065. Item two on the category II form is underlined and a handwritten note states "In NM Potash's LMR." YP 136, RP 005066.

BLM's decisions on Yates's APD's for four "Glow Worm" wells to be drilled immediately south of the WIPP site were issued on varying dates. In the earliest, dated July 12, 1993, BLM denied approval of the APD for the Glow Worm number 3 (IBLA 93-631) because it found that the tenth ore zone meets the "leasing criteria" and constitutes a "Potash Enclave" and that drilling "may result in undue waste of potash." YP 54a, RP 005011. The category II form noted that the tenth ore zone was located at the proposed well site. YP 135, RP 005012.

Decisions on the APD's for the Glow Worm numbers 5 (IBLA 94-751), 6 (IBLA 94-749), and 8 (IBLA 95-193) were issued July 6 and 27 and October 28, 1994. None identifies a specific ore zone but, like the decisions addressing the APD's for the Okerlund and Nancy wells, each states that drilling "would likely interfere with potash mining and result in undue waste of known enclave reserves" and "could also prove hazardous to the health and safety of potash miners." YP 56a, RP 005727; YP 57a, RP 005778; YP 58a, RP 005806. None of the three items listed on the category II forms are marked, but comments added at the bottom of the forms state that the proposed location of the Glow Worm number 5 "is within IMCF's LMR," that the proposed location of the Glow Worm number 6 "is within IMCF's ½ mile buffer zone," and that the proposed location of the Glow Worm number 8 "is within IMCF's LMR buffer zone." YP 137, RP 005728; YP 138, RP 005779; YP 139, RP 005807. In addition, the comments for the Glow Worm number 6 note that it is located within an area of potash enclave for the 10th ore zone and those for the Glow Worm number 5 state that the well site is within a potash enclave, but does not identify an ore zone. YP 137, RP 005728; YP 138, RP 005779. All three comments identify the distance and direction for an alternative drilling location and those for the Glow Worm number 5 specifically state that the site "is available within 150 feet of the North Pure Gold 9 Federal Well No. 5" and that "[a] Drill Island will be established around this well." YP 138, RP 005779.

BLM relied upon the same statements found in its decisions on the APD's for the Okerlund, Anise, Nancy, and Glow Worm wells to reject five additional applications filed by Pogo for the Mobil Federal number 9 well (IBLA 95-194) and the Federal 29 number 9 through 12 wells (IBLA 95-195 through 95-198). YP 59a, RP 005848; YP 60a, RP 005881; YP 61a, RP 005914; YP 62a, RP 005950; YP 63a, RP 005987. The proposed wells are part of the Sand Dunes group of wells in the southern portion of the Potash Area. BLM also used the category II form quoted above in relation to the Okerlund wells to review the applications. None of the three items on the form are marked to show that the reviewer recommended denying the APD's for the listed reasons, but each form has comments which were added at the bottom. The form for the Mobil Federal number 9

states:

> An APD, the Mobil Federal No. 5, was denied in the same 40 acres. IMCF filed a[n] LMR for this area and the location falls within the LMR. The proposed location is also within the Potash Enclave. The location falls within the 4th ore zone. The 10th ore zone is also present in this area. An alternate location is available approximately 1,400 feet to the south southeast, within 150 feet of the gas well. A drill island will be established at this location.

YP 140, RP 005849. The same comments appear on the category II forms for the Federal 29 number 9 through 12 wells, except they state that APD's had previously been denied for the Federal 29 numbers 2, 3, 6, and 7 wells and identify different distances and directions for the alternative drilling sites. YP 141, RP 005882; YP 142, RP 005915; YP 143, RP 005951; YP 144, RP 005988. The Appellants explain that the five APD's "were filed by Pogo as preferred alternative locations for the given spacing units to which they apply" and that "those locations replace the Mobil Federal #5 & Federal 29 #'s 2, 3, 6 & 7." App. PH Brief at 186.

II. Basis of Review

II. A. Legal Authority

Both potash and oil and gas leases are issued under the Mineral Leasing Act of 1920 (MLA), 30 U.S.C. §§ 181-287 (1994), and regulations promulgated pursuant to it. Potash was not originally included in the MLA, but was brought under it in 1927 by legislation replacing earlier statutes that had allowed prospecting permits, patents, and leases for potash. Ch. 66, § 5, 44 Stat. 1057, 1058 (Feb. 7, 1927), codified as amended at 30 U.S.C. §§ 281-287 (1994), see ch. 62, 40 Stat. 297 (Oct. 2, 1917). The MLA authorizes the Secretary "to prescribe necessary and proper rules and regulations and to do any and all things necessary to carry out and accomplish" its purposes. 30 U.S.C. § 189 (1994); see, id. § 281. This provision grants the Department broad authority, Arch Mineral Corp. v. Lujan, 911 F.2d 408, 415 (10th Cir. 1990); Getty Oil Co. v. Clark, 614 F.Supp. 904, 916 (D.Wyo. 1985), aff'd sub nom. Texaco Producing, Inc. v. Hodel, 840 F.2d 776 (10th Cir. 1988), but its exercise is necessarily subject to various limitations, including those found in the Administrative Procedure Act (APA), 5 U.S.C. §§ 551-559, 701-706 (1994).

Pursuant to the MLA and other authority, the Department has promulgated regulations governing the issuance of both oil and gas and potash leases and their respective operations. [12/] The regulations recognize that:

> The granting of a permit or lease for the prospecting, development or production of deposits of any one mineral shall not preclude the issuance of other permits or leases for the same lands for deposits of other minerals with suitable stipulations for simultaneous operations * * *.

43 CFR 3000.7. In particular, the regulations authorize BLM officials to require stipulations as a condition for issuing an oil and gas lease and, within limitations, allow officials to impose "reasonable measures * * * to minimize adverse impacts to other resource values." 43 CFR 3101.1-2, 3101.1-3. BLM also has supervisory authority:

> to require that all [oil and gas] operations be conducted in a manner which protects other natural resources and the environmental quality, protects life and property and results in the maximum ultimate recovery of oil and gas with minimum waste and with minimum adverse effect on the ultimate recovery of other mineral resources.

43 CFR 3161.2, see id. 3162.1(a), 3162.5-1(a). The regulations do not identify specific measures BLM may or must impose, but more detailed requirements governing

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[12/] Effective November 1, 1999, the Department adopted revised rules governing sold mineral leasing under Title 43, Part 3500. 64 FR 53512 (Oct. 1, 1999). Citations to regulations in this decision are taken from the 1997 edition of the CFR Prior to their amendment, the regulations had been unchanged since 1986. The solid mineral operations regulations date from 1988 and have not been amended.

operations are provided by order. See 43 CFR 3164.1, 3164.2.

The regulations which govern leasing solid minerals, other than coal and oil shale, also provide that issuance of a permit or lease for one mineral does not preclude issuing a permit or lease for another mineral deposit on the same land. 43 CFR 3500.6. More particularly, the regulations require that permits and leases "reserve the right to allow any other uses * * * of the leased lands that will not unreasonably interfere with the exploration and mining operations of the permittee or lessee," who is required to "make all reasonable efforts to avoid interference with such authorized uses." 43 CFR 3500.6. The specific regulations governing potassium permits and leases likewise allow stipulations to protect "the lands and their resources." 43 CFR 3531.6, 3532.8-4. Those governing mining operations give BLM officials broad authority to supervise mining and to prevent "damage to other formations, deposits or nonmineral resources" and require lessees and permitees to "avoid, minimize or repair * * * [w]aste and damage to mineral bearing formations," 43 CFR 3590.2(c), 3591.1(b)(1), but do not further identify the measures to be taken. In addition, mining operations are to be conducted in a manner which will result in maximum recovery of the mineral "consistent with the protection and use of other natural resources * * *." 43 CFR 3594.1.

The MLA and the regulations invest BLM officials with considerable authority over the content of both oil and gas and potash leases and allow BLM wide latitude to impose requirements on operations. The regulations contemplate that both potash and oil and gas will be developed, indicating that the Appellants should be allowed to develop their leases, but do not directly address the manner in which conflicts in development are to be resolved other than by BLM engineers, geologists, and other personnel identifying specific limitations and establishing conditions by which operations will be conducted. Consequently, the regulations do not offer a sufficiently specific basis to resolve in this forum the issues the Appellants raise or the conflicts between oil and gas drilling and potash mining the appeals represent. In particular, they do not offer a basis for construing provisions of the Secretary's 1986 Order.

Throughout the proceedings the Appellants have pointed out that the Federal Land Policy and Management Act of 1976 (FLPMA), 43 U.S.C. §§ 1701-1784 (1994), provides that the public lands are to be managed "on the basis of multiple use and sustained yield unless otherwise specified by law." Id. §§ 1701(a)(7), 1732(a) (1994); see also 30 U.S.C. § 21a (1994). App. PH Brief at 42, 82; Yates Final SOR at 24; Pogo Final SOR at 57-61; App. Prelim. SOR at 45-50; Pogo Summ. J. Brief at 9-11. Their reliance on the provision, however, does not strengthen their case. Oil, gas, and potash are not renewable resources and, therefore, considerations governing sustained yield uses of Federal lands do not apply. See 43 U.S.C. § 1702(h) (1994). "Multiple use" is defined as:

> the management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use

> to conform to changing needs and conditions; the use of some land for less than all of the resources; a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output.

Id. § 1702(c). The definition recognizes that a particular parcel of land may be used for some or all of its resources, but multiple use does not require that every parcel be used for every purpose. See Headwaters, Inc. v. Bureau of Land Management, 914 F.2d 1174, 1182 (9th Cir. 1990); Rocky Mountain Oil and Gas Ass'n v. Watt, 696 F.2d 734, 738 (10th Cir. 1982), reh'g denied, 940 F.2d 435 (9th Cir. 1991); Utah v. Andrus, 486 F. Supp. 995, 1002-03 (D. Utah 1979). While the Secretarial Orders have provided for multiple mineral development within the Potash Area, neither the policy of multiple use nor the 1986 Order mandates that oil and gas drilling be allowed at any specific location within the Potash Area. Consequently, contrary to the Appellants' suggestions, the policy does not require that any of their APD's be granted; nor is it sufficient to resolve the specific disputes this case presents.

The Appellants' additional claim that FLPMA requires BLM to undertake a "multiple use analysis" also does not provide them any assistance. See App. PH Brief at 82; Pogo Final SOR at 61; Yates Final SOR at 25; App. Prelim. SOR at 49. [13/] To the extent they mean that BLM is required to consider and provide for multiple use within the Potash Area, the Department has already done so. As stated in a 1983 Directive issued by Assistant Secretary Garrey E. Carruthers, co-signed by BLM Director Robert F. Burford, the 1975 Order "adequately reflects the Secretary's current policy of providing multiple mineral development within the Potash Area while protecting the rights of both oil and gas and potash lessees." YP 249. The 1986 Order is essentially unchanged from the 1975 Order. Thus, the Department's conclusions about how both potash mining and oil and gas drilling may be carried out within the Potash Area are found in the provisions of the Secretarial Orders. To the extent the Appellants contend that BLM must make specific determinations about multiple use for each proposed wellsite by evaluating the potash resources present, estimating whether and when potash mining may occur and determining whether drilling will cause an undue waste of potash, the argument invokes factors set forth in the 1986 Order, the subject of this decision, and does not support

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[13/] The argument may derive from a proposed Multiple Minerals Development Plan drafted by BLM in August of 1991 when reviewing some of the initial APD's at issue in this appeal, but not formally adopted due to negative comments from both industries. YP 145, attach. 2; see Herrell: 2840-41; Morehouse: 12160-61; YP 419. In early appeals to the Director, Pogo argued that BLM had failed to conduct an objective multiple use analysis under FLPMA and had simply applied a blanket preference for potash. YP 80 at 2; YP 81 at 2-3.

finding that a separate analysis is required. In addition, if BLM were to apply the policy of multiple use to make a decision about the specific site identified in an APD, it would also need to consider other laws and policies which govern administration of the public lands. See, e.g., 43 U.S.C. § 1701(8)(1994).

The Appellants also point to the Multiple Mineral Development Act of 1954, ch. 730, 68 Stat. 708, codified as amended at 30 U.S.C. §§ 521-531(1994), and the Classification and Multiple Use Act of 1964, Pub. L. No. 88-607, 78 Stat. 986. See App. PH Brief at 14-15, 20; App. PH Reply at 82. Neither has any direct bearing on the case. The former was enacted to allow lands to be both leased under the MLA and located under the Mining Law of 1872, ch. 152, 17 Stat. 91, codified as amended at 30 U.S.C. §§ 22-47 (1994), and provides for operations to be conducted under their separate statutory authorities. See 30 U.S.C. § 526 (1994). It has no direct application in this case because both potash and oil and gas are leased under the MLA. See Lear, "Multiple Mineral Development Conflicts: An Armageddon in Simultaneous Mineral Operations?" 28 Rocky Mt. Min. L. Inst., 79, 111 (1982). The latter statute required the Department of the Interior to survey and classify the Federal lands administered by the Department and it expired after the final report of the Public Land Law Review Commission. Pub. L. No. 90-213, § 2, 81 Stat. 660 (1967); see Pluess-Staufer (California), Inc., 106 IBLA 198, 199 n.1 (1988); Lear, supra at 113.

Absent any statutory or regulatory provision specifically addressing the relation between oil and gas and potash development and operations, in 1951 Secretary Oscar L. Chapman issued the first Secretarial Order governing the Potash Area "[f]or the purpose of providing for concurrent operations in the prospecting for and the development and production of oil and gas and potash deposits * * *." 16 Fed. Reg. 10,669 (Oct. 18, 1951). Revised Orders were issued in 1965, 1975, and 1986. The 1986 Order has not been addressed in any previous Departmental decision except the one referring these appeals for a hearing. Its predecessors have been the subject of only three Departmental decisions. One, Texaco, Inc., 68 I.D. 194 (1961), addressed lease suspension following denial of an APD, is not discussed by the parties, and has no apparent bearing on the issues in this case. [14/] The other two Departmental decisions are Belco Petroleum Corp., 42 IBLA 150 (1979), and Bass Enterprises Production Co., 48 IBLA 11 (1980), aff'd sub nom. Bass Enterprises Production Co. v. Watt, Civ. No. 80-431-C (D.N.M. June 29, 1982).

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[14]/ Texaco's sublessee had filed an APD which was opposed by the potash lessee "on the ground that the prospective well would penetrate commercial potash deposits which the potassium lessee planned to mine in the near future." Texaco, Inc., supra at 196. The USGS regional oil and gas supervisor "concluded that drilling for oil and gas within the potash ore body would result in undue waste of potash and otherwise interfere with mining operations" and denied the APD. Id. at 197. Texaco then filed an application for relief from operating requirements and requested suspension of the two leases. The Director of the USGS denied the request on the grounds that the Department could not suspend the lease "in interest of conservation" because drilling was already limited by restrictions in the 1951 Order. The Assistant Secretary reversed the Director, stating: "That the order was in the interest of conservation seems self-evident, as the record indicates that the appellant has been prevented from drilling on the lands in the leases because drilling would result in the waste of potash ore." Id. at 198.

They are relevant precedent, but the parties disagree as to their meaning and import. They are discussed below, but do not clearly resolve the issues raised in this proceeding.

The 1986 Order has been mentioned by the courts in reviewing Pogo Producing Co., 138 IBLA 142 (1997), which reversed a decision by the New Mexico State Office to reject the high bid for a competitive potash lease within the Potash Area made by Yates and Pogo and to subsequently award the lease to IMC. See also IMC Fertilizer, Inc., 138 IBLA 160 (1997). In reversing the IBLA's decision, the U.S. District Court quoted several provisions of the 1986 Order but did not discuss them. IMC Kalium Carlsbad, Inc. v. Babbitt, 32 F. Supp. 2d 1264, 1267 (D.N.M. 1999). Of some relevance, it described the Order itself as having "limited oil and gas drilling within the Eddy and Lea County, New Mexico, potash area" and as having "restricted oil and gas drilling in potash regions." Id. at 1267, 1277. The district court's decision was reversed by the Tenth Circuit Court of Appeals. IMC Kalium, Carlsbad, Inc. v. Interior Board of Land Appeals, 206 F.3d 1003 (10th Cir. 2000). The circuit court also quoted portions of the 1986 Order but did not discuss or analyze their import, apparently because resolution of the dispute before it did not turn on questions about their meaning and application. Consequently, although some of the APD's at issue in this proceeding are for sites within the disputed lease area, the judicial decisions do not provide substantive guidance in interpreting the 1986 Order. [15/]

II. B. The Proposed 1991 Order, R-111-P, and the "Industry Agreement"

As previously mentioned, in 1991 the Department published a proposed revision of the 1986 Order which included changes corresponding to those which had been adopted in 1988 by the NMOCC in its Order R-111-P. 56 FR 5697 (Feb. 12, 1991); see YP 262, YP 266. Most significantly, the revision would have replaced potash enclaves, as introduced and defined in the 1975 Order and continued under the 1986 Order, with areas denominated as "life of mine reserves" (LMR). Although a final version of the proposed Order was signed by Secretary Lujan on January 8, 1992, it was not published in the Federal Register, apparently due to continuing disagreement between potash and oil and gas companies compounded by a moratorium on issuing new regulations. See Tr. 3346; Cone: 10588-91, 11059; YP 274 at 22, INT 408, INT 409.

As described above, the decisions at issue in this proceeding do not expressly identify the fact a proposed well site is within an LMR or its buffer zone as a reason for denying approval of the APD, but the fact is noted in many of the decision rationales. It

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[15/] There also does not appear to be judicial precedent addressing a similar conflict in the development of two minerals leased under the MLA which might be applied by analogy. See Lear, "Multiple Mineral Development Conflicts: An Armageddon in Simultaneous Mineral Operations?" 28 Rocky Mt. Min. L. Inst., 79, 97-98, 136-40, 178-81 (1982); Schissler, "Developmental Conflicts and Constraints Dealing with the Problem of Coexistent Estates," 22 Rocky Mt. Min. L. Inst., 203, 244-46 (1976); Deering, "Multiple Use Problems of Operators Both On and Off the Public Domain," 7 Rocky Mt. Min. L. Inst., 541, 604 (1962). Similar stipulations have appeared in oil and gas leases issued for lands in the oil shale areas of Colorado, Wyoming, and Utah. See William S. Burness, 1 IBLA 180, 181 n.1 (1970); 33 FR 14789 (Oct. 3, 1968).

is also identified on the initial category II form as a fact to review in relation to an APD and, as quoted above, the later category II form lists the distance of a proposed well from an LMR as one of the three reasons for denial of an APD. At the hearing, Herrell acknowledged that in making decisions on APD's' BLM tried to maintain the buffer zones of one-quarter mile for shallow wells and a half mile for deep wells which R-111-P sets as limits on approval of APD's and described various circumstances in which BLM applied LMR's. Herrell: 1904-05, 1976-79, 2001-03; see Cone: 10736. From early on, the Appellants have objected to BLM's reliance upon LMR's when denying approval of their APD's, contending that it lacks authority to do so. Pogo Final SOR at 40-41; Yates Reply to BLM and Int. Responses to Yates Motion for Partial Summary Judgment at 16-17; Pogo & Devon Reply in Support of Motions for Summary Judgment at 1-2

When referring these appeals for a hearing, the IBLA directed that: "Should the evidence show that the denied APD's seek to drill wells within properly established enclaves, the applicability of the two exceptions to the 1986 Order's stated policy of denying approval of APD's within such enclaves should also be explored." Yates Petroleum Corp., supra at 236. In its footnote five, the IBLA indirectly referred to Order R-111-P and the Department's proposed 1991 Order, stating:

> We note that appellants argue that some of the denied APD's sought to drill wells on lands unleased for potash at the time the APD was filed and that some of the appealed decisions suggest that BLM equated potash enclaves with life of mine reserves submitted by potash lessees, which submissions identified both leased and unleased potash deposits. To the extent that the evidence establishes either of these assertions, the Administrative Law Judge should explore the propriety of BLM's actions under the 1986 Order.

Id. at 235-36.

Only a few matters need to be addressed in regard to BLM's reliance upon LMR's. Most important, the proposed 1991 Order has no legal effect in this proceeding. It was not fully promulgated pursuant to the procedures of the Administrative Procedure Act and does not have the force and effect of law. 5 U.S.C. §§ 552, 553 (1994); Chrysler Corp. v. Brown, 441 U.S. 281 (1979). Consequently, as stated by the IBLA, the proposed 1991 Order "has no bearing on the issues raised by these appeals." Yates Petroleum Corp. et al., supra at 231. Its provisions cannot constitute a legally sustainable basis for denying approval of an APD.

BLM recognizes that the proposed 1991 Order did not become effective, but has consistently described LMR's as a "tool" it could utilize "without an Order directing its use" because the 1986 Order requires it to "consider" rules and regulations of the New Mexico Oil Conservation Division (NMOCD) and R-111-P includes LMR's. BLM Response to Summ. J. at 25; BLM PH Brief at 14. Herrell: 1906-07, 1940-41, 2261-62, 2270, 2764, 3705, 3707; Manus: 4440; Cone: 10602, 10726, 10822, 11093; YP 264; see YP 273 (Aug. 23, 1993 letter to IMC: "To the greatest extent possible, we are making decisions consistent with R-111-P, the Industry Agreement, and our Secretary's Order."). More

specifically, in responding to the appeals before the IBLA, BLM claimed that "[t]he LMR concept is valid under the existing order only as it relates to potash enclaves" and contended that LMR maps provide "the most accurate determination of the potash enclave boundary as defined in the 1986 Order." BLM Resp. to Prelim. SOR at 3; BLM Supp. Resp. to Prelim. SOR at 15, RP006027 (emphasis omitted). BLM also stated that "[t]he term LMR and potash enclave are interchangeable, when areas are leased for potash." BLM Supp. Resp. to Prelim. SOR at 15, RP006028.

BLM's position is based upon a misreading of the 1986 Order. The portion to which BLM refers states that "[i]n taking any action under Part A, Items 1, 2, 3 and 4 of this Order, the authorized officer shall take into consideration the applicable rules" of the NMOCD. Appendix A, § III.A; see BLM Ans. to App. SOR at 16; Int. Ans. to Final SOR at 23-24, 44. The items one through four of part "A" which the provision refers to are oil and gas lease stipulations which the Order requires be made part of every oil and gas lease issued within the Potash Area. Each stipulation, as will be discussed in greater detail, includes language calling upon BLM to make various determinations when reviewing a proposed oil and gas well. For example, the first stipulation states that drilling:

> shall be permitted only in the event that the lessee establishes to the satisfaction of the authorized officer, Bureau of Land Management, that such drilling will not interfere with the mining and recovery of potash deposits, or the interest of the United States will best be served by permitting such drilling.

Appendix A, § III.A.1. On its face, the stipulation concerns "potash deposits." An LMR is defined as a "potash deposit[] * * * reasonably believed by the potash lessee to contain potash ore in sufficient thickness and grade to be mineable using current day mining methods, equipment, and technology." YP262 at 10, RP006688. The fact a potash lessee has a reasonable belief that an area contains a potash deposit meeting the definition and has identified it as within an LMR would certainly be a relevant fact for BLM to consider when making a determination under the stipulation. Application of the first stipulation to deny an APD, however, would depend upon BLM's own determination that a potash deposit is present and would not necessarily be based upon the same standard as the lessee's identification of an LMR. The information relied upon by the lessee, which R-111-P calls for potash companies to provide to BLM, could, of course, be quite helpful. See id. If BLM determines that a potash deposit is present, the further questions defined by the stipulation are whether the oil and gas lessee has established to BLM's satisfaction "drilling will not interfere with the mining and recovery of" the deposit and, if not, whether "the interest of the United States will best be served by permitting such drilling."

Potash enclaves are not addressed in "Part A" of the 1986 Order but in part "D" which, as previously noted and will be further discussed, defines them as areas "where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics." Appendix A, § III.D.1.c. Although BLM properly points out that the definition of an LMR is similar to the definition of a potash enclave, as the Appellants correctly argue, it is also different in at least two respects. See App. PH

SOR at 51. First, the definition of potash enclaves includes the word “economics,” a term not mentioned in the definition of an LMR. Second, LMR's are established based upon the "reasonable belief" of a potash lessee, while an enclave consists of potash ore which is “known to exist." Similar to potash deposits under the first oil and gas lease stipulation, BLM could certainly "consider" the fact that a proposed drill site is within the LMR identified by a potash lessee, but an LMR is not the same as a potash enclave and does not function the same. Among other matters, Order R-111-P calls for denying all APD’s for drilling sites within LMR’s and their buffer zones, unless agreed to by the potash lessee, while the 1986 Order allows drilling from barren areas and drilling islands within potash enclaves. See YP 262 at 11-12. The fact a potash lessee has concluded that there is potash of “sufficient thickness and quality to be minable” and has included the area within an LMR would be important for BLM to note, but the relevant facts for it to examine in identifying a potash enclave would be the information it received from the potash lessee. As previously described, the location of a proposed well site within an LMR or its buffer zone is identified in a number of decision rationales and in the category II forms as one of the reasons for the recommendation that the APD be denied. To the extent the recommendations were based upon the presence of an LMR or its associated buffer zone, they were not in accord with the 1986 Order.

The provisions of both Order R-111-P and the proposed 1991 Order which address LMR's originate in a document titled: "Statement of Agreement between the Potash Industry and Oil and Gas Industry on Concurrent Operations in the Potash Area in Eddy and Lea Counties, New Mexico." YP 262, ex. B. BLM and the Intervenors have referred to this document as "the industry agreement" because it was developed in meetings among personnel from both the potash and oil and gas industries. See Int. PH Brief at 64-66. The Appellants strongly object to the name because they disagree that the document sets forth an agreement between the two industries and they further maintain that it has never been ratified by any oil and gas company. See App. PH Brief at 50; App. PH Reply at 104-05; Yates Final SOR at 14.

It is clear that the NMOCC regards the document as constituting an agreement between the two industries. Its Order R-111-P states that the document is attached as an exhibit "for the purpose of providing background information and acknowledging the consensus reached by representatives of the Oil and Gas and Potash Industries * * *." YP 262 at 2, para. 7. The term “representatives” is used throughout memoranda and other documents issued by the State of New Mexico in coordinating development of the agreement. INT 276, INT 278 at IMC-03080, INT 279 at IMC-03103, INT 280, YP 191 at 2. For purposes of this decision, however, it does not matter whether or in what sense those who drafted the document may have been "representatives" of their respective industries. There is no indication in the record, nor has it been argued that, the participants in the meetings who were employed by oil and gas and potash mining companies were authorized to legally bind either the companies for which they worked or their respective industries by virtue of their signatures on the document. In particular, there is no basis for concluding that the "representatives" from oil and gas companies had authority to legally bind either Yates or Pogo. Lacking such a basis in the record, this forum cannot conclude that, for purposes or this proceeding, Yates or Pogo, or for that matter IMC, are bound by provisions of the Industry Agreement. See Cooper: 276-77;

Patterson: 610-12.

In summary, the policy and provisions set forth in the 1986 Order of the Secretary govern this proceeding. The regulations enacted pursuant to the MLA are not sufficiently specific to provide a basis for construing the provisions of that Order. Nor does FLPMA apply because oil, gas and potash are not renewable resources, so concepts of sustained yield do not apply. Multiple use does not require that every parcel be used for every purpose, especially simultaneously. The 1986 Order provides for multiple mineral development across the Potash Area, but does not mandate that any particular well be allowed at any specific location. Courts and the administrative agency (IBLA) have addressed the 1986 Order, but have not clearly resolved the issues raised in this proceeding. The Order signed by the Secretary in 1991, but never published as a final rule, is of no effect. LMR's and the attendant buffer zones, which are included in R-111-P, and were included in the proposed 1991 Order, do not equate to potash enclaves as used in the 1986 order. While the information provided in connection with LMR's is undoubtedly useful to BLM in making its decisions, BLM must follow the criteria set forth in the 1986 Order. Finally, the Industry Agreement has the force given it by the State of New Mexico in adopting R-111-P and making decisions on APD's in the state Potash Area, but does not bind the parties in this proceeding.

II. C. Standards of Review

The ultimate issue for resolution in this decision is whether the New Mexico State Director's decisions denying the APD's based upon the Secretary's 1986 Order were "arbitrary, capricious, an abuse of discretion, or otherwise not in accord with the law." 5 U.S.C. § 706(2)(A) (1994); see Alamo Ranch Co., Inc., 135 IBLA 61, 67 (1996); Petex, Inc., 104 IBLA 72, 74 (1988). As noted by the IBLA, Appellants have the burden of establishing error in those decisions. Yates Petroleum Corp. et al., supra at 236. Their burden must be met by a preponderance of the evidence, a standard frequently described as proof "that something is more likely so than not so." Woods Petroleum Co., 86 IBLA 46, 50 (1985); see Bender v. Clark, 744 F.2d 1424, 1428-30 (10th Cir. 1984). Consequently, this decision will be based upon review of the administrative record provided by BLM, and the testimony and exhibits presented at the hearing. See 5 U.S.C. § 556 (1994); 43 CFR 4.24. Some additional documents have been submitted as exhibits to the parties' briefs. Issues regarding their inclusion in the record will be addressed at the time the subject matter of the document is reviewed. In addition, conclusions about factual issues will be based upon findings as to the credibility of witnesses. See Bureau of Land Management v. Carlo, 133 IBLA 206, 211 (1995).

The Appellants accept that they bear the burden of proof and that "arbitrary, capricious, and abuse of discretion" constitutes the general standard for review of BLM's decisions. App. PH Brief at 9-10; App. PH Reply to BLM & Int. Briefs at 12. The Intervenors frame matters somewhat differently. They assert that review is limited to "whether BLM properly exercised the discretion granted by the Secretary of the Interior." Int. PH Brief at 82. Apparently concerned that this forum might adopt the Appellants' position and "radically alter the scheme" the 1986 Order "provides for balancing the competing interests in the Secretary's Potash Area," id. at 82-83, the Intervenors make a

series of claims about the extent of review to be undertaken in this decision and the standards to be applied. The assertions exaggerate the nature of the decisions under review and the scope of this decision. The most significant errors are addressed seriatim.

First, the Intervenors incorrectly assert that my July 10, 1996, Order denying the motions for summary judgement stated that an "ALJ has no authority to review, rewrite, or strike down duly promulgated decisions, policies, or guidelines signed or adopted by the Secretary (or by the Assistant Secretaries)." Id. at 83. In fact, the order simply stated that, consistent with IBLA decisions, "this tribunal lacks jurisdiction to consider the validity of an order or policy of the Secretary." See Bass Enterprises Production Co., 48 IBLA 11, 13 (1980). Review of the Secretary's 1986 Order in order to consider whether, as the Appellants argue, BLM has misunderstood and misapplied its provisions does not require a determination as to its validity. It was duly promulgated by the Secretary and the Appellants do not argue that any of its provisions exceeded his authority. See Alamo Ranch Co., Inc., 135 IBLA 61, 66 (1996). It remains in effect and, as stated by the IBLA, its provisions control resolution of the factual and legal issues which have been raised in the proceeding. Yates Petroleum Corp. et al., supra at 231.

Review of BLM's application of provisions of the 1986 Order also does not require ruling on policy. For purposes of this decision, the 1986 Order can be regarded as a statement of policy by the Secretary, published as a final rule in the Federal Register in compliance with the Administrative Procedure Act, which is binding upon not only this tribunal but also BLM, the Appellants, and potash mining companies which hold leases within the Potash Area. See 5 U.S.C. § 552(a) 1994; Chrysler Corp. v. Brown, 441 U.S. 281, 301-05, 313-16 (1979). [16/] Only three portions of the Order, however, make specific statements about policy. One has already been mentioned. It is the express declaration that: "It is the policy of the Department of the Interior to deny approval of most applications for permits to drill oil and gas test wells from surface locations within the potash enclaves * * * ." Appendix A, § III.E.1. This policy is a significant feature of the Order and the IBLA has found that it "discloses a decided preference for potash operations." Belco Petroleum Corp., 42 IBLA 150, 153 (1979). It will be mentioned and discussed throughout this decision and, for simplicity, will be referred to as the "enclave policy." [17/]

Another portion of the 1986 Order states that "The Department of the Interior shall cooperate with the New Mexico Oil Conservation Division in the implementation of that agency's rules and regulations." Appendix A, § III.E.3. Although the sentence provides an instruction from the Secretary to BLM, the only indication as to what such cooperation might entail is that the remainder of the paragraph states that "[i]n this

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[16/] The Tenth Circuit, however, has stated that "the IBLA is authorized to interpret and apply the 1986 Order, including making policy choices * * *." IMC Kalium, Carlsbad, Inc. v. Interior Board of Land Appeals, 206 F.3d 1003, 1012 and n. 14 (10th Cir. 2000).

[17/] As quoted, the policy pertains to potash "enclaves." At times, however, the Intervenors have incorrectly referred to it as applying to the mandatory lease stipulations. See Int. PH Brief at 99, 101.

regard, the Federal potash lessees shall continue to have the right to protest to the New Mexico Oil Conservation Division the drilling of a proposed oil and gas test on Federal lands," but that "the Department shall exercise its prerogative to make the final decision of whether to approve the drilling of any proposed well * * *." The third declaration of policy is found in the portion of the Order which states that the Department "reaffirms its position that the lease stipulations contained in the Order of November 5, 1975, adequately protect the rights of the oil and gas and potash lessees and operators." Appendix A, § III.A. It is addressed later in this decision.

While these provisions, as well as other portions of the 1986 Order, may reflect executive decisions about the relative importance of potash mining and oil and gas development in the Potash Area, a decision by BLM to reject an APD based upon its understanding of provisions of the 1986 Order is not a decision that establishes policy. See WMA PH Brief at 20. Nevertheless, several of the Appellants' arguments raise issues related to policy that are not appropriately resolved in an administrative hearing. They will be identified and separated from the matters addressed in this decision.

Ultimately, the Intervenors are not concerned that I might strike down portions of the Secretary's 1986 Order, but that I might conclude that BLM incorrectly construed and applied some of its provisions when rejecting the Appellants' APD's. In this regard, they assert that my "jurisdiction is limited to determining whether, given the language of the Order and the facts that have emerged from the hearing, BLM's denials of Appellants' APDs represent a permissible interpretation and application of the 1986 Order." Int. PH Brief at 83; see BLM Answer to Final SOR at 4; WMA PH Brief at 20. The claim is incorrect in several respects. Most importantly, the concept that this decision is reviewing BLM's "interpretation" of the Order is fundamentally misleading. No one document sets forth an "interpretation" of the 1986 Order by BLM. Nor do BLM's decisions which are the subject of the hearing expressly provide an "interpretation" of the Order. While it is obvious that the decisions are based upon BLM's understanding of the Order's various provisions, it is not the task of this forum to study statements in the decisions in order to infer the "interpretation" they "represent." Absent an express, formal interpretation of the 1986 Order by BLM, the issue for review is whether BLM correctly understood and applied its provisions to the facts when denying approval of the Appellants' APD's.

Citing Beard Oil Co., 105 IBLA 285 (1988), the Intervenors also claim that "[t]o the extent that Appellants challenge procedures adopted by BLM that implement, but are not expressly part of, a Secretarial Order or of any duly promulgated regulation or that have not been expressly adopted by the Secretary (or the Assistant Secretary)" they must be upheld "as long as they are reasonable and consistent with the governing law." Int. PH Brief at 84; see Int. Answer to Final SOR at 28-29. Beard, however, is not controlling. The "procedures" it "enforced" were provisions of the BLM Manual governing the time and date mail is stamped as received. See Beard Oil Co., supra at 288. The BLM Manual does not have the force and effect of law and may not be applied to control resolution of legal issues or adversely affect the rights of a party. See Christensen v. Harris County, 120 S.Ct. 1655, 1662-63 (2000); Chevron U.S.A. v. Natural Resources Defense Council, 467 U.S. 837 (1984). Because the BLM Manual instructs its employees about the manner in which they are to carry out their responsibilities, in some circumstances BLM may be

required to comply with the procedures the BLM Manual sets forth. See New Mexico Wilderness Coalition, 129 IBLA 158, 162 (1994), see Robert S. Glenn, 124 IBLA 104, 108-09 (1992); Mobil Producing Texas & New Mexico, 115 IBLA 164, 169 (1990). The Intervenors, however, do not cite the provisions of the BLM Manual which govern the review of APD's and do not argue that they should be applied or upheld. See BLM Manual part 3160-1. [18]/

Nor can the "procedures" BLM may have followed in issuing its decisions serve to preclude substantive review of its application of the 1986 Order in rejecting the Appellants' APD's. The Order itself, of course, is not challenged by the Appellants and must be regarded as "reasonable and consistent with the governing law" because it was approved by the Secretary and, as previously noted, the MLA grants the Secretary broad authority. The procedures set forth in the regulations address the timing and content of applications for permits to drill, but not the standards by which they will be approved or denied. See 43 CFR 3162.3-1. The answer to a question whether a decision rejecting one of the Appellants' APD's was "reasonable and consistent with the governing law" depends upon whether BLM correctly understood and applied provisions of the Order, not the "procedures" it followed in reviewing the APD's. If BLM's decisions to deny issuance of permits were not consistent with the standards the Order sets forth, its decisions were arbitrary, capricious, an abuse of discretion, and otherwise not in accord with the law. 5 U.S.C. § 706(2)(A) (1994).

The Intervenors also incorrectly claim that "the 1986 Order commits the decision whether to approve or deny an APD to agency discretion * * *." Int. PH Brief at 84. The 1986 Order does not state that a decision to approve or deny an APD is committed to BLM's discretion; nor does any statute or regulation so provide. See 5 U.S.C. § 701(a)(2) (1994); Webster v. Doe, 486 U.S. 592, 599-600 (1988). The oil and gas lease stipulations which are required by the 1986 Order state:

> 1. Drilling for oil and gas shall be permitted only in the event that the lessee establishes to the satisfaction of the authorized officer, Bureau of Land Management, that such drilling will not interfere with the mining and recovery of potash deposits, or the interest of the United States will best be served by permitting such drilling.
>
> 2. No wells shall be drilled for oil or gas at a location which, in the opinion of the authorized officer, would result in undue waste of potash deposits or constitute a hazard to or unduly interfere with mining operations being conducted for the extraction of potash deposits.

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[18]/ The Intervenors also cite Black Butte Coal Co., 109 IBLA 254, 260 (1989), which states that "[a]s a general rule, this Board has upheld the policy guidelines adopted by BLM in implementing its responsibilities under regulations promulgated pursuant to statutory authority." The IBLA, however, concluded that provisions of the guideline at issue were "contrary to the express terms of the regulations" and reversed the portion of BLM's decision that was based upon the guidelines. Id. at 261.

> 3. When the authorized officer determines that unitization is necessary for orderly oil and gas development and proper protection of potash deposits, no well shall be drilled for oil and gas except pursuant to a unit plan approved by the authorized officer.
>
> 4. The drilling or the abandonment of any well on said lease shall be done in accordance with applicable oil and gas operating regulations (43 CFR 3160), including such requirements as the authorized officer may prescribe as necessary to prevent the infiltration of oil, gas or water into formations containing potash deposits or into mines or workings being utilized in the extraction of such deposits.

Appendix A, § 3.III.A. These provisions require BLM to make various factual determinations before approving an APD; they do not insulate the authorized officer's conclusions from review. Likewise, the section of the 1986 Order which addresses the enclave policy describes circumstances in which oil and gas drilling is prohibited or allowed. The decision of an authorized officer to approve or deny an APD is discretionary only in the sense that a lessee is not legally entitled to have a particular application approved and disapproval of one drilling location does not preclude approval of another. See Sierra Club et al. (On Judicial Remand), 80 IBLA 251, 260, 264 (1984) (oil and gas lease suspension), aff'd, Getty Oil Co. v. Clark, 614 F. Supp. 904 (D. Wyo. 1985), aff'd sub nom. Texaco Producing, Inc. v. Hodel, 840 F.2d 776 (10th Cir. 1988). The questions to be reviewed are whether BLM's decisions are supported by the record, whether they are in accord with provisions of the 1986 Order, and whether BLM's discretion was "exercised within the parameters established by that Order." Yates Petroleum Corp. et al., supra at 235.

Finally, the Intervenors claim that "the agency's interpretation of its own regulations is entitled to particular deference where BLM's efforts in exercising its discretion are implemented by trained personnel and guided by established criteria and procedures." Int. PH Brief at 85. Quoting Sierra Club v. Clark, 774 F.2d 1406, 1409 (9th Cir. 1985), they assert that "[d]eference is especially appropriate where `statutory construction involves "reconciling conflicting policies, and a full understanding of the force of the statutory policy in the given situation (depends) upon more than ordinary knowledge respecting the matters subjected to agency regulations."'" Id. at 86; IMC Answer to Final SOR at 30.

These claims entail several errors. First, this case concerns a Secretarial Order and does not present any issue about BLM's "construction" of a statute or regulation, let alone a policy Congress has established by statute. Second, as has been noted, no document expressly provides BLM's "interpretation" of the 1986 Order. Third, the case is not about reconciling a conflict between two general policies, but concerns a conflict between parties who wish to be able to develop different mineral resources. Fourth, to the extent BLM personnel were "guided" by the "established criteria and procedures" stated in the 1986 Order, the correctness of their understanding and application of its provisions is central to many of the matters at issue. Deference to BLM's knowledge and experience that has been expressed only in conclusions reached in decisions rejecting the

Appellants' APD's would necessitate finding that those decisions must be correct.

More significantly, the Intervenors fail to recognize that the language they quote from Sierra Club v. Clark appears in Chevron U.S.A. Inc. v. Natural Resources Defense Council, Inc., 467 U.S. 837, 844 (1984), and originates in United States v. Shimer, 367 U.S. 374, 382 (1961). In Chevron the Court stated:

> If Congress has explicitly left a gap for the agency to fill, there is an express delegation of authority to the agency to elucidate a specific provision of the statute by regulation. Such legislative regulations are given controlling weight unless they are arbitrary, capricious, or manifestly contrary to the statute. Sometimes the legislative delegation to an agency on a particular question is implicit rather than explicit. In such a case, a court may not substitute its own construction of a statutory provision [sic] for a reasonable interpretation made by the administrator of an agency.

Chevron U.S.A. Inc. v. Natural Resources Defense Council, Inc., supra at 843-44. The regulations which BLM has promulgated governing potash and oil and gas leasing and operations are not at issue. Consequently, there is no need to defer to the agency interpretation they represent.

Perhaps even more important to this decision, the deference the Supreme Court requires is based upon its recognition that an administrative agency possesses, and courts do not have, "more than ordinary knowledge respecting matters subject to agency regulations." Id. The hearing was being conducted and this decision is authored by an administrative law judge within the Department of the Interior and, in all likelihood, will be reviewed by the IBLA exercising authority delegated by the Secretary of the Interior. 43 CFR 4.1. Should this case eventually reach a Federal court, the matter reviewed will not be BLM's "interpretation" of the 1986 Order as "represented" by its decisions denying the APD's, nor the interpretation found in this decision. The "agency" decision before the court will be the written opinion issued by the IBLA and it will be entitled to the deference the law provides. See IMC Kalium, Carlsbad, Inc. v. Interior Board of Land Appeals, 206 F.3d 1003, 1009-1010 (10th Cir. 2000); see also Bender v. Clark, 744 F.2d 1424, 1430 (10th Cir. 1984) ("The deference given to an Agency's decision on a matter requiring expertise should be made only in the judicial forum after the final Agency determination is made following its review of all the evidence presented."); Alamo Ranch Co., Inc., 135 IBLA 61, 67 (1996); Mobil Producing Texas & New Mexico, Inc., 115 IBLA 164,169 (1990).

The deference recognized in the Departmental decisions the Intervenors cite does not concern the interpretation of regulations or documents but factual determinations by Departmental experts. In Conoco, Inc., 61 IBLA 23, 27 (1981), and Richard J. Leaumont, 54 IBLA 242, 245, 88 I.D. 490 (1981), deference was given to findings by BLM personnel that various lands did and did not qualify for inclusion in wilderness study areas. Deference was given in West Cow Creek Permittees v. Bureau of Land Management, 142 IBLA 224, 238-42 (1998), to a rangeland study which established the amount of available forage, while Harvey Catron, 134 IBLA 244, 265-66 (1995), concerned the findings in a

report by an Office of Surface Mining technician as to the amount of spoil available to eliminate a highwall. Within the Department, such deference is not required as a matter of law but is a practice which recognizes the knowledge and experience of Departmental personnel who specialize in matters the Department administers as well as the need within an administrative agency to make factual and technical determinations in order to reach a decision and carry out the Department's responsibilities. In such instances, it is not sufficient for a party challenging a decision to simply offer a contrary finding by its own expert. Rather, a party challenging the agency determination is expected to show error in the methodology used, error in the data collected, or error in the factual conclusions drawn from the data, or that the agency failed to consider relevant data. See West Cow Creek Permittees v. Bureau of Land Management, supra at 238.

In this case, current and former BLM personnel testified as witnesses for the Appellants about BLM's review of the APD's at issue, events related to the decisions at issue, and documents found in BLM files, not as expert witnesses. BLM's sole witness was Leslie Cone, the Roswell District Manager during the time most of the decisions were issued. The fact that BLM's decisions denying the APD's may have been issued following review and recommendations by its personnel who had expertise in the area is not sufficient to require deference when their analysis and conclusions are not part of the record. See Vulcan Power Co., 143 IBLA 10, 23-24 (1998). There may be specific factual determinations about the APD's at issue which were made by appropriate agency experts and are entitled to deference, but they do not include conclusions about the meaning of provisions of the 1986 Order. Otherwise, as indicated above, the deference BLM's findings might be accorded can be overcome by the Appellants showing error in its determinations.

In contrast, many of the Appellants' and Intervenors' witnesses testified about scientific and technical matters based upon their "knowledge, skill, experience, training, or education." Fed.R.Evid. 702. Their qualifications to do so were established at the hearing through questioning by counsel and in some cases by their resumes or curriculum vita which were introduced as exhibits. As this decision reflects, the scientific and technical issues which have been raised not only concern a variety of subjects but are interrelated. Considerable latitude was allowed counsel in questioning expert witnesses and obtaining expert opinion. As a consequence, however, portions of the testimony of some witnesses extended beyond the areas of expertise indicated by their qualifications and experience. Recognition that testimony based upon such "free floating expertise" has limited value and weight will be implicit in the discussion of the topics which follow.

In a similar vein, counsel sometimes persisted in asking leading questions on direct examination of witnesses, whether those witnesses were testifying as experts or not, so that the response was colored or controlled by counsel's discourse. Recognition that such a practice lessens the value and weight of the resulting testimony will likewise be implicit in the discussion of the topics at issue.

II. D. Historiography

While the Intervenors would narrow the focus of review, the Appellants seek to

establish a broad basis for understanding the Secretary's 1986 Order. In part they do so by describing the development of the Secretarial Orders in relation to historical events, the relative need for potash and oil and gas, positions advocated by the oil and gas and potash industries, and statements made in a variety of memoranda and other documents prepared by Departmental personnel prior to issuance of the revised Order in 1975, as well the earlier versions of the 1986 Order. See App. PH Brief at 13-49; App. PH Reply at 71-104. Although the history is interesting, except for a few Departmental documents, the record does not reveal the origin of provisions of the Orders and there is no clear confirmation that the matters the Appellants describe actually motivated adoption of any specific provision of the Orders. Nevertheless, to the extent they rely upon particular documents to support their understanding of specific provisions of the 1975 and 1986 Orders, their arguments are relevant and the documents will receive considerable attention in this and subsequent sections of this decision.

For the most part, however, the Appellants do not rely upon the documents they cite and history they discuss to analyze the meaning of specific words or phrases in the 1986 Order or its predecessors. Rather, they claim that the documents establish the intended meaning of a portion of an Order or that the Secretary intended a provision to serve a particular purpose or intended to incorporate a particular policy about administration of the Potash Area. They suggest that relying upon the documents and history to ascertain Secretarial intent is similar to the common practice of interpreting the provisions of a contract by ascertaining the intent of the parties. See App. PH Reply 72-73.

The idea that interpreting the Secretarial Orders is like interpreting a contract is fundamentally mistaken. While an oil and gas lease, including required stipulations, constitutes a contract between the Department and the lessee, its terms are not the result of negotiations. More to the point, although the Secretarial Orders were issued after holding discussions with and receiving comments from operators in both the potash and oil and gas industries, the provisions of those Orders were not established by mutual agreement as to their wording. Consequently, there is no reason to believe that a "meeting of the minds" preceded issuance of the Orders and no basis for relying upon a statement appearing in a document written by a Departmental official prior to issuance of an Order to infer the intent of the parties. Even more significantly, the 1975 Order was not written by the Secretary but was prepared by his subordinates and signed by him. There is no basis upon which to determine the Secretary's "intent" other than ascertaining the meaning of the words of the Order itself.

In effect, the Appellants seek to convert their understanding of the purposes and policies they find in the history of the Potash Area into an interpretation of provisions of the 1986 Order. There are no documents, however, other than the Orders themselves and a Secretarial Directive issued in 1983, which affirmatively state policy or give instructions for administering the Potash Area. [19/] Reviewing historical circumstances and documents under the guise of determining an underlying "intent" or, more simply, to infer

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[19/] See section II.C, supra.

that a specific policy is implicit in a Secretarial Order or that a provision was written to achieve a certain purpose, would require articulating that purpose or policy for the first time and falls just short of creating it. Defining an unstated Secretarial policy, whether past or current, is not an appropriate task for this decision.

Moreover, statements found in documents related to the administration of the Potash Area and development of the Orders must be viewed with caution because they reflect the points of view of their authors and it can be difficult to ascertain their import. A number of documents which preceded issuance of the 1975 Order are critical to understanding and resolving issues about the 1986 Order, particularly the provisions about potash enclaves that were included for the first time. As will be discussed in considerable detail, revision of the 1965 Order was initiated by officials of the United States Geological Survey (USGS), the agency then responsible for administering the Potash Area, meeting with representatives from potash and oil and gas companies and receiving and reviewing position papers prepared on behalf of the oil and gas and potash industries. The process seems to have occurred due to ongoing conflicts between oil and gas development and potash mining.

Clarence E. Hinkle, Esq. wrote to the Assistant Secretary for Energy and Minerals and the Chief of the Conservation Division, setting forth the position of the New Mexico Oil and Gas Association. His May 2, 1973, letter stated:

> In the 22 years since the Orders of the Secretary and the Commission were issued, it appears that the administrative authorities have developed a practice whereby the development of potash deposits are being given preferential treatment over oil and gas. This practice is clearly contrary to the original intent that there be simultaneous development of potash and oil and gas.

YP 234, attachment at 2-3, BLMCO17492-93. The charge of preferential treatment for potash was taken from a resolution of the Association which accompanied the letter. YP 234, INT 351 attachment at BLMCO17498; see App. PH Reply at 84 n.13.

Hinkle also asserted that the USGS had followed "a number of administrative practices * * * which are believed not to be in accordance with the applicable regulations." [20/] In particular, he claimed that, when a potash lessee filed a protest of an APD for a wellsite within one mile of the potash lease:

> We understand that in these cases the Supervisor of the United States Geological Survey will not approve a drilling location unless it is satisfactory with the United States Mining Supervisor at Carlsbad, and apparently his practice has been to not approve any location where

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[20]/ Because there are no formally promulgated regulations which specifically govern administration of the Potash Area, presumably, "regulations" refers to the 1965 Order. This use of the term in relation to the Secretarial Orders and administration of the Potash Area is not unusual. See, e.g., YP 236 at BLMCO17401, BLMCO17404.

> requested not to do so by the owners of potash leases. This procedure would not appear to be in keeping with the spirit or the literal interpretation of the regulations which, as indicated above, were for the purpose of carrying on concurrent operations for potash and oil and gas.

YP 234, attachment at 5, BLMCO17495; see App. PH Reply at 84-85. In concluding, Hinkle stated that "very few, if any, new rules or regulations" were needed "to open up the potash area to orderly exploration and development of oil and gas" and requested that the Department allow wells to be drilled "in accordance with applicable regulations except in cases where drilling will interfere with actual mining operations * * *." YP 234, attachment at 7, BLMCO17497.

During the same period, the Area Oil and Gas Supervisor addressed arguments which had been raised by Teledyne Potash in objecting to approval of an APD filed by the Phillips Petroleum Company. YP 233. In a March 30, 1973, memorandum he addressed a number of matters, including Teledyne's "request that the `. . . USGS return to their previously established policy of careful technical evaluation of the total effect of each request to drill oil and gas wells through potash reserves.'" YP 233 at 7, BLMCO17545. The Area Supervisor rejected the premise of the request:

> The criteria used by this office to judge a location in the Secretary's Potash Area as drillable or not drillable has not been changed. Each case is judged on its own merits with the overriding consideration being conservation of both petroleum and potash resources. * * * We interpret the Secretary's orders of 1951 and 1965 and the NMOCC R-111-A regulations to call for concurrent operations, not denial of exploitation of oil and gas so that a potash ore body that may never be mined remain unpenetrated. Under this interpretation, past policy has been to approve oil and gas well locations in the postulated ore body if it is reasonably estimated that such wells will be depleted and plugged prior to the time such ore is mined.

Id.

Although both the New Mexico Oil and Gas Association and Teledyne believed that administration of the Potash Area had changed, they seem to have had quite different understandings of how it had been previously administered, the change that had occurred, and the "policy" or "practice" or "procedure" that was then being carried out. The Area Oil and Gas Supervisor, of course, had a different view of the situation, and in some respects his views seem to have differed from those of the Area Mining Supervisor. See YP 236 at BLMC017401. There is no need to determine who was correct. For purposes of this decision, the differences show that while statements made in such documents may provide some indication as to how the Potash Area was being administered at a particular time, they reflect the perspectives of their authors and cannot be readily relied upon to establish historical fact as to official Departmental policy or practice. In particular, the differences establish that such documents do not easily allow a conclusion that a specific statement or discussion in them resulted in the adoption of a

particular provision of an Order or that a provision was adopted to achieve a particular purpose or establish an underlying policy. Rather, the basis for finding that a contemporaneous document had some bearing upon the content of an Order is that it used the same or similar language as the subsequent Order.

II. E. Maxims of Interpretation

The Appellants claim that two principles or "maxims" should govern interpretation of the 1986 Order, or at least section III which is titled "General Provisions." App. PH Brief at 61. As the Intervenors note, there is something odd about the Appellants' assertion that the 1986 Order "is so definitive and the language is so precise that the Order must be interpreted in light of maxims" which are neither stated in the Order nor clearly identified in its history. See App. PH Brief at 61; Int. PH Brief at 100, 102; Yates Final SOR at 16. Ultimately, however, the problem with the "maxims" is that they are neither implicit in the provisions of the 1986 Order the Appellants identify nor supported by the documents they rely upon.

II. E.1 Equal Footing

The Appellants state:

> The first maxim is that in enunciating a purpose of concurrent development, the Secretary has placed both industries on an equal footing with regard to the development of their respective resources, as indicated by the revocation of the 1939 Order, the statement that the lease stipulations adequately protect the rights of operators and lessees, and by the mutuality of the lease stipulations.

App. PH Brief at 61-62; Yates Final SOR at 16. The facts the Appellants refer to are not in question. The 1951 Order revoked the 1939 withdrawal of lands from oil and gas leasing and stated that it was being issued "[f]or the purpose of providing for concurrent operations." Appendix A, § 1. It also set forth four stipulations which it required be included in subsequently issued oil and gas leases and one stipulation to be included in potash leases. On several occasions, including in the 1986 Order, the Department has stated that the stipulations "adequately protect the rights of the oil and gas and potash lessees and operators." Id. § 3.III.A. The Appellants, however, do not explain why these facts either support or establish a "maxim" of "equal footing." Taken at face value, they indicate that the two industries are equal only in the simplistic sense that the 1951 and subsequent Orders allow both potash and oil and gas to be leased and produced within the Potash Area and mandate that one or more stipulations be included in potash and oil and gas leases.

The Appellants' claim to "equal footing" seems to rest upon little more than the presence of the term "concurrent operations" in the first paragraph of the 1951 and subsequent Orders. See App. PH Brief at 61-62; App. PH Reply at 110. Indeed, throughout the proceedings they have given extensive, but largely unexplained, emphasis to the opening sentence of the Secretarial Orders, which in its current form states: "This

Order revises the rules for concurrent operations in prospecting for, development and production of[,] oil and gas and potash deposits owned by the United States within the designated Potash Area * * *." Appendix A, § 1. The Appellants regard the provision as granting oil and gas drilling equal importance in developing any particular portion of the Potash Area. See App. PH Reply at 13, 71-72; Pogo and Devon Reply to BLM and IMC Answers to Final SOR at 8-9; App. Prelim. SOR at 7, RP 006412; Reply to Sol. and BLM Resp. to Prelim. SOR at 5, RP 006577; Yates Final SOR at 2, 15. On its face, however, the sentence is a description of the Order which follows and not a declaration of the relative importance of the two industries. If it has any prescriptive weight, its wording indicates that BLM must allow both oil and gas and potash operations to occur within the designated Potash Area; not that BLM must allow both of types of operations throughout the Potash Area. See Melton: 1506; Cherry: 3063-64. Much like the policy of multiple use, the provision has no particular consequence in deciding whether to grant or deny an APD for a specific wellsite.

Nevertheless, the Appellants maintain that, with the statement of purpose in the 1951 Order, "the policy of the Secretary shifted from protecting mineralization to assuring concurrent development, thereby protecting the rights of the operators and lessees." App. PH Brief at 16, 25, 56; Pogo & Devon Response to Int. Motion for Summ. J. at 6. They point to a contrast between the statement in the 1939 Order that it was being issued "[f]or the purpose of protecting and conserving the potash deposits belonging to the United States" (4 FR 1012 (Feb. 25, 1939) and the wording of the 1951 and later Orders referring to prospecting, development, and production of oil and gas and potash deposits. App. PH Brief at 16, 56, 59; App. PH Reply at 13, 74. Ultimately they claim that "the Secretary has not authorized or granted the Local Agency [BLM] discretion to protect `potash deposits' in the 1986 Order." App. PH Reply at 109.

The distinction has neither the basis nor the consequence the Appellants attribute to it. They quote a press release issued with the 1951 Order as evidence of the change of policy. See App. PH Brief at 17-18, 57. [21/] They claim: "It is obvious from the plain language of the 1951 Order as well as the Press Release, that the 1951 Order established a dignity of estates, namely, that both industries were placed on an equal footing regarding development of their leaseholds." App. PH Reply at 75. Although the Appellants correctly note that the press release states that the Order was being issued "for the purpose of encouraging exploratory drilling to discovery additional oil reserves," they overlook its declaration that the Order also "provide[d] adequate protective measures to prevent damage to the Nation's only known important potash reserves." App. PH Brief at 57. Presumably, the measures referred to are the mandatory oil and gas lease stipulations. The Appellants offer no explanation as to why encouraging exploration for oil and gas

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[21/] The document was not introduced as an exhibit at the hearing, but the Appellants have quoted it in their post hearing brief and provided a copy in the documents submitted as an appendix to their brief. Without explanation, they also claim that it "establishes that the Secretary intended that Order R-111 provide the specific rules for implementation of the rules for concurrent development set forth in the 1951 Order." App. PH Brief at 57. They appear to believe that any oil and gas well drilled in accordance with the provisions of R-111 or its successors must be approved by BLM. See id. at 58-60.

within the then 300,000 acre Potash Area under stipulations which limit the locations where oil and gas drilling may occur was understood to give, or should now be regarded as having given, oil and gas development equal status or "equal footing" within, let alone throughout, the Potash Area. The matter may be obvious to the Appellants, but "concurrent" is not the same as "equal."

There is no doubt that in 1951 the Department revoked the 1939 withdrawal and thereby stopped using withdrawals to preclude oil and gas leasing and limit drilling. The provisions of the 1951 and subsequent Orders, however, do not show that the Department thereby ceased all protection of potash deposits or created a "policy" of protecting only "the rights of operators and lessees" as the Appellants insist. They rely upon a false dichotomy that, because potash deposits were no longer protected by a withdrawal, they ceased to be protected at all. See App. PH Reply at 13, 74. As noted above, the Appellants go so far as to assert that BLM lacks authority to protect potash deposits under the 1986 Order." App. PH Reply at 109. Their claim ignores the wording of the oil and gas lease stipulations which, in their current form, require that drilling not "interfere with the mining and recovery of potash deposits," prohibit drilling at locations which "would result in undue waste of potash deposits," allow BLM to require unitization "necessary for orderly oil and gas development and proper protection of potash deposits," and allow BLM to prescribe requirements on the drilling and abandonment of wells "necessary to prevent the infiltration of oil, gas, or water into formations containing potash deposits." Contrary to the Appellants' assertions, these stipulations not only allow BLM to protect potash deposits but requires it to do so by denying approval of APD's and imposing conditions on drilling. It appears that one way the oil and gas lease stipulations "adequately protect the rights" of potash lessees and operators is by allowing BLM to protect potash deposits. The wording of the stipulations requires rejecting not only the Appellants' distinction but also their claim that a principle of "equal footing" underlies the 1951 and subsequent Orders. The term "concurrent operations" means simply that, as of 1951, oil and gas leasing and production would be allowed within the Potash Area along with potash leasing and production. See YP 234 at BLMCO17492 ("dual development of the area").

At times the Appellants stress the fact the Order states that it provides "rules for concurrent operations." They regard the lease stipulations as constituting those rules and assert that "[t]he Secretary recognized the equal dignity of both estates by providing for reciprocal lease stipulations * * *." App. PH Reply at 77. They also have claimed that the stipulations apply only when both an oil and gas lease and a potash lease have been issued for the same land and there may be a conflict between operations under those leases. See Yates Summ. J. Brief at 12; Pogo Summ. J. Brief at 9; Oral Argument on Summ. J. at 20-21, 34-35. Correspondingly, they assert that, when a potash lease has not been issued for the land included in an oil and gas lease, concurrent operations are not possible, there is no conflict or potential conflict to resolve, and the "rules for concurrent operations" provided by the 1986 Order do not prevent approval of an APD. See App. PH Brief at 76-77; Yates Summ. J. Brief at 12-13; Pogo Summ. J. Brief at 8, 11-12; Tr. Oral Argument on Summ. J. at 20-21, 35-36. Indeed, from the outset the Appellants have claimed: "In light of the express purpose of the 1986 Order, the lease stipulations must be read as allowing oil and gas exploration and development in areas removed from existing mining operations." App. Reply to BLM Responses to Prelim. SOR at 14. They have also claimed

that "[t]he Secretary's intent in requiring stipulations on potash leases [22/] recognizes that oil and gas operations would be allowed to proceed and, in fact, would be allowed to be fully developed in areas where oil and gas operations precede potash mining." Id. [emphasis in original].

Having persuaded themselves that the Secretarial Orders have given them a right to drill throughout the Potash Area, the Appellants charge BLM's "Local Agency" 23/ with a "complete disregard for the purposes for which the Order was drafted, that being, `to provide the rules for concurrent development,' i.e., to provide a rational and reasoned response and direction to the Agency when conflicts arise." App. PH Reply at 71. They assert that the 1986 Order "provides rules for concurrent development" and that BLM's "interpretation of the Order as something which is designed to keep the industries from developing their resources when there is a conflict goes to the very heart of the Local Agency's misinterpretation and misapplication of the Order." Id. at 72. Once BLM issues an oil and gas lease, the Appellants claim, "the acreage of the lease is drillable, subject to the lease stipulations which apply in the event of an actual conflict with mining operations being conducted." Id. at 109 [emphasis in original]. They explain that the lease stipulations "were intended to circumscribe only the actual operations of developers of both resources in development areas of close proximity to one another." Id. at 109-110.

The Appellants' various statements derive from their misreading of "concurrent operations" to allow oil and gas development throughout the Potash Area and their identification of the lease stipulations as the "rules" governing conflicts in development. The latter appears to be based upon their understanding of the oil and gas lease stipulations and the potash lease stipulation as being somehow "reciprocal," a term they adopt from the IBLA's referral decision. App. PH Brief at 111-12, 123, 138, 144-45, 149; App. PH Reply at 77; see Yates Petroleum Corp., supra at 232. As noted earlier, the 1986 Order provides "mutual" stipulations only in the sense that it requires one or more stipulations in each type of lease. The Appellants, however, regard the stipulations as substantively "reciprocal." They assert that:

> The terms in the potash lease stipulation are parallel to the terms set forth in the oil and gas lease stipulation. Therefore, the terms "mining and recovery of potash deposits," and "mining operations being conducted for the extraction of potash," are analogous to the "orderly development and

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22/ Although the Secretarial Orders have set forth only one stipulation that must be included in potash leases, the Appellants frequently refer to them as requiring multiple stipulations. In addition, they sometimes denominate the four stipulations that are required as part of oil and gas leases as "potash stipulations." To avoid confusion, this decision refers to the stipulations based upon whether they are part of an oil and gas lease or a potash lease.

23/ The Appellants explain that they refer to the Carlsbad Resource Area office, the Roswell Area office, and the New Mexico State office as the "Local Agency" to distinguish "implementation of policy from actual Secretarial policy as written." App. PH Reply at 1 n.1. In particular, they believe that application of the 1986 Order changed after Leslie Cone became the District Manager. App. PH Reply at 71, 132-35.

> production under any oil and gas lease issued for the same lands." The respective terms plainly refer to the production and development activities of each industry.

Pogo Response to Int. Sur-Reply at 15. [24/]

Although the "terms" of the stipulations the Appellants quote may be similar in some respect, their understanding that the stipulations are simply the "rules" governing conflicts in "production and development" ignores the language of the stipulations themselves. The Appellants' appear to deny that they have an obligation when filing an APD to establish "to the satisfaction of the authorized officer," as called for by the first oil and gas lease stipulation, "that such drilling will not interfere with the mining and recovery of potash deposits, or the interest of the United States will best be served by permitting such drilling." Nor do they seem to recognize that the second stipulation allows BLM to deny approval of an APD when, "in the opinion of the authorized officer," drilling the proposed well "would result in undue waste of potash deposits." Likewise, it appears that the Appellants do not believe BLM can require unitization of the wells they propose to drill when it "is necessary for orderly oil and gas development and proper protection of potash deposits" as provided in the third stipulation. The Appellants may even disagree that, under the fourth stipulation, BLM may prescribe "such requirements as necessary to prevent the infiltration of oil, gas or water into formations containing potash deposits." The Appellants' position that the stipulations in their oil and gas leases apply only when there is a conflict with potash mining operations is untenable.

To the extent the 1986 Order defines the relative status of the two industries, the relevant language is not found in the statement of purpose, but in the declaration of policy added in 1975 that the Department will "deny approval of most applications for permits to drill oil and gas tests from surface locations within the potash enclaves * * * ." 40 FR 51486, 51487 (Nov. 5, 1975). In Belco Petroleum Corp., 42 IBLA 150, 153 (1979), the IBLA stated that this provision "discloses a decided preference for potash operations." The policy is restated in the 1986 Order in modified language and is applicable in this case. It is sufficient to reject Appellants' assertion that the 1986 Order places the oil and gas and potash industries on an "equal footing." On the other hand, a preference for potash operations within potash enclaves is not in itself a sufficient basis for sustaining BLM's decisions to deny the Appellants' APD's. See WMA PH Brief 20-21. Rather, the propriety of the decisions depends upon application of specific provisions of the 1986 Order and the facts pertaining to each proposed wellsite.

[24/] The Appellants adopt the term "parallel" from IMC Kalium, Carlsbad, Inc. v. Interior Board of Land Appeals, 206 F.3d 1003, 106 (10th Cir. 2000). Pogo Response to IMC Sur-Reply at 3-4. The court used it in initially describing the 1986 Order prior to quoting the first and second oil and gas lease stipulations and the potash lease stipulation. Id. at 1006. The case, however, did not present an issue as to the meaning of the wording of the stipulations or their application and there is no indication that the court used "parallel" to mean anything more than that the Order requires that both types of leases include one or more stipulations which limit operations. Nevertheless, the Appellants restate their position in terms of the "parallel lease stipulations." See Pogo Response to Int. Sur-Reply at 3-4, 7-8.

The Appellants' attempt to construe "concurrent operations" to require equal status in developing any particular part of the Potash Area is also contrary to evidence that BLM has not usually used "concurrent" to refer to two activities occurring at the same time and place. For example, the Area Oil and Gas Supervisor's memorandum quoted above relies upon the concept of "concurrent operations" to suggest allowing drilling for oil and gas when "a potash ore body that may never be mined [would] remain unpenetrated." YP 233 at 7, BLMCO17545. Prior to issuance of the 1975 Order, the Deputy Oil and Gas Supervisor and the Mining Supervisor for the Rocky Mountain Area prepared a joint review of the position papers which had been submitted by the potash and oil and gas industries. Among other matters, they addressed the question "What is [the] correct definition of concurrent potash and oil and gas operations?" YP 236, INT 12 at BLMC017404. After describing their positions, the supervisors stated: "We do not believe that concurrent operations means oil and gas wells and mining for potash could be conducted at the same time at the same spot." Id.; see Melton: 1349-51; YP225 at 1-2, BLMCO17707-08. In a separate memorandum, the Central Region Conservation Manager disagreed, stating that "the term must, of necessity mean slightly different things according to time and circumstance." YP 237 at 2, BLMC017409. In particular, he was concerned that: "Given the proper time and circumstances (i.e. a national emergency), we may well decide to approve simultaneous operations in the same area." YP 237 at 2, BLMC017409.

This understanding of the difference between "concurrent" and "simultaneous" operations is also found in testimony by BLM personnel. The most relevant testimony was that of Leslie Cone, the BLM District Manager during the period when most of the decisions at issue were made. She distinguished "concurrent" as meaning "at the same time, but not necessarily the same place," and "simultaneous" as meaning "at the same time at the same place." Cone: 10622. In response to a further question to compare the two, she stated: "Well, concurrent is same time, but different places. Simultaneous is same place, same time." Cone: 10623; see Herrell: 2810; see also YP 80 at 3. This usage is also found in Departmental regulations. See 43 CFR §§ 3000.7, 3500.6. However, the terms "concurrent" and "simultaneous" do not have inherently narrow or distinct meanings and some documents indicate that BLM's usage over the years has varied, including a few instances which support the Appellants' position. See YP 223; Melton: 1267-68.

II. E.2 First in Time, First in Right

The second "maxim" the Appellants propose is a principle of "first in time to develop, first in right," which they assert is "proved" by the requirement of paragraph III.C of the 1986 Order that potash leases include a stipulation:

> to the effect that no mining or exploration operations shall be conducted that, in the opinion of the authorized officer, will constitute a hazard to oil or gas production, or that will unreasonably interfere with orderly development and production under any oil or gas lease issued for the same lands.

Appendix A, § III.C; see App. PH Brief at 63; Yates Final SOR at 17-18. The Appellants point to an "analogous" provision in the oil and gas lease stipulations that drilling may not

"result in undue waste of potash deposits or constitute a hazard to or unduly interfere with" potash mining operations. App. PH Brief at 63. They also claim that the required lease stipulations, and the Department's affirmations of them as adequate to protect the rights of oil and gas and potash lessees, show "that the policy in the Secretary's Area is to promote concurrent development of both resources on a first in time to develop, first in right basis." App. PH Brief at 4, 39; see Yates Final SOR at 19.

Like the notion of "reciprocal" lease stipulations which seems to underlie the Appellants' maxim of "equal footing," their principle of "first in time to develop, first in right" seems to be based upon little more than the fact the Orders have required stipulations in both oil and gas and potash leases and the appearance of the phrase "orderly development and production" in the potash lease stipulation. See Pogo Response to IMC Sur-Reply at 4. They claim that the "lease stipulations were written by persons who are knowledgeable in the respective industries" and that "orderly development and production" is used with the meaning it has as a term of art in the oil and gas industry and allows them to drill "step out" wells and fully develop their leases. App. PH Brief at 63-65.

The phrase "orderly development and production" has appeared in the Secretarial Orders since 1951 and, although there is no evidence in the record about its origin, there is no need to determine its meaning in the context of the Orders. The Appellants correctly understand that:

> the potash lease stipulation is designed to apply to potash mining and exploration activities in areas which the potash lessee holds under lease, and precludes potash mining from interfering from orderly oil and gas development on the same lands. Therefore, if an area is leased for potash and oil and gas development is occurring, the potash lessee may not, under the lease stipulations, conduct such activities as would unreasonably interfere with orderly development and production under that lease.

App. PH Brief at 77; see Pogo Response to IMC Sur-Reply at 7, n.4. This statement, however, simply paraphrases the language of the potash lease stipulation.

Instead of arguing that they have a right to "orderly development and production" as a consequence of a stipulation in a specific potash lease, the Appellants assert that the potash lease "stipulation must necessarily apply to development wells in enclaves because it would certainly be the aim of the potash operator to lease areas containing known commercial potash mineralization." Id. Having declared that the stipulation applies to all areas of potash enclave, rather than only that area included within a potash lease, the Appellants conclude that "the 1986 Order contemplate[s] orderly oil and gas development in areas of likely known potash mineralization," that it "affirmatively precludes potash lessees from interfering with such development," and that the "stipulation most assuredly reflects the first in time to develop/first in right approach." Id. at 78. With their right to development secure, the Appellants claim that:

> the effect of the BLM's decision was to completely nullify the potash lease stipulations and allow mining and/or exploration activities (and in most

> instances, completely hypothetical activities projected into the far distant future) to not only interfere with but to preclude orderly development and production of the oil and gas leases on the same lands.

Id. In other words, the Appellants contend that stipulations which might someday appear in potash leases currently give them a right to orderly development under their oil and gas leases, and they charge BLM with nullifying those stipulations in potash leases which have not been issued by allowing hypothetical operations under them to negate the development rights they have under stipulations in those unissued leases. BLM's decisions cannot nullify a potash lease stipulation when a potash lease has not been issued "for the same lands." The Appellants' position is untenable.

In asserting their principle of "first in time to develop, first in right," the Appellants' also claim that the maxim finds support in the enclave policy found in the 1985 Order, which they term its "test wells" provision. App. PH Brief at 65. [25/] They discuss a number of documents which preceded its inclusion in the 1975 Order. Their discussions of the documents are deficient because they are self-confirming. There are no documents which clearly state or show that a principle of "first in time to develop, first in right" was made part of the Secretarial Orders in 1951, 1975, or 1986. Because the Appellants believe that the "maxim" is implied or required by the mandatory lease stipulations, the potash lease stipulation in particular, they find it to be recognized in documents which merely refer to the stipulations.

Of particular importance, the Appellants discuss the July, 1973 position paper submitted to the Department by the Potash Committee of the New Mexico Mining Association and the New Mexico Potash Industry as part of the review process leading to issuance of the 1975 Order. YP 235. They believe that it "represents the potash industry's understanding of the proper interpretation and implementation of the lease stipulations." App. PH Brief at 32. "That understanding," the Appellants assert:

> was that the oil and gas operator was entitled to orderly development and production of his lease under the lease stipulations contained in potash

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[25/] The Appellants explain that the provision places "more stringent requirements on the drilling of exploratory wells in those areas which potash lessees are developing, and in the areas in close proximity to mining operations." App. PH SOR at 65; see Yates Final SOR at 18. Thus, they suggest that potash development receives protection when it has been "first." Like many of the Appellants' assertions, their explanation entails erroneous interpretations of several provisions of the Order. Their assumption that the policy applies only to exploratory wells is addressed in the "Test Wells" section of this decision. Their explanation also misconstrues a policy which on its face requires denying approval of APD's by recasting it as one which merely imposes "more stringent requirements," as though drilling might proceed under special conditions or stipulations. In addition, the Appellants convert a policy governing "potash enclaves" into one which only affects those "areas" of a potash lease which are being developed or which are near mining operations. Their claim that potash enclaves are limited to lands which have been leased for potash is addressed in a section bearing that title.

> leases, as required by the 1951 and 1965 Secretarial orders. The potash industry, not the oil and gas industry, understood Secretarial policy under the lease stipulations to be consistent with a first in time to develop, first in right basis. The memorandum reflects a further understanding that Secretarial policy was being implemented in precisely a first in time to develop, first in right manner in the 1970's. The potash industry urged that present regulations remain in effect, thus, urging the Secretary to maintain the policy of first in time to develop, first in right under the lease stipulations.

App. PH Brief at 32 [emphasis in original]. In particular, they assert that with the document, "[t]he potash industry subscribed to the first in time to develop first in right concept * * *." App. PH Brief at 69.

The portion of the document the Appellants rely upon to support their claims is not the position paper itself but an accompanying exhibit titled "Report to Potash Committee Concerning Prospecting for Oil & Gas in the Potash Area" which was prepared by the International Minerals & Chemical Corporation. YP 235 at BLMC042117, Exh. K at BLMC042164 through 42183. That report addresses the issue:

> Should prospecting for oil and gas be conducted in or through potash-bearing land without satisfactorily establishing that such drilling would not interfere with the mining and recovery of potash deposits or cause undue waste of potash or constitute a hazard.

YP 235, Exh. K at BLMC042166. Although this and other portions of the report paraphrase or quote the lease stipulations, neither the report nor the position paper mentions "first in time to develop, first in right." See, e.g., YP 235, Exh. K at BLMC042169. The Appellants' claim that the potash industry recognized, understood, urged, or subscribed to a principle of "first in time to develop, first in right" seems to be based only upon the fact that the report mentions the lease stipulations. Because they believe the stipulations entail the principle, they read the references to the stipulations as references to the principle and support for the stipulations as support for the principle.

Similarly, the Appellants claim that the Area Oil and Gas Supervisor's March 30, 1973, response to Teledyne "confirms the first in time to develop first in right approach," but they do not explain why the statements they quote from his memorandum provide such confirmation. App. PH Brief at 67. They point out that, after quoting several of the lease stipulations, the Area Supervisor stated:

> These stipulations are obviously to prevent interference between current operations of potash and petroleum lessees on the same lands; not just interference with mining operations but also petroleum drilling and production operations. The multiple use concept is not unilateral for potash recovery first and petroleum later and was intended as a two-way street.

App. PH Brief at 67-68, quoting YP 233 at 2, BLMCO17540. The Area Supervisor's statement acknowledges that the stipulations operate to limit both oil and gas and potash operations and that the policy of multiple use recognizes that both potash and oil and gas may be developed within the Potash Area. It does not, however, indicate that he believed that being "first" established a "right" to proceed, let alone that such a principle applied throughout the Potash Area.

The Appellants also quote the Area Supervisor's rejection of Teledyne's assertion that it had been USGS's policy "to prohibit the drilling of gas and oil wells through potash ore bodies":

> This statement is untrue. The policy and the purpose of the Secretary's orders, and R-111-A, is to allow multiple use for oil and gas and potash. There are many cases in the record of locations in a postulated ore body being approved by both USGS and the NMOCC because the potash company had no immediate plans to mine.

App. PH Brief at 68, quoting YP 233 at 3, BLMCO17541. In addition, they quote a portion of the previously quoted response to Teledyne's assertion that Departmental policy had changed. Id. Although the Area Supervisor's responses to Teledyne indicate that he did not consider the presence of a potash ore body to be a sufficient reason to deny an APD, they do not even remotely suggest that he believed a policy of "first in time to develop, first in right" governed the Potash Area. To the contrary, he recommended denial of the APD at issue at the time because the wellsite was "within four miles of active mining" and "in the edge of the postulated langbeinite ore body" and because the potash lessee had testified at an NMOCC hearing that it had plans to mine the area "possibly in 5 years, probably in 10 years and certainly within 15 years," while Phillips Petroleum Company had testified that the estimated life of the well was 8 to 10 years, and "the two industries' operations would conflict." YP 233 at 7, BLMCO17545.

In addition, the Appellants claim that a 1962 memorandum from the Chief of the Branch of Mining Operations to the Chief of the Conservation Division:

> reflects that the departmental interpretation of the lease stipulations allowed for precisely the full development of each resource * * * reflects that the only concern related to areas where both oil and gas and potash leases sought to develop in the same area and the same time * * * reflects an understanding that a potash lessee would logically be required to plan its mining operations around existing wells if the oil and gas lessee were the first to develop * * * [and] reflects the prevailing interpretation of the lease stipulations at the Washington D.C. level * * * entirely consistent with a first in time to develop first in right approach.

App. PH Brief at 66. The Appellants explicitly assert that the memorandum "recognized a `first in time to develop, first in right' policy" and "establishes that the prevailing USGS policy under the lease stipulations in 1965 was first in time to develop first in right." App. PH Reply at 81. They further claim that, in issuing the 1965 Order, "the Secretary rejected

any proposal of a withdrawal and confirmed the lease stipulations which provided for a first in time to develop first in right policy." App. PH Brief at 67.

The memorandum was written by the Chief to address "[s]ome topics discussed during my recent field trip," apparently one of which was that "[d]evelopment of oil and gas and potash is not compatible at the same time." YP225 at 1 (BLMCO17707). He recognized that there were "rights of dual occupancy on a large portion of the so-called oil and gas potash area," but stated that he believed that "maximum development and recovery of the oil and gas and potash from the same area simultaneously is not compatible." YP225 at 1-2 (BLMCO17707-08). As the Appellants note, the Chief suggested "withdrawing certain areas known to contain valuable potash and capable of development operations within a reasonable time" and suspending oil and gas leases as a "partial solution." YP225 at 2 (BLMCO17708). The memorandum, however, does not mention "full development" or "first in time to develop, first in right." Although the Appellants believe the document supports their "maxim," they do not explain why any specific statement in it "reflects" the matters they attribute to it.

Nor do the Appellants offer any factual basis for finding that the memorandum was reviewed by the Secretary when issuing the 1965 Order or that he otherwise "rejected" a proposal to withdraw land in the Potash Area. Their suggestion that by signing the Order the Secretary "confirmed" a policy of "first in time to develop first in right" is based upon only the fact that it continued to require that the stipulations be included in leases and the Appellants' belief that the stipulations provide such a policy. Indeed, they consistently construe Secretarial approval of the revised Orders to "reaffirm," "not retreat from," or "recognize" their principle of "first in time to develop, first in right." See App. PH Brief at 4, 25, 39, 47, 64-65, 67. They do not explain, however, why, if a principle of "first in time to develop, first in right" has been an integral part of the Orders governing the Potash Area since 1951, it has never been explicitly stated in a Departmental document, it has not previously come into controversy, and supervisory officials have never corrected its improper application by subordinates. More broadly, the Appellants appear to contend that the administration of the Potash Area by the USGS and later BLM has been inconsistent with Orders signed by four Secretaries, but they offer no explanation as to why such mismanagement was never noted and corrected by them or by Departmental officials.

Nevertheless, the Appellants' claims about the potash lease stipulation are central to their charge that BLM acted arbitrarily and capriciously and abused its discretion. They contend that BLM's:

> local office single-handedly, arbitrarily, and unilaterally failed to apply the 1986 Order as it is written. In so doing, the local office nullified the rights of oil and gas lessees to develop their leases in an orderly manner, which rights were confirmed by the Secretary of the Interior in 1951, 1965, 1975 and 1986.

App. PH Brief at 112; see Pogo Resp. to Int. Sur-Reply at 8-9. These claims are made based upon what the Appellants term a "remarkable admission" by Leslie Cone, the BLM

District Manager, that she "did not apply the reciprocal potash lease stipulations and did not consider BLM to be bound by the potash lease stipulations." App. PH Brief at 111. They quote her testimony:

> Q. And in fact, the stipulation that appears in the potash leases, which says that there should be no allowance of mining operations that would interfere with the production and development of oil and gas was already in existence, wasn't it?
>
> A. Yes. That stipulation is for the potash companies, not -- it's not a BLM or a USGS stipulation. It doesn't impact how we process the APDs.
>
> Q. But it would and should be taken into consideration when the BLM decides what they are going to allow and what they're not going to allow in the KPLA, doesn't it?
>
> A. No. That is a stipulation so that the potash companies can't interfere with oil and gas, and the same with the oil and gas companies. That doesn't affect how the BLM processes. We have to process it by whatever Order there is in effect.
>
> Q. Well, the Order, in fact, the '86 Order and the '75 Order said that they were going to rely on the stipulations in the leases to take care of most of the situations.
>
> A. No. The primary purpose of the stipulations was to make sure that each other's rights were protected, and there were no issues on taking. They don't lay out the policy of where you can drill and where you can't drill. And I think the stipulations talk about potash deposits, not enclave.

App. PH Brief at 111, quoting Cone: 11018-19. This testimony, the Appellants contend:

> established in less than one minute of hearing time what Appellants have been attempting to prove and have been saying for months, if not years. The effect of BLM's failure to even consider the potash lease stipulations rendered meaningless an entire portion of the 1986 Order and more significantly, renders utterly ineffective, specific provisions contained in numerous potash leases, which provisions were directed to be included by the Secretary of the Interior. The local office has thumbed its nose at policy mandated by the Secretary in every Secretarial Order from 1951 through the present. Apparently, the local office determined that it just did not like the potash lease stipulations and therefore would not consider them, apply them, or deem itself to be bound by them.

App. PH Brief at 111-12; see Pogo Response to Int. Sur-Reply at 8-9.

The Appellants' complaints derive from their failure to recognize the potash lease

stipulation cannot apply when land has not been leased for potash. Like its predecessors, the 1985 Order does not itself prohibit potash mining and exploration operations which will constitute "a hazard to oil or gas production or unreasonably interfere with orderly development and production." Instead, it requires that "[a]ll potash permits and leases hereafter issued or * * * renewed" include a stipulation that allows BLM to disapprove mining and exploration operations which, in the opinion of the authorized officer, "will constitute a hazard to oil or gas production, or that will unreasonably interfere with orderly development and production under any oil or gas lease issued for the same lands." If, as the Appellants claim, their APD's are for lands which have not been leased for potash, there was no potash lease stipulation to "nullify," no potash lease provisions were rendered "ineffective," BLM did not render "meaningless" a portion of the 1986 Order, BLM did not ignore a Secretarial policy, and its decisions were not arbitrary and capricious for failing to apply the non-existent potash lease stipulation.

In attempting to convert the potash lease stipulation into a "maxim" of "first in time to develop, first in right," the Appellants overlook the limitation it imposes on potash mining operations and the protection it provides to oil and gas operations. Just as the Appellants were required to file the APDs' at issue in this case, a potash lease operator must file and obtain approval of a plan of operations. 43 CFR 3592.1(a). The stipulation requires a potash operator to affirmatively satisfy BLM that its proposed plan will not create a hazard to oil or gas production or unreasonably interfere with oil and gas development and production for "any oil and gas lease issued for the same lands." See Cone: 11142-44; INT 206 at BLMCO16571. Thus, the stipulation recognizes and "adequately protects" the rights granted an oil and gas lessee by the Department. Indeed, the stipulation appears to protect those rights even when the oil and gas lessee has not been the first to initiate development operations. It does not, however, grant either lessee rights based upon being "first." Cone correctly testified that the potash lease stipulation "doesn't impact how we process the APDs." [26/]

Considered in a broader context, the Appellants' claim that a policy of "first in time to develop, first in right" has been part of the Secretarial Orders is wholly without merit. Such a principle has been suggested as a way to resolve the conflicts between oil and gas and potash lessees, but the suggestion implicitly recognizes that the principle is not part of the law. See 6 American Law of Mining, §§ 200.04[2][d][i] (2d ed. 19); 2 Law of Federal Oil and Gas Leases, § 23.07[2][c] at 23-39 (1998) ("Interior's policy is fairly stated as one that allows the potash lessee to mine first, based upon the premise that oil and gas

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[26/] In other respects, Cone's quoted testimony cannot be approved. Her suggestion that the stipulations have to do with "issues on taking" and don't affect BLM's processing of APD's is contrary to the wording of the oil and gas lease stipulations which call upon the "authorized officer" to make various determinations in deciding whether to allow drilling. See also Cone: 11020. The testimony occurred during cross examination while counsel for the Appellants was asking questions that appear to have been intended to elicit her agreement on the limits of the "test well" provision of the 1986 Order (the potash enclave policy). See Cone: 11012-20. Some confusion may have occurred because counsel asked questions based upon the Appellants' understanding of the provision, while Cone responded based upon her understanding that it supports BLM's denial of the APD's.

can always be recovered later. This policy stems from the fact that simultaneous operations have resulted in waste of the potash ore."). One author has suggested that the principle is implied by the regulations which allow BLM to impose stipulations for "simultaneous development," but he recognized that in New Mexico "potash mining has proceeded regardless of lease priority." Lear, "Multiple Mineral Development Conflicts: An Armageddon in Simultaneous Mineral Operations?" 28 Rocky Mt. Min. L. Inst., 79, 209-211 (1982); see 2 Law of Federal Oil and Gas Leases, § 23.21 at 23-68 (1998).

III. Defining Potash Enclaves

The first broad issue which was the subject of considerable testimony at the hearing concerns the proper identification of potash enclaves under the 1986 Order. As has been stated, the 1986 Order establishes an "enclave policy" by its statement that: "It is the policy of the Department of the Interior to deny approval of most applications for permits to drill oil and gas test wells from surface locations within the potash enclaves established in accordance with Part D, item 1 of this Order." Appendix A, § III.E.1. "Part D, item 1" requires potash lessees to annually file a map or maps showing (1) "areas where active mining operations are currently in progress in one or more ore zones," (2) areas "where active mining operations have been completed in one or more ore zones," (3) "areas that are not presently being mined which are considered to contain a mineable reserve in one or more ore zones," and (4) areas within potash enclaves "believed to be barren of commercial ore." Id. § III.D.1. BLM is required to "review the information submitted in this regard and make any revisions in the boundaries of the proposed mineable reserves (potash enclaves) which are consistent with the data available at the time of such analyses" and commit its findings to a map. Id. § III.E.

The enclave policy first appeared in the 1975 revision of the Order. Both it and the 1986 Order have provided two exceptions. One allows vertical and directional wells to be drilled "from barren areas within potash enclaves" when they "will not adversely affect active or planned mining operations in the immediate vicinity of the proposed drillsite." Id., § III.E.1.a. The other exception allows vertical and directional wells to be drilled "from a drilling island located within a potash enclave" when (1) there is no barren area or drilling is not permitted from any barren area because it would interfere with mining operations, or (2) drilling directionally or vertically from a barren area would not reach the target formation, or (3) the target formation cannot be reached by directionally drilling from outside the potash enclave. Id. § III.E.1.b.

Because the Order establishes a policy to deny approval of most APD's within potash enclaves and because the exceptions are limited, the proper basis for identifying potash enclaves is a critical issue. The term "potash enclave" is not directly defined in the 1975 or 1986 Orders, but its meaning is found in that portion which explains that the "minable reserves" a potash lessee is to map are "those areas (enclaves) where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics." Id. § III.D.1.c. Consequently, for purposes of interpreting the 1986 Order, "minable reserve" and "potash enclave" are synonymous and denote areas "where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics."

III. A. Appellants' Arguments about Potash Enclaves

The Appellants' arguments concerning potash enclaves have evolved during the course of the proceedings. In appealing to the IBLA and requesting a hearing, they stated they would "establish that in most instances the potash mineralization present at the APD locations is not commercial, is not likely to be commercial in the future, * * * and it is unlikely that many of the potash deposits will ever be mined." App. Prelim. SOR at 20-21

(RP006425-26). They also stated that their arguments and evidence would "focus on the determination of Measured Ore Reserves and whether BLM has correctly made such determination based upon current technology and economics." Id. at 21-22. In particular, they challenged the standards which had been used to prepare maps showing the location of potash enclaves. As will be discussed in greater detail, in 1974 the USGS adopted standards of 4 feet of 10% K_2O as sylvite or 4 feet of 4% K_2O as langbeinite, or an equivalent combination of the two, delineated by at least three data points no more than 1 ½ miles apart, as the minimum thickness and quality needed to identify an area a "minable reserve" or "potash enclave." See YP 565, INT 19. The Appellants claimed that BLM has continued to use these standards without modification and therefore "uses outdated and insufficient criteria to determine which areas to designate as containing measured ore reserves, thus precluding oil and gas drilling." App. Prelim. SOR at 23.

Not only did the Appellants contend that the standards applied by BLM did not reflect current economics, they also claimed that "BLM grants significantly too broad an area of influence to potash core holes particularly in light of the fact that in many of these areas potash mineralization can be very erratic in quality and thickness." Id. at 28 (RP006433). In addition, they argued that, although the 1984 potash enclave map relied upon by BLM in denying their APD's had been prepared using a method recognized by the Mining Engineering Handbook published by the Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers (SME), the method was designed for identifying resources rather than mineable potash and BLM had changed the SME standards of "proven," "probable," and "possible" ore to the "lesser standards" of "measured," "indicated," and "inferred" ore. App. Prelim. SOR at 29 (RP006434); see Pogo Final SOR at 38. They also claimed that BLM had relied upon an insufficient number of core holes to meet the Handbook's standard of four core holes per section. App. Prelim. SOR at 30 (RP006434); see App. Reply to BLM Resp. to Prelim. SOR at 15-17 (RP006587-89); Pogo Final SOR at 36-39.

In reply to the response filed by IMC as an intervenor, the Appellants asserted that if "potash enclaves were properly designated" to identify areas where potash was known to exist as called for by the definition, "the areas subject to the potash enclave exception would be very small" and that "most, if not all, of their proposed well locations would not be in enclaves." App. Reply to IMC Resp. to Prelim. SOR at 3-4 (RP007405-06) [emphasis in original]. They also disagreed with IMC's assertions that BLM's standards had been established as a matter of policy and that their validity is not subject to review. The Appellants stated that they were not only "prepared to prove that BLM has designated as enclaves vast areas where it is not possible for the BLM to know that the potash ore meets the standards for known potash ore required by the 1986 Order," but also were "prepared to prove that the BLM has designated as enclaves vast areas in which BLM affirmatively knows that the potash ore does not exist in sufficient thickness and quality to be mineable under existing technology and economics," that "in many instances" the standards were "insufficient to be minable under existing technology and economics," and "that most, if not all, of their APDs fall within barren areas and should be approved." App. Reply to IMC Resp. to Prelim. SOR at 4-5 (RP007406-07) [emphasis in original]; see Pogo & Devon Resp. to IMC Motion for Summ. J. at 3. They further claimed that "[e]ach area in the Oil-Potash Area will have different economics for mining of potash due to depth, distance,

insolubles, infrastructure requirements, among other factors." App. Reply to IMC Resp. to Prelim. SOR at 5 (RP007407).

In referring the appeals for a hearing, the IBLA observed that BLM's authority to deny APD's pursuant to the enclave policy " is predicated on the area's proper designation as an enclave in accordance with the requirements of the Order" and that, "if an area has not been correctly identified as a potash enclave, BLM cannot base its denial of an APD for a well in that area on the policy * * *." Yates Petroleum Corp. et al., 131 IBLA at 235. The Board then stated:

> Since Yates contends that virtually none of the denied APD's embraces lands within properly designated potash enclaves, resolution of the factual dispute as to whether the areas subject to the denied APD's qualify as potash enclaves under the 1986 Order is critical to the disposition of the issues raised in these appeals. Accordingly, we grant Yates' request for referral of these cases to an Administrative Law Judge for a hearing.
>
> The primary focus of the hearing will be on whether BLM's denial of the APD's accords with the provisions of the 1986 Order. Resolution of that question hinges on numerous subsidiary determinations. Principal among those ancillary issues are whether the APD's encompass lands within areas qualifying as potash enclaves under the parameters established by section 3.III.D.1.c. of the Order, i.e., whether the lands are currently unmined areas within Federal potash leases "where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics" * * *.

Id.

It is not clear whether the IBLA believed that the hearing would primarily address information about the quantity and quality of potash deposits present in the areas where the Appellants seek to drill or whether the Board understood that the Appellants would attempt to show that the standards BLM had used to identify potash enclaves no longer accurately describe potash which is "minable under existing technology and economics." Whatever the case, the issue of the proper designation of potash enclaves has become factually even more complex and the Appellants have raised additional arguments which would preclude or limit application of the enclave policy. The briefs they separately filed prior to the hearing not only reaffirmed their previous arguments, but raised for the first time a claim that the term "test wells" in the 1986 Order refers to exploratory wells and, consequently, the enclave policy does not limit them from drilling development wells. Yates Final SOR at 18-19; Yates Reply to BLM and IMC Resp. to Final SOR at 19-20. They also asserted that the 1986 Order allows only land which has been leased for potash to be designated as a potash enclave. Pogo Final SOR at 6; Pogo & Devon Reply to BLM and IMC Ans. to Final SOR at 10-14; Yates Reply to BLM and IMC Resp. to Final SOR at 14-18. Arguments regarding the latter claim were the primary basis of motions for partial summary judgment filed separately by Yates, Pogo, and Devon. Yates Summ. J. Brief at 1, 7-8, 11-13; Pogo Summ. J. Brief at 7-9. As noted at the outset, the motions were denied

without reaching the merits.

The Appellants' post-hearing brief restates their position that potash enclaves are limited to lands leased for potash without presenting additional arguments. See App. PH Brief at 76. In addition, they contend that the enclave maps have been "created to distinguish between those areas which would be available for competitive leasing and those areas which would be available for the issuance of a prospecting permit for potash" and as "lease maps * * * could not properly be used to deny Appellants' APDs". Id. at 114; see App. PH Reply at 17-18. This claim concerns testimony by Donald Van Sickle, the BLM geologist who was responsible for preparing a series of potash enclave maps issued in 1974, 1975, and 1979, and, after he retired, an additional map in 1984. Based upon his testimony, the Appellants argue that the 1984 map "cannot properly be considered an enclave map." Id. at 116-17.

The Appellants also point out that Gary Hutchinson, a mining engineer with experience in mineral economics who testified for them at the hearing, used information available to BLM to prepare maps of potash ore zones which show "that mining will not occur in the area of Appellants' APDs." App. PH Brief at 117. These maps, the Appellants contend, were based upon each mine's "actual experience":

> Each mine has differing technological and economic standards. Each mine produces from different depths, some use specialized mining equipment; each uses different mining methods; each has its own economic and technological parameters for acceptable degrees of insolubles and contaminants; each mine has different economic cut off grades; each mine has different processing and milling capabilities; and each mine has its own markets, customers and transportation methods.

Id. at 118. The Appellants argue that the "existing technology and economics" language of the 1986 Order requires that potash enclaves be identified based upon such facts. Id. They charge that, instead of designating enclaves based upon current economics, "BLM has utilized twenty-five year old lease standards and attempted to state that those lease standards reflect existing economics." Id. at 122. They argue that, consequently, BLM's maps do not properly identify potash enclaves and that "BLM abused its discretion in denying Appellants' APDs either in whole or in part on the grounds that the APDs were located within measured ore as reflected on BLM's maps." Id. at 123. Ultimately, the Appellants claim that none of the maps the USGS and BLM have prepared and relied upon over the years has complied with the definition of potash enclaves provided by the 1975 and 1986 Orders. App. PH Reply Brief at 17-18, 53, 55, 68-69. Instead, they maintain, "the 1986 Order required precisely the methodology utilized by Mr. Hutchinson." App. PH Brief at 123.

The arguments the Appellants raised in their briefs supporting their motions for summary judgment will be addressed in the next five subsections, along with related arguments in other briefs. The next section will respond to their arguments regarding the term "test wells." The section after that will address the various issues the Appellants have raised concerning the origin of BLM's standards for designating potash enclaves in support

of their claim that the USGS and BLM have failed to prepare potash enclave maps as called for by the 1975 and 1986 Orders. Following resolution of the Appellants' general arguments about potash enclaves, this decision will turn to more technical issues about the designation of potash enclaves. Hutchinson's testimony will be described, his testimony and the Appellants' arguments about the proper designation of potash enclaves will be addressed, and the question whether the standards continue to identify potash ore "in sufficient thickness and quality to be mineable under existing technology and economics" will be considered.

III. B. Lands Leased for Potash

III. B.1 The Oil and Gas Lease Stipulations

Prior to reviewing the specific arguments the Appellants raise in their motions for partial summary judgment, it will be helpful to address several related claims they make about the first two oil and gas lease stipulations. In its current form, the first stipulation provides:

> Drilling for oil and gas shall be permitted only in the event that the lessee establishes to the satisfaction of the authorized officer, Bureau of Land Management, that such drilling will not interfere with the mining and recovery of potash deposits, or the interest of the United States will best be served by permitting such drilling.

Appendix A, § III.A.1 After quoting the essential language of the stipulation from the 1975 Order, the Appellants assert:

> The Order thus recognizes that wells could be drilled in the Oil-Potash Area as long as they did not interfere with the mining and recovery of potash deposits. Of course the existence of a Federal potash lease was a prerequisite to the mining and recovery of potash deposits. The logical conclusion from the lease stipulation is that drilling may proceed in areas unleased for potash.

Yates Summ. J. Brief at 7. Although not framed as an argument about potash enclaves, the Appellants' "logical conclusion" that "drilling may proceed" on land unleased for potash has the same result as limiting potash enclaves to land leased for potash. In either case, the enclave policy would not apply to require denial of their APD's.

Like their attempts to construe the "concurrent operations" provision of the 1986 Order and the potash lease stipulation in a manner that would require approval of their APD's, the Appellants' claim that "drilling may proceed" would convert the first oil and gas lease stipulation into an affirmative basis for approving their APD's. The stipulation, however, does not say that wells may be drilled so long as they do not interfere with potash mining, but requires BLM to deny approval of an APD when the lessee does not establish that "drilling will not interfere with the mining and recovery of potash deposits," unless it determines that drilling would best serve the interest of the United States. Not

only does the stipulation address “potash deposits” rather than potash leases, [27/] a finding by BLM that drilling a particular well would not "interfere," as stated in the first stipulation, would not constitute a determination that the APD satisfies the other three oil and gas lease stipulations or other portions of the Order so that "drilling may proceed."

The Appellants have also attempted to construe the "interest of the United States" provision of the first oil and gas lease stipulation as a mandate that drilling "shall be allowed" when it is in the national interest, which, of course, they believe is the case with their APD's. App. Prelim. SOR at 51 ; Yates Final SOR at 22-25; App. PH Brief at 78-83; see App. PH Reply at 126-27, 137 ("any of the other conditions may give way to the best interest of the United States"); Pogo Response to Int. Sur-Reply at 11-12. Their assertions overlook the wording of the stipulation. Rather than imposing an affirmative obligation on BLM to allow drilling, the stipulation requires the lessee to satisfy BLM that "drilling will not interfere with the mining and recovery of potash deposits." As phrased in the stipulation, the question whether drilling would best serve the interest of the United States arises only when the applicant either concedes that "such drilling" will "interfere with the mining and recovery of potash deposits," or fails to show that drilling will not interfere. In such a case, the stipulation allows the lessee the alternative of establishing that the interest of the United States would be best served by allowing drilling. There is no language in the stipulation suggesting that a finding by BLM that drilling would serve the interest of the United States overrides the other stipulations or other portions of the Order so that "drilling may proceed." Rather, it allows BLM to permit "such drilling," which, in context, refers to drilling that will "interfere with the mining and recovery of potash deposits."

The Appellants' "logical conclusion" that the first stipulation allows drilling on land unleased for potash derives from an erroneous assumption that the phrase "the mining and recovery of potash deposits" refers to operations which are underway, or at least planned, at the time an APD is filed or reviewed. Based upon the assumption, they infer that "of course" a potash lease must have been issued. The first oil and gas lease stipulation, however, does not refer to either current mining operations or leased land. In contrast, a portion of the second oil and gas lease stipulation prohibits not only drilling which would "unduly interfere" with mining operations but also those which would "constitute a hazard to or unduly interfere with mining operations being conducted for the extraction of potash deposits." Appendix A, § III.A.2 [emphasis supplied]. Likewise, the fourth stipulation not only allows BLM to prescribe requirements "as necessary to prevent the infiltration of oil, gas or water into formations containing potash deposits," but also allows imposing requirements to prevent infiltration "into mines or workings being utilized in the extraction of such deposits." Id. § III.A.4 [emphasis supplied].

Thus, while the fourth stipulation and a portion of the second address mining operations underway at the time an APD is reviewed, the first stipulation, contrary to the Appellants' claims, addresses whether drilling, and the consequent well, will "interfere

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[27/] The Appellants' assertion that the stipulations do not allow BLM to protect potash deposits is addressed in subsection II.E.1 supra.

with the mining and recovery of potash deposits" which may occur at a later time regardless of whether the land has been leased for potash. As a practical matter, a proposed well has the potential to interfere with future mining operations because a federal oil and gas lease is issued for a term of years and so long thereafter "as oil or gas is produced in paying quantities" and the lease term may be extended by a variety of other events. 30 U.S.C. § 226(e) (1994); see 1 Law of Federal Oil and Gas Leases, §§ 9.02[1], 14.05-14.14 (1999). Whether a well will in fact "interfere," depends, of course, upon a variety of factors, including whether there is a potash deposit in the vicinity of the well, the extent to which the well will physically preclude or limit operations to mine the potash, whether it will do so in conjunction with other wells in the area, whether mining operations are likely to occur during the life of the well, and whether mining operations may be conducted after the well has finished producing.

The Appellants also misconstrue the second oil and gas lease stipulation. It states:

> No wells shall be drilled for oil or gas at a location which, in the opinion of the authorized officer, would result in undue waste of potash deposits or constitute a hazard to or unduly interfere with mining operations being conducted for the extraction of potash deposits.

Appendix A, § III.A.2 In discussing the "methodology for processing APD's" they believe the 1986 Order requires, [28/] the Appellants combine language from the first and second stipulations to assert:

> where an area is unleased for potash, any determination by BLM that drilling would interfere with the mining and recovery of potash deposits or constitute an undue waste or hazard or unduly interfere with mining operations being conducted for the extraction of potash would be entirely speculative and hypothetical. If an area is unleased for potash, necessarily, there are no plans to mine the area, the mining company has made no investment and expended no capital in the area, and there would be a complete absence of facts to support a determination that an actual interference, an actual waste, or an actual hazard would result from drilling operations.

App. PH Brief at 76. The Appellants claim that BLM must "have more than a hunch that an area may be mined some day" and "[t]here must be sufficient articulable facts to show a rational basis for a determination of undue waste, undue interference, and hazard in an area which is unleased for potash." Id. at 76-77. However, they believe "that absent a particularly unique circumstance (which is certainly not present in this case) such a finding would be unsupportable in an area which is unleased for potash." Id. at 77.

[28/] The Appellants' "methodology for processing APD's" is quoted in subsection I.B supra. As previously noted, their methodology is at odds with their subsequent claims that the oil and gas lease stipulations apply only to resolve conflicts between operations.

The Appellants misconstrue the phrase "mining operations being conducted for the extraction of potash deposits" in the second stipulation to apply to the entire stipulation. [29/] They overlook the fact that "or" appears three times. The first use makes the stipulation applicable to either "oil or gas" drilling. The second "or" separates the requirement that BLM determine whether drilling "would result in undue waste of potash deposits" from the remainder of the stipulation. The third "or" links the parallel terms "constitute a hazard to" and "unduly interfere with." While the syntax would allow the Appellants to legitimately argue that a proposed well cannot pose "a hazard to or unduly interfere with mining operations" which are not currently "being conducted for the extraction of potash deposits," it does not allow them to claim that the potential for a well to cause an "undue waste of potash deposits" also depends upon the presence of mining operations. Instead, like the question whether drilling will "interfere with the mining and recovery of potash deposits" under the first stipulation, the determination whether drilling may "result in undue waste" depends, as an initial matter, upon whether there are "potash deposits" in the vicinity of the proposed well.

In addition to assuming that the stipulations refer to current or planned mining operations, the Appellants' assertions that "drilling may proceed in areas unleased for potash" and that it would be "speculative and hypothetical" to prohibit drilling on unleased lands err in treating a proposed wellsite as the only "area" of concern. Potash leases and oil and gas leases are not necessarily issued for coextensive areas. When leases have been issued for both minerals in a portion of the Potash Area, the areas leased may overlap, lie adjacent to each other, or be separated by some distance. The factual questions whether a proposed well will "interfere with the mining and recovery of potash deposits," "result in undue waste of potash deposits," or "constitute a hazard to or unduly interfere with mining operations" does not depend upon whether the proposed wellsite is on land which has been leased for potash, but upon the proximity of the well to a potash deposit or a mining operation.

Ultimately, the Appellants' attempts to interpret the first two oil and gas lease stipulations has an inherent weakness. Although their "methodology for processing APD's"

[29/] An issue arose about the scope of the phrase "mining operations being conducted." When Monte Jordan was asked about his understanding of it, he initially explained that he relied upon his "professional staff to tell me what it meant." Jordan: 2588. When further pressed, Jordan explained that "mining operations runs a gamut from exploration, core drilling, mapping, to actual -- you know, driving your shafts, doing whatever you're doing, producing it, hauling it, the whole thing." Id. When again asked about the phrase, he stated that to him there was "no difference * * * if you're planning to do it or you're doing your core drilling, or whatever, it's part of the same thing." Jordan: 2589. The Appellants' witness, Gary Hutchinson, was asked about Jordan's testimony and stated that he disagreed with it because, if the approximately 2000 core holes in the Potash Area "were a determination of mining operations, there wouldn't be any oil and gas drilling allowed anywhere within the KPLA." Hutchinson: 7880-81. The witnesses were addressing different matters. The activity of drilling a core hole can be considered to be a "mining operation," but once drilled the physical presence of a core hole is no longer an activity "being conducted for the extraction of potash deposits."

provides that, in areas unleased for potash, BLM reviews an APD "pursuant to the oil and gas lease stipulations" the consequence of their assertion that any determination not to allow drilling on land which has not been leased for potash would be "speculative and hypothetical" precludes any basis upon which to deny approval of an APD under the two stipulations except when, as the Appellants state, there is a "particularly unique circumstance." It would be unreasonable to believe that the stipulations were drafted so narrowly as to preclude denying approval of an APD in any but the rarest of circumstances. Nor is there any reason to believe that the two stipulations were understood and administered in such a manner either prior to the addition of the potash enclave provisions in 1975 or at any time prior to the present controversy.

The wording of both stipulations derives from the 1951 Order. In 1951, the first stipulation referred to geology, not whether the land had been leased for potash or whether mining operations were underway. It stated:

> No wells will be drilled for oil or gas in formations above the base of the Delaware sand, or above a depth of 5,000 feet, whichever is the lesser, except upon approval of the Director of the Geological Survey, it being understood that drilling for production to these formations will be permitted only in the event that it is satisfactorily established that such drilling will not interfere with the mining and recovery of potash deposits or the interest of the United States would best be subserved thereby.

16 FR 10,669 (Oct. 18, 1951), YP 218. The depth restriction was removed when the Order was revised in 1965, but the essential language was retained:

> No wells will be drilled for oil or gas except upon approval of the Regional Oil and Gas Supervisor of the Geological Survey, it being understood that drilling will be permitted only in the event that it is satisfactorily established that such drilling will not interfere with the mining and recovery of potash deposits, or the interest of the United States would best be subserved thereby.

30 FR 6692 (May 15, 1965), YP 228. Removal of the depth limitation expanded the application of the stipulation by making all wells subject to the limitation that "drilling will not interfere with the mining and recovery of potash deposits" rather than only those targeted at formations above the base of the Delaware or a depth of 5,000 feet. [30/] The

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[30/] The Appellants incorrectly describe the 1965 Order as having "removed the depth limitations on unitization." App. PH Reply at 82. In contrast to the first stipulation of the 1951 Order which generally prohibited wells above the stated depth, the second stipulation prohibited drilling:

> in formations below the base of the Delaware sand, or below a depth of 5,000 feet, whichever is the lesser, except pursuant to a unit plan approved by the Director of the Geological Survey, unless drilling is otherwise required or approved by the Director to protect the lease from drainage.

16 FR 10,669 (Oct. 18, 1951), YP 218. The 1965 Order did not simply "remove" the reference to

change does not provide a basis upon which to infer that the first stipulation was thereby limited to either lands with mining operations or those leased for potash. The only change made to the first stipulation in 1975 was to redelegate authority to the Area Oil and Gas Supervisor. 40 FR 51,486 (Nov. 5, 1975); YP242. In 1986, the stipulation was given its current form. Because its essential language remains unchanged from 1951, it continues to apply to all "[d]rilling for oil and gas."

The wording of the second stipulation is unchanged from what was the third stipulation of the 1951 Order, except that "will" became "shall" and the decision-making authority was redesignated. Compare 16 FR 10,669 (Oct. 18, 1951), YP 218 with Appendix A, § III.A.2. Neither change allows a conclusion that the application of the stipulation was changed. In 1951, the stipulation did not have a depth limitation, but, as in the 1986 Order, provided that "[n]o wells" could be drilled that "would result in undue waste of potash deposits or constitute a hazard to or unduly interfere with mining operations being conducted for the extraction of potash deposits." 16 FR 10,669 (Oct. 18, 1951), YP 218. While, as discussed, the second portion of the stipulation refers to mining operations, the prohibition of "undue waste of potash deposits" does not.

III. B.2 Leases Which Are Then Held

The Appellants' primary argument in claiming that enclaves are limited to lands leased for potash is based upon the requirement of the 1975 and 1986 Orders that a potash lessee annually file maps showing active and completed mining operations and mineable reserves "with respect to the Federal Potash leases which are then held." Appendix A, § III.D.1; see Yates Summ. J. Brief at 7, 11; Pogo Summ. J. Brief at 8. They point out that the 1986 Order provides that BLM "shall review the information submitted in this regard and make any revisions in the boundaries of the proposed mineable reserves (potash enclaves) which are consistent with the data available at the time of such analyses." Appendix A, § III.D. They understand that, "[o]nce the potash lessee has designated proposed enclaves, the 1986 Order, like the 1975 Order, requires BLM to revise the information and commit it to a map." Yates Summ. J. Brief at 12; Pogo Summ. J. Brief at 8. They contend that "[t]he designation of an area as an enclave is necessarily limited to areas of federal potash leases which are then held." Pogo Summ. J. Brief at 8; see Yates Summ. J. Brief at 7-8; Yates Reply to Resp. to Summ. J. at 2 ("in order to be designated an

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depth, but replaced the stipulation with a new stipulation which, as in the 1986 Order, provided that unitization could be required when "necessary for orderly oil and gas development and proper protection of potash deposits." 30 FR 6692 (May 15, 1965), YP 228. The new stipulation appears to have derived from a different portion of the 1951 Order, omitted in the 1965 Order, which mandated unitization upon the discovery "of any oil or gas pool or field * * * unless it is shown * * * that independent operation will not jeopardize maximum economic recovery of the natural resources of the area." 16 FR 10,669 (Oct. 18, 1951), YP 218. Elimination of the second stipulation of the 1951 Order may have resulted in a problem because in 1975 an additional provision was added making unitization "mandatory in those cases where completion of the proposed well as a producer would result in the drainage of oil and gas from beneath other Federal lands within a potash enclave." 40 FR 51486, 51487 (Nov. 5, 1975).

enclave, the area must show on a map submitted by [a] potash lessee"); Oral Argument on Summary Judgment Motions at 20. Thus, the Appellants believe that BLM's task is simply to verify and modify the boundaries of potash enclaves identified on the maps submitted by potash lessees within the boundaries of their leases. See Pogo & Devon Reply to BLM and Int. Answers to Final SOR at 9, 12; Yates Reply to BLM and Int. Resp. to Final SOR at 16. [31/]

In making these claims, the Appellants overlook the division of the "Mineable Reserves" section of the 1975 and 1986 Orders into paragraphs and several differences in the language used to describe the responsibilities of potash lessees and BLM. The initial paragraph containing the phrase "with respect to the Federal potash leases which are then held" on which the Appellants rely is numbered "1." Four paragraphs identified as "a" through "d" describe the kinds of areas a potash lessee is to identify, including in paragraph "c," areas "which are considered to contain a minable reserve." Thus, as the Appellants correctly understand, the Order indicates that a potash lessee is to identify and map the area within its "leases which are then held" which it "considers" to contain mineable reserves based upon information it has about the potash deposit and the "technology and economics" of its mining operations. The Appellants fail, however, to note that in calling on BLM to "review the information submitted" neither the 1975 Order nor the 1986 Order has required a potash lessee to provide BLM with any "information" other than the map or maps on which have been "delineated" the areas described in paragraphs "a" through "d." As further discussed below, a February 14, 1974, memorandum from the Chief of the Conservation Division to the Director of the USGS, which was submitted to the Secretary of the Interior for approval, included text that became the potash enclave provisions of the 1975 Order. YP 239, YP 240. It included a sentence stating: "The potash lessee will be responsible for submitting sufficient data to justify any area which is proposed as a mineable reserve." YP 239 at 3. The sentence was eliminated when the text of the 1975 Order was approved for publication in the Federal Register a year and a half later. YP 241. Consequently, the 1975 and 1986 Orders cannot be construed to have limited the USGS and BLM to reviewing the information a potash lessee used to identify the boundaries of potash enclaves and determining whether it correctly interpreted that information. Instead, the Order directs BLM to "make any revisions in the boundaries of the proposed mineable reserves (potash enclaves) which are consistent with the data available at the time of such analyses." The Order instructs BLM to identify potash enclaves "consistent with" its own available data.

BLM's responsibility cannot be satisfied by merely confirming or modifying the potash enclave boundaries identified by a potash lessee. Its "available data" would include any information provided by any of the potash lessees and, perhaps more significantly, the body of data about the Potash Area which the USGS and BLM have accumulated over the years. Presumably, that data would include relevant information about areas adjacent to and near a leased parcel that would be relevant in evaluating the quantity and quality of

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[31/] The Appellants' argument and the response in this decision concern interpretation of the 1986 Order rather than the method actually used by the USGS and later BLM to develop potash enclave maps because potash lessees did not file maps identifying areas of potash enclave within their leases.

potash within the leased area. If the information were to indicate that a qualifying potash deposit extends beyond the leased area, the "revisions in the boundaries" of potash enclaves required by the Order would necessarily place those boundaries beyond the leased lands. It would not be consistent with the data to arbitrarily draw the potash enclave boundary coincident with the lease boundary.

BLM's broader responsibility to identify potash enclaves based upon its own data is confirmed by the next sentence of the Order which both instructs it to "commit the initial findings to a map(s) of suitable scale" and requires that it "thereafter revise that map(s) as necessary to reflect the latest available information." The obligation is independent of the requirement that potash lessees file maps of potash enclaves.

The same expectation that BLM would develop a potash enclave map based upon its available data can be found in the 1983 Directive which instructed BLM to update the 1979 enclave map "to reflect the most current data available." YP 249 at RP 006305. The accompanying Instructions explained that the map would be updated "[s]o that the BLM, the potash industry, and the oil and gas industry [will] have the most current data available to make decisions concerning operations within the Potash Area * * *." YP249 at RP 006306. Although the Directive also told BLM to "require potash mining operators to submit three-year mine plans annually to assist in the establishment of drilling islands," it did not instruct BLM to require them to file potash enclave maps in order to provide "the most current data available." YP 249 at RP 006305. To the contrary, the Directive and Instructions seem to presume that BLM already had "the most current data available" and would be able to prepare the new potash enclave map based upon that data.

The Appellants argue that the Instruction's restriction on three-year development plans to "areas with respect to which the operator holds existing potash leases" supports a similar limitation on potash enclaves. Yates Summ. J. Brief at 9, quoting YP 249 at RP006308. The Directive, however, calls for development plans for the purpose of establishing drilling islands rather than potash enclaves. Like the 1975 Order, the 1986 Order prohibits establishing a drilling island "within one mile of any area where approved mining operations will be conducted within three years" and allows BLM to "require affected potash mining operators to furnish a three-year mining plan." Appendix A, § III.E.b. Because mining operations occur on leased land, the designation of drilling islands is restricted only near land which has been leased for potash. If, however, the Appellants are correct that potash enclaves are limited to land leased for potash, there would be no need to limit mining plans to leased land. The area outside of a lease could not be designated as potash enclave and, because drilling islands are within potash enclaves, there could not be a drilling island outside of leased areas. It would not matter whether a potash lessee included an area outside of its lease in its development plan because it would not effect the location of drilling islands.

Perhaps the most significant deficiency in the Appellants' assertion that the 1975 and 1986 Orders limit potash enclaves to lands leased for potash is the absence of any evidence that either the USGS or BLM has ever understood the potash enclave provisions of the 1975 and 1986 Orders to include such a limitation. Every potash enclave map issued since 1974 has identified potash enclaves throughout the Potash Area regardless of

whether or not the land was leased for potash. See Melton: 1543-44, 1574-75. Indeed, the maps have not identified areas which have been leased for potash except indirectly in portraying the location of mine workings. Nor have the maps identified potash enclaves using the straight lines which define subdivisions of the public land survey and potash lease boundaries, as would be the case in at least some areas if potash enclaves were limited to areas leased for potash. See 43 CFR 3501.1.

While it is possible that USGS geologists and other personnel misunderstood the 1974 memorandum and the 1975 Order and mistakenly identified potash enclaves for unleased lands, the corresponding notion that the Departmental officials who drafted, reviewed, and approved the 1975 Order and were responsible for assuring that it was properly administered never noticed and corrected the error it is not credible. There is no evidence that any Secretary, Director of the USGS, Director of BLM, or other Departmental official has ever pointed out that a potash enclave map was improperly prepared because it was not limited to "leases which are then held." Nor has any official ever stated that the Orders do not allow unleased lands to be included in potash enclaves. See Melton: 1475; Cherry: 3069; Van Sickle: 7079-80; Cone: 11180. Accordingly, there is no basis upon which to conclude that the 1986 Order restricts BLM to identifying potash enclaves within "leases which are then held."

III. B.3. The Referral Order

The Appellants claim that the IBLA recognized "that the existence of a federal potassium lease is a prerequisite to the proper establishment of an enclave" when it referred their appeals for a hearing. Yates Summ. J. Brief at 13. This assertion is based upon the presence of a prepositional phrase in the Board's statement that the case presents an issue:

> whether the APD's encompass lands within areas qualifying as potash enclaves under the parameters established by section 3.III.D.1.c. of the Order, i.e., whether the lands are currently unmined areas within Federal potash leases "where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics" * * *.

Yates Summ. J. Brief at 14, and Pogo Summ. J. Brief at 11, quoting Yates Petroleum Corp. et al., 131 IBLA at 235 [emphasis by Appellants].

There are three difficulties with the Appellants' reliance on the emphasized phrase. First, in their briefs before the IBLA the Appellants neither asserted that potash enclaves are limited to lands which have been leased for potash nor relied upon arguments that their proposed well sites were on lands unleased for potash. Rather, they repeatedly claimed that their proposed wells were far from any area where mining was likely to occur and that, in any event, production would be completed and the wells plugged and abandoned before mining began. As described above, their primary contention was that the standards BLM had relied upon to designate potash enclaves on the 1984 map did not accurately identify areas of "sufficient thickness and quality to be mineable under present day technology and economics" and they questioned the validity of the data BLM had

relied upon and its mapping method. The Appellants did not expressly argue that the 1986 Order limits potash enclaves to land which has been leased for potash until filing their final statements of reasons prior to the hearing and they have primarily addressed the matter in their briefs in support of their motions for partial summary judgment. Consequently, there is no reason to believe that the prepositional phrase represents a ruling on the issue.

Second, it is extremely unlikely that the IBLA intended the phrase to constitute an interpretation of a key provision of the 1986 Order when it did not acknowledge any issue related to it. Limiting potash enclaves to lands leased for potash would significantly restrict the acreage eligible for inclusion. There were relatively few potash lessees operating within the Potash Area and, at the time, each lessee was limited to holding 51,200 acres in leases and permits. 43 CFR 3530.3, amended 64 FR 53512, 53543 (Oct. 1, 1999). The result of limiting potash enclaves to land leased for potash would be that the Departmental policy to "deny approval of most applications for permits to drill oil and gas test wells" within potash enclaves could apply to only a portion of the approximately 497,000 acre Potash Area. Whatever the merits of the Appellants' other arguments that potash enclaves are limited to land leased for potash, the appearance of the phrase "within Federal potash leases" cannot be regarded as a ruling on an issue of significant consequence for administration of the Potash Area.

Third, the Appellants' claim that the IBLA has already resolved the issue seems inconsistent with footnote 5 of the referral order which states:

> We note that appellants argue that some of the denied APD's sought to drill wells on lands unleased for potash at the time the APD was filed and that some of the appealed decisions suggest that BLM equated potash enclaves with life of mine reserves submitted by potash lessees, which submissions identified both leased and unleased potash deposits. To the extent that the evidence establishes either of these assertions, the Administrative Law Judge should explore the propriety of BLM's actions under the 1986 Order.

Yates Petroleum Corp. et al., 131 IBLA at 236 n.5. If the phrase "within Federal potash leases" was a ruling that potash enclaves are limited to lands leased for potash, there would have been little need for a hearing to determine "whether the APD's encompass lands within areas qualifying as potash enclaves." Id. at 235. That question could have been answered for almost all of the APD's at issue by directing BLM to look at its record of current potash leases to determine whether any proposed drill sites were on land which had not been leased for potash. The question of "propriety" to explore is whether the 1986 Order allows such APD's to be denied. As the Appellants otherwise recognize, footnote 5 directs this tribunal to address the issue. App. PH Brief at 196; App. PH Reply at 96; see Pogo & Devon Reply Supp. Summ. J. at 4; Pogo & Devon Reply to BLM and Int. Answers to Final SOR at 10-11; Yates Reply to BLM and Int. Resp. to Final SOR at 14-15; Pogo & Devon Resp. to Int. Motion for Summ. J. at 5.

III. B.4 Belco and Bass

As stated in reviewing the applicable law, the parties disagree about the effect the decisions in Belco Petroleum Corp., 42 IBLA 150 (1979), and Bass Enterprises Production Co., 48 IBLA 11 (1980), aff'd sub nom. Bass Enterprises Production Co. v. Watt, Civ. No. 80-431-C (D.N.M. June 29, 1982), have upon the designation of potash enclaves. BLM contends that the decisions establish a definition of "enclave" which is not limited to land leased for potash. BLM Resp. to Summ. J. at 7. The Intervenors rely upon Belco's recognition that the potash enclave policy provides a "preference for potash operations" to argue that the decisions recognize that potash enclaves may include unleased land. IMC Resp. to App. Prelim. SOR at. 18; Int. Opp'n to Summ. J. at 12-15; Int. Reply Supp. Summ. J. at 8-10; Int. Answer to Final SOR at 19. The Appellants have variously argued that the two decisions were predicated on findings that the lands at issue had been properly designated as an enclave (App. Reply to IMC Resp. to Prelim. SOR at 7-8; Pogo & Devon Reply to BLM and Int. Answers to Final SOR at 11), that they may not be good law after issuance of the 1983 Directive and Instructions (Yates Reply to Responses to Summ. J. at 15), that they address only the question whether the applicants qualified under the exceptions for barren areas and drilling islands within potash enclaves and should be reconsidered in regard to lands outside of mining operations (App. PH Brief at 196-98; Pogo Final SOR at 32-34), and that neither decision decided the issue (App. PH Reply at 95-96).

Review of the two decisions discloses that, although the Board treated the 1975 Order as allowing potash enclaves to include land not leased for potash, neither decision indicates that an issue about the propriety of including such land had been raised by the parties or was recognized by the Board. Absent any express finding, the decisions cannot be regarded as resolving the issue.

In Belco, the Area Oil and Gas Supervisor denied approval of an APD because drilling "would result in undue waste of commercial potash deposits," but indicated that the USGS might approve an APD for directional drilling from an adjoining section. Belco Petroleum Corp., supra, at 151. The Acting Director of the USGS affirmed, finding that neither of the exceptions for barren areas and drilling islands applied. Id. at 152. On appeal, Belco did not challenge the Director's findings regarding the exceptions, but argued that the Area Supervisor had improperly refused to approve the APD based upon suppositions "that a potash lease would issue in the future and that undue waste would be caused to such lease by Belco's drilling." Id.

Quoting the enclave policy, the IBLA stated that the Order "discloses a decided preference for potash operations." Id. at 153. It described potash enclaves as "those presently unmined areas which are considered to contain a mineable reserve in one or more zones" and concluded that "[t]he fact that an area is presently unmined does not deny it the preference accorded active mines." Id.. In responding to Belco's claim that the land was not leased for potash, the Board noted that the record showed that a competitive potash lease application had been submitted prior to the Area Supervisor's decision and also included statements by the Area Geologist and Area Mining Supervisor supporting a finding that potash reserves existed "in the proposed drilling area in mineable thickness and grade." Id. The Board held that, "in light of this Department's preference for potash development in a designated Potash Area, * * * the Director's decision properly followed

the Secretarial order and, therefore, was neither unreasonable, arbitrary, nor an abuse of discretion." Id.

While it is clear that Belco applied the preference for potash operations to land which had not been leased for potash, the basis on which it did so is not obvious. Although the Board stated that it was reviewing the Director's decision, Belco had not disputed the Director's finding that it did not qualify under the exceptions. Consequently, there is no reason to believe that Belco argued that its drilling site was not within a potash enclave, let alone that the potash enclave improperly included land not leased for potash. Indeed, the decision does not state whether the land at issue was within a designated potash enclave.

Instead, Belco challenged the Area Supervisor's reliance on a future potash lease and his finding of "undue waste," a term used in the second oil and gas lease stipulation. The Board's term "presently unmined" in its response appears to be taken from the 1975 Order which required potash lessees to submit a map of "presently unmined areas which are considered to contain a mineable reserve" (changed in the 1986 Order to "areas that are not presently being mined"). YP 242, 40 Fed. Reg. 51486, 51487 (Nov. 5, 1975). If so, its statement that "presently unmined" land is not denied the "preference accorded active mines" simply reflects the wording of the Order and was made without considering whether, as the Appellants have argued, the Order required the "unmined" land also to be within a potash lease. Belco Petroleum Corp., supra at 153. The Board's agreement that the land contained a "minable reserve" was based upon statements in the record by the area geologist and mining supervisor rather than the formal designation of the land as a potash enclave. The earlier of the two statements has the same date as the Area Supervisor's decision. Finally, the absence of any issue regarding the proper designation of potash enclaves is indicated by the confused description of a "preference for potash development in a designated Potash Area," rather than a "potash enclave," used in the Board's holding. Id.

In Bass the IBLA again upheld decisions by the Director of the USGS affirming decisions to deny approval of two APD's because drilling would result in undue waste of potash deposits and, in one case, would constitute a hazard to future mining operations. Bass Enterprises Production Co., supra, at 12. The Director affirmed because the wellsites were within a potash enclave and the enclave policy applied. Id. The Board pointed out that the 1975 Order:

> clearly states that it is Departmental policy to deny approval of applications to drill oil and gas tests from surface locations within "potash enclaves" in the designated potash area, that is, areas where potash ore is known to exist in sufficient thickness and quality to be mineable under present day technology and economics, subject to two specific exceptions. USGS properly denies a permit to drill where the applicant for a permit to drill a well from within a potash enclave fails to show that its application comes within either of these exceptions.

Id. at 13-14. [32/] Identifying the two proposed well sites as within the "Potash Area," the Board turned to the question whether they were within a "potash enclave" and concluded that a "memorandum with supporting maps and tables based on drilling data from two other wells previously drilled" in the same section "supports the conclusion that these sites are located in an area meeting the criteria for a potash enclave and Bass has shown nothing to the contrary." Id. at 14. The Board also found the information to show that neither of the exceptions applied. Id.

Like Belco, the result in Bass seems to be based upon the fact the record showed the land to contain mineable potash rather than any determination about the propriety of including unleased land in a potash enclave. The Board's decision does not mention whether the proposed wellsites had been leased for potash, but they seem not to have been. See Bass Enterprises Production Co. v. Watt, supra, at 2 (the objections to approving the APD's were brought by "potash mining companies owning leases within a one mile radius of the proposed wells"). While the omission could be construed to indicate that the Board did not regard the issuance of a potash lease to be a controlling factor in designating potash enclaves, more likely it simply reflects the fact that no issue about the status of the land and the proper designation of potash enclaves had been raised on appeal. In addition, the decision upholds the Director's holding that the sites were within a "potash enclave" based upon a memorandum and "supporting maps and tables" pertaining to two wells drilled in the same section without mentioning whether the land had been identified as within a potash enclave prior to the Director's decision. Id. at 12, 14; cf. Bass Enterprises Production Co. v. Watt, supra, at 4-5 (upholding the finding that the well sites were within potash enclaves). Thus, like Belco, the decision does not appear to address any issue about the proper designation of potash enclaves under the terms of the 1975 Order.

III. B.5 The 1974 Guidelines

In responding to the Appellants' arguments that potash enclaves are limited to land leased for potash, BLM and the Intervenors have relied upon a sentence in a 1974 memorandum stating that the USGS Area Geologist would "prepare the data required * * *

[32/] The quoted passage ends by citing Belco. The citation is not to the text of the Belco decision but to its headnote which apparently refers to the fact that the Director of the USGS had "found that Belco was covered by neither exception." Belco Petroleum Corp., supra, at 152. Belco, however, did not challenge that finding on appeal and, as discussed above, the Board upheld the Director's decision because "unmined" land is not denied the "preference accorded active mines" and the geologists' statements supported a finding that the land contained a "minable reserve." In addition, the Board rejected Belco's second argument which was based upon the potash lease stipulation. See id. at 153. It stated that Belco had not presented any facts showing that a well could not be directionally drilled or that doing so was not economically feasible and "[t]hus, it cannot be said that the potential potash production has unreasonably interfered with Belco's operations." Id. at 154 [emphasis in original]. There seems to be little relationship between Belco's headnote and the matters discussed in the opinion. Bass, however, has essentially the same headnote and in that case the Board determined that neither exception applied.

for unleased Federal lands in the Secretary's Potash Area" (YP 238 at 2, BLMCO17425) to justify including unleased lands in potash enclaves. BLM Response to Summ. J. at 8-9; Int. Opp'n to Summ. J. at 16-18. The Intervenors requested a ruling on the provision in their motion for partial summary judgment. Int. Motion Summ. J. at 8-10. Conversely, the Appellants have argued that the omission of the sentence when the 1975 Order was published in the Federal Register, 40 FR 51,486 (Nov. 5, 1975), as well as its omission from the 1986 Order, indicate that a decision was made not to include unleased land in potash enclaves. Pogo & Devon Reply Supp. Summ. J. at 4; Yates Reply to Responses to Summ. J. at 13; Pogo & Devon Response to Int. Motion for Summ. J. at 7-8; Yates Response to Int. Motion for Summ. J. at 6; Pogo & Devon Reply to BLM and Int. Answers to Final SOR at 13-14.

The resolution of the issue lies in the history of the enclave section added by the 1975 Order. As the parties discuss and document, due to controversies between oil and gas and potash companies the USGS initiated a review of its administration of the Potash Area by inviting both the oil and gas and potash industries to submit position papers. See YP 234, YP 235; INT 21, BLMCO17341. The Deputy Oil and Gas Supervisor and the Mining Supervisor for the Rocky Mountain Area submitted a joint review of the position paper by the Potash Committee of the New Mexico Mining Association and the previously quoted May 2, 1973 letter from Charles E. Hinkle to the Chief of the Conservation Division along with copies of those documents. YP 236. The Central Region Conservation Manager submitted additional comments. YP 237.

The term "enclave" was first used by the Acting Chief of the Conservation Division in a December 7, 1973, memorandum forwarding the joint review and comments to the Director of the USGS YP 238, INT 14. The Chief made a number of recommendations which became part of the 1975 Order, including that the Department "reaffirm its position that [the] Secretarial Order of May 11, 1965, adequately protects the rights of the oil and gas and potash industries." YP 238 at 2, BLMCO17425. He also recommended that each potash lessee be required to file by July 1, 1974, a map or maps showing, "with respect to the Federal potash leases which it then holds," areas of active and completed mining operations, and:

> c. The presently unmined areas which are considered to be a mineable reserve, i.e., those areas where potash ore is known to exist in sufficient thickness and quality to be mineable under present day technology and economics.
>
> d. The areas within the postulated mineable reserve which are believed to be barren of commercial ore.

YP 238 at 2, BLMCO17425. The Chief further proposed that "[t]he Area Geologist, in consultation with the Mining Supervisor, will prepare the data required in subparts c. and d. above for unleased Federal lands in the Secretary's Potash Area." YP 238 at 2, BLMCO17425. He then stated:

> The potash lessee will be responsible for submitting sufficient data

> to support any area which he proposes as a mineable reserve. The Area Geologist, in consultation with the Mining Supervisor, will review the information furnished in this regard and make any revision in the boundary of a proposed mineable reserve which is considered to be consistent with the data available at the time of the analysis.

YP238 at 2, BLMCO17425. Thus, he proposed both that potash lessees would provide data supporting the potash enclaves identified on their maps and that the USGS would map potash enclaves for unleased lands.

Although the Chief did not use the term "enclave" in describing mineable reserves, he used it in his third recommendation that:

> After July 1, 1974, it will be departmental policy to deny oil and gas drilling operations within the "potash enclaves" established in accordance with Item 4 hereof, except in those barren areas within a reserve where the mining supervisor determines that oil and gas drilling operations would not adversely affect present mining operations. Thus, an oil and gas operator wishing to test the oil and gas potential of a lease within a reserve will, in most cases, be required to drill a directional hole from a surface location outside the enclave. However, if the areal extent of any enclave is such that present technology precludes the drilling of a directional well from outside the enclave to test a remote interior lease and there are no barren areas in the enclave from which the drilling can occur, the Mining Supervisor will, in consultation with the Oil and Gas Supervisor, establish an island within the enclave from which drilling of that well and subsequent wells will be permitted. * * *

YP238 at 3, BLMCO17426 [emphasis supplied]. The reference to "Item 4" was clearly a mistake. Although the Chief's fourth recommendation used the term "enclave," it did not define a method for establishing an enclave but called for mandatory unitization when "completion of the proposed well as a producer would result in drainage of oil and gas from beneath other Federal lands within a potash enclave." YP238 at 3, BLMCO17426. [33/]

By memorandum dated February 15, 1974, the Director of the USGS forwarded a revised version of the Chief's memorandum to the Secretary, stating that, if he concurred in the recommendations, "the Conservation Division will prepare the necessary implementation papers." YP 240, INT 17. The revised memorandum explained that the December 7, 1973, memorandum had been reviewed by the Director, the Assistant

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[33/] The record does not indicate the origin of the error. The Conservation Manager's fourth recommendation to the Chief had been that potash lessees be required to provide geological information and mining plans showing that a proposed oil and gas well would "[p]enetrate a potash deposit of sufficient thickness and quality to be considered a mineable reserve within the next 25 years." YP 237 at 2-3, BLMCO17409-10. A previous draft of the Chief's memorandum may have addressed potash enclaves in "Item 4" but was replaced by the second recommendation that potash lessees submit maps.

Secretary for Energy and Minerals, and "representatives" of the New Mexico oil and gas and potash industries and that position papers had been received and a meeting had been held in Albuquerque, New Mexico. YP 239 at 2, BLMC017383, INT 17 at 2, BLMC017394. [34/] Although the memorandum describes the meeting as "very productive" and states that it "disclosed the need for revision of some segments of the proposed procedures," the recommendations which follow differ little from those of the December 7, 1973, memorandum. Id. Of particular interest, however, the term "enclaves" was added in parentheses to the requirement that a potash lessee submit a map of mineable reserves (as in the 1986 Order) and it was substituted for "the postulated minable reserve" in describing the requirement to identify barren areas. YP 239 at 3, BLMC017384, INT 17 at 3, BLMC017395. Both the provision that potash lessees would submit data to support proposed mineable reserves and the statement that the Area Geologist would prepare data for unleased Federal lands were unchanged, although "(potash enclave)" was added to the requirement that the Area Geologist revise "the boundary of a proposed minable reserve." Id. The reference to "Item 4" was corrected. Id.

On March 1, 1974, Acting Secretary John C. Whitaker signed a statement that "adoption of the recommendations * * * would be in the public interest and authority to proceed as recommended is hereby granted." YP 240 at 2, INT 16, 17, and 18, BLMCO17388.

By memorandum dated July 10, 1975, the USGS Director sent the Secretary "a proposed revision" of the 1965 Order. INT 21, BLMCO17341. The Director reminded the Secretary that "several significant controversies between the oil and gas and potash industries" had prompted "a full review of departmental policy with respect to operations in the Potash Area" culminating in "the Under Secretary's approval to issue certain recommended new guidelines to field personnel." Id. He stated that a copy of the guidelines was enclosed and that "the proposed Order also includes pertinent portions of these guidelines." Id. The draft Order omitted both the requirement that potash lessees would submit "sufficient data to justify any area which is proposed as a minable reserve" and the provision that the Area Geologist would prepare data for unleased Federal lands. Acting Secretary Kent Frizzell approved the draft on October 7, 1975, and it was published in the Federal Register on November 5, 1975.

The record provides no documentation of any meeting or other review of the guidelines between March 1, 1974, and July 10, 1975, or of the proposed Order between the latter date and October 7, 1975. Consequently, there is no indication of the reasons the two sentences were dropped from the Order. On their face, the two omissions have incongruous implications.

As the Appellants argue, omission of the provision that the Area Geologist would prepare data for unleased Federal lands can be construed as indicating that a decision was

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[34/] As cited, the Appellants' exhibit YP 239 bears different record numbers than the Intervenors' exhibit, INT 17. The latter bears a March 11, 1974, date stamp showing that it was received by the USGS in Carlsbad, New Mexico. The date stamp identifies the authoritative copy of the memorandum; however, the text of the two exhibits is identical.

made not to identify potash enclaves for those lands but only for lands leased for potash. If the sentence was eliminated for that reason, however, it made no sense to also eliminate the requirement that potash lessees provide the USGS with the data they had used to identify potash enclaves. That data would have provided the "information" necessary for the USGS to understand, review, and revise the potash enclave boundaries identified by each potash lessee. Without it, the Area Geologist would not know the standards of thickness and quality used by the lessee, what the lessee understood to be meant by "existing technology," and the economic factors which the lessee had applied. The USGS would not know the reasons the lessee "considered" the area "to contain a minable reserve." It would be able to review the proposed boundary lines on the map submitted by the lessee only after defining its own standards for the thickness and quality of potash, determining what it considered to be the "existing technology," and deciding upon what it regarded as the relevant economic factors. If, however, the sentence requiring potash lessees to submit “data” was omitted in order to compel the USGS to develop and rely upon its own standards as well as its own "data available at the time," there was no reason for the Order to require potash lessees to submit, and the USGS to review, maps of potash enclaves. It could have more simply and clearly directed the USGS Area Geologist to prepare the data and identify on maps the areas of potash enclave within Federal lands leased for potash.

As indicated, omission of the requirement that potash lessees provide supporting data suggests that a decision was made that the information was not needed because the USGS would identify and rely upon its own standards for identifying potash enclaves. In particular, that it would establish its own standards of “thickness and quality,” determine what it considered to be the “existing technology,” and decide upon the relevant economic factors. One benefit of such an approach is that potash enclaves could be identified and established on a uniform basis throughout the Potash Area. It would also eliminate the work of reviewing and evaluating the various factors and differing methods of analysis that each potash lessee might use to identify what it "considered" to be a mineable reserve. If the requirement to provide data was eliminated in order to implement this approach, however, it seems inconsistent to have also eliminated the provision that the Area Geologist would prepare data for unleased Federal land. Geology does not respect lease boundaries, and information about the geologic formations and extent of potash underlying unleased lands surrounding a leased area would be needed to evaluate the "thickness and quality" of potash present within the lease. In addition, once the USGS completed the initial work of identifying the thickness and quality of potash “minable under present day technology and economics,” application of the standards based upon the “data available” would not depend upon whether the land had been leased for potash but upon the geologic facts. If the purpose had been to limit potash enclaves to areas which had been leased for potash, the sentence about unleased Federal land could have been modified to state that the area geologist would prepare the data and identify potash enclaves within lands which had been leased for potash.

The most plausible explanation is that the two sentences were omitted because both had become unnecessary. As will be discussed in greater detail, more than a year before the USGS Director sent the revised Order to the Secretary, the Acting Secretary had approved the guidelines and authorized the USGS "to proceed as recommended." YP 240,

INT 17. The Chief of the Conservation Division then issued a memorandum advising that his recommendations had been approved and should be implemented and, in turn, the Central Region Conservation Manager instructed personnel in New Mexico that the "revised operating instructions should be adopted immediately." INT 18. The Area Geologist, Donald M. Van Sickle, then issued a document titled "Guidelines for map showing Potash Enclaves (Measured and Indicated Potash Reserves)" which adopted the numerical standards of 4 feet of 10% K_2O as sylvite or 4 feet of 4% K_2O as langbeinite, or equivalent combination of the two, delineated by at least three data points no more than 1 ½ miles apart, as the minimum thickness and quality needed to identify a potash enclave. YP 565, INT 19. Using its available data, the USGS had prepared and issued the 1974 potash enclave map. YP 565, INT 19; Melton: 1436. Thus, there was no need for the Order to state that the Area Geologist would "prepare the data required * * * for unleased Federal lands in the Secretary's Potash Area." It had already been done. [35/] Nor was there a reason to require potash lessees to provide data to support the areas they identified as potash enclave within their leased lands. The potash enclave map had already been drawn. Whatever the reasons the Acting Chief of the Conservation Division had for including the two sentences in his December 7, 1973, recommendations, neither sentence served any purpose by the time the Director of the USGS sent the Secretary "pertinent" portions of the guidelines on July 10, 1975.

III. C. "Test Wells"

As has been stated, the 1975 Order included for the first time an "enclave policy" which declared: "It will be departmental policy to deny approval of most applications for permits to drill oil and gas tests from surface locations within the potash enclaves established in accordance with Part D, item 1 hereof." 40 Fed. Reg. 51486, 51487 (Nov. 5, 1975) [emphasis supplied]. The 1986 Order modified the wording to state that "[i]t is the policy of the Department of the Interior to deny approval of most applications for permits to drill oil and gas test wells * * *." Appendix A, § III.E.1 [emphasis supplied]. The effect of the policy is to limit drilling within potash enclaves to the "exceptions" for barren areas and designated drilling islands.

The Appellants contend that the terms "tests" and "test wells" refer to exploratory wells and that the Orders thereby incorporate the oil and gas industry's distinction between exploratory and development wells. App. PH Brief at 3, 48, 70-71, 113-14; Yates Final SOR at 18-19. Consequently, they believe that the enclave policy applies only to exploratory wells and does not limit development wells within potash enclaves to sites within barren areas and drilling islands. See Yates Final SOR at 19. Because the Appellants understand that almost all of their APD's are for development wells, with only a few unspecified wells perhaps qualifying as exploratory wells, they contend that the enclave policy does not apply to the APD's at issue and cannot require their denial. App. PH Brief at 72, 114; Pogo Response to Int. Sur-Reply at 14; see Cooper: 295, 344-46 (all

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[35/] The effect of publishing the Order in the Federal Register was not to instruct USGS personnel as to the actions they were to take, but to notify oil and gas and potash lessees of matters that would affect them. See 5 U.S.C. §552 (1994).

Pogo APD's for development wells); Tr. 775-77; Patterson: 790, 793, 836-38, 841-44.

Similar to other arguments which have been addressed, the Appellants base their claim on documents which led to adoption of the 1975 Order. In particular, they maintain that the enclave policy derives from recommendations made in the position paper submitted by the potash industry which sought to prevent or limit oil and gas drilling in potash reserves. App. PH Brief at 62-63, 69-70; App. PH Reply at 86-88. They also claim that use of a distinction between test and development wells in administering the Potash Area dates back to Order R-111 issued by the New Mexico Oil Conservation Commission (NMOCC) in 1951. App. PH Brief at 3, 18, 65-66; App. PH Reply at 76-78, 136. They argue that documents related to the development of that Order, which they have appended to their post-hearing brief, reveal "that all participants in the oil-potash area understood the distinction between exploratory test well drilling and development drilling and production, and that no party intended or contemplated that mining would be allowed to interfere with or disrupt oil and gas development." App. PH Brief at 66. [36/]

On the surface, the Appellants' position is plausible. It relies upon a distinction which appears to be widely recognized within the oil and gas industry. As explained at the hearing:

> a wildcat or an exploratory well would be one that typically is drilled to an objective, where there's, in a general sense, no nearby production from that particular horizon, which would, by nature, have more risk associated with it.

Cooper: 345; see Patterson: 493, 829-30; May: 4695-98; Fant: 5692-93. In contrast, "a development well would be considered to be a well with a very high probability of success, one which you would expect would produce." Cooper: 344; May: 4695; Hoose: 5692. Likewise, a leading treatise on oil and gas law defines "test hole or well" as "[a]n exploratory well drilled to determine whether a particular horizon will be productive of minerals." 8 Williams & Meyers, Oil and Gas Law at 1101 (1998) (YP 350); see YP 196. The issue in this proceeding, however, is not the meaning of terms used within the oil and gas industry but the meaning of the terms "oil and gas tests" and "test wells" in the 1975

[36/] The Appellants' represent that the documents they have attached to their brief come from files maintained by the New Mexico Oil Conservation Division and request this tribunal to take judicial notice of them. App. PH Brief at 19; see 43 CFR 4.24(b). While the Intervenors do not wholly oppose consideration of the documents, they have pointed out that the Appellants' post-hearing brief does not identify any specific portions of them as supporting their claims and requested in their post hearing brief an opportunity to respond if the Appellants were to make specific claims. Int. PH Brief at 151, n.46. Because the Appellants' Reply brief provides some citations to the documents (while continuing to make other assertions without specific citation), the Intervenors have renewed their request. Int. Motion to file Sur-Reply at 4. For reasons discussed in the next subsection, the Appellants' request to admit the documents to the official hearing record is denied, although the documents will remain within the record of proceedings as an attachment to their brief. Correspondingly, the Intervenors' request for an opportunity to address the documents is denied.

and 1986 Orders.

The issue can be resolved based upon documents prepared by Departmental officials in developing the enclave section which appeared in the 1975 Order and other uses of "test" in the 1975 and 1986 Orders. Prior to doing so, it is necessary to respond to the Appellants' claims that "test" was first used in relation to the Potash Area in the NMOCC's Order R-111 and that the enclave policy derives from the potash industry's position paper. In addition, the term was the subject of testimony at the hearing which will be reviewed in order to address several evidentiary disputes which have arisen among the parties.

III. C.1 Documents the Appellants Rely Upon

Assuming that use of a term in a document issued by the State of New Mexico in 1951 is relevant to understanding the Secretary's 1975 and 1986 Orders, there are two problems with the Appellants' argument regarding the NMOCC's Order R-111 (YP 219). First, to the extent the Appellants rely upon the documents from the NMOCC's files, they fail to analyze specific portions of them in support of their assertions. In effect, the Appellants claim that we know "tests" was used in the 1975 Order to refer to exploratory wells because "exploratory test well" was used in Order R-111 to refer to exploratory wells, and we know "exploratory test well" was used in Order R-111 to refer to exploratory wells because "test" was used in the NMOCC proceedings to refer to exploratory wells. It may be the case that the term "test" was used in the 1951 proceedings to refer to exploratory wells, but the question is whether it was used to refer to only exploratory wells and, if so, whether "all participants" understood this use of the term as the Appellants assert. Assuming the point could be established from the documents, the Appellants' further claim that the usage was incorporated into the term "exploratory test well" in Order R-111 requires an analysis of the use of "test" in the NMOCC documents in the context of the issues being discussed and manner in which "exploratory test well" in Order R-111 addresses those issues. Once such an analysis established the basis of the use of "exploratory test well" in Order R-111, the question of the relation between it and "tests" in the 1975 Order could be considered. The Appellants have made assertions about the NMOCC documents but have not offered any reason to adopt their understanding of them.

Second, the Appellants' assertion that the Order R-111 "plainly distinguished between `test wells' and `development wells'" is not persuasive. App. PH Brief at 18, 65-66; App. PH Reply at 76; Yates Response to IMC Sur-Reply at 59. Although "exploratory test wells" appears frequently in Order R-111, the term "development well" is not used and the word "development" appears only once in the initial finding that "the promulgation of rules and regulations for the orderly development of oil and gas resources in such an area known to be productive of potash" was within the NMOCC's authority. YP 219 at 1. Otherwise, Order R-111 refers simply to "wells." Although "exploratory test wells" clearly associates "test" with "exploratory," equating the two words makes the term redundant. The Appellants offer no explanation as to why the NMOCC would use such terminology not just once but seven times. App. PH Reply at 77; see YP 219 §§ III(1)(a), III(1)(c), III(2)(a), IV(1), IV(3)(b)(i), and IV(4)(a).

Order R-111 does not define "exploratory test wells" and there is no need to rule upon its meaning in this decision. It is sufficient that the phrase cannot bear the narrow meaning the Appellants assign it. In capital letters Order R-111 defines itself as providing "the rules and regulations governing the exploration and production of oil and gas." YP 219 at 1. If "exploration and production" does not encompasses both "test" and development wells and the Appellants are correct, the NMOCC issued a thirteen page order prohibiting further drilling of exploratory wells in areas where potash mining operations were in progress, but allowed development wells to be drilled without regard for ongoing mining operations. See YP 219 §§ II(1)(b), III(1)(b). It is not reasonable to believe that the NMOCC decided that it was necessary to prohibit owners of outstanding oil and gas leases from drilling exploratory wells "through any open potash mines or within 1,320 feet thereof unless agreed to in writing by the potash lessee involved," but saw no need to restrict development wells from being drilled through active mining operations. See YP 219 § III(1)(a); App. PH Brief at 58. Nor is it plausible that the NMOCC developed and promulgated detailed casing requirements for "the drilling of oil and gas exploratory test wells" which applied to exploratory wells but that the NMOCC either did not consider requirements for casing for development wells or did not think that casing was needed. See YP 219 § IV(1). [37/]

To the contrary, the Appellants recognize that Order R-111 "provided a drilling and casing program for all wells to be drilled within the potash area." App. PH Brief at 59; see App. PH Reply at 77 ("drilling and casing of oil and gas wells in the Secretary's Area"). Likewise, they seem to accept that the notice and protest procedures defined under the title "Locations for Test Wells" which required that potash lessees be notified "[b]efore drilling for oil or gas" applied to both exploratory and development wells. YP 219 § VII. Their understanding of these provisions is consistent with the Order's statement that its rules "are applicable to oil and gas operations and to exploration for and production of oil and gas." YP-219 § II(1). Their understanding that "tests" refers only to exploratory wells is not. Perhaps most telling, the Appellants have not suggested or attempted to show that the NMOCC administered the "exploratory test well" provisions of Order R-111 in a manner which recognized that they applied only to exploratory wells.

The right of a potash lessee under Order R-111 to receive notice of all proposed wells and to protest all oil and gas drilling within its lease seems to have been confirmed

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[37/] At times the Appellants refer to R-111's provision that "[u]pon the discovery hereafter of oil and gas" the NMOCC "shall promulgate field or pool rules for the affected area" as supporting a distinction between "test" and development wells. YP 219, §III(3); see App. PH Reply at 78-80, 136-37. The title of section III is "Exploration of areas." Thus, the Appellants correctly understand that Order R-111 contemplates that drilling an "exploratory test well" could result in a discovery of oil or gas. In going further to equate "exploratory test well" with "test well," as they understand the term, the Appellants imply that a development well cannot also "discover" oil or gas. Whatever the use of the term "discovery" within the oil and gas industry, "pool rules" address matters such as well spacing and production and it seems highly unlikely that they would specify such matters as casing requirements and the distance of wells from mining operations. See 6 Williams & Meyers, Oil and Gas Law, ch. 9 (1999).

by its 1955 revision (R-111-A) which retitled "Locations for Test Wells" as "Locations for Wells." YP 220, § VII. Although most instances of the term "exploratory test wells" were eliminated, Order R-111-A continued to use it in defining shallow and deep zones and identifying casing requirements. YP 220 §§ IV(1), IV(3(b)(i), IV(4)(a). A new sentence, however, clarified that "[a]ll drilling of oil and gas wells in the Potash Area shall be subject to these Rules and Regulations." YP 220 § III(1); see YP 221. The Appellants do not claim that the 1955 revisions significantly changed the scope of Order R-111 by including development wells for the first time. Correspondingly, there is no reason to believe that "exploratory test wells" in Order R-111 referred only to exploratory wells.

The Appellants also point to a protest filed by Kermac Potash Co. objecting to "a wildcat oil well" and a 1967 memorandum by the regional mining supervisor referring to the well as an "oil and gas test" and an "oil test." YP 229, YP 230. They believe that Kermac's letter "acknowledged that the proposed well was a wildcat or exploratory well" and that the "memo is important because it showed that not only was the mining and oil and gas industry using the word `test' in the context of a wildcat well, but that the agency understood the term." App. PH Brief at 26. These claims misrepresent the documents. Kermac's letter refers to the proposed well as a "wildcat" but neither uses the word "test" nor describes the well as "exploratory." Consequently, it does not show that Kermac (let alone the potash mining industry) used the term "test" to refer to a wildcat well. Specifically, it does not provide a basis for finding that the company considered any of the terms to be equivalent. While the supervisor's memorandum uses "test" to refer to the "wildcat" well, and to that extent supports the Appellants' claim about BLM's use of the term, it does not establish that he understood "test" to refer only to exploratory wells and would not have used the term to refer to a development well.

Of greater importance, the Appellants claim that the use of "test" in the 1975 Order originated with the previously discussed 1973 position paper "Waste of Potash Resulting From Drilling Through Known Potash Deposits" submitted to the Department by the New Mexico Potash Industry and the Potash Committee of the New Mexico Mining Association. App. PH Brief at 3, 31-33, 62-63, 69-70, 113-14; App. PH Reply at 14-16, 86-88. In particular, they quote the portions which state that "potash deposits as well as mines should be protected from exploratory wells for oil and gas," and that "[a] wildcat well cannot be considered orderly development and production" and should not be allowed to "penetrate a delineated, proven potash ore reserve," and the recommendation that the Department should "[d]isallow any wildcat location that would penetrate a delineated, proven potash ore reserve." App. PH Brief at 31-32, quoting YP235, INT 10 at BLMCO42172, BLMCO42180 and BLMCO42167; App. PH Reply at 86-87; Yates Response to Int. Sur-Reply at 66. The Appellants claim:

> The potash industry proposed an exception to the present policy in order to address a particular situation, namely, the situation where a wildcat location was proposed in a proven delineated potash reserve. Ultimately, that proposal was accepted and inserted as the test well portion of the 1975 Order. The paper confirms that the test well portion of the 1975 and 1986 Orders was designed to address the concerns by the potash industry of exploratory drilling in delineated proven potash ore reserves, and that the

> test well portion of the 1975 and 1986 Orders is unrelated to orderly development and production.

App. PH Brief at 32-33; see id. at 70 (the "recommendation was incorporated in the 1975 Order as the test well portion of the Order"); App. PH Reply at 136 (the Secretary responded to the potash industry "seeking to prevent exploratory drilling through its proven delineated commercial reserves").

As pointed out in discussing the Appellants' reliance on the potash industry's position paper to support their "maxim" of "first in time to develop, first in right," the document they discuss is not the position paper itself but a report included as an exhibit. See YP 235, INT 10 at BLMC042164. They correctly identify the question the report addresses, but wrongly attribute it to the position paper:

> Should prospecting for oil and gas be conducted in or through potash-bearing land without satisfactorily establishing that such drilling would not interfere with the mining and recovery of potash deposits or cause undue waste of potash or constitute a hazard.

App. PH Brief at 69, quoting YP235 at BLMC042166. The Appellants are correct that the report can be read to recognize a distinction between exploration and development. The report, however, uses the term "wildcat" and never "test." Consequently, even assuming that it influenced the specific content of the enclave section in the 1975 Order, it is not a clear basis upon which to conclude that the Order used "test" to refer only to exploratory wells.

The Appellants attempt to strengthen their reliance upon the report by incorrectly portraying the potash industry as concerned only about exploratory wells. They quote a portion of the report which states:

> It seems quite clear, in both the Federal Order and the State Order, that deposits of oil and gas, as well as deposits of potash, should be protected and not interfered with by exploration for the other. Both Orders refer to the orderly development and production of oil and gas and not the exploration for oil and gas. It seems clear that potash deposits as well as mines should be protected from exploratory wells for gas and oil.

YP 235 at BLMCO42172. The Appellants then assert:

> The Potash Industry clearly distinguished between oil and gas development and exploration, recognizing that the lease stipulations allowed for orderly development and production of oil and gas and that the lease stipulations did not deal with exploration for oil and gas. The Potash Industry sought a provision that would protect potash deposits from exploratory wells for gas and oil.

App. PH Reply at 86 [emphasis in original].

Although the Appellants are correct that the passage they quote from the report distinguishes between oil and gas exploration and development and refers to the potash lease stipulation, it does not state that "the lease stipulations" do not apply to exploration for oil and gas. The Appellants' description entails two errors. First, they incorrectly read "both orders" as referring to "the lease stipulations in the 1951 and 1965 Orders." App. PH Brief at 31. As the initial quoted sentence of the report makes clear, "both" refers back to "the Federal Order and the State Order." YP 235 at BLMCO42172. As the portion of the paragraph preceding the quoted passage makes clear, those orders are the Secretary's 1951 Order and the NMOCC's Order R-111. Id. The relevant provisions of those documents are the NMOCC's finding that it had authority to set rules "for the orderly development of oil and gas resources" and the portion of the potash lease stipulation regarding "orderly development and production under any oil or gas lease." YP 218 at 1; YP 219 at 1. Thus, the point the report makes is that the Orders clearly provided for and allowed orderly oil and gas development but did not affirmatively refer to and allow exploration for oil and gas.

Second, the Appellants err in construing the report's broad statement that the Orders do not "refer to" exploration for oil and gas to mean that the "potash industry" understood that the oil and gas lease stipulations do not "deal with," i.e. apply to limit, oil and gas exploration. Arguably, both the report and the Appellants are correct that the potash lease stipulation does not “deal with” oil and gas exploration because it uses the words "orderly development and production." If so, however, the consequence is that the stipulation does not limit mining operations for the purpose of allowing exploratory drilling under an oil and gas lease "issued for the same lands" as a potash lease. The report could not have been making the same inference about the oil and gas lease stipulations because it was discussing the Secretary's 1951 Order and the NMOCC's Order R-111. In 1951, the oil and gas lease stipulations did not include the term "orderly development and production." See YP 218. Rather than "recognizing" that "the [oil and gas] lease stipulations * * * did not deal with exploration for oil and gas," as the Appellants seem to contend, the report noted that the Secretary's 1951 Order had allowed oil and gas leasing "with stipulations that drilling would not be permitted if it would result in undue waste or result in a hazard to any of the potash deposits." YP 235 at BLMCO42172. Instead of construing the absence of an express mention of exploration in the oil and gas lease stipulations to mean that exploration was not limited by them, the report regarded the lack of explicit language allowing oil and gas exploration to mean that a provision limiting exploratory drilling to protect potash deposits would be consistent with, if not called for, by the language of the Orders.

The report may reflect a special concern the potash industry had about exploratory wells, but it was not that the 1951 Order, and the 1965 Order, failed to provide limits on exploratory wells. To the contrary, it recommended that "[p]resent regulations should remain in effect" and that "wildcat" wells be allowed "when the well will not penetrate a valuable potash deposit" and disallowed when it "would penetrate a delineated, proven potash ore reserve." YP 235 at BLMCO42167. Thus, the Appellants wrongly construe the report to argue that a new provision was needed to protect potash deposits from exploratory drilling because the prior Orders did not do so. Consequently, the report is not a basis on which to conclude that "tests" in the 1975 Order means only exploratory

wells.

The position paper itself indicates that the potash industry sought a much broader goal than limiting exploratory drilling. Its outline identifies the subject to be addressed as the "Waste of potash resulting from drilling through known potash deposits." YP235, INT 10 at BLMC042097. The paper states at the outset:

> This report presents the position of the New Mexico potash industry concerning the problems associated with oil and gas drilling in the Secretary's potash area. It urges that rules be promulgated prohibiting either [sic] exploratory or development drilling through any known potash deposit.

YP 235, INT 10 at 1, BLMCO42100. Throughout the paper it is clear that the industry was concerned about drilling without regard to whether the wells were exploratory or developmental. Ultimately the paper concludes: "Drilling through known potash deposits with its resultant waste of potash must continue to be prevented." YP 235, INT 10 at 14, BLMC042118. To the extent the Appellants are correct that the enclave section was added in the 1975 Order in response to the potash industry's position paper, the proper inference is that the enclave policy prohibits drilling through all potash deposits which qualify as potash enclaves without regard for whether drilling would interfere with mining those deposits, result in their undue waste, or constitute a hazard to or unduly interfere with mining operations under the first and second oil and gas lease stipulations. In this regard, "oil and gas tests" must be construed to refer to both exploratory and development wells. [38/]

III. C.2 Relevant Testimony

Testimony by witnesses does not control legal interpretation of provisions of the 1975 and 1986 Orders, but the understanding of terminology described by BLM personnel and their experience in administering the Potash Area is relevant and requires consideration. Reviewing their testimony will also allow discussing several documents and lead to resolution of a confusion which has arisen in arguments on the "test well" issue.

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[38]/ The Appellants have pointed to a variety of other documents to find a distinction between test wells and development wells. See App. PH Reply at 104; App. Resp. to IMC Sur-Reply at 59-60; Pogo Resp. to Int. Sur-Reply at 16. In some instances, they assume that "test" is used to refer to an exploratory well. See, e.g., YP 240 ("oil and gas tests"). In others, the language used to distinguish between exploratory and development wells has no obvious bearing upon the issue of whether the 1986 Order distinguishes between "test" and development wells. See YP 330 at 4 (casing design for development and exploratory wells); 57 FR 32756, 32758 (July 23, 1992) (YP 416) (Onshore Oil and Gas Order No. 1 defining "development well" and "exploratory well"); 53 FR 46798, 46805 (Nov. 18, 1988) (YP 417) (Onshore Oil and Gas Order No. 2 using "wildcat exploratory well and defining "exploratory well"); 55 FR 48958, 48969 (Nov. 23, 1990) (YP 418) (Onshore Oil and Gas Order No. 6 defining "exploratory well"). "Test well" in the model unit agreement form for unproven areas appears to mean an exploratory well but is not a regulatory definition. See 43 CFR 3186.1, para. 9 (YP 333).

Although questioning at the hearing and discussion of the testimony had been frequently framed in terms of whether the USGS and BLM distinguished between exploratory wells and development wells, the issue is not whether agency personnel conceptually understood the distinction but whether they understood it to be part of the enclave policy of the 1975 and 1986 Orders.

When asked about the meaning of "oil and gas test," Wayne Melton, a BLM geologist who began working in Roswell in 1977, stated that "[t]o me personally, every well is a test" and repeated that "to me personally, in my experience, every well you drill is a test, unless you're God and know it's there." Melton: 1144, 1174, 1380-82. He also testified that he did not "remember having any discussion about using test versus test well" when the 1986 Order was drafted and that, in his experience, BLM does not make any distinction among type of wells. Melton: 1433, 1521-22, 1575, 1580.

Armando Lopez, who was assistant district manager for minerals during 1992-93 and later worked for BLM as a petroleum engineer (Lopez: 1661-62), agreed that in his experience BLM did not use the definition of "test well" the Appellants advocate, but rather: "We've used -- anytime that they drill the well, regardless of whether it's exploratory, development, we've always used that as test well, interchangeably used with exploratory or -- we didn't differentiate between exploratory and development." Lopez: 1693, 1734, 1814.

Tony Herrell, a geologist who began working for BLM in Carlsbad in 1988 and at one time was head of the solid minerals section, also understood that "test wells is basically any oil and gas well." Herrell: 1868, 1875, 2137, 2862. He testified that BLM staff members, including geologists and mine engineers, had internal discussions about the term "test wells" which had occurred "off and on from 1990 through today." Herrell: 1881. When asked whether they had come to any conclusion, he stated:

> What we thought, it uses test wells in the Order, and then it uses holes, and I think it has exploratory and production wells. We thought that test wells -- and we did talk to some of the people in the oil and gas shop, too, and in the Bureau, too. And it was kind of everybody's consensus that it just meant any well. You know, any oil and gas well.

Herrell: 1881, 2272-73. In his experience, BLM had not distinguished between exploration and development wells in reviewing APD's, although the type of well may have been indicated on the application. Herrell: 2463, 3704, 3931.

Richard Manus, who became the Carlsbad Area Manager in June of 1987, did not remember there having been any specific discussion about the use of the term "test wells" in the Order. Manus: 4380, 4573.

Leslie Cone also understood "test wells" in the 1986 Order to refer to both exploratory and development wells, although she acknowledged that her understanding of the term was acquired from the other BLM personnel. Cone: 10731, 11014, 11023, 11172-73. She also understood that the oil and gas industry distinguished between

exploratory and development wells, but considered the issue of the use of "test" in the Secretarial Orders to have arisen only during the course of this litigation. Cone: 10731-32, 10780-81, 11012-13.

The Appellants rely upon testimony by Francis Cherry, who served as the Roswell District Manager from February 1985 to September 1991. Cherry: 3006; App. PH Reply at 93. During redirect examination, he agreed that the use of the terms "oil and gas well," "well for oil and gas," and "well" in portions of the 1986 Order and the subsequent use of the term "drill oil and gas test wells" in the enclave policy would lead him "to conclude that there is a distinction between oil and/or gas well [sic] and an oil and/or gas test well under the '86 Order." Cherry: 3211-12. His agreement, however, is of little consequence. Recognition that the Order uses several different terms does not in itself establish their meanings. Taken at face value, Cherry did not agree that a "test well" is an exploratory well but that an "oil and/or gas test well" is distinct from an "oil and/or gas well" in some unspecified respect. His testimony must also be considered in light of his statements during direct examination that he was not familiar with the term “development wells” until it was explained to him, could not address the use of the term “tests” in a document, could not “reconcile the use of the term ‘oil or gas test’ with an exploratory or wildcat well,” and did not understand the meaning of the term "test wells." Cherry: 3035-36, 3039, 3055, 3070. In addition, he testified that in reviewing APD's BLM was not concerned with whether the proposed well was a development, wildcat, or exploratory well. Cherry: 3059, 3113, 3131, 3286. In this regard, his testimony was consistent with that of the other witnesses and, like them, indicates that the USGS and BLM never understood that "tests" in the 1975 Order and "test wells" in the 1986 Order were terms limited to exploratory wells.

The Appellants also claim that their distinction between test and development wells appears in a May 22, 1985, memorandum from Cherry to the State Director. They quote a portion which states:

> Most controversies stem from applications to drill oil and gas tests in the area and the real or perceived impact the well will have on the potash lessee. The same is true for the effects of potash operations on development of existing oil and gas fields within the area.

YP 255, Int. 362 at BLMCO17194-95. As the Appellant's maintain, "tests" can be read to refer to exploratory wells, but it could equally refer to both exploratory and development wells. The Appellants contrast "test" with "development" in the second sentence, but the latter sentence is concerned with "the effects of potash operations" on oil and gas development. See App. PH Reply at 100. What it refers to as the "same" is that controversies also arise due to the potential impact of oil and gas operations on the development of potash. Presumably, those controversies do not depend upon whether the oil and gas well is exploratory or developmental. Cherry's next sentence identifies the same scope: "The granting or denial of these locations reaches further than just operational conflicts * * *." YP 255 at BLMCO17195.

In broader context, "test" in Cherry's memorandum clearly refers to all wells. See

Melton: 1573; Cherry: 3039. It reviewed the steps BLM had taken to comply with the 1983 Directive and Instructions. The sentence preceding those quoted by the Appellants expressed Cherry's view that "more specific decision criteria is [sic] needed to adequately evaluate applications and ensure fair and consistent policy implementation." YP 255 at BLMCO17194. The proposed "Criteria for Processing APD's in the Secretary's Potash Area" he provided the State Director do not depend upon whether a proposed well is exploratory or developmental. YP 255 at BLMCO17197-98. Significantly, his criteria are drawn from the 1975 Order. He first proposed that "If [the] location is within one mile of mine workings or one mile of the approved three year mine plan the APD will be denied." YP 255 at BLMCO17197. The distances are those limiting the location of drilling islands for "oil and gas tests." Appendix A, § III.E.b. He also drew upon the portion of the Order that calls for routine approval of some applications to offer a criterion that "If [the] proposed APD is not enclave or within 1/4 mile for oil test or ½ mile for gas test from enclave approve APD." YP 255 at BLMCO17197. These criteria reflect an understanding that "test" in the 1975 Order was not limited to exploratory wells.

Van Sickle, the BLM geologist who was responsible for preparing the potash enclave maps, appeared as a witness for the Appellants. A controversy has developed about a map titled "Map Showing Oil & Gas Well Tests in the Potash Area." INT 428. The original version had been prepared at the same time as the 1974 potash enclave map, but the version included in the record includes information from 1979. Van Sickle: 6946, 6948. Van Sickle explained that the map had been prepared by a draftsman in Roswell "where all the oil and gas records are kept," including "individual well record books, a sheet of paper for every well drilled." Van Sickle: 7072. He did not know, however, where the term "well tests" in the title had originated. Van Sickle: 6949, 6951. The Intervenors contend that the map depicts all wells in the Potash Area and, consequently, shows that the USGS considered all wells to be "test wells." Int. PH Brief at 149-50. The Appellants point out that the map's legend explains the symbols used to designate the different types of wells shown on the map and argue that it does not depict all wells as "oil and gas well tests." App. PH Reply at 90-91. One of their witnesses explained that the reference to "tests" had to do with the portion of the legend showing the geological formations which various wells had tested and pointed out that not all wells on the map had such identifying marks. Muncy: 7315-18.

At best, the map is inconclusive evidence. As explained at the hearing, one portion of its legend lists geological formations and some wells are identified by the symbolic mark for a formation. Although the Appellants understand the symbols to identify discovery wells (see App. PH Reply at 91), the legend does not say so. See Muncy: 10125-26. Nor does it appear to be the case. Two wells discussed at the hearing are identified on the map as drilled to the Bone Springs producing zone and are part of the Bell Lake Unit. INT 428; Muncy: 7316. Unless both are discovery wells, "well tests" in the map's title must include both exploratory and development wells. On the other hand, another portion of the legend shows the map to identify not only producing oil and gas wells, but also wells which had been abandoned or suspended, as well as dry holes and water wells and injection wells. While, as the Intervenors contend, this indicates that the map identifies all wells as "tests," it is also a more comprehensive use of the term and leaves unclear how "Oil & Gas Well Tests" in the title may relate to the distinction between exploratory and

development oil and gas wells.

In other respects, Van Sickle's testimony provides only minimal support for the Appellants' position. He testified that a "test well" is "a well that is drilled to test some formation at some depth that is not a development-type well" and that he had applied the distinction in relation to unit operations and classifying known geologic structures. Van Sickle: 6951-53. He did not, however, testify that the USGS had administered the enclave portion of the 1975 Order to apply only to exploratory wells. See also YP 550 at 1; YP 556 at 25. Consequently, the evidence provided by BLM personnel supports a finding that "oil and gas tests" in the 1975 Orders and "test wells" in the 1986 Order refer to both exploratory and development wells.

In addition to BLM personnel and former employees, one of the Appellants' witnesses, Brent May who worked for Yates as a petroleum geologist, discussed the use of "test." He described a "test well" as "very similar to an exploration well or a wildcat well" and explained that the New Mexico Oil Conservation Division (OCD) identifies a "wildcat or exploratory wells as any well that's more than a mile from an established pool." May: 4695. He subsequently identified definitions issued by the OCD as the basis of his description. May: 4699-700; YP 448. During cross examination, May acknowledged that the NMOCD rules used the term "wildcat" rather than "test," but stated that he considered a wildcat well to be a test well. May: 5102. On redirect, he confirmed that, as asked by counsel, "[t]he issue of test and development wells are based on the rules of the OCD which we have read into the record * * *." May: 5233. He also testified that portions of the potash industry's 1973 position paper showed that it was aware of "the distinction." May: 5236. As has been discussed, however, the paper uses the terms "exploratory wells" and "wildcat" rather than "test wells" and does not support the Appellants' position. Similarly, May's equation of the terms "test," "exploratory," and "wildcat" is not a sufficient basis to conclude that the OCD definitions incorporate the distinction advanced by the Appellants.

III. C.3 Origin of the Term "Test"

As the parties otherwise seem to agree, use of "test" in the 1975 and 1986 Orders most clearly originates in a September 6, 1973, memorandum by the Central Region Conservation Manager, George H. Horn, to the Chief of the Conservation Division. YP 237, INT 13; App. PH Brief at 34-35; Int. Reply at 149. Rejecting the arguments made in the position papers as not "particularly appropriate to the problem at hand," he stated:

> It is our opinion that at this particular time of economic difficulty on the part of the New Mexico potash industry and of critical need for oil and gas reserves development on the part of the oil and gas industry, increased emphasis has to be given to the determination as to whether "the best interests of the United States would be subserved" by the approval or disapproval of any given oil or gas test well in the oil-potash area.

YP237 at BLMCO17408 [emphasis supplied]. Horn opposed amending the 1965 Order because it "furnishes adequate protection to both industries" and recommended that the

Secretary reaffirm that Order "by stating that, after a full policy review, he has concluded there should be no change * * *." YP237 at BLMCO17409. However, Horn made a number of recommendations, including that:

> 3. Before any oil or gas test well (exploratory or otherwise) within the Known Potash Area be considered for approval or disapproval, the oil and gas lessee be required to furnish sufficient geological and geophysical evidence to convince the Area Oil and Gas Supervisor and the Area Geologist that the drilling of such well is justified. * * *
>
> 4. Before any oil or gas test well (exploratory or otherwise) within the Known Potash Area be considered for approval or disapproval, the potash lessee be required to furnish sufficient geological evidence and/or mining plans to convince the Area Mining Supervisor and the Area Geologist that the drilling of such well will:
>
> a. Penetrate a potash deposit of sufficient thickness and quality to be considered a mineable reserve within the next 25 years.
>
> b. In prospective gas areas, penetrate a potash deposit that will actually be mined within 15 years and, in prospective oil areas, a deposit that will be mined within 20 years. * * *

YP237 at BLMCO17409-410 [emphasis supplied, original emphasis omitted]. The emphasized parenthetical establish that the Conservation Manager did not regard "test well" to be restricted to exploratory wells.

Horn's three final recommendations make clear that he was quite capable of distinguishing between exploratory wells and development wells when he wished to. He recommended that the USGS announce that it would:

> a. Require directional drilling, where possible, to avoid commercial potash ore during the drilling of exploratory wells.
>
> b. Require all development drilling and producing operations to be conducted under an approved unit plan of operations.
>
> c. Require all development wells, where possible, to be directionally drilled from multi-well surface location "islands" so that one pillar could serve to support a number of wells (the same concept as that being used for development of the Prudhoe Bay field -- similar to platform drilling on the Outer Continental Shelf).

YP237 at BLMC017410 [emphasis supplied]. Thus, "tests" in the 1975 Order originates in recommendations that all "oil or gas test wells" be reviewed to determine the best interests of the United States, that all APD's be reviewed based on geological information, and that, "where possible," development wells be directionally drilled from drilling islands.

The Chief of the Conservation Division forwarded the Conservation Manager's memorandum to the Director of the USGS accompanied by a cover memorandum dated December 7, 1973. YP 238. It provides further evidence that the Appellants are mistaken. The memorandum is titled: "Drilling of oil and gas tests in the Secretary's Potash Area, southeastern New Mexico." YP 238 at BLMCO17424. In addition to the title, the Chief used the phrase "oil and gas test" three times. First, his introduction states that for Federal lands in the Potash Area, "the Area Oil and Gas Supervisor, in consultation with the Area Mining Supervisor, is charged with the responsibility of deciding which proposed oil and gas tests may be drilled." YP238, INT 14 at BLMCO17424. Because the sentence is descriptive of the supervisor's authority to approve or disapprove all wells drilled on Federal land, "tests" refers to both exploratory and development wells. See YP 228 (Regional Oil and Gas Supervisor); Melton: 1529 (by 1973 authority had been delegated to area supervisor). Second, the Chief recommended that the Department reaffirm its intent to cooperate with the NMOCC and that "potash lessees shall continue to have the right to protest to the NMOCC the drilling of a proposed oil and gas test on Federal lands." YP 238, INT 14 at BLMCO17426. As previously discussed, Order R-111-A provides that potash lessees could protest all wells, not just exploratory wells. It is unlikely that the Chief was recommending that the Department "cooperate" with the NMOCC by recognizing that potash lessees may protest only exploratory wells. The inclusion of development wells under R-111-A is confirmed by the Chief's further recommendation that "[t]he Department reassert its prerogative to make the final decision of whether to approve the drilling of any proposed oil and gas well on Federal lands within the Secretary's Potash Area." Id. at BLMCO17426 [emphasis supplied.] Third, the Chief recommended that:

> Applications for permits to vertically drill an oil or gas test at a location that is outside the State of New Mexico's Oil-Potash Area and which does not directly offset an enclave (within a quarter mile if an oil test or within one-half mile if a gas test) be routinely approved.

Id. at BLMCO17427 [emphasis supplied]. Limiting "test" to exploratory wells would largely defeat the benefit of routine approval the recommendation gave oil and gas drilling.

The Appellants quote the Chief's recommendation that it be Departmental policy to deny oil and gas drilling operations within "potash enclaves" and they emphasize portions of the subsequent sentences stating that "an oil and gas operator wishing to test the oil and gas potential of a lease within a reserve will, in most cases, be required to drill a directional hole" from outside the enclave and that, if technology precludes drilling "from outside the enclave to test a remote interior lease," the Mining Supervisor will establish a drilling island. App. PH Brief at 35-36, quoting YP238 at BLMCO17426; see App. PH Reply at 89. "Test" in these instances, however, is used as a verb, not a noun or an adjective. Many of the APD's at issue similarly state that "Yates Petroleum Corporation proposes to drill and test the Delaware and intermediate formations." YP 3 to YP 18, YP 30 to YP 52, YP 54 to YP 57, YP 76 to YP 79. Consistent with the Appellants' assertions that few of their wells are exploratory wells, the use of "test" in this manner cannot be

regarded as designating an exploratory well. See May: 4814-15, 5106-07. [39/]

Any remaining doubt that the Chief used "test" to include development wells is resolved by his further recommendation that, "to protect the equities between oil and gas lessees while at the same time reducing the number of oil and gas wells which operators propose to drill," unitization be mandatory when:

> completion of the proposed well as a producer would result in drainage of oil and gas from beneath other Federal lands within a potash enclave. In other words, unitization will be a prerequisite to the approval of any well which is (1) located adjacent to an enclave (within a quarter of a mile if an oil test or one-half mile if a gas test) and which is to be drilled vertically to the prospective formation; (2) to be directionally drilled from an adjacent surface location to bottom in a formation beneath an enclave; or (3) to be vertically or directionally drilled from a barren area or island within an enclave.

YP 238 at 3, BLMCO17426. Clearly, "oil test" and "gas test" refer to "any well." It would have been inordinately strange, if not irresponsible, for the Chief to have recommended mandatory unitization prior to drilling an exploratory well near a potash enclave but not to have recommended unitization of development wells in the same circumstances. Development wells are drilled because the operator anticipates that they will produce oil or gas and, if near an enclave, would potentially drain land within the enclave. Excluding them from mandatory unitization would be contrary to the stated purpose of "reducing the number of oil and gas wells which operators propose to drill in the Potash Area." YP 238 at 3, BLMCO17426. It appears that the Chief regarded all wells to be "test wells" and thought that the critical question was whether a well "would result in drainage of oil and gas from beneath other Federal lands within a potash enclave" if it became a producing well. Id.

As has been discussed, a revised version of the Chief's December 7, 1973, memorandum became the February 14, 1974, memorandum approved by the Acting Secretary. That memorandum retained the use of "oil and gas tests" in the title and in describing the Area Oil and Gas Supervisor's responsibility and a potash lessee's right to protest before the NMOCC, but changed the phrase to "vertical tests for oil and gas" in describing routine approval of APD's for locations outside the State's Oil-Potash Area which do not offset enclaves. YP239 at BLMCO17382, 17385. The revised memorandum also stated the enclave policy differently. Instead of "oil and gas drilling operations," the revised memorandum used the words which subsequently appeared in the 1975 Order, "applications for permits to drill oil and gas tests." YP 239 at BLMCO17384. The revised

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[39/] This use of "test" apparently refers to the practice of conducting drill stem tests or other procedures to evaluate a formation encountered during drilling. See Patterson: 887, 953-54; Melton: 1499; May: 4812-15, 5012-13; Hoose: 5380-88, 5526; Fant: 6008-11. The fact such tests are commonly conducted, suggests a reason wells could come to be generally referred to as "test wells" regardless of whether they are exploratory or development wells. See May: 5013 (Yates conducts drill stem tests on all wells); House: 5527, 5590-93.

memorandum also used "test" in stating that "[f]uture controversies as to whether to permit the drilling of an oil and gas test in the Secretary's Potash Area" that could not be resolved locally would be referred to the Chief of the Conservation Division. YP 239 at BLMCO17386.

There is no indication in the record of the reason "oil and gas tests" was substituted in the February 14, 1974, memorandum for the phrase "oil and gas drilling operations." [40/] Consistent with their understanding of the term "tests," the Appellants might contend that the change was for the purpose of limiting application of the enclave policy to exploratory wells. Such a narrowing of the provision seems exceedingly unlikely, however, given the context of the use of "test" in the Central Region Conservation Manager's September 6, 1973, recommendations, the use of "oil and gas tests" in the Chief of the Conservation Division's December 7, 1973, memorandum, and retention of "tests" in other portions of the February 14, 1974, memorandum. Such a limitation would pose problems in understanding other provisions of the February 14, 1974, memorandum and in interpreting and applying the provisions of the 1975 and 1986 Orders which derive from the history which has been discussed. Presumably, the exceptions allowing drilling "vertical or directional holes" in barren areas and designated drilling islands would also apply only to exploratory "test" wells. Limiting those exceptions, however, would largely defeat the rationale the memoranda provide for them because subsequent development wells could be drilled in mineable potash reserves unrestricted by the enclave policy. Nor, under such an interpretation, would mandatory unitization serve to significantly reduce oil and gas wells in the Potash Area. In addition, the 1975 Order would misrepresent the right of a potash lessee to protest "the drilling of a proposed oil and gas test on Federal lands."

The Appellants further claim that the addition of "wells" to the enclave policy in the 1986 Order without deleting the word "tests" indicates that the section applies only to exploratory wells. App. PH Brief at 48, 73; App. PH Reply at 103; Pogo Response to Int. Sur-Reply at 16; Yates Response to Int. Sur-Reply at 62-63. Although documents indicate that some changes in wording were made when the Order was reviewed in Washington, with one exception, there is no evidence of what those changes were or the reasons for them. See YP 257, YP 258. Testimony indicated that the primary reason for revising the Order was to adjust it for administrative changes, replacing references to the regional oil and gas supervisor and other USGS officials with the "authorized officer," and to add acreage. Melton: 1428-29; Cone: 10721, 10735. The Appellants' claim assumes that "tests" in the 1975 Order referred only to exploratory wells, so that its retention has one meaning while its deletion, or replacement by the term "wells," would have had another. If "tests" in the 1975 Order referred to both exploratory and development wells, however, its modification to "test wells" in the 1986 Order has no particular significance.

Ultimately, the Appellants may be correct that the enclave section was added in the

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[40/] It is possible that the wording was changed so that the enclave section would apply only to new oil and gas wells and applications for changes in "oil and gas drilling operations" at existing wells could not be denied under the policy. See 43 CFR 3162.3-2, 3162.3-3.

1975 Order at the potash industry's urging, but it seems highly unlikely that members of that industry and BLM personnel were so shortsighted as to have believed that confining exploratory wells to barren areas and drilling islands would be sufficient to protect potash deposits. Nor is it plausible that they deemed mandatory unitization of exploratory wells near potash enclaves to be sufficient to reduce the number of oil and gas wells drilled in the Potash Area. See Appendix A, § III.E.2. Instead, both the documentary background of the 1975 Order and the text of that Order and the 1986 Order require interpreting "test wells" to include both exploratory and development wells.

III. D. Potash Enclave Maps

In addition to seeking to narrow the application of the enclave policy by restricting it to exploratory "test" wells and limiting potash enclaves to land which has been leased for potash, the Appellants would preclude BLM from applying the policy by challenging the maps of potash enclaves which the United States Geological Survey (USGS) and BLM have produced. They claim that those maps were not developed based upon standards for identifying potash ore which is "mineable under existing technology and economics" as called for by the 1975 and 1986 Orders but, instead, were prepared based upon standards for identifying "[l]ands known to contain valuable deposits" of potash, which by statute must be leased through competitive bidding. App. PH Brief at 27, 38, 114-15.; see 30 U.S.C. § 283 (1994); 43 CFR subpart 3535. In particular, the Appellants claim that the standards which the Area Geologist, Donald M. Van Sickle, identified in his guidelines and the USGS and BLM have subsequently applied are the same as those which were established in 1969 by the USGS Mineral Land Classification Board for the purpose of identifying lands subject to competitive leasing. App. PH Brief at 114-15; App. PH Reply at 54, 83; Yates Final SOR at 36. Consequently, they argue, the maps are not proper enclave maps as called for by the Orders and cannot serve as a basis for denying their APD's when their wells are located within a potash enclave. App. PH Brief at 115-16; App. PH Reply at 17-18, 54; Yates Final SOR at 36.

Although the Appellants are correct about the origin of the numerical standards adopted in 1974 to prepare a potash enclave map, they fail to acknowledge that the maps produced by the USGS and BLM have been more complex than would have been the case if their only purpose was to identify lands subject to competitive leasing. In order to discuss the 1984 potash enclave map, it will be helpful to describe the events preceding preparation of the 1974 enclave map and the series of maps which followed. It is also necessary to respond to an argument raised by the Intervenors that the 1983 Secretarial Directive which required preparation of the 1984 map precludes review of its validity.

After addressing the Appellants' claim based upon Van Sickle's testimony that the maps have been leasing maps, several additional arguments they raise will be considered. The Appellants have argued that Van Sickle's numerical standards were not based upon economics as required by the 1975 and 1986 Orders. They also contend that his standards are inconsistent with provisions of the 1973 edition of the SME Mining Engineering Handbook published by the Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers, which define "measured ore" and discuss the number of core holes needed to reliably identify potash reserves. In addition, the

Appellants claim that two documents prepared in studying the proposed Waste Isolation Pilot Plant (WIPP) site show that the numerical standards were leasing standards. Finally, in a more recent filing Yates has asserted that the IBLA recognized that BLM applies a leasing standard in its decision addressing BLM's rejection of Yates's and Pogo's high bid for a competitive potassium lease within the Potash Area, Pogo Producing Co., 138 IBLA 142 (1997), rev'd sub nom. IMC Kalium Carlsbad, Inc. v. Babbitt, 32 F.Supp.2d 1264 (D.N.M. 1999), rev'd, 206 F.3d 1003 (10th Cir. 2000).

III. D.1 Drawing the Potash Enclave Maps

As described in addressing the Appellants' arguments concerning the 1974 Guidelines, the Chief of the Conservation Division's February 14, 1974, memorandum was approved by the Acting Secretary on March 1, 1974. YP 240, INT 17. As also noted, his signature gave the USGS "authority to proceed as recommended." YP 240, INT 17. The Chief of the Conservation Division then issued a memorandum instructing that the recommendations be implemented and on April 2, 1974, the Central Region Conservation Manager instructed personnel in Roswell and Carlsbad to do so immediately. INT 18. Three days later Van Sickle, the Area Geologist, issued a memorandum dated April 5, 1974 adopting "Guidelines for map showing Potash Enclaves (Measured and Indicated Potash Reserves)." YP 565, INT 19; Van Sickle: 6933. He defined "mineable" as "Potash ore of minimum quality and thickness greater than 4' of 10% K_2O/Sylvite or 4' of 4% K_2O/Langbeinite or equivalent combination of the two." YP 565, INT 19, at BLMCO55405. He also distinguished two types of mineable reserves:

1. Measured Mineable Reserves (Potash Enclave)

   a. Measured ore will be delineated by data points no more than 1 ½ miles apart if geologic inference shows these projections to be reasonable.

   b. Measured ore will not be delineated by less than 3 data points that meet all other distance and thickness and grade criteria.

   c. Measured ore will not be projected further than ½ mile from a data point which meets thickness and quality standards where no projection or geologic inference data exists.

2. Indicated Reserves

   That area where spacing of data points does not meet measured Ore Criteria; yet data points show mineralization higher than minimum thickness and quality.

YP 565, INT 19, BLMCO55405.

Van Sickle supervised BLM employees in preparing a map using the standards

established by his memorandum. Van Sickle: 6924-27, 6933-34, 7073. As he explained, the USGS sent personnel to Carlsbad:

> where all the core hole data was situated. And they came up with the procedure to put--to make--cut the Potash Area into four quadrants. In other words, they needed the work on a larger scale in order to plot all the core holes and all the--and the mines, mine workings, et cetera, on these maps. So, they needed a larger scale to work on, in order to--to identify each individual ore zone. So, they cut the Potash Area was cut. It was prepared in four separate quadrants.

Van Sickle: 6926, 7075, 7101; see Herrell: 3871. The core hole data used for the map and subsequent maps appears to have come from a variety of sources, including the potash industry, government agencies such as the Bureau of Mines and, in more recent years, the Department of Energy. Cherry: 3106, 3109. In addition to core hole data, the USGS treated mine face samples as providing a valid data point and used oil well electric logs to confirm mineralization, but not as data points. Van Sickle: 6936, 7074-75, 7107-7108; see Melton: 1438; Herrell: 3680-83, 3965.

For each quadrant, the USGS prepared a map showing potash deposits in each ore zone or in some instances several zones. Van Sickle: 6926-27. An initial step was to:

> draw the boundary at what was supposedly the four feet of 4% or the four feet of 10%. With the number of core holes that were above those grades and below those grades, the line would be drawn between a core hole that had substandard grade and one that had more than the standard grade. And that would be the outside boundary line.

Van Sickle: 6935. After further identifying potash enclaves in each ore zone, the geologists compiled a large map which was a composite of the individual ore zone maps and submitted it, along with two other maps showing "Oil & Gas Well Tests in the Potash Area" and the "Secretary's Oil-Potash Area and NMOCC R-111A Areas," to the Chief of the Conservation Division on June 6, 1974, and made them available to the public. Van Sickle: 6927, 6942-44, 7000, 7070-71; see YP 560, YP 561. The maps were also presented to the NMOCC. Van Sickle: 6954. [41/] The quadrant maps showing individual ore zones

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[41/] Van Sickle's two page statement to the NMOCC appears as both the Appellants' YP 559 and as part of their YP 565. The former bears page identification numbers BLMCO17365 and BLMCO17366, while the latter is numbered BLMCO55407 and BLMCO17408. Copies of the latter also appear in the record as part of INT 19. The statement refers to an order approved by the Secretary and the Director of the USGS, but the document is not part of the exhibits. Presumably, it was the February 15, 1974, approval which appears in the record as YP 240. Both YP 559 and INT 19 include a third page (BLMCO17367, BLMCO17409) which bears definitions of "measured" and "indicated." In addition, both INT 19 and YP 565 include, in sequential number, Van Sickle's "Guidelines for map showing Potash Enclaves (Measured and Indicated Potash Reserves)" and a page numbered “2" bearing the title "Glossary of Resource Terms")(BLMCO17405, BLMCO17406).

were not released to the public because the core hole data they provide and the resulting areas of potash enclave they identify are confidential information. See Herrell: 3676-78; Cone: 10729.

In 1976 and 1979 Van Sickle supervised revisions of the map using the same procedures to add new data to the individual ore zone maps and combine them into a composite map. Van Sickle: 6941-42, 6958-59, 7079-80; YP 709, YP710. He stated that preparing the 1976 map had been:

> just a matter of getting the '74 ore zone maps out, putting on any new data points, any new mine working, any new mine face analysis, because they had done mining in the meantime, and then drawing the individual ore zone maps again.
>
> Or I should say updating the individual ore zone maps. I don't think they redid them.

Van Sickle: 6942. When issued, both maps were titled: "Preliminary Map Showing Distribution of Potash Resources, Carlsbad Mining District, Eddy and Lea Counties, New Mexico." YP 709, YP 710A.

On May 3, 1983, Assistant Secretary Garrey E. Carruthers issued the Secretarial Directive and the accompanying "Instructions to Implement the Departmental Directive Concerning the Secretarial Order of November 5, 1975," which were also signed by BLM Director Robert Burford. YP249. Along with matters discussed elsewhere in this decision, the Directive required that the 1979 "Potash Enclave Map * * * be updated in 1983 to reflect the most current data available." YP249, INT 28 at RP006305 and BLMC017245. The Instructions provided that:

> A potash enclave shall be designated as an area where potash ore is known to exist in sufficient thickness and quality to be minable under present day technology and economics. An area shall not be designated as an enclave if it does not include a single ore body consisting of at least four (4) feet of ten percent (10%) K_20 of sylvinite or four (4) feet of four percent (4%) K_20 as langbeinite.

YP249, INT 28 at RP006306.

Van Sickle had retired in 1980 and was awarded a contract to prepare a revised map. Van Sickle: 6961, 6964-65; see YP 550, YP 551, YP 556; Melton, 1176. He worked with Richard Melton, who had previously worked on some of the maps and who essentially had replaced him as the area geologist. Melton: 1145; Van Sickle, 7082-83. Van Sickle testified that he had used the same standards and procedure as with earlier maps to produced a new composite map in 1984. Van Sickle: 6965-67; YP557. There were, however, problems in getting a final version of the map produced and on November 8, 1984, the New Mexico State Director suspended approval of APD's pending its completion. YP 253; Melton: 1416-17; see YP 254. The primary difficulty appears to have

been the printing contractor had produced maps of poor quality. Melton: 1416-18, 1422. Eventually, the Roswell District Manager, Francis R. Cherry, proposed that BLM issue the printed maps "with a disclaimer explaining that they are purely illustrative and should only be used as general guidance." YP 255 at BLMCO17194.

Revised potash enclave maps were issued in 1993 to incorporate additional data and in 1995 to update the portrayal of mine workings. Melton: 1565; Cone: 10504-05, 10728; see YP 199 (dated Jan. 1996), YP 336, BLM 3 (1995). The parties have frequently referred to the 1984 map in their arguments and testimony at the hearing concerned the 1984 and 1993 composite maps or copies of them upon which other information had been added. The discussion of the composite maps is understood to apply to the series of individual ore zone maps from which the full scale map was prepared. The individual ore zone maps were used by BLM in making the decisions at issue and copies of portions of those maps are attached to the decision rationales and are part of the case file for each APD. A set of the ore zone maps is part of the record. Like the parties, the discussion which follows will address issues about the validity of those maps by referring to the 1984 potash map.

III. D.2 The 1983 Instructions

Van Sickle appeared at the hearing as a witness for the Appellants. Prior to addressing issues pertaining to his testimony, it is necessary to respond to a specific matter the Intervenors have raised. Based upon the paragraph in the 1983 Instructions quoted in the previous section, they contend that the standards BLM used to identify potash enclaves were established as a matter of policy and are not subject to review. Int. Resp. to App. Prelim. SOR at 4, 14, 17; Int. Motion Summ. J. at 5-6; Int. Answer to Final SOR at 28, 35-36; Int PH Brief at 111, 123.

The document the Intervenors rely upon consists of a "Directive" which affirmed that the 1975 Order "adequately reflects the Secretary's current policy of providing multiple mineral development within the Potash Area while protecting the rights of both oil and gas and potash lessees." YP 249 at RP06305. In order "[t]o ensure that the Secretary's policy is adequately implemented," the Directive required BLM to take five "actions": (1) update the 1979 potash enclave map "to reflect the most current data available" and "ensure that the best possible determinations are made under the Order;" (2) upon completion of the potash enclave map, review suspended oil and gas leases "to determine which leases will remain in suspension and which leases can be drilled from an island or barren area;" (3) establish drilling islands "pursuant to the procedures set forth in the Secretarial Order;" (4) "require potash mining operators to submit three-year mine plans annually to assist in the establishment of drilling islands;" and (5) "hold meetings with the oil and gas and potash industries and the public to discuss policies and procedures under the Order and this Directive." Id. Accompanying the Directive are more extensive "Instructions to Implement the Departmental Directive Concerning the Secretarial Order of November 5, 1975." Id. at RP006306.

The Intervenors' claim that the paragraph from the Instructions quoted in the previous section adopted the numerical standards as a matter of policy overstates its

content. Its first sentence does not define "potash enclave" for purposes of interpreting the 1975 Order but simply repeats the words of that Order. While the Appellants are precluded from arguing that the Secretary should have adopted some other definition in the Order, its repetition in the Instructions cannot be construed to foreclose them from raising questions about the meaning and application of the terms used in the definition. The paragraph's second sentence repeats the numbers which Van Sickle adopted in 1974, except that it omits "or equivalent combination of the two." YP 565, INT 19, at BLMCO55405. [42/] It uses "not" twice, stating that, if an area "does not include a single ore body" meeting the standards, it "shall not be designated as an enclave." As the Appellants have noted, the effect is to establish a minimum, not to affirmatively require that an area meeting the standard be designated a potash enclave. See Herrell: 2899-2900. [43/]

The Intervenors base their argument on IBLA decisions, such as Belco Petroleum Corp., supra, and Bass Enterprises Production Co., supra, which recognize that Secretarial policies are not subject to review. The documents at issue, however, are styled simply as a "Directive" and "Instructions." The former refers to policy twice, first in affirming that the 1975 Order "adequately reflects the Secretary's current policy of providing multiple mineral development within the Potash Area" and, second, in requiring BLM to hold meetings "to discuss policies and procedures under the Order and this Directive." YP 249 at RP 006305. The latter, like the other four numbered items, directed BLM to take specific action, rather than establishing a general principle under which it was to administer the Potash Area. Similarly, the opening portion of the "Instructions" describes the four numbered items which follow, including the previously quoted paragraph, as "points of clarification" and describes the remainder of the "Instructions" as providing "guidelines" to "insure that the Secretarial Order is implemented in a manner consistent

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[42/] The statement of work for Van Sickle's contract to prepare the 1984 map also omits the phrase. YP 550 at 1, YP 556 at 25. Van Sickle testified that he prepared the 1984 map using the description in the statement of work, but also stated that he "applied the same precise leasing standards" as the previous maps. Van Sickle: 6965-67. The legend of the 1984 map states that the criteria included "or an equivalent combination of the two minerals." No party has suggested that the 1984 map was not prepared using data for combinations of the two ores.

[43/] It seems ironical that the Appellants have described the same paragraph of the Instructions as distinguishing between potash enclaves, referred to in the first sentence, and the "leasing standards" they understand to be identified in the second sentence. They argue:

> If the leasing standards were synonymous with the enclave standards, paragraph 3 makes no sense. If leasing standards were intended by the Secretary to constitute enclave standards, he simply would have said that the KPLA is an enclave. It would not have been necessary to distinguish beyond the lease classification standards.

App. PH Reply at 17; see id. at 54. Under this analysis, the Appellants might well agree with the Intervenors that the Instructions are binding on BLM. The deficiency in their argument is that, as subsequently discussed, the map which resulted from application of the "leasing standards" was not simply a map of the KPLA.

with the Departmental Directive." Id. at RP 006306.

Neither the "Directive" nor the "Instructions" identify themselves as establishing policy. Rather, they appear to be managerial in nature, setting forth for BLM personnel the process by which they were to attempt to resolve the issues which had arisen at the time. A determination that the 1983 Directive and Instructions were issued to establish general policy, or that portions of it establish specific policies which in some manner legally control BLM's review of APD's under the 1986 Order, and this forum's review of its decisions, would requiring resolving questions about their issuance and legal status which the parties have not addressed. See 5 U.S.C. § 552(a) (1994); see Christensen v. Harris County, 120 S.Ct. 1655, 1662-63 (2000); Chevron U.S.A. v. Natural Resources Defense Council, 467 U.S. 837 (1984).

At best, the paragraph the Intervenors rely upon might be construed to represent a factual determination by the Assistant Secretary that the numerical standards continued to identify the "thickness and quality" of potash "minable under present day technology and economics." While such a reading might preclude reviewing the validity of the numerical standards as of 1983, it would not require rejecting the Appellants' claims that the standards did not reflect "present day technology and economics" in 1992 and 1993 when their APD's were rejected. The Assistant Secretary could not, of course, determine that the standards accurately described the quality and thickness of potash which would be mineable in the future. The validity of the standards as of the time of rejection of the Appellants' APD's is the issue to be resolved in this proceeding. As stated by the IBLA, it is "whether the APD's encompass lands within areas qualifying as potash enclaves under the parameters established by Section 3.III.D.1.c of the Order." Yates Petroleum Corp. et al., supra at 2356.

III. D.3 The Mineral Land Classification Board

Turning to the Appellants arguments, they are indisputably correct that the numerical standards for thickness and grade which Van Sickle adopted in 1974 were those that had been approved by the Director of the Geological Survey in 1970 for the purpose of defining the boundaries of the area subject to competitive leasing rather than prospecting permits. That area has been referred to as the "Known Potash Area" (KPA) as well as the "Known Potash Leasing Area" (KPLA). See Melton: 1308-09; Herrell: 3670-74. Van Sickle testified that he had served on the USGS Mineral Land Classification Board which in 1969 had revised the standards previously adopted in 1957 for the purpose of identifying the area subject to competitive leasing known as the KPLA. Van Sickle: 6918-22, 6983-84, 7021; see YP 554, YP 555. Likewise, the subject heading of the Board's 1969 minutes states that they were a: "Revision of the potassium classification standards used to delimit the Carlsbad, New Mexico Known Potash Area." YP 555, INT 6. The memorandum from the Chief of the Conservation Division to the Director also describes them as "new potash standards to be used to delineate acreage in New Mexico available only by competitive lease." YP 554, INT 6.

In addition, Van Sickle testified that he had supervised the preparation of the 1974 map and that the purpose had been "to establish the outer limits of the potash leasing area

according to the new standards." Van Sickle, 6925. In presenting the map to the NMOCC Van Sickle stated that "[t]he minimum quality and thickness criteria corresponds [sic] to the USGS Classification standards in use for several years, which identifies those U.S. lands that must be leased competitively." YP 565, INT 19 at BLMCO55408. During his testimony, Van Sickle was frequently asked questions about the purpose or nature of the 1974 and subsequent maps, and he consistently agreed that they had been lease maps or were prepared using the leasing standards. Van Sickle: 6926, 6938-39, 6955, 6961, 6979-80, 6997, 7102. For example, he testified: "Actually, since the first map was based on and drawn on leasing standards, that carried all the way through to my map of '84. We were outlining the leasing standards, or outlining the farthest extent of the leasing standards." Van Sickle: 6980.

Although the Appellants are correct about the origin of the standards for the grades and thickness of potash, they err in contending that Van Sickle prepared the 1974 map solely for the purpose of identifying lands subject to competitive leasing and that it, as well as subsequent maps, are simply "lease maps." The maps themselves present a more complex picture. The 1974 map is titled a "Map Showing Distribution of Potash Deposits in the Carlsbad Area, New Mexico." It portrays not only the boundary of the KPLA but also identifies four types of areas: "Measured Mineable Potash Reserves (Potash Enclave) in one or more ore zones," "Indicated Mineable Potash Reserves," "Barren Area or area of minor Potash mineralization," and an "Area of no data." In addition, it shows areas that had been first and second mined. If the sole purpose for preparing the map had been to identify areas leaseable for potash, there was no need either to classify four additional kinds of areas or to distinguish among them. It is also telling that the map does not identify areas which had already been leased for potash and, therefore, were not available for competitive leasing.

More specifically, the 1974 map states that the KPLA includes 271,747 acres and dates the boundary as "May 1, 1971." These note appears to refer to the May 1, 1971, minutes of the Mineral Land Classification Board which state that "[s]ubsequent to the revision of the classification standards, Jim S. Hinds compiled new ore zone maps which delineate the potash ore zone boundaries." INT 7 at 5, BLMCO57763. The minutes provide public land survey descriptions of 271,747 acres as the recommended "area considered as not subject to the issuance of potassium prospecting permits." Id. at 6-12, BLMCO57764, BLMCO57754-59. That area is identified on the 1974 map by a dark line. In addition the 1974 map shows 66,590 acres as an "Undefined Addition to the Carlsbad Known Potash Leasing Area" with a date of June 5, 1974. YP 708. That date is one day before Van Sickle sent the map to the Chief of the Conservation Division, although curiously the map itself is dated May 1974. YP 560, INT 20; YP 708. To the extent Van Sickle was charged with preparing an updated "leasing" map in 1974, his responsibility would have been satisfied by the addition of the "undefined" KPLA area.

The KPLA identified on the 1974 map, however, is distinctly different from the potash enclaves called for by the 1974 guidelines and the 1975 Order and from the areas of potash enclave identified on the map. The KPLA includes not only "Measured Mineable Potash Reserves," but also some areas of "Indicated Mineable Potash Reserves" as well as areas identified as barren of potash. See YP 708; Van Sickle: 7026; Herrell: 3671-72. The

Mineral Land Classification Board had recommended including "encircled lands, although known to be barren or unexplored, in the potash leasing area to facilitate administrative decisions and to avoid leaving interior gaps or windows within the outer boundaries of the leasing area." INT 7 at 6, BLMCO57764. Although barren and unexplored areas are within the KPLA, they cannot be said to contain four feet 10% K_2O/as sylvite or four feet of 4% K_2O/as langbeinite, or equivalent combination of the two. Consequently, the Appellants' assertion that Van Sickle applied his numerical standards only for the purpose of identifying areas to be competitively leased for potash is mistaken. [44/]

The legend on the 1974 map does not define the areas it identifies, but the legends on the subsequent maps are instructive. The 1976, 1979, and 1984 maps have defined "Measured Potash Reserves (Potash Enclave)" as:

> Resources for which tonnage is computed from dimensions revealed in workings and drill holes. The grade is computed from the results of detailed sampling. A minimum of three data points in any one ore zone meeting quality and thickness standards no more than 1 ½ miles (2.4 km) apart, have been used to delineate measured reserves.

YP 709, YP 710A. Each map has also identified the minimum quality and thickness criteria using the same numerical standards established by Van Sickle. He testified that the maps had been prepared using these standards. Van Sickle: 6941, 6957-58, 6968. He also testified that both measured and indicated potash reserves had been included in the KPLA--as are "Unevaluated Potash Areas" and "Barren and/or Minor Potash Mineralization Areas" on the 1976 and 1979 maps and "Inferred Potash Resources" on the 1984 map. Van Sickle: 7026, 7067. He agreed that only measured and not indicated potash reserves were included in the areas which are potash enclave. Van Sickle: 7060, 7065-67; see Herrell: 3671-72 ("measured resources are what we call are (sic) enclave"), 3965. The difference between potash enclaves and the KPLA is reflected in the Appellants' analysis that 34% of the Potash Area is identified on the 1984 map as areas of measured reserves, i.e. potash enclave. YP 571.

Consistent with the maps, the "Statement of Work" under which Van Sickle prepared the 1984 map listed delineation of the KPLA boundaries as a separate task from identifying areas of potash enclave based upon application of the thickness and grade standards. It provided that the contractor would:

> a. Post all data to individual ore zone base maps at a scale of 2 inches = one mile, and will include the following on each map:

[44/] The Appellants' suggestion that Van Sickle's numerical standards for the grades and thickness of potash cannot be potash enclave standards because they predate the 1975 Order overlooks two additional requirements not included in the USGS Mineral Land Classification Board standards. See App. Reply at 34. He limited potash enclaves to ore "delineated by data points no more than 1 ½ miles apart" and no "less than 3 data points that meet all other distance and thickness and grade criteria." INT 19, BLMCO55405.

1. Core hole locations;
2. Mine workings as of January 1, 1983;
3. Values of ore quality (thickness and grade);
4. Known Potash Leasing Area Boundaries

YP 550, INT 42; see YP 556 at 25. In addition, the contract provided that the contractor would:

> b. Delineate areas, using current established procedures, meeting classification standards of 4 feet of 10% K20 as sylvite and 4 feet of 4% K20 as langbeinite within each individual ore zone map. The contract will use Measured, Indicated, Inferred and Barren or Subeconomic categories based on data quality and distribution criteria.

YP 550, INT 42; see YP 556 at 25.

Despite the Appellants' assertions, it is apparent that the 1974 and subsequent maps were prepared to achieve more than simply an outline of the land subject to competitive leasing for potash. See Cone: 10649. Indeed, after Van Sickle had reviewed a number of documents during cross-examination, including the February 14, 1974, recommendations, he stated that "we had an idea, yes, that the map would be used for various reasons, or various purposes" and that they had "to do partly with the problems with the oil and gas drilling, and partly--partly for our classification work." Van Sickle: 7046. In particular, the 1974 map was prepared to identify potash enclaves within the Potash Area as Van Sickle had been instructed to do by the Central Region Conservation Manager in accord with the 1974 guidelines. INT 18, YP239. No other conclusion seems possible given that his memorandum states that it provides "Guidelines for map showing Potash Enclaves" and the 1974 map itself states that it identifies areas of "Measured Mineable Potash Reserves (Potash Enclave)." Even Van Sickle ultimately agreed on cross-examination that potash enclaves were limited to measured reserves, while the KPLA included measured and indicated reserves, and, consequently, in his opinion there was a difference between the "leasing standards" and potash enclave. Van Sickle: 7065-67; see Cone: 10650-51.

Consequently, it must be concluded that the 1974 and subsequent maps not only identify lands subject to competitive leasing but also portray potash enclaves as defined by Van Sickle's April 5, 1974, memorandum. See also INT 69, appendix C. This conclusion does not mean that the 1984 and 1993 potash enclave maps must be upheld as validly identifying areas "where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics." Indeed, Leslie Cone acknowledged that the 1984 map was "outdated," "didn't reflect the current mine workings," and "didn't reflect the latest core hole information" which BLM had available and that, for these reasons, BLM had prepared the 1993 map. Cone: 10505-06. The conclusion that the maps have identified potash enclaves as defined by Van Sickle's standards also does not resolve the Appellants' more sophisticated arguments that his numerical standards are not the kind required by the definition of "potash enclave" in the 1975 and 1986 Orders. Those issues will be addressed in subsequent sections. Before

turning to them, several other of the Appellants's arguments related to their claim that the potash maps are leasing maps require a response.

III. D.4 Reliance on Economics

The Appellants also rely upon Van Sickle's frequent statement that he "didn't get into the economics" when preparing the maps to argue that they are leasing maps because they are not based upon economics. Van Sickle: 6939, 6959, 6980, 6986, 7048-49, 7108; see App. PH Brief at 115-16; App. PH Reply at 54. Their claim overlooks the fact the KPLA standards themselves are based upon matters related to technology and economics.

In 1957, the USGS's Potash Board adopted standards of a minimum four foot thickness and minimum quality of 8% K_2O as sulphate ore (langbeinite) and 14% K_2O as chloride ore (sylvite) for identifying the "areas in which valuable deposits of potash ore are known to exist." INT 1 at 13-15; see 43 CFR 3500.0-5(i). In doing so, the Board gave "consideration to the methods of pricing that have developed over the years, but particularly to those geologic conditions which influence the occurrence of commercial ore." INT 1 at 13.

In 1969, the Mineral Land Classification Board, revised the 1957 standards because "additional prospecting and advances in technology have extended the area known to contain valuable potash deposits." YP 555, INT 6 at 1. In particular, the Board noted that one company had "developed selective flotation methods that recover both sylvite and langbeinite from mixed ores" which allowed "commercial mining of mixed ores in which neither the sulfate nor chloride K_2O equivalent alone would meet the 1957 classification standards." Id. The Board also stated that the new minimum quality standards "should approximate the lower limits of ore grades which can be profitably recovered under foreseeable economic conditions." Id. at 2. Based upon the market price of refined sylvite, the Board calculated approximate mining and milling costs and described the minimum standard of 10% sylvite as "realistic" and representing "ore that can and will be economically recovered." Id. at 3. The same mining and milling costs and formula were used to arrive at the minimum standard of 4% langbeinite as the "breakeven grade." Id. Likewise, the Director of the USGS approved the standards based upon the Chief of the Conservation Division's recommendation that they reflected "technological advances in the potash industry made since 1957" and were "based on current and projected economic conditions." YP 554, INT 6 (March 24, 1970).

Although there was testimony at the hearing as to the validity of the Mineral Land Classification Board's numbers and analysis (see Hutchinson: 7527-35; Waugh: 11489-90), for purposes of this decision, it does not matter whether the Board was correct. The record shows that the Board revised its standards in 1969 because it believed they no longer identified ore that could be economically mined and that the new standards were based upon considerations of technology and economics. In presenting the revised standards to the Director of the USGS for approval prior to implementing them, the Chief of the Conservation Division stated that they "reflect technological advances made in the potash industry since 1957" and were based upon "current and projected economic conditions." INT 69, appendix B. Whether or not Van Sickle considered matters

concerning technology and economics when he issued his April 5, 1974, memorandum, the numerical standards he adopted were inherently economic. On cross examination, he recognized that they included an economic component. Van Sickle: 6992, 7052; see Hutchinson: 7528, 8428. This fact, however, does not resolve the Appellants' argument that the numerical standards no longer reflected "existing technology and economics" when BLM rejected their APD's in 1993.

III. D.5 "Measured Ore"

From the outset, the Appellants have challenged the potash enclave maps as not being consistent with the 1973 Handbook of the Society of Mining Engineers (SME) and industry practice. See App. Prelim. SOR at 28-30; App. Reply to BLM Responses to Prelim. SOR at 15-17 (RP006587-89); Pogo Final SOR at 37-38; Yates Final SOR at 35-38; App. PH Reply to BLM & Int. Briefs at 55-56. Although they have stated their argument in a variety of ways, their position seems to rest on two points. First, they note that the Handbook defines "measured ore" as:

> ore for which tonnage is computed from dimensions revealed in outcrops, trenches, workings, and drill holes and for which the grade is computed from the results of detailed sampling. The sites for inspection, sampling and measurement are so closely spaced and the geologic character is so well-defined, that the size, shape and mineral content are well-established. The computed tonnage and grade are judged to be accurate within stated limits, and no such limit is judged to differ from the computed tonnage or grade by more than 20%.

SME Mining Engineering Handbook (New York, 1973) § 32.2.4 at 32-39 (YP 572); see App. PH Reply at 55; App. Reply to BLM Responses to Prelim. SOR at 15. The Appellants claim that the definition adopted by the USGS lowered this standard. See App. Prelim. SOR at 29 (RP006433); App. Reply to BLM Resp. to Prelim. SOR at 15-17 (RP006587-89); Pogo Final SOR at 38 (1993 map). Second, as will be subsequently discussed, the Appellants argue that the potash enclave maps have been deficient because, applying Van Sickle's memorandum, the USGS and BLM have used a standard of three core holes within a mile and a half rather than four core holes per section as described in the Handbook.

The Appellants' first argument is based upon several errors. First and most basic, they do not seem to understand that the definition of "measured ore" they quote and rely upon is not a definition established by the Society of Mining Engineers. The Handbook explains that "there are two schools of thought" about ore-reserve classification:

> The concepts in both instances are of such a similar legitimate nature that, in their respective applications essentially the same total quantity of ore will be arrived at, but because of a different outlook or mode of approach, the ore classifications into unit types often are at variance. For example, the U.S. Geological Survey and the U.S. Bureau of Mines, both governmental agencies, are primarily and fundamentally concerned with the determination of the future potential mineral resources of a given mine

> which either, or both, may be studying. That is, although they are directly interested in an ore-reserve classification, their distinction of class types is based largely upon a projected rather than upon a present potential.
>
> On the other hand, a reserve analysis made by, or for, a private enterprise usually is designed to resolve the estimate in such a way as to show the various ore tracts classified on the basis of their currently minable nature.

SME Mining Engineering Handbook § 32.2.4 at 32-39 (New York, 1973). [45/] The Handbook goes on to state: "The classification used by the Geological Survey and the Bureau of Mines are [sic] summarized in the material which follows." Id. It then sets forth the definition of "measured ore" quoted above, as well as definitions of "indicated ore" and "inferred ore." Id. at 32-39 to 32-40. Turning to "commercial mining geology, which is guided primarily by direct economic factors," the Handbook explains that "ore reserves often are classified" as "developed or proved" ore, "probable" ore, and "possible or extension" ore. Id. at 32-40. Thus, the definition of "measured ore" the Appellants rely upon is not one established by the SME and is not presented in the Handbook as a definition used by the mining industry, but one used by the USGS and the Bureau of Mines at the time.

In arguing that the enclave maps are leasing maps, the Appellants point out that a 1978 USGS open file report on "Potash Ore Reserves in the Proposed Waste Isolation Pilot Plant [WIPP] Area, Eddy County, Southeastern New Mexico" (1978) states that the USGS "minimum standards for leaseable potash ore are 4 feet of 10% K_2O as sylvite, 4 feet of 4 percent K_2O as langbeinite, or 4 feet of equivalent mixed ore as defined by a minimum of three data points in any one ore zone." INT 47 at 2 (RP 007905); see App. PH Reply at 55, 60. [46/] The source the report cites for the numbers seems to have been the 1976 potash enclave map. See INT 47 at 26 (RP 007929), 47 (RP 007950). This reference to Van Sickle's numerical standards supports the Appellants' position, but the document provides them little benefit. Rather than contrasting potash "reserves" with a "leasing

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[45/] The Handbook notes that the Securities and Exchange Commission (SEC) "also uses classifications of Proven Ore and Probable Ore" that are "essential equivalents of Measured Ore and Indicated Ore, as such designations are employed by the Bureau and the Geological Survey." SME Mining Engineering Handbook § 32.2.4 at 32-39 (New York, 1973). Neither the SEC definitions nor more recent proposals by the Society for Mining, Metallurgy, and Exploration need be addressed to resolve the issues in this case. See generally, Michael D. Fricklas and Douglas D. Foote, "Obligations and Consequences of Ore Reserve Disclosures--Can Your Client and its Shareholders (and the SEC) Live Happily Ever After?", 39 Rocky Mt. Min. L. Inst. 12-1, § 12.3[2] at 12-21 (1993).

[46/] The Appellants' exhibits YP 712a and 712b are copies of pages from the Intervenor's INT 47 which bears IMC reference numbers. In both exhibits the document's page numbers are obscured by a stamp stating that the document is for use in this case only. The complete documents are also part of the record proper and those page reference numbers are cited rather than IMC's.

standard," it provides definitions of measured and indicated reserves and other terms "consistent and in accordance with the definition of resources and reserves defined in US Geological Survey Bulletin 1450-A (1976)." INT 47 at 25 (RP 007928). That document, titled "Principles of the Mineral Resource Classification System of the US Bureau of Mines and US Geological Survey," provides definitions of "measured" reserves and resources which are almost verbatim the definition of "measured ore" found in the Handbook. See BLM 25, INT 44; see also YP 588 ("Principles of a Resource/Reserve Classification for Minerals," Geological Survey circular 831 (1980), revision of Bulletin 1450-A).

The definitions in the USGS open file report are also the same definitions which appear on the 1976 map and include the requirement of three data points no more than a mile an a half apart. See INT. 47 at 25 (RP 007928). The report explains that these "classification criteria were used for the potash distribution maps," except that "the terminology in the explanation and the title of plate 3 reads differently because potash bearing material below lease grade cutoff comprises only resources, not reserves." INT. 47 at 27 (RP 007930). Notably, plate 4, showing the "Distribution of Potash Reserves as 4.0% K_2O as Langbeinite and 10.0% K_2O as Sylvite in the WIPP Area, Eddy County, New Mexico", is labeled "lease-grade reserves." (RP 007952.) Likewise, the report finds that there are "major reserves" in the 4th and 10th ore zones and "lesser reserves" in five additional ore zones "that contain potash ore which meets or exceeds current U.S. Geological Survey leasing standards." INT. 47 at 29-30 (RP 007932-33). Thus, the report adopts the "leasing standard" definition of the 1976 enclave map to identify "measured reserves" and identifies it as consistent with the definition of "measured ore" found in Bulletin 1450-A which is also that found in the SME Handbook. It does not support the Appellants' suggestion that Van Sickle's standard cannot describe a "mineable reserve" as defined in the 1986 Order because it is a "leasing standard."

The descriptions of "measured ore" the USGS printed on its potash enclave maps beginning in 1976 do differ from those in the Handbook and Bulletin 1450-A, but the differences do not seem significant. [47/] The first two sentences of the definition found on the maps repeat the first sentence of the Handbook's and Bulletin's definition, but identify only mine workings and drill holes as sources of samples. The obvious reason for the omission of other sources of data is that potash in the Potash Area lies hundreds of feet underground and apparently there are no outcrops or trenches from which samples can be taken. See Van Sickle: 6989. The Handbook's and Bulletin's remaining two sentences are not part of the maps' legend but little analysis is needed to understand why. See Van Sickle: 6955-58. Rather than the general requirement that sample sites be "closely

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[47]/ Van Sickle did not testify as to the source of the definitions used on the potash enclave maps; nor does any document specifically identify their origin. George B. Griswold, reported in his exhibit prepared for the Intervenors, "Historical Review of Drill Spacing and Verification of BLM Measured Reserves for Four Mining Leases" that he had "not been successful in finding documentation of how the Van Sickle definition was arrived at." INT 69 at 1. Definitions may have accompanied Van Sickle's April 5, 1974, memorandum when it was presented. See note 1, supra. When asked about the glossary of terms during direct examination, Van Sickle stated that he believed it had been attached to his April 5, 1974, instructions. Van Sickle: 6939; but see Van Sickle: 7068-69.

spaced," the legend appears to substitute, based upon Van Sickle's memorandum, a specific standard of three data points no more than 1 and ½ miles apart. Similarly, the legend omits the requirement that the geologic character of sample sites be "well-defined," but the specific numerical standards for thickness and quality which appear elsewhere in the legend render the more general language unnecessary. The Appellants may not agree that the standards set forth in Van Sickle's memorandum are valid and may not believe that the resulting "size, shape and mineral content" portrayed on the potash enclave maps is "well established," but they do not argue that the USGS failed to apply the standards it established. Finally, the last sentence found in the Handbook's and Bulletin's definitions is omitted on the potash enclave maps, but the purpose of the maps was to identify "areas that are not presently being mined which are considered to contain a mineable reserve in one or more ore zones" rather than compute tonnage and grade. Appendix A, § III.D.1.c (emphasis supplied). Thus, the USGS did not lessen the definition of "measured ore" found in the Handbook as the Appellants assert, but adapted it, or what seems to be more likely the case, modified the definition found in Bulletin 1450-A.

III. D.6 Core Holes

As previously noted, the Appellants also argue that Van Sickle's requirement that measured ore be delineated by three "data points no more than 1 ½ miles apart" does not satisfy the SME Handbook's statement that:

> At Carlsbad, N.M., individual deposits are several square miles in area, and can be located by exploration drilling on 1-mi centers. Ore reserves can be blocked out on four holes per section. Complexities, such as salt domes, anticlines, etc., can ruin an otherwise minable deposit.

SME Mining Engineering Handbook (New York, 1973) at 5-56 to 5-57. See App. Prelim. SOR at 30 (RP006434); App. Reply to BLM Resp. to Prelim. SOR at 16 (RP 006588); Yates Final SOR at 35. As explained by Van Sickle, the "data points" used to prepare the potash enclave maps were core holes and mine face samples. Van Sickle: 6936, 6967.

Although the Appellants' criticism of the standard has been part of their case from the outset, the record is not clear as to the manner in which the USGS and BLM applied Van Sickle's standard in preparing their enclave maps. The standard of three "data points no more than 1 ½ miles apart" was not part of those adopted by the Mineral Land Classification Board in 1970. Van Sickle explained that he had selected it because:

> Well, the potash -- the McNutt zone covers a wide, wide area, and the several -- or the numerous potash mineralized ore zones cover large areas. Therefore, when you have at least three data points in one ore zone that were that close together, or not that far apart, from the same ore zone, it -- more or less, we felt that it showed that ore would extend over the area encompassed by those three core holes, because of the nature of the deposit.

Van Sickle: 6936; see Herrell: 3678-79; Cone: 10729. However, he did not remember

how the standard had been decided upon. Van Sickle: 6990, 6999. [48/] Nor was he specifically asked to explain what he had meant by the phrase or to describe the manner in which the USGS had applied the standard when developing its potash enclave maps. See Herrell: 3688. As previously quoted, Van Sickle spoke only of drawing a line between qualifying and non-qualifying core holes. Van Sickle: 6035.

Each party seems to regard the meaning of the phrase as obvious, but several significantly different descriptions were offered at the hearing. In testifying about the manner in which he understood BLM to have prepared its maps, Gary Hutchinson, testifying for the Appellants, described the phrase as meaning that each of the three data points could be within a mile and a half of the others and he described instances in which he had found portions of the enclave maps for the fourth and tenth ore zones to have been based upon core holes more than a mile and a half apart. Hutchinson: 7548-49, 7555-56; YP 703, YP 704; see Hutchinson: 8048-49, 8051. As illustrated by one of his exhibits, Hutchinson understood that Van Sickle's method allowed, as a maximum, the three core holes to form an equilateral triangle with a core hole at each corner a mile and a half from the others, encompassing an area of approximately 623 acres. Hutchinson: 7700; YP 730; see Hutchinson: 7704-05, 8237, 8358. The Intervenors, however, state that the standard:

> does not mean that all three data points must be within a mile and a half of each other. Rather, it means that it is possible to draw a circle around one of the data points with a radius of a mile and a half, such that the other two data points will be within the boundary of the circle.

Int. PH Brief at 128. Under this approach, three data points could form a line almost three miles long if each data point was a mile and a half from another data point.

Dr. George B. Griswold, who testified for the Intervenors, prepared a report for them titled "Historical Review of Drill Spacing and Verification of BLM Measured Reserves for Four Mining Leases." INT 69. Somewhat differently from the Intervenors' brief, he states that BLM's standard does not allow drilling on 1.5 mile centers because, given two core holes 1.5 miles apart, the third hole would be 2.12 miles away. INT 69 at 5. The distance appears to be the length of the hypotenuse of a triangle formed by the three holes. Instead, Griswold determined that "drilling a rectangular pattern must be on no more than 1.06066-mile (5600 feet) centers in order to conform to the 3 hole requirement of the BLM rule." Id.

David Waugh, also a witness for the Intervenors, believed that BLM's standard of three core holes in a mile and a half was "an excellent method to be applied to the Carlsbad Basin" and a "reasonable and fair approach." Waugh: 11376, 11380. He also responded to Hutchinson's testimony regarding errors in BLM's enclave maps by stating that he had looked at the exhibits and found they had been correctly drawn in

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[48]/ George B. Griswold, "Historical Review of Drill Spacing and Verification of BLM Measured Reserves for Four Mining Leases" (undated) states that "[t]he earliest citation of the 1.5-mile spacing and no less that 3 holes rule that the BLM currently uses" is Van Sickle's April 5, 1974, letter. INT 69 at 1; Griswold: 12786.

conformance with BLM's criteria. Waugh: 11628-29. He did not, however, further discuss his review of the maps or elaborate upon his understanding of how the standard of three core holes in a mile and a half had been or should be applied.

The different techniques for applying Van Sickle's standard cannot be reconciled based upon the record. In regard to the Appellants' claim about the SME Handbook, however, there seems to be little difference between three "data points no more than 1 ½ miles apart" and four core holes per section. Drilling four core holes in one section at the center of each quarter section would result in core holes that are ½ mile from each other. [49/] If the two core holes in the north half of a section revealed the presence of potash "greater than 4' of 10% K_2O/as sylvite or 4' of 4% K_2O/as langbeinite or equivalent combination of the two," meeting Van Sickle's grade and thickness standard, and so did a core hole in an adjacent quarter section to the east or west, the same ore body would be "blocked out" whether based upon three "data points no more than 1 ½ miles apart" or core holes drilled on center at four per section. Thus, it appears that Van Sickle's standard of three "data points no more than 1 ½ miles apart" may have been an adaption of the Handbook's statement about four core holes per section, modified to account for the fact that core holes in the Potash Area generally have not been drilled at regular intervals. See YP 768, YP 769; INT 69, figures 1A to 6B.

The issue the Appellants raise does not concern simply the number of core holes which are needed but their relative spacing because the information core holes provide must be used to project the geology underlying the areas between core holes, in particular, both quality and thickness of the potash. The example discussed in the previous paragraph placed the three core holes on a line, which geometrically has no width. Potash enclaves, however, are areas "where potash ore is known to exist." Underlying the Handbook's statement that "[o]re reserves can be blocked out on four holes per section" is the recognition that a geologist must infer that the geology of the underground area between core holes is similar to what is disclosed by the core holes and, using geologic interpretation of the data and recognized geologic mapping methods, project or interpolate the extent and richness of the potash disclosed by the core holes into the area between core holes. See SME Mining Engineering Handbook at 32-28 to 32-33, 32-44 to 32-47 (New York, 1973); Griswold: 11369-70; Ivey: 12617-18. [50/] As Brent May, a

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[49/] The Appellants clearly err in equating four core holes within an areal section of one square mile with four core holes within a linear mile. See App. PH Reply at 56; Yates Response to Int. Sur-Reply at 52.

[50/] During cross-examination, the Appellants' witnesses Nelson Muncy was asked whether the triangulation and polygon methods described in the SME Handbook were acceptable for mapping ore reserves and he responded that he thought they were used in the potash industry. Muncy: 10093-94. When the subject was brought up during redirect examination, he stated that they are "absolutely not used for the determination of ore" and "can be used to delineate proven, probable, or possible ore," but that the methods "are not speaking to the economics * * * or as the economics are spoken to in the Secretary's '86 Order." Muncy: 10166-67. Muncy also stated that, although "BLM did probably use the triangulation method," the portion of the Handbook discussing the method "absolutely does not talk about economics, and it's not used to define ore."

petroleum geologist for Yates, explained in regard to his work using information from oil and gas wells:

> You have different wells in the area, you take that data that you have, that cutoff, and determine that for those points. And then you make an interpretation over the area, what you feel will be the thickness * * * in other parts of that area.

May: 5112-13; see May: 5111. As was the case with many exhibits presented at the hearing, such maps seem to be prepared now using computer programs. See Hutchinson: 8196; Waugh: 11369-70, 11495-501; YP 533; INT 290. Thus, the question of the number of core holes needed to identify potash enclave is a question about whether, given what is known about the geology of the area, the data disclosed by the core holes can be reliably projected to portray the unexplored area between core holes.

Testimony at the hearing indicates that there are significant differences of opinion about the relative distance of core holes needed to make reliable projections in the Potash Area. When asked whether drilling on half-mile centers is sufficient to define an ore body, Bill Bessinger, a witness for the Appellants stated:

> Well, there are a lot of people that think it is and there are people that think it's excessive, but based on my own experience, I think quarter-mile drilling is what you really need to get the information required to make an honest to God mine plan.

Bessinger: 9835; see Waugh: 11336. On the other hand, he agreed with a statement in a report by Waugh that "every deposit within the Carlsbad Basin is different requiring site-specific evaluation of the core hole spacing required to bring each deposit to a level of confidence necessary for making economic and mining decisions." INT 426 at 2; Bessinger: 9876. There also seems to be some disagreement about the extent of disagreement. Griswold's report looked at the number of core holes that had been drilled at the time an operator with a prospecting permit obtained a lease in order to identify the number which was regarded as sufficient to define an ore body. Griswold: 12976-77; INT

Muncy: 10167; YP 572. Responding to a question about the requirements of the 1986 Order, he stated that the portion of the SME Handbook was "[c]ompletely void on that issue." Muncy: 10168. On recross examination, however, he agreed that the polygon and triangulation methods are used within the mining industry to determine the tonnage of ore reserves. Muncy: 10185.

The section of the SME Handbook Muncy discussed is titled "Integration of all Factors and Ore-Reserve Computations." As previously discussed, "proven ore," "probable ore," and "possible ore" are terms used in commercial mining geology to classify ore reserves, and the triangulation and polygon methods are used to make weighted volume estimates to determine "the volume and/or tonnage of an ore deposit." SME Mining Engineering Handbook (New York, 1973) § 32.2.4 at 32-39 to 32-40, 32-43 to 32-44. The Handbook was published two years prior to issuance of the 1975 Order and clearly could not have addressed its definition of potash enclaves. The apparent claim that the methods used by mining engineers to project the size of ore bodies and calculate reserves are unrelated to identifying areas of "potash ore" under the 1986 Order is not credible. See Muncy: 10192-93.

69. One sentence states: "The subject of drill hole spacing remains debatable." INT 69 at 2. When asked about the statement, the Appellants' witness Nelson Muncy said he disagreed with it. Muncy: 7252, 7478-79. His statement, however, was based upon his experience at the Amax mine, where the company had determined that it needed a minimum of five core holes per section to identify sylvite ore in the third ore zone. See Muncy: 7235-36, 7252-53, 7472-73, 7478-79, 10095-96, 10098, 10115. Muncy also agreed with the Handbook's statement that four core holes per section were needed to define ore reserves. Muncy: 7295.

As indicated in his statement quoted above, Bessinger believed that core holes should be drilled at quarter-mile intervals, i.e. at the rate of 16 per section. See Bessinger: 9872-73. In contrast, Griswold explained that he and others considered "one-mile centers" to be "certainly adequate." Griswold: 12747. His evaluation of potash resources within the proposed WIPP site was based upon 21 core holes drilled at a minimum spacing of one per square mile interspersed among those previously drilled and the results were used by the Bureau of Mines to conduct an economic analysis. YP 804 at 37-38. Griswold's report finds that the average spacing of core holes for six leases in the Potash Area had ranged from 2500 to 6300 feet and that the corresponding acreage attributed to each core hole varied from 219 to 1920 acres. INT 69 at 5. He concluded that BLM's three core hole requirement limiting core hole spacing to 5600 feet (1.06066-mile centers) matched "quite well for the range of spacing used by the mining companies with a bias toward more conservative drilling." INT 69 at 5. He also found that, treating each new hole as a "step out" from known ore, the resulting area of 624 acres "matches the range" of the reported acres per hole for five of the six mines. INT 69 at 5-6.

Needless to say, Griswold's report was subject to criticism by several of the Appellants' witnesses. Bessinger provided considerable testimony critical of its statements and exhibits. See Bessinger: 9846-71. Muncy explained that the 35 core holes Griswold had used in calculating 219 acres per core hole for what became the Amax mine had been drilled by Farm Chemical Resources Development and did not include 25 other core holes. Muncy: 7257, 7484; YP 591. After commenting on a number of portions of the report, Hutchinson was asked about Griswold's statement that his objective had been "to determine where BLM Lease Grade ore exists under the lease" and answered that the report "seems to be a confirmation that three core holes in a mile and a half for leasing purposes is a good standard to use. It doesn't go beyond that, in my opinion." Hutchinson: 7908-09.

In contrast to Bessinger, Waugh thought it "inconceivable" to drill core holes at quarter-mile spacing because there was no point in identifying local variations within the potash as mining companies had done when they initially began mining potash. Waugh: 11334, 11361. Instead, he explained:

> The best thing you can do is come up with the regional understanding that there is an ore body there, it's an average grade. And when you mine that particular section, and you look at -- you only mine a small part of that section a year. When you've finished mining the section, you can expect that the average grade of all that ore is going to probably

closely approach what the drilling indicated that you'd have.

Waugh: 11334; see Waugh: 11360-62. Waugh believed a number of factors influence the decision as to the number and density of core holes, including "the nature of the ore body, the people, the professionals who are actually doing the work with it and their experience, and the philosophy of the company, in dealing with the level of investment." Waugh: 11765; see Waugh: 11336-43; INT 445.

As indicated in Waugh's testimony, the extent to which the grade of potash varies within the Potash Area is a factor in the discussion of the number of core holes needed to identify potash deposits. Of some interest, in applying for a royalty reduction, IMC explained that:

> Potash ore in the Carlsbad area is notorious in its heterogeneity. Carlsbad potash ore bodies typically are defined by one to five drill holes per section (square mile). Drilling at closer spacings has not proven useful economically, as grade varies so greatly over even a few feet that boreholes are useful for little more than definition of an ore body.

YP 451 at 10 (BLMCO22558). After discussing specific information regarding its mine, IMC stated that, since mining occurred at the rate of about 10 acres a month, it would take an "unrealistic spacing" of 64 boreholes per square mile to drill one core hole for each month of mining. YP 451 at 10 (BLMCO22558).

As will be described in greater detail, Hutchinson addressed the question of reliability by counting the number of core holes in areas where mining had occurred and dividing the number into the acreage to calculate an "area of influence." Depending upon the type of potash, the portion of the Potash Area, and whether the core holes were for new or "sustained" development, he found that mining operations had occurred where there had been one core hole per 39, 40, 47, 59, 62, 87, 113, and 160 acres. YP 727; YP 731. In contrast, he understood BLM's standard of three core holes within a mile and a half of each other encompassing a maximum area of 623 acres to provide a density, or area of influence, of 208 acres per core hole. Hutchinson: 7704-05; YP 731.

In comparison to Hutchinson's "area of influence," Van Sickle seems to have adopted a very different procedure in specifying that "[m]easured ore will not be projected further than ½ mile from a data point which meets thickness and quality standards where no projection or geologic inference data exists." YP 565; INT 19, BLMCO55405. In other words, absent additional geologic data, measured ore could be projected to the point where the next core hole would be drilled if core holes were drilled at regular intervals of four core holes per section. If so, the initial step of Van Sickle's method may have been to identify three qualifying "data points no more than 1 ½ miles apart" and draw a circle with a half mile radius around each. Each core hole would define an area of potash enclave covering the same area as a circle drawn within a 640 acre section, each area overlapping those identified by the other two core holes. Some form of geologic analysis would be needed to more precisely define the contours of potash enclaves based upon the varying values disclosed by the core holes, including nonqualifying core holes. See Herrell: 3867-

69, Van Sickle: 6935.

Whatever the proper understanding of Van Sickle's standard, the argument the Appellants initially raised that, based upon a standard of four core holes per section, the approximately 2000 core holes which have been drilled in the Potash Area are insufficient to reliably identify potash enclaves in one half million acres is without merit. See App. Prelim. SOR at 30; Pogo Final SOR at 38. The reliability of the core hole data does not depend upon the total number of core holes which have been drilled in the Potash Area but, as the witnesses discussed, their relative proximity to each other. A sparsity of core holes in one portion of the Potash Area would have no bearing on whether potash enclaves could be identified in another portion where a greater number of core holes had been drilled. The 1974 map appears to have termed areas with few or no core holes areas of "no data" and areas with insufficiently spaced core holes to meet the numerical standards as areas of "indicated mineable potash reserves." Similarly, the 1976 and 1979 maps show "unevaluated potash areas" and "indicated potash reserves."

The Appellants' broader claim that some specific density of core holes is needed to reliably identify potash enclaves is contrary to evidence that potash mining companies do not actively drill core holes as part of their ongoing operations. Waugh testified that IMC had not drilled any core holes from the surface since 1976, except for when it drilled one in order to put in a mine shaft. Waugh: 11276, 11688-89; see YP 187. He also explained that it is relatively inexpensive to drill core holes from inside a mine to another ore zone rather than from the surface. Waugh: 11272-76. It seems, however, that even subsurface core hole drilling is uncommon. Waugh explained that he had requested that IMC drill four in the seventh ore zone, but they were the only ones he knew IMC to have drilled since 1994 and his request caused some complaint because the "equipment was in mothballs somewhere and hadn't been used for some period of time, and it would take them some period of time to get it operable." Waugh: 11675-78, 11685-89. [51/] Notably, Mississippi Potash did not drill additional core holes when it made separate purchases of the National Potash Mine property and the New Mexico Potash Mine, apparently because it regarded reserve estimates based upon those already drilled and other information to be sufficient. Foote: 12490, 12494.

As indicated by the testimony of a number of witnesses, the confidence a geologist has in the reliability of a projected ore body depends upon the amount of data used in making the projections along with other factors, but it does not appear that potash mining companies operate based upon any specific standard for the number of core holes needed. Nor does it seem that oil and gas geologists apply a specific standard. Several of Brent

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[51]/ The record is not clear as to whether BLM's data base includes subsurface core holes. See Waugh: 11686. In addition, although Van Sickle explained that the "data points" he used to prepare the potash enclave maps included mine face samples, the record does not indicate the extent to which they were used and the ore zone maps show areas of mine workings but do not clearly identify any of the readings as mine face samples. Although at times logs from oil and gas wells apparently were examined, there is no indication that BLM incorporated any information which may have been available from the numerous wells which have been drilled within the Potash Area. See Patterson: 487-88; Cherry: 3109; Van Sickle: 7087-88; Herrell: 3680-83.

May's exhibits for the Appellants were based upon the logs for seven wells. Although four of them in the vicinity of the Lusk APD's are within a distance of about a half a mile of each other, the fifth well is about a mile to the southeast, the sixth well is over two miles to the southeast of the fifth, and the seventh well about another mile further to the southeast. See YP 357, YP 358; May: 4808-09, 5114-15; see also Hoose: 5608-5610. Van Sickle's standard that measured ore be delineated by a minimum of three "data points no more than 1 ½ miles apart" may have been minimal, but the record does not establish that it was an improper geological method. [52/]

III. D.7 The Bureau of Mines

The Appellants additionally rely upon a U.S. Bureau of Mines Minerals Availability System Special Project report titled "Valuation of Potash Occurrences within the Waste Isolation Pilot Plant Site in Southeastern New Mexico" prepared for the Energy Research and Development Administration. YP 712B, RP 007957 (complete document). They describe the Bureau as using "criteria consistent with the industry practice" and "a cutoff grade of 8% K_2O as langbeinite, with a minimum thickness of 4 feet." App. PH Reply at 55. They understand that the Bureau "conducted an economic and financial analysis, and that the USGS simply used a leasing standard." Yates Response to Int. Sur-Reply at 47. The Intervenors object to the Appellants' description and conclusion. Int. Sur-Reply at 7-8.

As the parties seem to agree, the Bureau of Mines engaged in a fundamentally different kind of analysis than that undertaken by the USGS and BLM in preparing their potash enclave maps. In summarizing the discussion which follows, the report states that the USGS had determined in its open file report "Potash Ore Reserves in the Proposed Waste Isolation Pilot Plant [WIPP] Area, Eddy County, Southeastern New Mexico" (INT 47) that:

> there are 482.6 million short tons (437.8 million tonnes) of mineralization

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[52/] The Appellants' post hearing reply brief discusses a July 7, 1992, report prepared by the American Mine Service (AMS) for the New Mexico Potash Corporation. App. PH Reply to BLM & Int. Briefs at 56-58. Identified as YP 582 in their brief, the report appears in the volumes the Appellants prepared for the hearing as YP 584. The Intervenors object to consideration of the document because it was not introduced and admitted as evidence at the hearing. Int. Motion for Leave to file Sur-Reply at 3; Int. Sur-Reply at 9. The document will not be considered. It is a technical, factual study undertaken by engineers and others who are presumably experts in their fields. Regardless of the authority this tribunal may have to admit it into the record, doing so would burden this tribunal with the task of understanding and evaluating its content without the benefit of testimony, both explanatory and critical, by the Appellants' and the Intervenors' expert witnesses. Nor would an opportunity to respond by counsel for BLM and the Intervenors seem sufficient to address the report's technical content. For similar reasons, by Order dated March 14, 2000, this tribunal declined, in response to a motion by the Appellants, to accept into the record three attachments to Trona Industry Committee of the Wyoming Mining Association's post hearing amicus curiae brief. The documents were technical articles written by geologists and others who appeared to be experts in their fields. Like those documents, the AMS report will be retained as part of the physical record preserving the history of the proceedings, but is not admitted as part of the record upon which this decision is based.

> in the WIPP site in a minimum thickness of 4 feet (1.2 meters) at or above a cutoff grade of 3% K_2O as langbeinite, 8% K_2O as sylvite, or an equivalent grade of mixed langbeinite-sylvite mineralization. The U.S. Bureau of Mines adjusted the tonnage to a minimum mining height of 4.5 feet (1.4 meters) and an estimated 85% mining recovery, resulting in an approximate tonnage of 461.4 million short tons (418.6 million tonnes). Grades of mined material were adjusted. Economic analysis determined that of the 461.4 million tons (418.6 million tonnes) reported, about 48.46 million tons (about 43.95 million tonnes) are ore * * *.

RP 007965-66. The report goes on to describe the "low grade," "lease grade," and "high grade" numerical standards the USGS used in its report [53/] and states that the USGS "estimate at lease grade cut off is 357.9 million tons which, when adjusted for estimated mine recovery of 85%, is 304.2 million tons." RP 007966. The summary continues by stating that the USGS:

> reports 304.2 million tons of potash reserves in the WIPP site. The U.S. Bureau of Mines reports in this study that there are 48.5 million tons of potash ore reserves in the site meeting specific criteria. The range in values represented by the two estimates can by explained by carefully considering how each agency classified and calculated potash reserves.
>
> From the standpoint of mineral resource conservation, the USGS utilized potash grade and thickness parameters of the most efficient producers in the district. These minimum ore standards, excluding all other mineability parameters, include all material in the WIPP site having a minimum cutoff grade of 4% K_2O as langbeinite or 10% K_2O as sylvite in a thickness of 4 feet.
>
> The U.S. Bureau of Mines uses criteria consistent with industry practice in preparing economic feasibility studies and employs a method of potash ore reserve calculations using engineering design and economic analytical procedures including discounted cash flow to determine the tonnage of minable potash ore that will yield a 15% rate of return on total capital investment. * * *

[53/] The USGS study applied both an additional lower standard of "4 feet of 3% K_2O as langbeinite" and "4 feet of 8% K_2O as sylvite" to identify "potash resource" and a higher one of "4 feet of 8% K_2O as langbeinite" and "4 feet of 14% K_2O as sylvite" to identify "potash reserve." INT 47 (complete document) at 26 (RP 007929). These additional standards, the report explains, were added "in order to allow for estimates of the effects of possible fluctuations in the market price of potash." Id. If the possible fluctuations pertained to the 1978 market price of potash, it appears that the "leasing standard" was regarded as reflecting the then current price of potash and, consequently, identified potash which at that time was "mineable under existing technology and economics."

RP 007966-67.

As the Appellants note, the report states that the Bureau of Mines conducted an economic feasibility study, while the USGS used a standard based upon "the most efficient producers in the district." Indisputably, the Bureau's study was considerably more sophisticated than the USGS's analysis, but it does not follow that the USGS applied what the Appellants' term a "leasing standard." If, as the Bureau of Mines stated, the USGS used a standard which was based upon the potash being produced by "the most efficient producers in the district," it was using a standard that described potash actually being produced. It follows that the USGS applied a standard that identified potash of "sufficient thickness and quality to be mineable under existing technology and economics" by at least some producers at the time.

In contrast, the purpose of the Bureau of Mines' report was "to calculate an estimate of the values that will be foregone if the WIPP installation goes forward," which it found to be $51.8 million dollars. RP 007969. In arriving at this figure the Bureau looked at the costs of opening a new mine. Briefly stated, it analyzed the costs of sinking a shaft, constructing a processing plant, constructing an access road and rail spur, purchasing mining and milling equipment, and paying start up and break in operation costs. RP008032, 008041. It factored in a recovery rate of 85%, six months of operating costs as working capital, payment of 9% interest on borrowed investment capital, and a 15% return on investment. RP 007966, RP008033, RP008041. The result of the Bureau's study was that it "determined that one mining unit in the WIPP site, having a cutoff grade of 8% K_2O as langbeinite in a minimum thickness of 4.0 feet, is commercial under the Bureau's design and economic criteria." RP 007967.

The purpose of the Bureau of Mines's study was not to identify potash which was "mineable under existing technology and economics" under the 1975 Order but to determine the value of the potash which could not be mined if the WIPP facility was developed. Nevertheless, accepting that its analysis was "consistent with industry practice in preparing economic feasibility studies," its cutoff values for langbeinite can be accepted as evidence of the "thickness and quality" of potash ore which was "mineable under existing technology and economics" at the time. Because the study was both site and time specific, however, its cutoff grade cannot be generalized to apply throughout the Potash Area or at a subsequent time. Not only would the costs the Bureau reviewed vary by location and change with time, more significantly, the economic factors it applied, in particular payment of interest at 9% and a 15% return on investment, would change with economic conditions. Presumably, quite different numbers would have been used if the study had been undertaken in 1992-93 when the Appellants' APD's were denied.

III. D.8 Pogo Producing Co.

In order to fully resolve the Appellants' arguments about BLM's reliance upon a "leasing standard" it is necessary to address several assertions made in Yates's Response to the Intervenors' Sur-Reply. In discussing the Bureau of Mines document, Yates states:

"Intervenors accuse Appellants of confusing average grades with cut-off

> grades, referring to BLM's cut off grades." BLM does not have cut off grades. BLM has lease grades. This distinction was developed throughout this trial and recognized by the IBLA most recently in Pogo Producing Company. Each individual mine has a distinct cut off grade.

Yates's Response to Int. Sur-Reply at 47-48. Yates does not identify the source of the sentence it places in quotation marks. Nor does it cite the specific page of Pogo which it believes "recognized" a "distinction" between cut off grades and lease grades. The absence of a citation is notable because a finding by the IBLA that "BLM has lease grades" would have controlled the analysis of this portion of this decision and have rendered most of the discussion unnecessary. Moreover, if the effect of Pogo was to require a finding that the 1984 map is a leasing map and not a potash enclave map, there would be no need to address most of the remaining issues related to potash enclaves and considerable portions of the testimony given by many of the Appellants' and the Intervenors' witnesses could be passed over.

Yates's assertion appears to relate back to an earlier statement in its brief which declares that in Pogo the IBLA "determined the issue adversely to Intervenors" and that Pogo:

> specifically recognizes the distinction between mineralization subject to competitive leasing and those areas known to contain economically mineable ore. The IBLA specifically recognized that [it] is proper for Yates and Pogo to acquire the potash lease without having determined the ultimate mineability of the are [sic].

Id. at 42. Again, Yates does not provide a citation to Pogo, but, after charging the Intervenors with attempting "to merge the concepts of leaseability and mineability," it asserts that "not only the participants in the industry, but even the IBLA recognizes such a distinction * * *." Id. Yates goes on to quote (and miscite) a portion of a paragraph from Pogo which states in full:

> Whether or not BLM agrees with all the parameters utilized by Lammers and Hutchinson in evaluating the economic potential of the ore zones subject to the lease (and we note that BLM has acknowledged the reasonableness of Hutchinson's analysis), those evaluations reveal that appellants undertook a serious examination of the possible commerciality of the deposits and concluded that the potential for an economic return from mining the potash ore warranted submitting a bid for tract No. 2. That appellants state that additional core hole drilling and other exploration work must be performed before a definitive determination of the projected profitability of the deposit can be made and a detailed mining plan developed does not undermine the good faith of their decision to bid.

Pogo Producing Co., supra at 156. Similar to its previously quoted statement, Yates concludes by asserting: "Clearly the IBLA understands the difference between the determination of the quantity and quality of mineralization for purposes of lease

acquisition and the ultimate determination of mineability." Yates Response to Int. Sur-Reply at 43.

The evaluations by Gary Hutchinson and Leo Lammers to which the IBLA refers in the quoted paragraph were reports by consultants hired by Yates and Pogo which the companies provided BLM in seeking reconsideration of its decision to reject their high bid for a potash lease that included the sites of some of the proposed wells that are at issue in this case. See Pogo Producing Co., supra at 144. As described by the IBLA, the reports detailed "the presale geologic and economic analyses undertaken to ascertain the potential for economic return from lease acquisition." Id. The IBLA understood Yates and Pogo to claim that the reports, along with other materials given to BLM that day, "demonstrated that their bid was made in good faith upon a well-founded belief that, based on data currently available, at least the fourth ore zone subject to the offered lease contained a potentially economic deposit of potash." Id. In the quoted paragraph, the IBLA agreed that the reports showed that the companies had undertaken "a serious examination of the possible commerciality of the deposits" and had concluded that there was a "potential for an economic return from mining the potash ore," as they had argued in appealing to the Board. See id. at 147. As the Board subsequently stated, Hutchinson's report, and another by George Warnock which is part of the record in this case, "conform to appellants' acknowledged goal of pursuing the profitable development of both oil and gas and potash." Id. at 157.

In addition, the IBLA rejected an argument, apparently raised by the Office of the Solicitor, that Yates's and Pogo's statement that further core hole drilling and exploration work was needed prior to "a definitive determination of the projected profitability of the deposit" (language perhaps taken from their brief) was contrary to their assertion of good faith. See id. at 152. The argument concerned the companies' good faith, not a factual difference between potash "mineralization subject to competitive leasing" and "economically mineable ore." The IBLA did not reject the argument because it found that Yates and Pogo had determined that the proposed lease area contained potash "mineralization subject to competitive leasing," but because the reports by Hutchinson and Lammers showed the companies had examined "the possible commerciality of the deposits" and found there to be a "potential for an economic return from mining the potash ore." Yates's description of this ruling as recognizing that it and Pogo could properly acquire the lease without having determined the "ultimate mineability of the ore" is apt. Its inference and assertion that the Board thereby recognized a "distinction between mineralization subject to competitive leasing and those areas known to contain economically mineable ore" is erroneous. Yates imports the distinction from the Appellants' arguments in the present case.

Yates's description of the distinction it attributes to the IBLA includes the word "known." The term does not come from the IBLA's discussion of the issues in Pogo but appears to be taken from the definition of potash enclaves in the 1986 Order. As will be addressed, the Appellants believe that the definition requires identifying potash enclaves based upon something akin to "a definitive determination of the projected profitability of the deposit." Id. at 156. Because Yates believes this wording describes what the Order requires, it construes its appearance in Pogo to be about the definition of potash enclaves

in the 1986 Order. Pogo, however, does not mention the definition and the word "known" appears only in describing the potash and geothermal leasing statutes and in quoting a portion of Hutchinson's report. Id. at 153-54. Having construed "definitive determination" to refer to the definition of potash enclaves, Yates reads the IBLA's use of the qualifications "possible" and "potential" in describing the Hutchinson's and Lammers' reports (terms perhaps originating in the appellants' brief, see id. at 144) to contrast with "known" in the 1986 Order. Consequently, Yates understands the Board to be discussing what Yates is certain is not called for by the definition of potash enclaves, "mineralization for purposes of lease acquisition." Yates Response to Int. Sur-Reply at 42-43. Thus, Yates finds the paragraph to "recognize" the distinction the Appellants advocate in this proceeding.

Not only was the 1986 Order's definition of potash enclaves not at issue in Pogo, it was not discussed. Nor is there any indication in Pogo that Yates and Pogo had argued that their lease offer was made in good faith because they had determined that the offered lands contained "mineralization subject to competitive leasing." The issue in Pogo was Yates's and Pogo's good faith. The IBLA found that the Hutchinson and Lammers reports supported their assertion of good faith. After acknowledging Yates's and Pogo's explanation of the difference between Hutchinson's and Warnock's reports and a letter by Hutchinson, the IBLA determined that "BLM's conclusion, based on the inconsistencies between the Warnock and Hutchinson submissions, that appellants submitted their bid in bad faith is unwarranted." Pogo Producing Co., supra at 156-57. While Yates reasonably describes the Board as concluding that Yates and Pogo did not need to determine the "ultimate mineability of the ore" in order to bid in good faith, there is no basis in Pogo to equate this phrase with "known to contain economically mineable ore" or the definition of potash enclaves in the 1986 Order. The Board did not consider, let alone "recognize," a "distinction between mineralization subject to competitive leasing and those areas known to contain economically mineable ore." It did not consider, let alone "recognize," a distinction between lease grades and cut-off grades. The term "cutoff" appears three times in Pogo: first in noting that Hutchinson used "cutoff grades considerably higher than those used by the potash industry," then in describing the Deputy State Director's finding about "Hutchinson's use of high grade cutoffs," and finally in quoting a memorandum from Hutchinson to Yates's land manager that refers to BLM's "very low cut-off grades." Pogo Producing Co., supra at 145-46, 154. The IBLA did not "recognize" that "BLM has lease grades."

The Appellants' did not make such assertions about Pogo in their post hearing brief. This tribunal might have simply passed over Yates's injection of their position into the Pogo decision as fanciful and overstated advocacy, but Yates also charges that the:

> Intervenors do not even address the decision in Pogo Producing Company and have the temerity in the face of a plainly binding authority which they lost, to say, "it would not make sense for BLM to use one set of cut offs for leasing, and another for mining purposes." The only people who apparently fail to understand the distinction between lease cut offs and mining cut offs are [the] Intervenors, and Appellants suggest that the failure to understand the distinction is a pretense employed only for purposes of this case.

Yates Response to Int. Sur-Reply at 43. Again, Yates does not identify the source of the quoted statement it attributes to the Intervenors. None of the instances in which "cutoff" appear in Pogo have any bearing upon a "distinction between lease cut offs and mining cut offs." Like the other distinctions Yates finds in Pogo, its apparent belief that the IBLA does not "fail to understand" its distinction about cutoffs derives from what Yates imagines the Board's discussion to be about. Yates's unsupported assertions about Pogo are egregious distortions of potentially controlling precedent. Its criticisms of the Intervenors are unfounded.

IV. "Mineable under Existing Technology and Economics"

IV. A. The Issue of Enclaves

As has been discussed, the 1975 and 1986 Orders equate a "mineable reserve" with a potash "enclave" and define them as "those areas * * * where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics." Appendix A, § III.D.1.c. As noted in addressing the Intervenors' claims about the scope of review, the Orders also establish an enclave policy "to deny approval of most applications for permits to drill oil and gas test wells from surface locations within the potash enclaves * * *." Id. § III.E.1. And as noted at the outset, the IBLA identified a principal issue in deciding "whether BLM's denial of the APD's accords with the provisions of the 1986 Order" as:

> whether the APD's encompass lands within areas qualifying as potash enclaves under the parameters established by section 3.III.D.1.c. of the Order, i.e., whether the lands are currently unmined areas within Federal potash leases "where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics" * * *.

Yates Petroleum Corp. et al., 131 IBLA 230, 235 (1994).

The Appellants' various arguments that potash enclaves are necessarily limited to lands leased for potash, that the enclave policy applies only to exploratory wells, and that the USGS and BLM have prepared only potash leasing maps have required deferring review of the issue identified by the IBLA. The specific issue to be decided is whether the standards Van Sickle set forth in his April 5, 1974, memorandum currently define potash ore which is mineable under existing technology and economics. The Appellants, of course, maintain that they are not valid (if they ever were). During the course of argument and through testimony by their expert witnesses, they have raised a variety of issues regarding the facts about the economics of potash mining operations. That testimony, as well as testimony by the Intervenors' expert witnesses and many of the numerous documents both sides discussed, will be addressed in the sections which follow.

The Appellants also have presented a broader argument that the definition of potash enclave in the 1986 Order requires a site-specific analysis of various factors pertaining to each deposit, including matters such as mining, processing, and milling capabilities, available market, and transportation costs. App. PH Brief at 117-18; App. PH Reply at 59, 68. In particular, they argue that the 1986 Order requires identifying potash enclaves using the method of analysis described and applied by their witness, Gary Hutchinson. They criticize BLM for rejecting "site specific enclaves utilizing different mining standards for each mine similar to the manner in which Mr. Hutchinson recommended" and for concluding that "Hutchinson's methodology for mapping enclaves was improper as unduly burdensome and not what was contemplated by the 1986 Order." App. PH Brief at 123. They assert that "[t]o the contrary, the 1986 Order required precisely the methodology utilized by Mr. Hutchinson." Id. They explain:

> The 1986 Order requires each potash lessee to annually map those areas, "that are not presently being mined which are considered to contain a minable reserve in one or more ore zones, i.e., those areas (enclaves) where potash ore is known to exist in sufficient thickness and quality to be minable under existing technology and economics." The potash lessee is required pursuant to the 1986 Order to file such maps annually by January 1 with the District Manager of the BLM. The maps are to include other information as well. Thereafter, the Order directs the authorized officer to "review the information submitted and make revisions in the boundaries of the proposed minable reserves which are consistent with the data available at the time of such analyses."
>
> The Secretary recognized that each mine had distinct economic cut-offs, distinct tolerances for contaminants and insolubles, distinct milling processes, distinct transportation processes, distinct technological capabilities, and distinct degrees of certainty which it would require before determining that a particular body of mineralization underlying its leases would constitute a minable reserve. Whether or not an area is a minable reserve for one lessee does not make the same mineralization a minable reserve for another lessee. Thus, enclaves could not be designated on a blanket area-wide basis, and the Secretary knew this. The 1986 Order recognized that the starting point for any designation of an enclave necessarily related to the technological capabilities and economic parameters of the lessee. The provisions of the 1986 Order recognize that the Federal government cannot properly and should not properly determine the economics of mineralization for extractive industries.

App. PH Brief at 123-24.

The first quoted paragraph accurately describes the potash enclave section of the 1986 Order. There is, however, no obvious relation between it and the Appellants' claims in the second paragraph that the Secretary "recognized" or "knew" a variety of matters. The Order requires a potash lessee to file a map showing what it considers to be areas containing a "mineable reserve." It does not expressly require a potash lessee to prepare such a map based upon its "distinct economic cut-offs, distinct tolerances for contaminants and insolubles, distinct milling processes, distinct transportation processes, distinct technological capabilities, and distinct degrees of certainty."

The Appellants' assertions seem to derive from a mistaken understanding that "[t]he 1986 Order and its predecessor the 1975 Order, clearly required the Potash Industry to submit data necessary for mapping enclaves in the first instance." App. PH Reply at 17; see Hutchinson: 8110, 14772. As explained in response to their argument that potash enclaves are limited to "leases which are then held," the sentence in the Chief of the Conservation Division's February 14, 1974, memorandum stating that potash lessees were to submit "sufficient data to justify any area which is proposed as a minable reserve" was eliminated when the 1975 Order was published in the Federal Register. YP 239, YP 241. This misunderstanding underlies their argument that:

> In requiring potash lessees to map their enclaves in the first instance, the Secretary of the Interior recognized that in order to map reserves according to existing economics and technology, the maps must be created on a site specific basis using data compiled by the potash lessee developing the mineralization. Only that lessee can determine the extent of mineralization which is economic under the lease it operates. * * * This Court need only read the plain terms of the 1986 Order. Apparently the Local Agency did not. If the Local Agency had fulfilled the requirement of the 1986 Order to obtain enclave maps from the potash lessees in the first instance, it would have the site specific data required by the Order, and the Local Agency would then be required only to modify the areas mapped with information known to BLM.

App. PH Reply at 68-69. In other respects, the Appellants are correct that neither the USGS nor BLM enforced the requirement that potash lessees file the maps called for by the 1975 and 1986 Orders, but it does not follow that the maps would have provided the agencies with the kind of "site specific data" the Appellants describe.

The assumption that potash lessees are required to submit data supporting their potash enclave maps is also inherent in the Appellants' defense of Hutchinson's methodology as being in accord with the 1986 Order:

> [I]t is apparent that the Secretary of the Interior agreed that such a methodology was the appropriate means by which to map enclaves. The Secretary of the Interior clearly envisioned a site-specific map whereby each mine provided its owns parameters and economic cutoffs. Why else require that each mine submit the maps called for in the 1983 Directive and the 1986 Order. Mr. Hutchinson was instructed to do what the 1986 Order required the Potash Industry to do. Mr. Hutchinson did not select his methodology, the 1986 Order determined the parameters of Mr. Hutchinson's methodology.

App. PH Reply at 59. The Appellants may believe that the requirement to file a map of areas "not presently being mined which are considered to contain a minable reserve" entails a further requirement that mining companies undertake a site-specific analysis of the land within their leases using the factors the Appellants identify and provide BLM with the data, but their belief is not a basis upon which this tribunal can conclude that the 1975 and 1986 Orders have required the USGS and BLM to prepare potash enclave maps using such a method, let alone to use Hutchinson's methodology or something akin to it.

The Appellants' position also rests upon testimony by their witnesses about the meaning of terms used in the definition of a potash enclave. The thrust of their testimony was that, by using the terms "ore" and "reserve," the Order defines potash enclaves as areas where potash can be mined and extracted at a profit and requires using commercial standards for determining whether such mineralization is present. See Muncy: 7250, 7260-62, 7291-94, 7477-78; Hutchinson: 7541-46, 7562-66, 8354-55, 14734-36, 14770; Bessinger: 9823-30, 9870, 9876.

The testimony raises a valid point, but is insufficient to sustain the conclusion the Appellants wish to reach. "Ore" is a common word and has a variety of meanings, most simply: "A natural mineral compound of the elements of which one at least is a metal." A Dictionary of Mining, Mineral and Related Terms, at 772 (Paul W. Thrush ed., Bureau of Mines 1968). In the context of mineral development and mineral economics, "ore" appears to have a fairly consistent meaning. As the Appellants point out, the 1973 edition of the SME Handbook states:

> When minerals are found in sufficient concentration to warrant extraction by mining, the mineralized area is considered an ore deposit. The definition of ore is mineral that can be extracted from the ground at a profit. The economic connotation is implicit in the word ore.

SME Mining Engineering Handbook (New York 1973) § 1.1 at 1-2 [italics in original]; see also Glossary of Geology at 439 (Robert L. Bates & Julia A. Jackson eds., American Geological Institute, Alexandria, Virginia, 2nd ed. 1980). This meaning of the term, however, is not in dispute. BLM agrees that ore is "mineral that can be extracted at a profit." Cone: 10638; see Herrell: 2190; Waugh: 11383; see also A Dictionary of Mining, Mineral and Related Terms, supra ("The test of yielding a metal or metals at a profit seems, in the last analysis, to be the only feasible one to employ."). Even if the term "ore" by itself was used in the 1975 and 1986 Orders with its ordinary meaning to refer to mineral compounds with potassium as a component, the Orders define a "mineable reserve" as consisting of "potash ore" which is "mineable under existing technology and economics." See also A Dictionary of Mining, Mineral and Related Terms, supra at 777 ("minable" is "Material that can be mined under present day mining technology and economics"). It requires little knowledge of economics to conclude that potash which cannot be sold at a price which generates revenue equal to or exceeding the costs of production cannot be regarded as ore which is mineable under existing economics. See Van Sickle: 6934 ("minable" refers to "the lowest grade that would be mined, providing * * * that they had enough higher-grade ore to mix with the minimum ore"). The economic component of the definition is also reflected in the requirement that potash lessees identify areas which are "believed to be barren of commercial ore." Potash enclaves are, by definition, economically mineable deposits.

The manner in which a determination is to be made as to whether an area of "potash ore" is economically mineable so as to constitute a potash enclave is a different matter. A method of analysis cannot be deduced by examining the meaning of the words "ore," "economics" or "mineable" in the definition of potash enclaves. Mineral economics is not a branch of linguistic analysis. Nor does testimony about the meaning of terms in the definition of potash enclaves in the 1986 Order control its interpretation. The testimony presented at the hearing is instructive, but the definition appears as part of a legally binding order due to its publication in the Federal Register and its interpretation is a matter of legal interpretation to be made in the context of its other provisions.

After reading a portion of the SME Handbook stating that the USGS and Bureau of Mines are "primarily and fundamentally concerned with * * * future potential minerals resources" and "their distinction of class types is based largely upon a projected rather than

a present potential," the Appellant's witness, Nelson Muncy was asked:

> Q. * * * With respect to the guidelines in the '86 Secretarial Order, which, in your opinion, do you feel is required by that Order?
> A. We have to consider economics and what's -- can be mined currently, today.
> Q. Are you saying, then, that what you feel that the '86 Order requires is a classification or distinction based upon present potential?
> A. That's correct.

Muncy, 7294. In turn, when Hutchinson discussed the definition of potash enclaves, he referred to Muncy's testimony:

> So we're now talking about enclaves as those areas where potash ore is known to exist. "Known to exist." We're talking about some of the inferences in the definitions of measured ore that Mr. Muncy came up with yesterday. You may recall that the geologic structure is so well known that no more exploration need be done; that it will come within a certain range of what is actually mined. "Known," in this definition, somebody in 1975 knew what they were talking about when they used the word "known to exist."

Hutchinson, 7563. Undoubtedly, someone did know what they were talking about in 1975. As previously analyzed, the 1975 potash enclave map appears to have adopted, with the modifications noted, the definition of "measured ore" which the SME Handbook says the USGS used at the time and which appears in US Geological Survey Bulletin 1450-A (1976). See INT. 47 at 27 (RP 007930). In contrast, the "present potential" about which Muncy was asked referred to ore "reserve analysis made by, or for, a private enterprise" and is concerned with classifying tracts of ore "on the basis of their currently mineable nature." SME Mining Engineering Handbook (New York 1973) § 32.2.4 at 32-39.

In contrasting commercial and leasing standards, the Appellants overlook the fact that the Handbook's definitions of "developed," "probable," and "possible" ore do not directly include an economic component. "Developed ore" is "ore which is so completely exposed that its existence as to tons and tenor is essentially certain and which, in addition is available for immediate withdrawal by the mining method being employed." SME Mining Engineering Handbook (New York, 1973) § 32.2.4 at 32-40 (YP 572). The Handbook explains that this definition differs from that of "measured ore" in that "the factor of ready mineability may not always be equal." The other commercial ore standards are similarly defined based upon physical access to the mineral. "Probable ore" is ore for which "[a] definite grade can be assigned * * * but mining excavations have not progressed to the stage where the probable tons are available for current mining, although it could become available for withdrawal in a relatively short time" and "possible ore" is "based primarily upon the strength and continuity of geologic-mineralogic relationships and upon the extent of ore bodies already developed, and for which therefore a measure continuity is available as an indication of what may be expected as mining excavations

progress into farther reaches." SME Mining Engineering Handbook (New York, 1973) § 32.2.4 at 32-40 (YP 572). Thus, the key feature of the "commercial" standards reported in the Handbook is not whether the mineral may be economically mined but the increased certainty about what lies underground which results from having opened a mine and partially developed an ore body.

During cross-examination about the term "existing technology" in the definition of potash enclaves, Hutchinson was asked whether potash enclaves were to be "based upon the technology only that one particular mine has, or whether or not it's just available in a general sense." Hutchinson, 8104-05. In response, he explained that he had examined each mine in making his enclave maps and added that the matter was:

> Another indication as to why the maps from '74 to '93 are lease maps. Because for leasing, no one has proven a reserve or its geometry, as described in the definition of "measured reserves" in the 1980 document published by the Bureau of Mines, and the USGS. At the leasing point, you don't know the geometry, grade, or continuity of an ore body. Until you know that, you cannot design a mining system. Without a mining system, you cannot design a mine plan. Without a mine plan, you cannot determine mineability or economic mineability.

Hutchinson: 8105. Although this statement may describe the manner in which a mineral economist would analyze mineability for a mining company, or the Bureau of Mines might use in assessing compensation to be paid for potash leases within the WIPP site, BLM is not in the mining business. Adoption and application of the methods of ore reserve classification described by Hutchinson would require BLM to engage in gross speculation in designing a mining system and mine plan and projecting cash flow and expenses to determine economic mineability. It would require it to "determine the economics of mineralization for extractive industries" which the Appellants otherwise assert it should not do. See App. PH Brief at 125. Even if potash enclaves are limited to lands leased for potash as the Appellants contend, the fact information would be available from the lessee would not obviate BLM from having to “review the information submitted” and undertake its own analysis of the economics of the proposed or current operation in order to identify areas of potash enclave.

At best, the Appellants might have argued that, in requiring potash mining companies to identify areas they "considered" to contain potash enclaves "mineable under existing technology and economics," the Department expected that they would undertake a factual and reasoned evaluation of the area within their Federal leases that could be commercially mined. Hutchinson could have elucidated the manner in which he, as a mineral economist, would analyze and identify areas "where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics." Such testimony would have provided support for the Appellants' claim that each potash lessee is required to identify potash enclaves based upon facts pertaining to its own site and mining operation, but it would not have allowed them to further assert that the Order requires each lessee to do so using the “distinct” factors the Appellants identify. Nor would it have allowed them to claim that the Order requires BLM to identify potash

enclaves on the same basis. The 1986 Order is a legal document and, to the extent there are questions about the meaning of its terms and the definition of potash enclaves, its interpretation is a matter of legal interpretation. As was recognized at the hearing, Hutchinson's experience in mineral economics does not extend to expertise in legal interpretation. Tr. 8437-38.

IV. B. Scope of the Enclave Section

The 1975 and 1986 Orders do not provide any direct insight into how the definition of potash enclaves is to be interpreted and the enclave policy applied, but documents which preceded issuance of the 1974 Guidelines and the 1975 Order suggest several points. As has been discussed, the term "enclave" originates in the Chief of the Conservation Division's December 7, 1973, memorandum making recommendations to the Director of the USGS YP 238, INT 14. He did not, however, provide any explanation of the term. He had reviewed, and was forwarding, not only the position paper of the Potash Committee of the New Mexico Mining Association and Charles E. Hinkle's May 2, 1973, letter on behalf of the New Mexico Oil and Gas Association but also the comments on those documents which had been jointly prepared by the Deputy Oil and Gas Supervisor and the Mining Supervisor for the Rocky Mountain Area. YP 236, Int. 12.

In responding to the claim that the potash industry was receiving preferential treatment, the supervisors stated that, although they did "not believe that either industry has been discriminated against by our administrative practices," agreed "that guidelines should be established by the Survey to the extent necessary that both industries can anticipate in most cases whether or not drilling would be permitted." YP 236, Int. 12 at BLMCO17399. This comment suggests they believed that a clearer basis was needed to allow participants in both industries to anticipate whether an APD would be approved or denied, apparently to avoid the kinds of disputes that had arisen at the time. It also indicates that the supervisors did not regard the potash and oil and gas lease stipulations as sufficient for mineral developers to make reasonable estimates of whether oil and gas drilling would be allowed.

The supervisors, however, disagreed about application of the stipulations. The mining supervisor believed that the 1965 Order, then in effect, "contemplated permitting oil drilling only in those portions of the areas which were known not to contain potash ore bodies" and "did not specify or contemplate that the potash deposits should be mined within any specific or general period." Id. at BLMCO17401. In contrast, the oil and gas supervisor pointed to the prohibition on "undue waste" in the second oil and gas lease stipulation and, after quoting a definition of "undue," stated that it "clearly precludes its application to completely prohibit the drilling of wells through all potash deposits" and that the oil and gas division could not:

> agree that wells are prohibited in every mineable potash deposit in the area unless definite plans for the mining of such potash underlying the proposed well location can be established as occurring within a reasonable time. We believe that wells should not be drilled in potash ore certainly when ore will be mined in the well vicinity in 5 years; probably should not be drilled

> if the deposits underlying the location is to be mined within 10 years; but after such point in time, we believe justification for denying drilling becomes considerably weaker and would recommend that drilling operations should be permitted if mining the deposit underlying the location is to be deferred longer than 10 years * * *.

Id.

Despite this difference, the supervisors agreed "that the existing regulations are adequate to protect both industries." Id. at BLMCO17403. "[W]hat is now needed instead of new rules and regulations," they explained, "is interpretation of the present oil and gas lease stipulation[s] as to whether the time element of mining versus the anticipated productive time period of a proposed oil and gas well should be considered." Id. They also agreed: "It is virtually impossible for the Mining and Oil and Gas Supervisors to function without disagreement in the absence of [a] firmer Survey position on these difficult matters." Id.

The Chief of the Conservation Division reviewed not only the supervisors' comments but those of the Central Region Conservation Manager, who agreed with the supervisors that "the Order furnishes adequate protection to both industries and should not be changed." YP237 at BLMCO17409. The regional manager also appears to have agreed with the oil and gas supervisor that some kind of "time element" was needed in administering the Potash Area. He recommended that oil and gas lessees "be required to furnish sufficient geological and geophysical evidence to convince the Area Oil and Gas Supervisor and the Area Geologist that the drilling of such well is justified" and that potash lessees:

> be required to furnish sufficient geological evidence and/or mining plans to convince the Area Mining Supervisor and the Area Geologist that the drilling of such well will:
>
> a. Penetrate a potash deposit of sufficient thickness and quality to be considered a minable reserve within the next 25 years.
>
> b. In prospective gas areas, penetrate a potash deposit that will actually be mined within 15 years and, in prospective oil areas, a deposit that will be mined within 20 years.

YP237 at BLMCO17409-410.

The Chief of the Conservation Division agreed generally with both review documents "that more clear-cut procedures to assist the Supervisors in their decision-making processes should be adopted" and that "guidelines to implement the new procedures should be developed." YP 238 at BLMCO17425. Notably, however, he seems to have rejected the position that those "guidelines" be adopted without changing the 1965 Order. Instead, he proposed what became the enclave section of the 1975 Order. It is significant that his proposal includes the definition of potash enclaves, provides that the Area Geologist "prepare the data * * * for unleased Federal lands in the Secretary's Potash Area," and sets forth the enclave "policy to deny oil and gas drilling operations within the

`potash enclaves' established in accordance with" the Order. Id. at BLMCO17425-26.

The Chief's proposals may derive from the Central Region Conservation Manager's recommendations that decisions about APD's be based upon geological evidence and that oil and gas drilling not be allowed to penetrate a potash deposit "of sufficient thickness and quality to be considered a minable reserve." YP237 at BLMCO174010. In particular, the regional manager's recommendation that potash lessees provide geological information about potash deposits may have led to the Chief of the Conservation Division's recommendation that potash lessees be required to submit maps of potash enclaves and supporting data. See YP 238, INT 14 at BLMCO17425. The corresponding recommendation that oil and gas lessees furnish information to justify drilling did not survive and become part of the 1975 Order (except as already called for by the oil and gas lease stipulations). Nor did the Chief adopt his subordinates' recommendations that decisions on APD's be based upon an express period of years or other "time element" in which oil and gas operations or potash mining might occur. Instead, he introduced the concept that the "thickness and quality" of potash constituting a mineable reserve be identified based upon "present day technology and economics."

In addition, instead of "guidelines" for applying the oil and gas lease stipulations, as had been requested by the supervisors, the Chief stated a simple policy that the Department would deny oil and gas drilling within potash enclaves. This approach appears to have been contrary to the supervisors' advice on the issue of whether "[t]o delineate the portions of the potash area where oil and gas drilling can be conducted without interfering or preventing extraction of the potash deposits." The supervisors jointly stated:

> The concept of delineating portions of the potash area where drilling could be conducted would in effect divide the potash area. Such concept was suggested, considered, and dismissed as impracticable at the time the area was opened to oil and gas leasing. We believe it is still impracticable inasmuch as mapping of the potash ore zones has to be progressively revised as new control data is contributed from core tests, mining operations, and the radioactivity logs from oil and gas wells.

YP 236, Int. 12 at BLMCO17407.

In context, the enclave section and the enclave policy appear to have been designed as a "bright line" for reviewing APD's to provide the sort of predictability the supervisors thought was needed. While the general "guidelines" or instructions for applying the oil and gas lease stipulations they had requested might have led to continued disputes about application of not only the meaning of phrases in the stipulations but also the guidelines or instructions themselves, identifying potash enclaves based upon a "sufficient thickness and quality" standard would seem to limit disputes to factual questions whether geological data showed the potash in an area to meet the standard. It would also avoid speculative arguments about whether and when mining might occur, as could arise in relying upon some kind of "time element" in reviewing APD's. See Cone: 11178, 11203. The Chief, however, did not specify how the Area Geologist was to arrive

at a standard for the "thickness and quality" of potash "minable under present day technology and economics." Nor did he indicate how frequently the standard was to be reviewed and revised, but specified that the maps were to be updated annually or "whenever new information becomes available" and may have anticipated that changes in technology and economics would be subject to regular review and the "thickness and quality" standard adjusted as maps were updated. See YP 238 at BLMCO17425. If so, the present case could be said to arise because neither the USGS nor BLM subsequently reviewed the standards set forth in Van Sickle's April 5, 1974, memorandum.

Two additional points about the scope of the potash enclave section as added in the 1975 Order are important. First, although the position paper of the Potash Committee of the New Mexico Mining Association, the letter on behalf of the New Mexico Oil and Gas Association, and the supervisors' joint review of those documents each relied upon phrases found in the oil and gas lease stipulations, as did the Central Region Conservation Manager to a lesser extent, the Chief of the Conservation Division's memorandum does not. Nor does the potash enclave section. The question whether to deny an APD under the enclave section is separate from questions which may arise as to whether it may be approved consistent with provisions of the oil and gas lease stipulations. Correspondingly, the presence of a properly identified potash enclave is sufficient to deny an APD under the enclave policy, subject to the exceptions for barren areas and drilling islands.

An understanding that the enclave policy provides an absolute prohibition on drilling for oil and gas within potash enclaves, except for barren areas and drilling islands, is also reflected in the Assistant Secretary's 1983 Directive. He required that suspended leases "be reviewed upon completion of the updated Enclave Map to determine which leases will remain in suspension and which leases can be drilled from an island or barren area." YP 249 at RP 006305. He did not mention a possibility that wells could be drilled from other locations within potash enclaves. Consistent with his statement, the Instructions provided that suspended leases would "be reviewed after the update of the Enclave Map to determine if drilling may be allowed from barren areas or from drilling islands which may be established." YP 249 at RP 006305. Instead, BLM was further instructed to review "[a]ll drilled locations * * * to evaluate the potential of creating drilling islands where previous drilling activity has occurred." YP 249 at RP 006307. In addition, the Instructions provided that "[p]rior to leasing available acreage," BLM would review "the Enclave Map, established drilling islands and barren areas, and other current data so that oil and gas leases are issued only in areas where drilling may proceed." YP 249 at RP 006307. By implication, drilling could not proceed elsewhere within potash enclaves and, correspondingly, leases were not to be issued.

The Appellants have claimed that the words "drilling may proceed" mean that, prior to issuing their leases, BLM determined that wells could be drilled in areas within which the APD's at issue are located. See App. PH Brief at 60-61; App. PH Reply at 109, 129. Accordingly, they seem to believe that the potash enclave policy cannot be applied to preclude approval of their APD's. The record includes numerous memoranda addressing the leaseability and drillability of various parcels for oil and gas. Although the documents do not constitute final determinations by BLM to issue the leases, they raise troublesome questions about its decisions to do so because many of the evaluations appear have been

prepared without regard for the potash enclave section of the 1975 and 1986 Orders.

For example, although some memoranda identify whether or not land is within a potash enclave, some state only: "This land tract is not within one mile of current mine workings, nor within one mile of proposed Three Year Mining Plans, and is therefore leaseable and drillable using a vertical hole." Compare YP 293 (2 tracts "not in measured ore") with YP 295 (4 tracts) and YP 296. As has been mentioned and will be discussed in greater detail, the 1986 Order allows oil and gas wells to be drilled within potash enclaves from barren areas and, when a barren area is not available from a drilling island, but prohibits establishing a drilling island "within one mile of any area where approved mining operations will be conducted within three years." Appendix A, § III.E.1.b. The fact a proposed wellsite, or an area of land, is not within one mile of planned mining operations and a drilling island may be established, however, is not sufficient to determine whether a proposed well within a potash enclave may be drilled. Not only would the well need to be located within a barren area or designated drilling island, it would also be reviewed under the oil and gas lease stipulations which would become part of the lease when issued, requiring factual determinations which cannot be made until an APD for a specific location has been filed. More troublesome in this regard are the memoranda which state that parcels are leaseable or drillable because they are not within the one mile limit even though they are "within the potash enclave area in measured ore." YP 298; see YP 300, YP 307, YP 312 ("lands are underlain by ore in two ore zones"), YP 321. In other instances, there is no express statement whether the presence of a potash enclave was even considered, some documents bearing only handwritten notes of "ok" or "no." See YP 296 (tract 1 "should not be leased because it is within 1 mile of active mine workings," but other tracts may be leased), YP 297, YP 301, YP 303, YP 306, YP 309, YP 310, YP 311.

The propriety of the issuance of the Appellants' leases is not an issue in this hearing. On the other hand, a determination by BLM personnel that a parcel was leaseable and drillable which was not based upon review under the potash enclave policy cannot be accepted as precluding application of that policy. [54/] In context, it appears that the memoranda may reflect determinations by BLM that, recognizing variations in the wording used, the lands within potash enclaves were potentially drillable because the 1986 Order did not prohibit establishing a drilling island.

The second point to note about the potash enclave section is that potash enclaves are more limited areas than the "potash deposits" addressed in the oil and gas lease stipulations. If both terms identified the same areas, all APD's for wellsites located over mineable potash would be denied under the enclave policy, unless allowed under the exceptions for barren areas and drilling islands. Questions whether a well would "interfere with the mining and recovery of potash deposits" or "result in undue waste of potash deposits" could arise only in regard to wells located sufficiently close to mineable

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[54/] In addition, the parties disagree about what was meant by "drilling may proceed." BLM seems to understand that a tract was considered to be "drillable" if a single well could be drilled because completion of one producing well is sufficient to hold the lessee. See BLM PH Brief at 27-28. The Appellants, of course, find this explanation unsatisfactory because they wish to develop their leases using the 40 acre spacing allowed by the New Mexico Oil Conservation Commission.

potash or at the edge of a barren area next to mineable potash. There is no indication in the documents which preceded issuance of the 1975 Order that the enclave section was to limit or replace, rather than supplement, the oil and gas lease stipulations. In contrast to the general term "potash deposits" (under which the grade and extent of the deposit could be relevant in determining whether there would be "interference" or "undue waste") the "Mineable Reserves" section of the 1986 Order more narrowly defines potash enclaves as "mineable under existing technology and economics" and the enclave policy calls for denial of approval of all APD's except in barren areas and from drilling islands.

The more limited size of potash enclaves is also indicated by a portion of the Chief of the Conservation Division's memorandum which did not survive in the 1975 Order. After stating that drilling would be allowed in barren areas when it "would not adversely affect present mining operations," he stated that "in most cases" an oil and gas operator would "be required to drill a directional hole from a surface location outside the enclave," but "if the areal extent of any enclave is such that present technology precludes the drilling of a directional well from outside the enclave to test a remote interior lease and there are no barren areas from which drilling can occur," the USGS would establish a drilling island within the enclave. YP 238 at BLMCO17426. The provision indicates that the Chief anticipated that potash enclaves would in many cases be small enough that directional drilling could be employed. Of course, he also understood that some potash enclaves would be large enough to require a drilling island in order to drill on a "remote interior" oil and gas lease.

IV. C. Testimony by Gary L. Hutchinson

IV. C.1 Analysis of Potash Enclaves

The Appellants' primary witness to address the question of whether the standards BLM used to designate potash enclaves satisfy the provision of the 1986 Order that enclaves consist of potash ore "known to exist in sufficient thickness and quality to be mineable under existing technology and economics" was Gary L. Hutchinson. In general, his testimony was directed toward establishing that BLM's potash enclave map "has nothing to do with the '75 Order, the '83 directive, or the '86 Order" but was "clearly a leasing criteria map" because "it had nothing to do with economics of mining, and protecting those areas that were economically minable." Hutchinson: 7538-39. Most of his testimony on direct examination was based upon exhibits he had prepared to show the manner in which an enclave map could be prepared taking mineral economics into account. Some exhibits were also used to provide testimony that BLM was not justified in finding potash enclaves to exist in specific areas where it had denied the Appellants' APD's. In addition, Hutchinson was asked about a variety of exhibits that were not prepared by him as well as his opinion of statements which had been made by other witnesses. This section describes his testimony concerning whether the USGS and BLM complied with the 1975 and 1986 Orders when they prepared potash enclave maps, which the parties agree is "the central issue." Tr. 7641. Subsequent sections evaluate the Appellants' enclave theory as presented in Hutchinson's testimony and address the question whether BLM's standards continue to reflect "existing technology and economics."

Hutchinson's initial testimony critiqued the standards the USGS and later BLM had applied in preparing their enclave maps. He testified that he had evaluated the calculations used in the 1969 minutes of the Minerals Classification Board (YP 555) and had found a variety of problems. Hutchinson: 7528. After describing them, he summarized: "So, my whole point in this is that these are percentages that appear to have been arrived at in justification of figures that they already wanted to use, and have no basis in the economics that were current at the time." Hutchinson: 7535. Hutchinson also criticized the use of "minimum quality and thickness criteria" on making the 1984 enclave map, explaining that mapping reserves is different from mapping minimum quality and thickness because "economics change over time" and "[c]hanges [in] economics changes reserves." Hutchinson: 7542-43. He regarded the fact that the 1984 map continued to be based upon standards established in 1969 that had "never been updated" as indicating that "this is not an economic-based map." Hutchinson: 7544. In addition, Hutchinson testified that BLM should not have used a standard of three data points "no more than one and a half miles apart" for both sylvite and langbeinite because "[t]he depositional characteristics of langbeinite are such that it comes and goes quickly; that its areal extent is more erratic than sylvite, particularly in the southeast New Mexico Oil/Potash Area depositional environment." Hutchinson: 7545-46.

After testifying about the meaning of terms used in the definition of potash enclave in the 1975 and 1986 Orders, Hutchinson summarized his testimony by stating: "So, an enclave, as defined by the '86 Order, to me, means that it must be minable. There must be no doubt as to its mineability, using current technology and economics." Hutchinson: 7564. He further stated that, because "[t]he author meant what he or she said" and there was "no doubt" that "anything but economically-minable material is to be included in an enclave," he believed that when Van Sickle used the word "enclave" on his maps, "he was talking about something besides the definition" of potash enclaves and that the 1984 enclave map "does in no way meet the definition of enclave as the BLM was required to obtain from each potash lessee annually." Hutchinson: 7564-65. In Hutchinson's opinion, "the '93 map, the predecessors to the '84 map that I've seen, have nothing to do with the conflict here, and that the use of those maps in administering this conflict, is absolutely wrong." Hutchinson: 7566. Hutchinson also explained that, although the definition of lands included as potash enclave was "more formalized" on the 1976 map than on the 1974 map, the maps themselves were "virtually identical" and, consequently, "the basis for mapping and making the two maps must have been virtually identical." Hutchinson: 7571.

Extending this reasoning, Hutchinson testified that, because in 1974 "[t]here was no definition of enclave given to the BLM requiring them to map an enclave" and the two maps were essentially the same, he believed the definition of "enclave" found in the 1975 Order had not been "carried over" to the 1976 map. Hutchinson: 7572. Hutchinson further testified that the 1979 map was "virtually identical" to the 1976 map and the similarity showed "that the criteria for the '74 map, the criteria in making the '76 map, the criteria in making the '79 map have to be very, very similar." Hutchinson: 7573-74. Moving on to the 1984 map, he described it as "scientifically a little more accurate than the previous maps, in they went to the trouble of updating all their core hole information," but that, as Van Sickle had testified, the same criteria was used to prepare it. Hutchinson:

7574-75, 8094. Continuing this line of testimony, Hutchinson stated that the 1993 map was "extremely similar" to its predecessors and that Van Sickle had "obviously carried * * * forward" the "mapping criteria" from the 1974 map. Hutchinson: 7576, 7578. Thus, in Hutchinson's opinion, none of the maps were potash enclave maps as called for by the 1975 and 1986 Orders. Hutchinson: 7575, 7579.

In relation to his understanding that BLM had not used economic standards to prepare its enclave maps, Hutchinson discussed three exhibits he had developed using portions of BLM's core hole maps for the fourth and tenth ore zones in order to illustrate "how this [1984] map was actually constructed." Hutchinson, 7546. [55/] In regard to the map for the tenth ore zone (YP 703), he testified was that it was "marginal" whether one core hole should have been used to identify potash enclave because, although it was within a mile of a second hole, it "appears to be more than a mile and a half" from the next nearest core hole. Hutchinson: 7548-49. On cross-examination, however, he acknowledged that the distance was "[r]ight at the limit" and "right at a mile and a half" so that it "could have been or could not have been included," eventually agreeing that there were three core holes within a mile and a half of each other. Hutchinson: 8048-49, 8051. Hutchinson also testified that another core hole was not within a mile and a half of two other core holes and "shouldn't have been included in the enclave." Hutchinson: 7549. Likewise, he testified that one of the core holes on the map for the 4th ore zone (YP 704) did not qualify. Hutchinson: 7556. The third map (YP 705) is a composite of the two.

Hutchinson presented several other criticisms of the maps prepared by the USGS and BLM. He pointed out that there were instances where core holes used to identify potash enclave were four to eight tenths of a mile from core holes identified as barren of potash. Hutchinson: 7549-50, 7556. He construed this feature to show "that Mr. Van Sickle and his crew were looking just for outlines" and "there really wasn't much of an idea as to * * * whether this was really a reserve, or [sic] as defined by industry or economics." Hutchinson: 7550, 7557, 7596. On cross-examination, he further stated that while the closeness of barren core holes showed what could be "reasonably inferred from the geologic information," BLM had "just used the three core holes in a mile and a half." Hutchinson: 8050-51. In addition, Hutchinson noted that there were core holes for which potash values were shown as a percentage of K20, apparently combining the values of sylvite and langbeinite. Hutchinson: 7558. In his view, these were "a completely useless number for economic purposes." Hutchinson: 7592. He believed they indicated that the USGS was "looking for something that was obvious -- obviously above their minimums, and they didn't really care if it was -- what the economic value was." Hutchinson: 7596. Furthermore, according to Hutchinson, BLM could have identified exact grades of sylvite and langbeinite for those core holes which it had labeled "B" (which he understood to indicate a core hole with "lower than the lease minimum") or "M" and could have

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[55/] Most of Hutchinson's testimony on direct examination was received in closed proceedings. In keeping with the general practice of this decision, his testimony is described without presenting information considered confidential. In this instance, the numbers by which core holes are identified and the values of potash disclosed by them have been omitted. The numbers reported in the remainder of this subsection are used to describe his testimony and exhibits and are reported as representing his conclusions without a determination as to correctness.

designated percentages of langbeinite and sylvite rather than a general number for because he had found it to be available. Hutchinson, 7597-98, 7965.

Hutchinson also testified that, having developed a proper isopach map "showing the grades and how they increase and decrease" it would be possible to "anticipate where mining would occur by zone." Hutchinson: 7598. He explained that this could be done by looking at the areas proposed to be mined in the next three years, as identified in three year mine plans, or which had been actually mined and determine the grade of potash "predictive of mining operations * * * by seeing what the mining companies had actually done." Hutchinson: 7598-99. Speaking in reference to the USGS and BLM, Hutchinson stated:

> They could then take a look at the core hole density, that is, how close the core holes are together in the areas that were actually mined, or expected to be mined in the next three years, and project that core hole density information out to the unmined areas, to see if those areas should be protected, as is designed into the '75 and '86 Order, to become true enclaves.

Hutchinson: 7599. In other words, Hutchinson understood that the limits of previous and proposed mining could be used to establish a "cutoff grade" for identifying core holes with "sufficient thickness and quality to be mineable" and also the number of core holes needed to determine that "potash ore is known to exist." Hutchinson: 7599-601. He believed that BLM had erred in not developing potash enclave maps on such a basis. Hutchinson: 8155, 8176-77.

Using this method, Hutchinson prepared exhibits showing enclaves in 4th and 10th ore zones as of 1992 when the first APD's at issue were denied (YP 716, YP 717) and a composite map of the two (YP 718). Hutchinson: 7604. The maps repeat the portrayal of mined areas and workings on BLM's potash enclave map (presumably correctly) and brown dots identify the location of denied APD's. In regard to the map of the 10th ore zone, Hutchinson stated that the "dark, solid blue areas are areas that are enclaves, as defined by the '75 and '86 Order." Hutchinson: 7601. Two additional areas of light blue cross-hatching identified unleased areas which also met "the definition of enclave." Hutchinson: 7608. Hutchinson explained that the map includes:

> some black circles, about a quarter of an inch in diameter at this scale, scattered throughout the area. Those identify core holes that have "sufficient thickness and quality to be minable." They have the grades and the thickness to be minable, as defined by the Order, but they don't have the core hole density. They are not close enough together to satisfy the definition of "known" as it refers to ore and minable and reserve, and a word that was brought up yesterday, measured, in the true economic sense of the word "measured ore."

Hutchinson: 7601. Using lighter colored and smaller circles, the map also identifies core holes of "sufficient thickness and grade" south of the middle of the WIPP site which

Hutchinson gave "credit" for both langbeinite and sylvite because "at least one mining company, IMC, has the capability to process the mixed ore." Hutchinson: 7602, 7606-07. In addition, near the New Mexico Potash Mine in the center of the Potash Area, the map shows both dark blue areas of potash enclave and drill holes that Hutchinson had identified as having "sufficient thickness and quality" based upon a different core hole density and a different area of influence that he had found by looking at the core holes within the mined area. Hutchinson: 7603, 7605. Hutchinson also explained that he had given "credit" for both ores, apparently throughout the exhibit, because he had:

> tried to maximize the potential revenue, or the value from both sylvite and langbeinite, regardless of whether the mining company that had the area leased could currently mine it or not.
>
> So, I did give them the benefit of "existing technology and economics." I read that to mean what could be done. And IMC has certainly proved that it can be done, and have been doing it, or they were doing it in 1992. So, I thought if there's enough value, Western Ag or others would expand their operation and apply existing technology and economics to do as IMC has done.

Hutchinson: 7606-07.

Similarly, Hutchinson's map of the 4th ore zone (YP 717) portrays the Western Ag mine as of the end of 1992, dark blue areas identifying those areas he believed are enclaves of langbeinite, and additional core holes which show potash of sufficient quality and quantity. Hutchinson: 7610-11. Hutchinson explained that his maps were not designed to portray all possible potash enclaves throughout the KPLA. Hutchinson: 7614. He stated that he had also mapped, but not as exhibits, the areas in tenth ore zone near the closed Amax and Eddy Potash mines and also stated that he knew both Mississippi Chemical and IMC were mining in the seventh and fifth ore zones, but explained he had not had time to prepare maps of the fifth and seventh ore zones. Hutchinson: 7614-15.

Hutchinson testified that he had found in his research that in 1992 sylvite had "generally sold in the neighborhood of $74 per ton of product" or, based upon its content of 60% , "$123 per ton of equivalent," while langbeinite had sold at $78 per product ton or $355 based upon its K_2O. Hutchinson: 7628. Using public information, he determined that in 1992 Western Ag had received an "ultimate price" of $449 per ton of K_2O for langbeinite and the Potash Corporation of Saskatchewan had received "ultimate price" of $119 per ton of K_2O for sylvite. Hutchinson: 7629, see Hutchinson: 8135-41. These prices included transportation costs, which he regarded as "a very, very important cost" because, as he explained in a different context, the corn belt where most fertilizer is used in the United States is closer to the Canadian mines and "the Canadians have [a] considerable transportation advantage." Hutchinson: 7756, 7759; see YP 742, YP 744. Based upon this information, Hutchinson concluded that "langbeinite, on the major market, is 3.8 times as valuable as sylvite, per unit of K_2O * * *." Hutchinson: 7629; YP 721. Thus, he established a conversion ratio of 1 to 3.8. As he explained, using this standard:

> I could take a look at a core hole, and if it were 20% sylvite and 80% langbeinite, its value on the marketplace would be about 50/50. So, if it had -- if 80% of the combined mineral, that is, if there were four percent of -- 4% K_2O as sylvite and 8% of K_2O as langbeinite, it would clearly be a langbeinite predominant core hole on the market -- in the marketplace.

Hutchinson: 7632-33. Hutchinson stated that he had seen BLM documents using conversion ratios of "anywhere from 2.4 to 1 to 3.2 to 1" based upon FOB (freight on board) mine prices. Hutchinson: 7633. He explained that the FOB price was "what the mining companies, under their agreements, their lease agreements, pay royalty on," but because the material would be shipped and sold somewhere else, "those FOB prices don't necessarily reflect the true value of each of the products in the marketplace." Hutchinson: 7633-34. Hutchinson also testified that information in the record report by IMC in making royalty payments was "real close to the prices that I used" and "fall in line with the prices that I have come up with." Hutchinson: 7634-35; see YP 722.

In addition, Hutchinson testified about "dilution" due to mining height. As he initially explained, mining height is important because, whatever the actual thickness of the ore to be mined, the grade of potash produced will be reduced by the "head room" needed for the equipment used to mine it. Hutchinson: 7636-37. For example:

> If the grade of potash in a circumstance where we have a six-foot core, and we can talk about langbeinite. If it is ten percent K_2O as langbeinite in the core, and the core is six feet long, and we need to mine eight feet, we would have to take -- we would have to reduce the percentage of grade by three-quarters, or it would end up being 7.5%. In an underground mine, there's just no way around that. You just have to do that.

Hutchinson: 7637. Hutchinson explained that a mine might alter its mine plan depending upon whether the reduced grade was economical to mine and "that's why the grades in the core holes must be adjusted for a minimum mining height." Hutchinson: 7637-38. He regarded four feet of thickness as "valid for sylvite" because it could be mined using a continuous miner, but stated that, in the BLM reports he had reviewed, he had "never found where langbeinite was being mined as low as six feet thick." Hutchinson: 7638. Accordingly, he converted each core hole to the appropriate height for the type of mineral that was being mined:

> And if a core hole showed where sylvite was the predominant mineral in mixed ore, was more than four feet, I used, you know, the full grade. In langbeinite, if it was over six feet, I used the full grade. But I compromised the grade where it was less than what I could see was a practicable and practiced mining height, four feet and six feet.

Hutchinson: 7639.

Hutchinson prepared a series of isopach maps, which he termed "analytical maps,"

that he used to explain his method for developing a potash enclave map. Hutchinson: 7642. He apologized for the quality of some of the maps because they had been prepared in a short period of time and had not been changed since. Hutchinson: 7641-42, see Hutchinson: 8152-53. One map (YP 723) is of a portion of the tenth ore zone and shows an area shaded red to indicate less than "10% K_2O as sylvite, adjusted for mining heights and giving credit to the sylvite grade for langbeinite product shown on the core holes," a white area showing potash of 10% to 18% sylvite, and a blue area of 18% or higher grade. Hutchinson: 7642-44. Hutchinson explained that he had not used a mining height of four feet because he had been:

> able to look at the actual mining heights, and found that IMC, the predominant miner in here, drilled and blasted -- did a drilling and blasting mining scheme, and did not have continuous miners. So, they had to mine, and actually mined greater than six feet. I adjusted the grades to a six-foot thickness in this area, because that's the -- that's who has it leased, and that's who is mining there, and their mining system is drilling and blasting, and they don't mine less than six feet thick.

Hutchinson: 7644. He also explained that he had "arbitrarily picked" the 18% grade and, based upon his "core hole density" standard "tried to find those areas * * * where the core holes were close enough together that I considered it to be known, a known area; that there was sufficient information to call this minable, or measured or proven, or whatever." Hutchinson: 7645-46. In addition, Hutchinson noted that he had excluded areas "without the core hole information," even though the "contouring system" had included them within the 18%, because "it didn't appear to be of known quality to me." Hutchinson: 7646.

A second "analytical map" (YP 724) was designed to show langbeinite in the fourth ore zone in the area where IMC and Western Ag operate. Hutchinson explained that he had adjusted core hole grades to "a minimum mining height of six feet in this area, because it's -- I could find no evidence where IMC nor Western Ag, who mines in this area, had mined less than six feet consistently." Hutchinson: 7655. The map shows a red area of "4% K_2O as langbeinite or less," white areas of "above 4%, but less than 7% K_2O as langbeinite," and blue areas of "[a]bove 7% K_2O as langbeinite." Hutchinson: 7657. A heavy black line identifies the areas IMC and Western Ag had mined by the end of 1992. Hutchinson: 7655-58. Hutchinson explained that a lighter black line shows the area IMC had identified in a three-year mine plan submitted to BLM at the end of 1992 and, lacking a three-year mine plan for Western Ag, the area that company actually mined during the next three years. Hutchinson: 7658-59. He pointed out that IMC's mine plan extended "from a heavy black line near the figure 7 to the southeast, showing that they are definitely going to go into that ore body that's to the southeast, and their plan was to go down there and mine it." Hutchinson: 7659.

Discussing a more specific "analytical map" for the IMC mine (YP 725), Hutchinson set forth his theory that:

> taking the map generated purely from the core hole data information, as it was adjusted for mining thickness and mixed ore quality, and

> superimposing what was actually mined to confirm that. A person could anticipate what would be mined in the future, based on what had been mined in the past.

Hutchinson: 7661. As he more fully explained during cross examination in regard to one of his large maps:

> I contoured the data from the BLM core hole maps for the tenth ore zone in that area. Then I superimposed the area that was actually mined, or that had -- through '92, and that had been planned for the next three years. There was no mine plan, so I just used what they actually mined in the next three years, assuming that was their mine plan, or deducing that it was their mine plan, since that's where they mined. And tried to see where they were going, where they had actually mined, and come up with a grade, it would be a core hole-based grade that they would mine to.

Hutchinson: 8117.

In regard to his "analytical map" for sylvite in the tenth ore zone, Hutchinson explained that it was a blow-up of a portion of the previous map with a heavy black line added to show the extent of IMC's mining operation as of the end of 1992 and a green area showing the three-year mine plan IMC had submitted to BLM at the end of 1992. Hutchinson: 7658, 7661; YP 725. He regarded the map as providing "real good confirmation that use of the core hole data base is a pretty good predictive tool to find out what areas should be protected, and eventually, with enough analysis to be confirmed as enclaves." Hutchinson: 7661. He testified that, looking at the map, it is:

> obvious that the bulk of the three-year mine plan submitted by IMC is moving -- is to plan to go north into the area that would include the higher-grade material at the -- colored blue by itself, and to go south in a severely direction, continuing along what I perceive to be an enclave by the definition of -- in the '86 Order.

Hutchinson: 7662. He also described it as showing:

> that somewhere between 16 and 18% grade has been a consistent limit of mining, taking into consideration where the lease lines are, and where the 16 grade percent contour and the 18 grade percent contour, where the three-year mining plans are, that -- somewhere in the 16 to 18% area seems to be what IMC apparently likes to remain in, based on just the core hole -- the grade contours generated from core hole maps.

Hutchinson: 7663.

Hutchinson also prepared a similar map showing a portion of the area mined by New Mexico Potash in the tenth ore zone (YP 726), although it differed in showing the area mined as of 1991 and in identifying the area of the three-year mine plan based upon

actual mining because New Mexico Potash did not file three year mine plans with BLM until 1995. Hutchinson: 7665-66, 7667-68. The map also includes six barren areas that New Mexico Potash identified in an annual mine map. Hutchinson: 7665, 7671. Hutchinson stated that he had used a four-foot mining height because "New Mexico Potash is certainly capable of mining down to that minimum thickness," but had used only sylvite and not mixed ores because New Mexico Potash doesn't normally process langbeinite." Hutchinson: 7667, 8102, 8104. Based upon the map, Hutchinson stated that he had determined "that as far as the core hole information went, that somewhere around 12% core hole grade information seemed to be a reasonable limit that they would mine to on a core hole grade isopach basis." Hutchinson: 7677; see Hutchinson: 8117-20.

Hutchinson also testified that he had found the "minimum grades" for IMC and Western Ag in the fourth ore zone to range from 7 to 8% mixed ore as langbeinite. Hutchinson: 7687. He explained that:

> even though Western Ag doesn't process mixed ore, and currently, IMC doesn't process mixed ore, I gave them both credit for that, and added the sylvite values onto the langbeinite values * * * because if there is enough sylvite, and the grades are high enough mixed with the langbeinite, then * * * a prudent mining company would take a hard look at those economics and perhaps modify their plans to do what IMC has done in the past, and process both minerals.

Hutchinson: 7687.

During cross examination, Hutchinson more fully described how he had arrived at his minimum grades. He explained that:

> the minimum grades were based on the matching of the grade designations mapped only from the core hole data, matched to actual mined-out areas, or areas planned to be mined in the next three years, and through that matching, actual overlaying, at the same scale, one can see where that particular mining company, operating in that ore zone, has decided to stop mining relative to the core hole grades.
>
> Those core hole grades, of course, were put on maps and adjusted for thickness, and the combination of mixed ore so that it would maximize the revenue potential for the mining company. Whether or not they could mine mixed ore or not, they were all given credit for it, except for where there was no possibility of mixed ore economics.

Hutchinson: 7971-72. Hutchinson also explained that he had verified the numbers by looking at other data, including public financial data and information provided the companies in requesting reductions in royalties. Hutchinson: 7972-73. The numbers were, he stated, the "minimum grade * * * that the mining companies mined down to consistently in the respective ore zones that I examined in detail." Hutchinson: 7979. He agreed they were a cutoff grade in the sense that they identified "where mining was cut

off, if it weren't constrained by a lease line." Id.

Hutchinson also used his analytical maps to arrive at the "core hole density" which provided his basis for identifying areas where potash is "known to exist." He explained that he had "tried to use all of the information that was available, and that principally was for the core holes," and that his:

> theory was to take the areas that had actually been mined and equate that to the number of core holes that were within that actual mined area, or within the three-year mine plan area when those were available, and determine what I felt that mining company was comfortable with in the area of influence given to each core hole.

Hutchinson: 7690. Addressing an outline of IMC's mine in the 10th ore zone, Hutchinson testified that the company had mined approximately 1200 acres and had included an additional 530 acres in its three-year mine plan. Hutchinson: 7690-91; YP 728. He explained that he taken "the acreage actually mined, divide it by the number of core holes, and came up with what I think to be the comfort level of IMC in going into this area at 39 acres per core hole" and "for the three-year mine plan, I came up with an overall 47 acres per core hole." Hutchinson: 7691-92. This method, he believed, identified "how many core holes they felt, in my view, they felt they needed to exploit that ore body." Hutchinson: 7693.

Similarly, Hutchinson looked at the area mined by IMC and Western Ag in the fourth ore zone and, counting "the core holes that were actually inside the mined area, or touching the line, including three-year mine plan," he arrived at 70 acres per core hole for IMC and 73 acres per core hole for Western Ag. Hutchinson: 7695; YP 729. He explained that he had learned that Western Ag had proposed to drill a series of core holes in the area between it and IMC's mine and, if they did so, the resulting core hole density would be 40 acres per core hole. Hutchinson: 7697. Averaging the three densities, Hutchinson "came up with an overall average for the entire area for the fourth ore zone at being 62 acres per core hole" Hutchinson: 7698; YP 727. In addition, Hutchinson testified that an analysis of the core holes within an arbitrarily selected one-mile radius of the access shafts of the New Mexico Potash mine showed an initial area of influence of 113 acres and core holes "within or touching the mined area, plus the three-year mine plan," as determined by the area subsequently mined, showed an area of influence of 160 acres per core hole for sustained development. Hutchinson: 7707-08; YP 732.

Hutchinson also testified about exhibits he had prepared to compare his use of core hole density with BLM's standard of three core holes within a mile and a half. One portrays an area mined by IMC in the fourth ore zone (YP 730). On it, Hutchinson drew two equilateral triangles with core holes at or near their corners, each encompassing approximately 623 acres, "the maximum area that you can have with three core holes in a mile and a half." Hutchinson: 7700. One of the triangles includes 15 core holes, the other 10. Hutchinson: 7700-7701. Hutchinson calculated areas of influence of 42 acres for the triangle containing 15 core holes and 62 acres for the triangle containing 10 core holes. Hutchinson: 7704; YP 731. In addition, Hutchinson looked at an area of 4419 acres which

he had determined contained four feet of 4% langbeinite and found there to be 51 core holes, resulting in a density of 87 acres per hole and area of 1943 acres which IMC had mined that he found to have 33 core holes and 59 acres per core hole. Hutchinson: 7703; YP 731. He contrasted these numbers with the 208 acres per core hole which results from dividing the 623 acres with BLM's standard of three core holes within a mile and a half. Hutchinson: 7704-05. The exhibit also shows two long rectangles that Hutchinson explained show the area that could contain three core holes in a mile and a half. Hutchinson: 7701. These areas, he testified, could not be used to determine volume and tonnage of potash by which to calculate mineable reserves and, in his opinion, three data points per mile and a half should not be used to define known potash ore. Hutchinson: 7706.

Hutchinson established a core hole density for the New Mexico Potash mine by drawing a circle with a one mile radius around the shafts originally sunk by the Kerr McGee corporation for the mine. Hutchinson: 7707; YP 732. He explained:

> That because discounted cash flow analysis is so widely used in the mining industry, that they would put the shaft down at an area very near the ore that they were going to mine first, and that would be of the highest grade, so they would get the greatest cash flow back to get the proper -- or the necessary return on the investment.

Hutchinson: 7707. Counting the number of core holes within the circle, he found the density to be 113 acres per core hole. Hutchinson: 7708. Looking at the more extensive area which had been mined, including the "three-year mine plan" showing the area which had actually been mined, he determined that there was a core hole density of 160 acres per core hole. Id. He concluded that New Mexico Potash was satisfied with core hole densities of 113 acres per core hole for new development and 160 acres per core hole for sustained development. Id.

After testifying about specific areas where BLM had denied APD's, Hutchinson more generally discussed his study of core holes within the Potash Area. He had prepared as an exhibit a list "of any core hole in any zone that I felt, after the study, would approximate sufficient thickness and grade." Hutchinson: 7716-17, 7734; YP 737. The point of his testimony was that he had not found any additional ore zone in the vicinity of the APD's at issue to provide an area that could be classified as potash enclave. Hutchinson: 7738. In addition, Hutchinson gave testimony about life of mine reserve maps which had been prepared by mining companies and reserve figures reported in their annual reports to the Securities and Exchange Commission, after which he gave his opinion about the economic situation of the New Mexico potash industry:

> I think that the langbeinite mines will continue to exist far into the future. They appear to be economically run, and there is a market out there. The grades that I've isolated and put on my enclave map should reap profits, be them small, for some time to come.
>
> The sylvite deposits are another matter, and the situation began to

change in the early '60s, when the New Mexico Potash grades were declining, and the Canadian potash grades for the new Canadian mines were quite a bit higher, which means that they would have to mine far fewer tons to get up to their 60% K_2O saleability threshold.

Hutchinson: 7754.

IV. C.2 Review of Topics Addressed

The Appellants explain that, in preparing his maps, Hutchinson:

correlated core grades and mined grades based on actual mining history. Mr. Hutchinson determined the minimum mining grades mined by each mine as the first step in identifying an enclave. The mined grade, rather than the core hole grade provided the cut-off grade utilized by each mine. Mr. Hutchinson then determined whether potash ore was "known to exist" by determining whether the data points were sufficiently close to the data points actually required by the various mines before mining an area. The area of influence to be given any data point was based on each mine's actual operations.

Each mine within the Secretary's Area is different and Mr. Hutchinson mapped each enclave according to that mine's actual experience. Each mine has differing technological and economic standards. Each mine produces from different depths, some use specialized mining equipment; each uses different mining methods; each has its own economic and technological parameters for acceptable degrees of insolubles and contaminants; each mine has different economic cut off grades; each mine has different processing and milling capabilities; and each mine has its own markets, customers and transportation methods. By applying the "existing economics and technology" standard, the 1986 Order allows for such distinctions to be made, and indeed requires them.

App. PH Brief at 117-18.

Hutchinson did not undertake a detailed review of BLM's ore zone maps in order to determine whether they, and consequently the 1984 potash enclave map, had been prepared in accord with Van Sickle's standards or whether they otherwise accurately portrayed areas of potash enclave based upon core hole data and generally accepted methods for interpreting geologic information, although, as described in relation to his testimony, he did note a few specific problems with a portion of one of the zone maps. See Hutchinson: 8187-88. Instead, Hutchinson developed an analysis based upon his own understanding of the definition of potash enclaves in the 1986 Order. His method consists of a number of steps, each of which combines with the others to yield the very limited areas of potash enclave shown on his enclave maps (YP 716, YP 717, YP 718) that are far different from the large areas identified on the enclave maps which have been produced over the years by the USGS and BLM. As calculated by Nelson Muncy, 34% of the Potash

Area on the 1984 potash enclave map is measured ore. Muncy: 7284-85, 10090; YP 571. In contrast, most of the areas of potash enclave Hutchinson identified are within a mile of prior mining operations and probably amount to only a few percent of the acreage within the Potash Area. Stated in another manner, the maps represent wildly divergent views of the areas "where potash ore is known to exist in sufficient thickness and quality to be mineable under existing technology and economics." The differences can be understood by examining the elements of Hutchinson's method. [56/]

IV. C.2.a Core Hole Data

During discovery, BLM released to the Appellants data for the approximately 2000 core holes which have been drilled within the Potash Area. Hutchinson: 7597. Hutchinson testified that he had reviewed "every core hole on every core hole data map" in the area. Hutchinson: 7734, 7980. As previously described, he applied two conversions to modify the core hole data. First, he used a ratio of 3.8 to 1 to convert langbeinite to sylvite and vice versa. He explained that he had derived the ratio based upon an "ultimate price," including transportation costs, of $449 per ton of K_2O for langbeinite and an "ultimate price," including transportation costs, of $119 per ton of K_2O for sylvite. Hutchinson: 7629; YP 721. He believed that it was important to include transportation costs to reflect the market price of potash in the Midwest where most fertilizer is used. Hutchinson: 7756.

In contrast, David Waugh, testifying for the Intervenors, stated that including transportation costs when evaluating a mining property "only would confuse the picture" and including them in a market value ratio for sylvite and langbeinite "is only going to mislead you." Waugh: 11308-09. He agreed that using a ratio to convert the potash value of langbeinite and sylvite was "a normal method of giving an economic value" of one mineral for another. Waugh: 11460. Waugh believed, however, that the better way to derive a ratio was "to look at *** the product price at the gate, and use the ratio between those two" because the issue is "just how do you evaluate a ton of sylvite and a ton of langbeinite so that you know economically what that means as ore to you when you finally get it processed and sold." Waugh: 11310. Waugh pointed out that the 1992 sales prices without transportation costs shown on Hutchinson's exhibit would yield a ratio of 2.7 or 2.8 to 1, and he stated that those figures "would be in the range of what IMC sees as the economic factor that equalizes those two minerals." Waugh: 11311; see Hutchinson: 8141. Waugh also testified that IMC had historically used a conversion factor of 2.5, which is similar to the ratio of BLM's grade and thickness standards for langbeinite and sylvite. Waugh: 11311, 11709-11. In addition, he explained that the ratio of the relative

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[56/] Some difference is due to the fact that Hutchinson mapped only the fourth and tenth ore zones where active mining was occurring near the locations for which Appellants had filed APD's. Hutchinson: 7614, 8186. Due to time limitations, he did not prepare maps of the fifth and seventh ore zones which were also being mined. Hutchinson: 7614-15. He testified, however, that he had not found other areas that could be classified as potash enclave. Hutchinson: 7738.

K_2O value of langbeinite and sylvite was 2.8 to 1. Waugh: 11713-14; INT 117, table 1. [57/]

In relation to one of Hutchinson's exhibits for the tenth ore zone, Waugh pointed out that applying a higher ratio "drives up the lang portion * * * and will make that ore appear to you as being more valuable to you than it actually is." Waugh: 11462, 12062-63. In later discussing one of his own exhibits, Waugh noted that an area Hutchinson identified as potash enclave was actually larger than IMC would consider a mineable reserve, due to Hutchinson's "very high conversion factor for langbeinite of 3.8" which made the core hole values higher than evaluated using a factor of 2.5. Waugh: 11481; INT 448. Nevertheless, he understood that the selection of a ratio is up to "the particular operator who wants to do an analysis" and he acknowledged Hutchinson's ratio to be "one way of evaluating it." Waugh: 11310, 11710-11. He also understood industrial minerals to be "very sensitive" to transportation costs. Waugh: 12039.

Although Hutchinson and Waugh discussed transportation costs as a matter of adding a dollar amount to the value of the product, each of the figures used in Hutchinson's exhibit appears to have been taken from a different source. Hutchinson explained that his price of $74 per ton for sylvite "approximates" the actual price paid, recognizing that "[p]rices were plus and minus to that" and indicated that the amount had been taken from several sources, including publicly available information. Hutchinson: 8130. The 1993 figures reported by New Mexico Potash in seeking a royalty reduction generally support Hutchinson's understanding that in 1992 sylvite "generally sold in the neighborhood of $74 per ton of product" (Hutchinson: 7628), but the company reported sales in a range of prices. See YP 450, appendix A (BLMCO29604); see also INT 117, table 4, INT 130. Hutchinson did not explain how he had arrived at a single figure, but the lack of testimony is not critical because his "ultimate price" of $119 per ton of K_2O for sylvite was not the sum of his sales price plus transportation costs. Instead, Hutchinson attributed his figure to publicly available information from the Potash Corporation of Saskatchewan. Hutchinson: 7629; YP 721. Likewise, although he did not specify the source of his $78 per ton price for langbeinite, Hutchinson explained that his price for K_2O equivalent of langbeinite had come from monthly royalty reports by IMC and Western Ag, while his "ultimate price" for langbeinite which included transportation had been

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[57/] Pure sylvite (KCl) has an atomic weight of 74.55 and is 63.18% K_2O, while pure langbeinite with an atomic weight of 414.98 is 22.7% K_2O. YP 719. Material described as "63% K_2O sylvite" is pure sylvite ore and "23% K_2O langbeinite" is pure langbeinite ore. See Waugh: 11263-65; YP 719; INT 117, table 1; INT 458. For shipping and marketing purposes, the numbers are lowered and 60% K_2O sylvite and 22% K_2O langbeinite are used as industry standards to indicate its potassium content and reflect its value as fertilizer. Hutchinson: 7623-24, 7628; see Waugh: 11263-66. A ton of pure langbeinite is worth approximately 1/3 less than a ton of pure sylvite because it has less K_2O and therefore less potassium.

The figures relate to the amount which must be mined and thereby to mining costs. At 60% K_2O sylvite, approximately six tons of 10% K_2O sylvite must be mined and processed to yield one ton of marketable sylvite ore, while due to the lower K_2O content of pure langbeinite, only 2.2 tons of 10% K_2O langbeinite ore needs to be mined to yield a ton of marketable langbeinite. Waugh: 11266-67; INT 438.

calculated from publicly available annual reports and SEC filings by Western Ag. Hutchinson: 7629, 8132-37.

In addition to uncertainty about the basis of Hutchinson's ratio, his rationale for giving or not giving an area near a mine "credit" for one mineral or the other when preparing his exhibits is unclear. Hutchinson initially explained that for his large map of the tenth ore zone he had given "all the core holes" south of a line approximately mid-way in the WIPP site "credit for both" minerals because IMC could process mixed ore. Hutchinson: 7602; YP 716. He also testified, however, that, even though Western Ag did not mine in the tenth ore zone and did not process mix ores, he had given "credit" for both ores in the area of its mine because the technology was available and it could be economically feasible to process both ores. Hutchinson: 7606-07, 8109, 8143, 8198. Similarly, he gave both IMC and Western Ag "credit" for both minerals in the fourth ore zone, converting sylvite to langbeinite. Hutchinson: 7687, 8172. He explained that, as more fully quoted above, “even though Western Ag doesn't process mixed ore, and currently, IMC doesn't process mixed ore,” he had given both of them “credit” “because if there is enough sylvite, and the grades are high enough mixed with the langbeinite, * * * a prudent mining company would take a hard look at those economics and perhaps modify their plans * * * to do what IMC has done in the past, and process both minerals.” Hutchinson: 7687.

In contrast, Hutchinson stated that he had "used only sylvite" and not mixed ores in mapping the area around the New Mexico Potash mine in the tenth ore zone because the langbeinite was "sporadic," with core holes showing "small values," and because the company doesn't "as a normal rule, process langbeinite." Hutchinson: 7667, 8197; YP 726. Although this explanation seems to be at odds with his treatment of Western Ag, the New Mexico Potash mine is several miles north of the WIPP site, so the absence of much langbeinite may have been the controlling reason for not giving “credit” for that mineral. Complicating the matter, however, is that during cross-examination about one of his maps showing the 10th ore zone in the area of IMC and Western Ag's mines Hutchinson stated that even though langbeinite "dies out" to the north, he had "included it anyway." Hutchinson: 8197; YP 723. Because the map is of an area west of the WIPP site and extends further to the north, it appears that, whether or not included, the amount of langbeinite did not greatly increase potash values, but the testimony seems at odds with Hutchinson’s explanation that his large exhibit map for the 10th ore zone had been prepared using a line mid-way through the WIPP site.

IV. C.2.b Mining Height

Hutchinson's second adjustment was for mining height. Such an adjustment seems to be a recognized part of ore reserve analysis (see Waugh: 11485), but the mining height and potash values portrayed on some of the exhibits are uncertain. As previously quoted, Hutchinson initially explained that a four foot mining height remained "valid for sylvite," but that he had been unable to find that langbeinite was being mined at less than six feet. Hutchinson: 7638-39, 7655. Nevertheless, in describing his "analytical map" for sylvite in a portion of the tenth ore zone (YP 723) he stated that he had not used a four foot height but had applied a mining height of six feet because IMC used a drill and blast mining

technique and did not have continuous miners. Hutchinson: 7643-44. He had, however, applied a four foot mining height in the area of the New Mexico Potash mine because the company was "certainly capable of mining down to that minimum thickness." Hutchinson: 7666-67, 8102-103; YP 726. Hutchinson also testified that the grades shown on his "analytical map" for langbeinite in the fourth ore zone had been adjusted for a mining height of six feet. Hutchinson: 7655; YP 724. During cross examination regarding his large enclave map for the tenth ore zone (YP 716), Hutchinson confirmed that he had used a six foot height and stated that he still considered it to be valid because the continuous miners IMC had subsequently acquired were used in the fifth ore zone, some 10-12 miles away from the potash enclaves shown on his exhibit. Hutchinson: 8100-101, 8104. He explained that he had used a six foot mining height for IMC because "looking at the mining records * * * IMC is really a langbeinite mining company, it's predominantly a langbeinite mining company" which used drilling and blasting to mine langbeinite in the southern area of its mine. Hutchinson: 8105-06.

When cross examination resumed the next day, Hutchinson corrected his testimony stating that, although he had originally used a six-foot mining height in preparing his exhibits, he had "learned that IMC had plans to acquire and had acquired a continuous miner, and considered that relevant information, and made a decision to recalculate all of the core holes to a four-foot mining height, and that resulted in the map that we have, that is YP 716." Hutchinson: 8167. He further explained that the change was for the "entire tenth ore zone," i.e. "for both New Mexico Potash and IMC," but that he "did not change the fourth ore zone enclave map, because it's mainly langbeinite" for which "drill and shoot * * * is the latest technology available" and he had found "no evidence that -- that this type ore could be mined by continuous miners to a depth less than six feet." Hutchinson: 8167, 8169. He also affirmed that the red shaded area shown on the analytical map for a portion of the tenth ore zone (YP 723) was based upon the "BLM grade" and that the mining height had been changed to four feet. Hutchinson: 8191-92.

While there is no reason to doubt that Hutchinson recalculated his core hole readings prior to preparing his large maps of potash enclaves, it is unclear whether his small "analytical maps" also reflect the changed mining height and revised potash values. Interpretation of geologic data is not an appropriate task for this decision, but it is apparent that Hutchinson did not recalculate at least one core hole. During direct examination, while testifying that core holes in the area of the IMC and Western Ag mines had been adjusted for a six foot mining height, Hutchinson consistently described the red shaded areas on his analytical maps as identifying potash at or below four feet of 10% K_2O as sylvite. Hutchinson: 7642-45, 7661. Waugh testified that he had been puzzled about an area Hutchinson had portrayed as having potash of 10 to 16% K_2O as sylvite, along with an area identified as having 10% or less K_2O as sylvite, which Waugh knew IMC was mining and "getting very high grade out of." Waugh: 11482-83, 11919. He stated that he had checked the core holes and, as shown on an exhibit he prepared, found them to have much higher values and that "[t]he only thing I could see is that possibly, the conversion back to the four feet wasn't complete." Waugh: 11483; INT 474A. Waugh did not examine any other areas, but regarded the one to be "in error." Waugh: 11483.

To the east of the area Waugh reviewed and remapped, there is a small, isolated

area Hutchinson identified as containing 18% or greater K_2O as sylvite, which his exhibit shows to contain only one core hole. See YP 723, INT 474A. Another core hole lies less than a half mile to the south in an area Hutchinson mapped as having 16 to 18% K_2O as sylvite. An exhibit the Appellants introduced which is a portion of BLM's enclave map for the ore zone identifies the latter core hole as containing five and one half feet of more than 18% K_2O as sylvite. YP 795. Based upon these numbers, and without adjustment for mining height, the core hole should have been mapped as identifying an area of 18% or more K_2O as sylvite and either the isolated area extended to include it or a second isolated area noted. See Hutchinson: 7654. Adjusting the number found on the map to a six foot mining height, however, results in a value of somewhat less than 18%, consistent with Hutchinson's exhibit.

In other respects, the difference between Hutchinson's and Waugh's analysis of the disputed area likely stems from their use of different sources of information. During cross-examination about his exhibit, Waugh was shown an exhibit which the Appellants had prepared using a portion of BLM's ore zone map for the area. Waugh was uncertain as to what to make of it, explaining that prior to this case he had "never looked at a BLM map" and that the core hole information he had used for his exhibit had come from IMC's files. Waugh: 11914-15. A comparison of his exhibit and BLM's enclave map reveals that both identify numerous core holes as having high potash values, although Waugh's provides only a percentage grade rather than both a potash grade and number of feet as on BLM's map. In addition, BLM's map identifies a number of core holes as "M" and a few as "B," while Waugh's exhibit provides specific values for the holes. See Waugh: 11913-14; YP 795. Given Hutchinson's criticism of the "M" and "B" designations as useless in making an economic analysis, it appears that, except when he was able to obtain specific information from BLM, [58/] he assigned the "M" core holes BLM's standard value of a maximum of 4 feet of 10% K_2O as sylvite and mapped them as within the red shaded area on his exhibit. See Hutchinson: 7592, 14754-55, 14807-09. If so, the lower grades of potash Hutchinson found in the area which puzzled Waugh were likely due to Hutchinson's lack of specific data from BLM, while Waugh had IMC's records available. Otherwise, Waugh seems to have shared Hutchinson's low opinion of the "B" and "M" designations. In testifying about BLM's enclave map, he stated:

> It would surprise me if Mr. Hutchinson could generate the contour map that he did with this kind of information, that he would even use this kind of information, because it -- to put an M on there and try to put that

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[58/] Initially Hutchinson indicated that he had obtained from BLM and used specific information for most of the core holes for which it was not provided on the core hole maps. Hutchinson: 7597-98. Later he stated that he had requested additional information for 40 to 50 of the hundreds of core holes which lacked specific information and had received it over 50% of the time. Hutchinson: 7963-64. On another occasion he stated that when he had needed data for core holes identified as an "M or B or K_2O," the information had been available at least 75% of the time. Hutchinson: 8098. When the subject arose again toward the end of the hearing, however, Hutchinson stated that he had obtained the information for "a select few that were important." Hutchinson: 14809; see Muncy: 7470-71.

into a data base for contouring, as he did, it would lead you to making some errors.

Waugh: 11917; see Waugh: 11918-19.

If Hutchinson did not readjust his core hole data for all of his exhibits, as the example discussed indicates, the consequence would have been that the grades of potash shown affected other portions of his analysis. The initial adjustment for a six foot mining height would have lowered the grade of potash shown by core hole readings for beds of potash of lesser thickness by distributing the potash value over a greater depth. A core hole meeting BLM's standard of 4 feet of 10% K_2O as sylvite would adjust to a reading of six feet of 6.66% sylvite. See Herrell: 3548-49. A core hole would have to have the equivalent of four feet of 15% K_2O as sylvite--significantly above BLM's standard--to convert to six feet of 10% K_2O as sylvite. Depending upon the number of core holes affected, recalculation to a four foot mining height could have significantly increased the area shaded red on Hutchinson's maps and would have correspondingly increased the size and shape of areas shown to contain higher grades of potash.

In addition to uncertainty as to whether some of Hutchinson's exhibits reflect four or six foot mining heights, it is not clear that either number is appropriate. A 1991 investigation of an ignition of gas at the Eddy Potash Mine by the Mine Health and Safety Administration reports that "[o]verall mining height averages about 60 in." INT 176 at 2 (IMC-00063). A study of subsidence at IMC's mine in preparation for the hearing indicates that mining had occurred at heights ranging from 4 to 6.5 feet. INT 193 at 3. A chart comparing room closure lists 6 feet as the initial height for the Mississippi Potash Company mine and 5 feet for other New Mexico potash mines. INT 193 at 8. Likewise, Waugh testified that Western Ag uses a large continuous miner to extract langbeinite in the fourth ore zone and can operate at a minimum height of five feet, one inch. Waugh: 11406-08. Although, as Hutchinson recognized, the mining equipment which is available, or which is actually used, establishes a minimum mining height, the thickness of the ore bed would also affect the height actually mined. See INT 197 at 1 (potash bed varies from 5 to 15 feet in height); INT 289 at 10 (mined potash bed from about 7 to 14 feet); Waugh: 11493 (13.9 feet). In addition, it appears that in some areas the height actually mined is determined by the need to remove weak material that would allow roof falls. INT 170 at 158-59 (BLMCO53319-20).

Nor is it clear that the four foot depth which Van Sickle adopted from the Minerals Land Classification Board was originally established based upon the ability to physically mine at that height. The 1957 minutes of the Potash Board note that "recent statements of various authorities seem to establish a minimum mineable thickness of 4 feet of potash ore containing 8% and 14% K_2O equivalent, depending upon the minerals contained in the ore." INT 1 at 13. Unless mining methods at the time were quite different from those described at the hearing, a "minimum mineable thickness" may have described the desired thickness of an ore body relative to its grade and presumed that some amount of "dilution" would occur due to the need to remove additional material both above and below the ore bed. In other words, the standard may have recognized that a four foot ore bed of 4% langbeinite or 10% sylvite could be successfully mined whether mining methods at the

time allowed mining at a six, five, or four foot height.

IV. C.2.c Mine Plans and Potash Grades

As explained in his testimony, Hutchinson used his core hole data to develop isopach maps and he projected onto them either the areas shown on the three-year mining plan a company had filed with BLM or, if the company did not file a mine plan, the area it actually mined during the next three years. Hutchinson: 7658-59. His theory was that he "could anticipate what would be mined in the future, based on what had been mined in the past." Hutchinson: 7661. This approach was consistent with the Appellants' contention that the 1986 Order contemplates that BLM would identify potash enclaves based upon its review of the enclave maps submitted by potash lessees.

Waugh was critical of Hutchinson's approach. He considered the grade of potash mined in the past to have "no relevance to what the lowest grade [is] that they can mine to." Waugh: 11418, see Waugh: 11463-64. He explained that a mine produces an average grade that "contains the highs and the lows of the ore that they'll mine in any one area over whatever period that's measured, a year or a month or a week" and even "the lows don't necessarily reflect what is the lowest grade that a mine mined." Waugh: 11418. In order to determine the minimum grade of ore that can be mined under existing economics, Waugh explained, a mine "would look at the cost to mine a ton of ore, to process it, and to get it to their gate. All -- the fixed costs and the variable costs, the taxation, the depreciations, everything that's in there, how low a grade can they mine and break even." Waugh: 11419.

Waugh did not dispute Hutchinson's premise that a company will stop mining where the ore is uneconomic to mine, but criticized his method for assuming "that the company has not left that perimeter for other reasons than it became uneconomic to mine, or that, in fact, that they mined down to their lowest grade at that point." Waugh: 11451. He explained that there were a number of reasons a company might stop mining an area and pointed out that IMC deliberately mines low grade ore when the market is slow and its processing plant does not need a higher grade. Waugh: 11457-58, 11463-64; see also Waugh: 11475-76. Without knowing the factors that might have been reasons for leaving an area, Waugh stated, it was not correct to assume that mining had stopped because it had reached the mine's break-even grade for ore. Waugh: 11468, 11907-08. Waugh also presented a series of exhibits showing that over decades of operations IMC had stopped mining in many areas and returned to mine them in later years. Waugh: 11465-71; INT 123, INT 124, INT 125. He pointed out one area that IMC had stopped mining in 1991 due to its kieserite content but had returned to because "kieserite does not impact the process that they are now using" and he identified another area of "very high grade ore" consisting of sylvite with several percent of langbeinite that IMC had stopped mining because it decided to delay mining mixed ore until it had brought its plant back into production. Waugh: 11470-71. Other witnesses also discussed IMC's ability to change the immediate areas it is mining in order to respond to the needs of the processing plant. Morehouse: 12136-37; Thayer: 12428-30; see YP 451 at 10 (BLMCO22558).

The testimony and other evidence that IMC frequently shifts the location of its

operations due to changes in the quality of the ore being mined indicates that Hutchinson's use of the points at which mining stops at the end of a three-year period relied upon too little information to draw a general conclusion about the grade of potash which had been mined. It appears that he may have developed his method because he was not informed of the break even grades the mines in the Potash Area actually used and had limited financial information about their operations from which to ascertain the minimum grade of ore which can be economically mined. See Waugh: 11419, 11454. Given these limitations and the commercial nature of potash mining, it was reasonable to assume that the area identified in a three-year period mine plan contains potash ore of suitable "thickness and quality" to be "mineable under existing technology and economics." It is even more likely that an area which was in fact successfully mined during a three year period contained such ore. Hutchinson, however, did not analyze the grades of potash ore which had been identified within the area covered by a three-year mining plan or those actually mined during a three year period, but looked only at the places where mining had reached or was projected to reach at the end of three years.

Hutchinson's reliance upon three-year periods and mining plans was not based upon the definition of potash enclaves in the 1986 Order. It appears to have been adapted from a different part of the Order which states:

> No [drilling] island shall be established within one mile of any area where approved mining operations will be conducted within three years. To assist the authorized officer in this regard, he/she may require affected potash mining operators to furnish a three-year mining plan.

Appendix A, § III.E.1.b; see Hutchinson: 7616. Although the three-year framework provided Hutchinson an area to analyze, there is no reason to believe that the grade of ore being mined at a given location at the end of a three year period is any more definitive of the economically mineable grade of ore than the grade which was mined in that portion of the mine the month before or will be mined the next month or at the same or at some other part of the mine. Applying Hutchinson's method to the three-year mining plan submitted by a company the year before or a year later, or to the limits of mining at the end of the prior or following year, could result in quite different conclusions about the minimum "thickness and quality" of mineable potash ore.

Perhaps recognizing the inherent limitations on his method, Hutchinson initially described his approach in qualified terms and indicated that there had been some flexibility in his analysis. He stated that his method was not "rocket science" and described his "cutoff grade" of 12 to 16% K_2O as sylvite for IMC in the 10th ore zone as "a fairly good observation" about the "consistent limit of mining." Hutchinson: 7663. He similarly explained that his figure of "somewhere around 12% core hole grade" for New Mexico Potash was a "reasonable limit" and not "rocket science." Hutchinson: 7677. The proximate nature of the values he found for each mine can be seen on his analytical maps. Although the three year mine plan for IMC shown on Hutchinson's exhibit for the 10th ore zone can be read to show that the company anticipated mining primarily areas he identified as containing 18% sylvite equivalent and additional areas of 16% to 18% sylvite equivalent, it also shows that IMC planed to mine areas of lesser grade, including two

areas shown to contain less than 10% sylvite equivalent. See YP 725. Similarly, not only does the map for New Mexico Potash show that during three years it mined many areas of less than 12% sylvite equivalent, and some of less than 10% sylvite equivalent, but also that the company mined such lesser grades despite the apparent availability of higher grade ore adjacent to where it mined grades of 12% and higher. See YP 726.

Hutchinson acknowledged that his exhibit showed New Mexico Potash had mined areas "where the core hole data grades would be indicated to be less than 10%." Hutchinson: 8214. He also acknowledged that a forty acre parcel for which IMC held a private lease had been "successfully mined," even though he had not identified the area as potash enclave. Hutchinson: 8289-90. Related testimony was provided by Waugh, who identified two areas outside of Hutchinson's area of potash enclave as having been mined by IMC since 1995 using continuous miners. Waugh: 11479-80; INT 448. Waugh also pointed out two areas in the 4th ore zone that were outside the area Hutchinson had identified as potash enclave but which were being mined at the time of the hearing. Waugh: 11487-88; INT 447. In addition to the specific area discussed in the exchange, Hutchinson's large potash enclave maps show that extensive areas have been mined which adjoin areas that he did not identify as containing potash enclave. The fact that such areas were mined seems sufficient to establish that, prior to mining, they contained potash of sufficient thickness and quality to be "mineable under existing technology and economics." During cross examination Hutchinson was asked whether his position was that "there's no enclave outside of those straight-line boundaries" shown as the limits of mining on one of his large enclave maps. Hutchinson: 7967; see YP 718. He responded: "Yes. That's exactly what I'm saying." Hutchinson: 7967. However, the absence of potash enclave in adjacent areas on Hutchinson's maps indicates that his estimates of the limits of the grades of minable potash are too low. His conclusions may be reasonable readings of his exhibits, but they do not appear to identify the limits of ore grades which have been mined within the Potash Area.

IV. C.2.d Core Holes and Mined Grades

The Appellants maintain that Hutchinson's method of first adjusting core hole data for mining height and then identifying the grade of ore which has been mined identifies "the cut-off grade utilized by each mine" and is the proper method for identifying areas of potash enclave. App. PH Brief at 117-18. They contend that, "[b]y using core hole grades rather than mined grades to map measured ore, BLM expanded the areas of sub-economic mineralization to include areas of sub-economic mineralization, beyond those areas which fall within the definition of enclave pursuant to the 1986 Order." App. PH Brief at 117.

The Intervenors term the Appellant's distinction between core hole grades and mined grades "statistical trickery" because they regard the minimum mining height to correct for the fact that the height at which ore is mined will be greater that the height of the deposit. Int. PH Brief at 126. They explain:

> To understand the function of BLM's cutoff standards, it is important to distinguish between a mine's average grade, and its cutoff grade. The average grade is the same as the mill grade, or feed grade. As

> its name suggests, it is the average of all the grades, high and low, extracted and sent to the processing plant in a given period. The cutoff grade, also referred to as the breakeven grade, represents the lowest grade of ore that can be mined at a profit. Ordinarily, a mine will not mine beneath its cutoff grade. Thus a mine's average grade will always be higher than its cutoff grade. BLM's threshold standards of four feet of 10% K_2O as sylvite or four feet of 4% K_2O as langbeinite represent a cutoff grade, rather than an average grade.

Int. PH Brief at 113 [citations and footnotes omitted].

In addition to the parties' briefs, the meaning of the terms, their differences, and their relation to various exhibits was the subject of frequent testimony at the hearing. See, e.g., Hutchinson: 8322-23, 8445-46, 14744-45; Waugh: 11429-30, 11447-48, 11450-51. At times the different terms and their usages led to some confusion. For example, during cross-examination, Hutchinson was asked about one of his exhibits (YP 725) and confirmed that his view was that "you can anticipate what will be mined in the future by looking at what's been mined in the past." Hutchinson: 8207. In answering, he added the qualification "When it's being compared to the core hole data." Hutchinson: 8207. He subsequently confirmed that core hole grades are "the best data base you have with which to predict the future" and that he had used core hole grades. Hutchinson: 8208. Hutchinson was next asked about a series of bar graphs BLM prepared in response to the appeals to the IBLA (YP 761) which show both the average grades of potash mined by individual mines and the average grades of sylvite and langbenite mined in the Potash Area during a number of years. He rejected the suggestion that the decline in the average grade of sylvite they reported should affect his opinion, stating:

> No. We're not talking about the same animal. These are mined grades. Mined grades are different than core hole grades. Core hole grades are fairly [esoteric] measure[s] that when compared to mined areas, you can predict those areas. And enclaves, of course, are areas that we want to be able to predict in the future.
>
> And what the mined grades reflect are what was actually mined * * *.
>
> So, each mine -- each mine's economics are different, and but yet, these are not comparable to core hole grades. This is what was actually mined. And they're two different things.

Hutchinson: 8208-209. Hutchinson again confirmed that his method relied upon core hole grades and that they were different from the mined grades shown on BLM's graphs. Hutchinson: 8209-10. The following exchange then occurred:

> Q. All right. And that, to you, there's a difference between mined grades and core hole grades, if I understand you correctly?

A. Oh, there's quite a difference.

Q. All right. And what I want to understand is, are you, then, saying that the grades reflected by the core holes that are drilled in the Secretary's Potash Area, do not reflect what will actually be mined down there?

A. Not directly. They don't directly reflect what's actually going to be mined.

Q. So, if you have one of your core hole contour lines, where it shows that mining stopped, and let's say that your contour line from the core hole, let's say, is 10%.

A. Yes.

Q. What you're saying is the grade that was actually being mined when the mine stopped at that point might be different from the 10% shown by the core hole?

A. I guarantee it will be different.

Hutchinson: 8210-11. Of course, if what is shown by core holes is always different from what is actually mined in an area, core holes would be an unreliable basis upon which to identify potash enclaves and predict future mining.

In affirming that his method relied upon "core hole grades," Hutchinson appears to have meant his adjusted core hole readings. Undoubtedly, he did not mean the core hole grades the Appellants criticize BLM for using in preparing its potash enclave maps. Likewise, in calling the figures reported on BLM's bar graphs "mined grades," he meant they were, as identified by the exhibit, "average" grades and presumably did not mean the "mined grades" which the Appellants assert BLM should have used. In contending that Hutchinson "correlated core grades and mined grades," the Appellants presumably do not mean the he compared core hole readings to the grades of ore actually produced by the mines, which the Intervenors also term the "mill grade" or "feed grade," but that "mined grades" are the ore grades Hutchinson identified based upon his adjusted core hole readings. [59/] These, they believe, also constitute the minimum or "cutoff" grade for each

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[59/] The Appellants also assert that one of the Intervenors' exhibits shows dilution of ore grade and "established that there is no relation between core hole grades and mine grades." App. PH Brief at 117; see INT 473; Ivey: 12603-14. It identifies a potash grade and "bed height" at 22 places in a portion of the Mississippi East mine but does not report any core hole grades. A cross section shows the ore body to consist of 36 to 48 inches of sylvite of unidentified grade, layers of mud and salt 18 to 26 inches above the bed, an additional inch or two cut to the top of the drift, and one to three inches of mud below the ore body. INT 473. The Appellants' claim seems to be based upon an assumption that the reported grades are mined grades. See Hutchinson: 14747-48. If, however, they include "dilution" due to the mining height, the ore bed must have been very

mine.

Similar confusion in terminology may underlie Hutchinson's testimony about a portion of a mine inspection report which states that in one area New Mexico Potash was producing a "run of mine ore grade" of 14.4% and planned to mine the area until the ore grade dropped to about 8%. YP 182 at BLMCO20048. During cross examination, he was asked whether the number suggested that his 12% cutoff for the company was "a little bit conservative?" Tr. 8311. In response, he pointed out that the report also stated that the company was "cutting almost 2 feet of salt at the top of the face" and explained that his 12% was a core hole grade and that "core hole grades and mining grades are two different things" due to dilution. Hutchinson: 8312. Referring to a cross section drawing which is part of the report, he noted that it showed the company to also be mining a layer of salt and mud below the ore bed and stated that a core hole "evaluation would only evaluate the 3.1 feet of sylvite at 18 to 20%" shown on the drawing and in contrast the 8% was a "mined grade." Hutchinson: 8312.

When again asked about the exhibit during redirect examination, Hutchinson explained that New Mexico Potash had operated in the area without core hole information and had hit a barren zone but had drilled additional core holes and had found "that they should have gone further." Hutchinson: 8379. He indicated that the company may have decided "to mine down to a certain grade" which "doesn't have to be economic or anything" before deciding to move out of the area. Hutchinson: 8380. Asked about his suggestion that a company would mine ore below its cutoff grade "because there might be something better just on the other side," Hutchinson responded:

> I'm confident that in their setting 8% as a grade, they knew panels that they were mining elsewhere in the mine were 14, 15% grade, and the combination of the two over a long period of time would still be above their economic cutoff for the--for the mine as a whole.

Hutchinson: 8379-81. Not only does this answer seem to differ from Hutchinson's initial explanation that the 8% grade was simply the result of dilution, his suggestion that New Mexico Potash operated based upon an "economic cutoff" for its mine as a whole seems at odds with his method of establishing a cutoff off grade by examining where mining stopped or was projected to stop at the end of a three year period. It helps explain, however, why, as previously noted, his exhibits show mining to have occurred, or be projected to occur, in a variety of ore grades.

For purposes of this decision, there is no need to reconcile the various terms used by the parties. The dispute concerns the portion of the 1986 Order which defines potash enclaves as areas of potash ore of "sufficient thickness and quality to be mineable under

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high grade ore in order to produce the figures reported and a far higher grade than Hutchinson's "core hole" estimate. The decision rationales for some of the Wolf APD's in the same area report numbers for the "run of mine grade," described as the "full face grade which includes the waste taken above the ore zone to obtain the needed height for mining equipment and subsidence" that is somewhat consistent but describes a six inch ore bed. See e.g. YP 119 at RP 004099.

existing technology and economics." Both Hutchinson and Waugh understood that there is a grade below which a mining company will not mine because it is uneconomic to do so. As discussed by Hutchinson:

> There's a grade that will allow a company to know that they can mine down to that grade, and it won't hurt them. It won't provide a profit, necessarily, but it will meet their costs, all costs, including non-cash costs. Depreciation is an example of a non-cash cost, and usually a major one for a mine. Then there's the cash cutoff, and we know, in studying economics, that it's human nature that no matter how -- how you do something in a profitable entity, you never operate below your cash costs. I mean that's a real loss, if you -- if you spend more money to make a product than you can receive for it, you just can't do that.

Hutchinson: 7537-38. Similarly, Waugh explained that a "cutoff grade" is:

> the lowest grade that a mine will mine to in terms of break-even, that they will mine to it and that they're breaking even or not making money at. That is usually used as the number when they do their ore reserves.

Waugh: 11429; see also Waugh: 11807-11, Cone: 10633-34. It is quite possible that the two witnesses would differ in their analysis of the specific costs which are to be included when identifying a "break-even" grade, but such a grade would indisputably be based upon economics as called for by the definition of potash enclaves. [60/]

IV. C.2.e Core Hole Density and Areas of Influence

As described in presenting his testimony, Hutchinson also used his analytical maps to calculate core hole densities and areas of influence, which he spoke of in terms of what the mining companies were "comfortable with" or "makes them happy." Hutchinson: 7690, 8221, 8242, 8366-67. Although the Intervenors' objected to such characterizations, Waugh similarly discussed drilling core holes in terms of achieving a "confidence level" as a professional, but disagreed with Hutchinson's concept that a company would rely upon a specific standard for core hole spacing. Waugh: 11335, 11374, 11543-45; see INT 426 at 2 ("level of confidence necessary for making economic and mining decisions"). Instead, he testified about various factors which influence the decision of when there are sufficient core holes to analyze a deposit, including "the nature of the ore body, the people, the professionals who are actually doing the work with it and their experience, and the philosophy of the company, in dealing with the level of investment." Waugh: 11765; see Waugh: 11337-44, 11765-66; INT 445. The description is apt. The concept of achieving a level or degree of confidence or comfort in drawing conclusions using geological data

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[60/] There is a further question as to whether the definition of potash enclave contemplates that a mine will be profitable and calls for something more than a break even or cutoff grade. Alternatively, the definition can be said to implicitly recognize that a mining company will always mine ore above the minimum grade and is profitable whenever the cutoff grade has been minimally exceeded. See Cone: 10633, 10650.

seems to be common among geologists. When asked about his experience in making professional judgements, Brent May, whose work primarily dealt with the oil and gas producing formations in southeastern New Mexico, stated that "[i]t does help to have a feel" and when asked whether he had "that level of experience" responded "I feel comfortable, yes." May: 5069-70, 5114-15.

The Intervenors' objections seem to be less concerned with specific terminology than with two points. First, Hutchinson's statements appear to attribute the results of his analysis to the potash mining companies as though he was testifying based upon knowledge of their business practices and decision making processes. It is clear from the questions addressing his qualifications and experience that he did not have any direct knowledge. See Hutchinson: 8028. More fundamentally, the Intervenors object to Hutchinson's discussion of core hole density and areas of influence as though they were the controlling basis upon which the mining companies had made decisions when opening and expanding their mines. See Hutchinson: 14737. Waugh, a Canadian, commented that it was:

> the first time in my life, until I came down here, that I've ever heard anyone talk about core hole density, that it was any kind of an issue. You know that geologists wouldn't even talk about it. They would talk about the spacing and gaining the confidence level in your interpretation which allowed you to build the ore reserves to pitch it. This core hole density thing is not an issue that's familiar to me.

Waugh: 11347; see Waugh: 11374.

After seeing Hutchinson's exhibits and tables, Waugh prepared a study titled "Core Hole Density Calculation" (Sept. 25, 1996) to examine the analysis they represented. Waugh: 11353, 11772-73; INT 426. He believed that Hutchinson had counted all of the core holes drilled within an area without regard for not only the quantity and quality of potash they revealed but, more significantly, whether or not they had intersected the ore zone where mining subsequently occurred. Waugh: 11353-55, 11773; see Hutchinson: 7690, 7695, 8236; YP 728, YP 729, YP 730, YP 732. The consequence was to increase the number of core holes and thereby their density and correspondingly to reduce the "area of influence" assigned to each core hole in identifying an area of potash enclave. Waugh calculated core hole density by looking at the number of core holes within IMC's lease lines and found there were 2.4 core holes per section of the lease, equal to 257 acres per hole, and that looking at the area identified by IMC's life of mine reserves there were 2.8 core holes per section, or about 223 acres per hole. Waugh: 11367-68, 11373; INT 426, table 1. He regarded the fact that Hutchinson had arrived at different numbers for IMC and New Mexico Potash as showing the "fallacy" in his method because:

> it's the same ore body. It was obviously drilled by different people, different companies, which would have made different drill densities for different reasons.
>
> But unless you want to work back through all those reasons, and

> the timing of how those were drilled and who drilled it, and the experience of who drilled it and the company's philosophy of who drilled it and what the basis of the money that they were going to do -- I mean it -- you cannot logically assign a number without going into all that, and that, to me, makes no sense to do it.

Waugh: 11375. [61]/

There is no need to resolve the fundamentally different understandings Hutchinson and Waugh expressed about core hole densities or the numbers they calculated. In relation to this case, the disagreement is a controversy without a subject. As mentioned in discussing Van Sickle's standard of three "data points no more than 1 ½ miles apart," core holes provide critical information for evaluating the extent and richness of a potash deposit. IMC, however, has not drilled any core holes from the surface since 1976, apparently relying upon core samples drilled from underground to an ore zone either above or below the level of its mining operation. Waugh: 11276. Bessinger, who worked as a mine superintendent for IMC beginning in 1962 and later as mine manager and as production manager, testified that as far as he was concerned IMC did not have a mining plan at the time and, with one exception, he wasn't aware that there was "any core hole showing ore in the area in which we were mining at that time." Bessinger: 9769. Hutchinson testified that New Mexico Potash had drilled ten core holes to the 10th ore zone in December of 1991, but there is no indication that any of the mining companies engage in a regular program of core hole drilling as part of their mining operation. See Hutchinson: 7609, 7717. Consequently, the Appellants' insistence on a specific standard for the relative spacing or the density of core holes is misplaced.

It is worth noting, however, that the core hole density numbers Hutchinson identified would generally require drilling far more core holes than most of the experts who testified on the matter thought were needed. See YP 727, YP 731. His largest "area of influence" of 160 acres is approximately equal to the SME Handbook's reference to drilling four core holes per section. See Muncy: 7295. His smallest area of influence of 39 acres is similar only to Bill Bessinger's assertion that quarter mile drilling is "required to make an honest to God mine plan." Bessinger: 9835. Undoubtedly, IMC and the other mining companies rely upon the analysis of its geologists and other experts, undoubtedly those personnel have standards originating in both their education and experience by which they evaluate their "comfort" with their interpretation of data, and undoubtedly the "density" of data points is an important consideration. There is, however, no reason to believe that their evaluation of geologic data is, as an initial step, controlled by whether a predetermined number of core holes have been drilled within a specific area.

IV. C.2.f "Known to Exist"

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[61]/ Waugh's exhibit was prepared in advance of the hearing and, as would be expected, Hutchinson disagreed with Waugh's criticisms of his method. See Hutchinson: 7884-93. Bill Bessinger also critiqued a number of statements in the report. Bessinger: 9874-76.

The importance of Hutchinson's calculation of core hole densities and areas of influence lies in his application of them in determining whether potash ore is "known to exist" as provided in the definition of potash enclaves. Under his method of analysis, two criteria had to be met before an area could be identified as potash enclave. First, he required a core hole to show potash ore of the requisite "sufficient thickness and quality" and, second, after assigning the applicable area of influence to qualifying core holes, he required them to be sufficiently close to each other to form an area of potash enclave. Hutchinson: 7599-600, 7688-89, 8189-90.

The significance of the first criterion was brought out during cross examination about Hutchinson's application of his conversion ratio of 3.8 to 1 for langbeinite and sylvite. He agreed that a core hole showing 12% sylvite and 1% langbeinite, yielding 15.8% sylvite equivalent, "most likely would have been excluded" from identifying potash enclave because it was less than the 16%. Hutchinson: 8144-45, 8150. He also agreed that core holes in the fourth ore zone would not identify potash enclave unless they showed in excess of 7 to 8% langbeinite. Hutchinson: 8175. Thus, despite Hutchinson's recognition that the grades of potash he identified by examining the areas where mining had stopped at the end of three years were not precise, he applied his standards as the "cut offs" or "minimum grades" of the potash "mineable under existing technology and economics." See Hutchinson: 7599-600, 7971-72, 7979-80; YP 727. As a result, although he began by examining the approximately 2,000 core holes which had been drilled in the Potash Area, after applying his standards for mineable potash he found only a very limited number to have "sufficient thickness and quality" to identify potash enclave. See YP 737; Hutchinson: 7716-17, 7734-39, 7775-76, 7979-80, 8189-90.

Even more significantly, although Hutchinson calculated his areas of influence based upon all core holes drilled within an area without regard for the ore zone or zones they had intersected, he applied the resulting "area of influence" only to qualifying core holes in a particular ore zone. Without undertaking precise calculations, it appears that even core holes located one half mile apart at the centers of adjoining quarter sections, in accord with the statement the Appellants point to in the SME Handbook, would be insufficiently spaced to satisfy any but the largest of Hutchinson's core hole density standards. Looking at the map of core holes drilled within the Potash Area and other information about their location, it is obvious that the effect was to categorically exclude large areas within each ore zone from being found to contain potash enclave, regardless of the potash values they revealed, because the core holes intersecting the zone had not been drilled sufficiently close to each other to meet Hutchinson's area of influence standard. See YP 591.

On the basis of his theory about when a potash enclave is "known to exist," Hutchinson disputed a report that some 29 million tons of potash ore, valued at approximately 450 million dollars, had been wasted in an area east of the WIPP site. See YP 285, tab 26; YP 749. As he testified:

> I have looked long and hard for any ore that is east of the WIPP lands, and by the mining definition of ore, with its economic connotations, I can neither find that it exists in sufficient grade, nor are the points of

information close enough together to classify it as a reserve.

> Therefore, it can't be ore. * * * I disagree that there are any known potash reserves. Had there been, I would have found them in my search for enclaves.

Hutchinson: 7770-71. More particularly, Hutchinson explained in regard to his exhibit of the area for the tenth ore zone showing "the core holes that do meet sufficient thickness and grade" and their area of influence:

> Well, my conclusions are that yes, there are some core holes east of WIPP that do have sufficient thickness and grade, but they aren't -- they don't come close to -- there isn't nearly enough data to show that there are reserves or ore, certainly not in the tenth ore zone, based on the information available.

Hutchinson: 7773; YP 750. Similarly, Hutchinson testified that his exhibit of the same area for the fourth ore zone portraying "the area of influence of core holes and those core holes that meet sufficient thickness and grade" showed a qualifying core hole northeast of the WIPP site, "but it's isolated and by itself. Certainly not enough known area there to indicate that the fourth ore zone is commercial, given the information that we have available." Hutchinson: 7775; YP 751.

As reflected in his testimony, Hutchinson's conclusion that the areas do not contain a mineable reserve was the consequence of applying his two criteria rather than an analysis of the facts about the quantity and quality of potash in each area. The document Hutchinson criticized explains that the accompanying map shows "[t]he extent of ore around each core hole * * * using the polygon method," that "[t]he potash grade assigned to each core hole was taken from information gathered for the Department of Energy concerning the WIPP site," and that "[t]he value of the ore was determined using actual operating and extraction and recovery rates." YP 285, tab 26 at RP007075. The map shows polygons drawn around 12 core holes, circles of one half mile radius drawn around numerous wells, and areas of overlap shaded in yellow. Id. at RP007076. It is apparent that the area of overlap is the basis of the statement that two square miles of potash reserves had been wasted. The Intervenors provided testimony that the estimate had been based upon actual ore grades shown by core hole readings and an exhibit shows the calculation of the value of the ore. Morehouse: 12139: INT 208. In contrast, as Hutchinson testified, his maps show that only a relatively few core holes have sufficient thickness and grade and they are insufficiently spaced to qualify as potash enclave under the area of influence he assigned to them. Nevertheless, his map of the 10th ore zone agrees that the area of overlap identified in the report contains potash of 12% and higher grade. YP 750. There may be legitimate issues as to whether 12% grade potash is "mineable under existing technology and economics," whether the potash within the area of overlap was properly calculated to be worth $450 million, and the extent to which the potash had been "wasted" due to the presence of the wells, but Hutchinson's conclusions were based upon the limited number of core holes which met his thickness and grade standard and their relative distance rather than an analysis of these matters.

Hutchinson testified that potash enclaves did not exist in a number of other areas based upon the absence of sufficient core holes to satisfy his standards. As he stated in regard to a number of circles shown on his large map of the 10th ore zone (YP 716):

> Those identify core holes that have "sufficient thickness and quality to be minable." They have the grades and the thickness to be minable, as defined by the Order, but they don't have the core hole density. They are not close enough together to satisfy the definition of "known" as it refers to ore and minable and reserve, and a word that was brought up yesterday, measured, in the true economic sense of the word "measured ore." That ore which there's no doubt it's this concept.

Hutchinson: 7601; see 7716-17. Similarly, Hutchinson testified that there were core holes with sufficient thickness and grade in the tenth ore zone in the Sand Dunes area, but that he "couldn't classify it as an enclave, because the core holes are too widely spaced to make it an enclave under the definition in the '86 Order." Hutchinson: 7724-25; see Hutchinson: 8241-42; YP 733. Likewise in regard to the fourth ore zone, Hutchinson found there to be a small area "[t]hat meets all the criteria of an enclave" as shown on his large enclave map, but that numerous other core holes with sufficient thickness and grade, including five core holes north of the WIPP site, because there was "not enough data" to identify a potash enclave. Hutchinson: 7725-26, 7728-29; see YP 717, YP 734, YP 735. He also testified that a map of the tenth ore zone that included the same area showed core holes of sufficient thickness and grade but they were "very sporadic" and did not identify potash enclave. Hutchinson: 7729, 7732; YP 736.

Although the lack of qualifying core holes was not the only basis upon which Hutchinson testified that the potash under various proposed wellsites was uneconomic and would not be mined, it was a consistent part of his testimony. In addressing the Federal 23 APD's, Hutchinson stated:

> From previous exhibits, I've shown the potential from core drilling information of some tenth ore zone areas that meet sufficient thickness and grade in this area. However, the core holes are so--spaced so far apart that it doesn't meet the criteria required of an enclave that it is a known area.

Hutchinson: 7913. He also addressed a statement in the decision rationale for several proposed well sites that the first, second, and fourth ore zones “meet the BLM potash leasing criteria.” YP 82 at RP 001279. He stated: "Well, I found nothing that would meet the enclave standards in either the fourth or the tenth ore zone in that section. There might be some isolated core holes that did exceed those." Hutchinson: 7918. After further discussion of his use of the term "enclave," Hutchinson again stated that the area "does not meet the standards of enclave as I've developed them, for either the tenth or the fourth." Hutchinson: 7919. In regard to the second ore zone, Hutchinson pointed out that his exhibit listing qualifying core holes showed that there were three meeting his thickness and grade standard, but that the one shown on the small enclave map which was part of the decision rationale was insufficient to identify an area of potash enclave because it was "[j]ust a single core hole. There's nothing around it close enough to match it up to provide

anything more than a 40 to 60-acre area of influence." Hutchinson: 7921; YP 82; see Hutchinson: 8371-72, 8187-89. He likewise testified that another core hole in an adjoining section was "just a singular point in the section." Hutchinson: 7924, 8371-72; see Hutchinson: 8371-72, 8187-89.

It is apparent that Hutchinson's conclusions about the presence or absence of potash enclave in specific areas is a consequence of applying his criteria rather than a true analysis of all of the available information. Although he used core hole data to produce contours on his analytical maps, he identified potash enclaves based upon the area of influence of the core holes which qualified under his grade and thickness standards rather than the mineralization showing by the contours. Because relatively few core holes qualified, and even fewer were in sufficient proximity of each other that their area of influence allowed identifying an area of potash enclave, Hutchinson identified significantly smaller areas of potash enclave than shown on BLM's 1984 and 1993 potash enclave map.

In most instances Hutchinson testified as though his criteria were sufficient to determine whether potash enclave exists at the proposed well sites. He did not maintain this approach, however, when addressing another portion of the tenth ore zone in the area of the Lusk and Belco APD's, also known as the area of the Noranda potash leases. Similar to his other exhibits, Hutchinson initially explained that on his exhibit:

> The blue area was determined similarly to the way I determined the rest of the enclave areas on my maps, YP 716 and YP 717. And the blue area has sufficient thickness and grade to be minable, and the core holes that identify that sufficient thickness and grade are close enough together to show that it is a known area of sufficient thickness and grade.
>
> So, it meets the definition of enclave in that regard.

Hutchinson: 7812; see Hutchinson: 8302-03.

Hutchinson did not end his analysis with this conclusion, but explained that, because there was not an operating mine nearby and "it would take some considerable capital expense to open this deposit," he had been "forced to look at that part of the definition that requires there be a `minable reserve'" and "evaluate if this deposit would support [the] capital expenditure." Hutchinson: 7814-15. To do so, he evaluated the area that core holes showed to "have sufficient thickness and grade, and core hole density, calculated the gross tons of ore, applied a total recovery rate of 60%, and then:

> Calculated the grade mined from my maps with a minimum grade of 16%, included a mill loss of 20% of the K_2O, calculated the tons of K_2O that would then be for sale, and the revenue that would be obtained using a price FOB mine of $118 per ton.
>
> That provided the revenue. I subtracted a cash cost of $15 per ton, to include all costs, and then calculated the amount of money that would be left over and available for capital expenditure after returning a 15%

> return to the investor. And in all cases, the amount of money left over to buy the capital equipment to mine the mine or develop the mine, sink the shafts, and whatever, came up with a negative $15 million.
>
> I estimated what I thought the minimum amount of money would be in terms of plant or capital expenditure to put the mine into production at about $30 million.

Hutchinson: 7815-16; see YP 758, YP 759. Hutchinson concluded that "this deposit is not going to be developed because the production, even in total, * * * wouldn't support the -- the property required for the risk taken, nor the capital expense to develop the area." Hutchinson: 7816-17. He further concluded that there was not an ore body qualifying as a "minable reserve" under the 1986 Order because extraction would not be "economically worthwhile." Hutchinson: 7818.

Waugh provided a number of criticisms of Hutchinson's analysis. He considered Hutchinson's exhibit showing that the operation would loose 15 million dollars a "bit * * * misleading" because it included what looked to be a "net present value analysis" in which the 15% rate of return was applied to the initial capital investment from the outset, which did not mean that "you are, as an operation, losing money" and "in fact, even using Mr. Hutchinson's numbers, that operation as shown there would make money." Waugh: 11598-99; see YP 759. Waugh calculated that, using Hutchinson's figures, the return on investment would be four percent and that "no one would invest." Waugh: 11599. In addition, he explained that a "present value or rate of return analysis" is time-sensitive and that Hutchinson's exhibit did not show a yearly production that would determine how many years the reserve could be mined. Waugh: 11599-600. However, he considered Hutchinson's cash costs of $15 per ton to be "far too high" and his capital investment figure of $30 million to be "far too low." Waugh: 11599, 11602. Using Hutchinson's basic figures but substituting a lower production cost based upon IMC's actual operation and a set production rate, Waugh found that Hutchinson's loss of $15 million in net present value changed to a gain of $33 million and a "phenomenal" return on investment of 43%. Waugh: 11601-03; INT 437.

Whether or not Hutchinson was correct about the quantity, grade, and value of potash in the area, and his estimates of capital and production costs (Hutchinson: 8305-09), his analysis of the area contrasts with his testimony about the other areas in dispute. If the term "minable reserve" in the definition of potash enclave requires an analysis of such factors, it would equally require examining the same or similar factors to identify the "thickness and quality" of potash ore which is "mineable under existing technology and economics" in other portions of the Potash Area. As Hutchinson stated in explaining that the USGS's and BLM's maps were leasing maps because:

> At the leasing point, you don't know the geometry, grade, or continuity of an ore body. Until you know that, you cannot design a mining system. Without a mining system, you cannot design a mine plan. Without a mine plan, you cannot determine mineability or economic mineability.

Hutchinson: 8105; see Muncy: 10119-20. If this statement is correct, however, it is unclear why Hutchinson did not undertake a similar analysis of the areas where potash mines are operating. His analysis of those areas was not, contrary to the Appellants' arguments, based upon examining the depth at which each mine operated, its mining equipment and mining methods, the amount of insolubles and contaminants, the mine's processing and milling capabilities, or its markets, customers and method of transportation. Instead, Hutchinson examined the places where mining had stopped at the end of a three year period based upon his adjusted core hole readings and applied his findings to determine whether there is a sufficient density of core holes meeting his "thickness and grade" standard to identify potash enclave.

IV. C.3 Weight and Credibility

Several aspects of Hutchinson's testimony limit the weight it can be given. As previously discussed, his testimony about the meaning of terms used in the definition of potash enclaves, like that of other witnesses, cannot be accepted as controlling their interpretation. In addition, his insistence that his understanding of the terms of the definition constitutes its only proper interpretation indicates a lack of perspective. Even though the USGS and BLM had prepared a series of potash enclave maps over a period of 10 years, Hutchinson frequently asserted that they had never prepared maps in accord with the Secretarial Orders and that the resulting maps were leasing maps and have no bearing on the issues in this case. Hutchinson: 7566, 7575, 7579. This testimony was not based upon a factual review of the data and methods the USGS and BLM had used to prepare the maps (see Hutchinson: 8188) or an analysis of whether the standards set forth in Van Sickle's May 5, 1974, memorandum currently define the thickness and quality of potash "mineable under existing technology and economics," but upon his understanding of the meaning of the terms used in the definition. Indeed, at one point he stated that he could "only conclude that this might be the first attempt that's been made public, or exposed to everybody, where those guidelines were followed in a scientific and technical manner." Hutchinson: 7739.

Although such testimony is consistent with the Appellants' claim that the potash enclave maps have actually been leasing maps, it is also, as has been discussed, inconsistent with the information presented on the maps themselves. It is possible that over the years the USGS and BLM failed to properly analyze the core hole information and other data, that they relied upon erroneous data, that they applied mapping techniques that do not meet standards of professional geology, or that they erred in mapping portions of the areas they identified as potash enclave. What does not seem possible is that USGS and BLM personnel failed to understand the terms of the definition of potash enclaves found in the 1974 Guidelines, the 1975 Order, the 1983 Instructions, and the 1986 Order and that, like matters previously discussed, the Departmental supervisors who drafted and reviewed the 1975 Order failed to correct their subordinates' mistakes, the Assistant Secretary and the BLM Director who signed the 1983 Directive and Instructions failed to understand the definition of potash enclaves and failed to realize that it had been misapplied, and that the Departmental officials who prepared the 1986 Order and the Secretary who signed it also failed to recognize and correct its misapplication. Hutchinson's insistence that only he has understood the definition of potash enclaves

diminishes the value of his testimony. [62/]

Of particular significance, Hutchinson testified on direct examination that the use of the term "enclave" on the 1974 map could "only be concluded to be the generic definition of enclave" because the 1975 Order had not been issued. Hutchinson: 7570, 7948. On this basis, as previously described, he asserted that the similarity of the 1974, 1976, 1979, 1984, and 1993 maps showed they had all been prepared using the same criteria, had not been prepared in accord with the economic considerations required by the Orders, and were leasing maps. As he explained:

> I knew that in 1974, there was no '75 Order. There was no definition of enclave given to the BLM requiring them to map an enclave.
>
> I wanted to compare the '76 map to the '74 map for my own edification, to see if the economic requirements, as described in YP 706, the definition of an enclave in the '86 Order and the '75 Order, was carried over. And it definitely was not.

Hutchinson: 7572.

During cross examination, Hutchinson confirmed that "one reason" the 1974 map was not an "enclave map" was that "the '75 Order had not been issued, and therefore, there was no definition of enclave." Hutchinson: 8062-63. His attention was directed to the February 15, 1974, memorandum to the Secretary from the Acting Director of the Geological Survey and the accompanying February 14, 1974, memorandum from the Chief of the Conservation Division to the Director of the Geological Survey (INT 17). After reading the portion of the February 14th memorandum, Hutchinson agreed that it provided "a definition of enclave." Hutchinson: 8068. When asked about his testimony

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[62/] Hutchinson's testimony was replete with claims about the 1975 and 1986 Orders that were made without a clear factual basis. For example, early in his testimony Hutchinson asserted that the "authors * * * had some idea of the risk, the comparative risk situations between the two industries, because they provided for that in the '75 Order, and now the '86 Order." Hutchinson: 7521. While the Departmental personnel who drafted and commented upon the Orders may well have understood something about risk assessment, Hutchinson neither offered a basis for his claim about their knowledge nor identified any portion of the Orders as requiring BLM to undertake a comparative risk assessment. Nevertheless, he went on to describe the Department as providing a "carrot" to encourage oil and gas companies to obtain leases and spend "risk money" exploring for oil and gas by the 1975 Order, the 1983 Directive, and the 1986 Order Hutchinson: 7524; see Hutchinson: 8291-92. On this basis, he criticized BLM because "when the oil companies came in and had spent their high-risk dollars, and wanted the reward for having done that, they're being told by the BLM they can't drill. That's wrong in my opinion." Hutchinson: 7525. The motive Hutchinson attributes to BLM is not stated in either the words of the 1975 and 1986 Orders or the Departmental documents which preceded their issuance, but, at best, seems to be an inference he drew from his reading of them. See Hutchinson: 8416-21. While his criticism may express the Appellants' view of BLM's denial of their APD's, as discussed in responding to their claims as to the intent of the 1986 Order, it is not appropriate for this tribunal to articulate an unstated purpose or policy for the Orders.

concerning the 1974 map, however, Hutchinson asserted there was no connection: "I don't think that those words "enclave" have anything to do with each other. I don't think they're related." Hutchinson: 8068; see Hutchinson: 7948-49. He also testified that he did think the 1974 map had been prepared in response to the 1974 guidelines, and again stated that he believed it had been drawn due to "the necessity to establish an area that would -- inside of which leases for potash must be acquired through competitive bidding, and those areas outside that would not require competitive bidding." Hutchinson: 8068-69.

After reading the instruction in the 1974 memorandum that the area geologist and the area mining supervisor were to review the data submitted by potash lessees and prepare a map or maps by June 1, 1974, and after agreeing that Van Sickle was the area geologist in 1974 and had prepared the 1974 map, Hutchinson was asked whether the 1974 maps was "the map that Mr. Van Sickle prepared in response to these guidelines?" Hutchinson: 8070. He answered: "Absolutely not. Mr. Van Sickle had many responsibilities. One responsibility he had was for this leasing criteria map, which he made. And he testified that's exactly what it is." Hutchinson: 8070. Hutchinson next stated:

> My testimony was that I have never seen the map anticipated here come out of the BLM files or the USGS files. From a technical, analytical point of view, that map, the YP 708, is not an enclave map under any circumstances, as defined by this memo, Intervenors' 17, or any interpretation, any reasonable interpretation of economics.

Hutchinson: 8070.

Hutchinson's statement that the 1974 map was not prepared in response to the 1974 guidelines and his inference that the subsequent maps were not based upon the 1975 and 1986 Orders are as untenable as his assertions that USGS and BLM personnel have never properly understood the terms of the definition of potash enclave. It reflects, at best, a profound misunderstanding of the series of Departmental documents, discussed throughout this decision, that led to issuance of the 1975 Order and the administrative procedure they represent. His assertion that the use of "enclave" in the guidelines was unrelated to the 1975 definition was neither logical nor credible given that the same 43 words found in the February 14th memorandum are those used in the 1975 Order. His responses to the questions seem to have been made for no other reason than to preserve his testimony that the USGS did not have a definition of potash enclave when it prepared the 1974 enclave map because the 1975 Order had not been issued.

Other aspects of Hutchinson's testimony indicated a lack of knowledge of, or misunderstanding of, matters fundamental to the administration of the Potash Area. During cross-examination by counsel for BLM about the use of "B," "M," and K20 in designating core hole values, Hutchinson stated that he had asked Van Sickle about them and that:

> He said they were looking for a place to put the line that would be

> leaseable or could be subject to a prospecting permit, and for those areas that were obviously highly mineralized, they just took the shortcut and made an M, and when they were barren or less than the minimums, depending on what they thought to be the primary -- or the principal mineral, they would use the B. He could not explain to me why they used the K_2O designation.

Hutchinson: 7964-65; see Hutchinson: 7550, 7557. Later, counsel for the Intervenors asked him about this statement and Hutchinson responded by saying that Van Sickle had "referred to a term common with the USGS of `known geologic structures'" (KGS) and stated that he thought the term applied to "all leaseable minerals." Hutchinson: 8071-72; see Hutchinson: 8431-32. Hutchinson also identified the blue line he had drawn around the area of "Measured Mineable Potash Reserves" on the 1974 enclave map as identifying a KGS. Hutchinson: 8072; see YP 708. When then asked about his large potash enclave map (YP 718), Hutchinson correctly identified the line showing the Known Potash Leasing Area which had been reproduced from BLM's potash enclave map and explained that "potash must be leased competitively inside that line." Hutchinson: 8074.

Hutchinson was then asked whether it was his "understanding that with respect to leasing, is everything within that KPLA line subject to competitive bid, or is it only that within the blue, as drawn by the BLM?" Tr. 8076. In response, he stated that "[i]nside the blue, there was no doubt that it met the leasing criteria -- the mapping criteria to meet leaseable reserves" and went on to explain that:

> There were questionable areas where they couldn't lift it into that -- that group, that through -- I mean this guy is a geologist. He had geologists working for him. They didn't operate in a vacuum. And he said there are some other areas that might be in there, but we can't -- we're not confident that they're in there, and we're going add those areas on the map, too, so that if someone asks for a lease, that goes into an area of what he called indicated, that the administrator, or the people making the decision or recommendations to lease or not lease, would have some guidelines to say I think we better put that up for competitive lease or, if the offer for a prospecting permit was great enough, and the work commitment great enough to the permittee, that they would say all right, but you've got to drill a certain number of holes.
>
> You know, that's the way the business works, I guarantee you that.

Hutchinson: 8076-77. When immediately asked whether a prospecting permit could be obtained within the KPLA "in areas outside the blue," Hutchinson replied, "I don't believe you can." Hutchinson: 8077.

Prior to the amendment of the Mineral Leasing Act in 1987, the designation of KGS's was part of the law governing oil and gas leasing. See Pub. L. No. 100-203, 101 Stat. 1330, 1330-256 (1987). The statutes governing potash, however, have required that "[l]ands known to contain valuable deposits" of potash be competitively leased. 30 U.S.C.

§ 283 (1994). The term "Known Potash Leasing Area" refers to the statutory language applicable to potash. The problem is not that Hutchinson was unfamiliar with the different terms used in the statutes, but that when confronted with a conflict between his claim that the lines Van Sickle had drawn were for leasing potash and the obvious implication that a line showing the "Known Potash Leasing Area" must control potash leasing, he was unable to acknowledge the problem. Instead, he offered a wholly speculative explanation, which he attributed to Van Sickle, that "questionable areas" could be either competitively leased or subject to a prospecting permit if the right offer were made or negotiated because "that's the way the business works." BLM is not engaged in a business. Its responsibility is to administer public lands in accord with the requirements and limitations established by numerous statutes and regulations.

When the subject came up again, Hutchinson admitted that he did not know whether a prospecting permit could be obtained for potassium within the KPLA. Hutchinson: 8436. His lack of understanding casts doubt on his pronouncements about the 1975 and 1986 Orders and the enclave maps the USGS and BLM have issued.

IV. D. "Existing Technology and Economics"

IV. D.1 Scope of the Issue

Although the 1986 Order calls for potash enclaves to be identified based upon "existing technology and economics," relatively little testimony was presented about the technology of potash mining and even less specifically addressed the changes in technology which have occurred since 1974 when Van Sickle adopted his standards. As indicated at the outset, the Intervenors' witness, David Waugh, provided the most extensive description of the mining methods and equipment currently used. The most significant change in mining technology appears to have been the introduction of continuous miners, something which IMC apparently undertook after issuance of the decisions at issue, although the equipment seems to have been available and some type of continuous miner was used at other mines many years before. See Muncy: 7178; Teufel: 8617; Waugh: 11795-96; INT 197 at 2. Waugh described IMC's use of continuous miners in the tenth ore zone as a "phenomenal success" and testified that they had enabled the company to lower its mining costs by a dollar a ton, an amount he termed a "[s]ubstantial savings." Waugh: 11406, 11900. He also testified that Western Ag had successfully begun using continuous miners to mine langbeinite. Waugh: 11406-08.

In addition, Waugh explained that IMC had developed the use of "super panels," consisting of 18 to 20 rooms separated by pillars, that give it flexibility and lower production costs by contributing to the mine's economy of scale. Waugh: 11393, 11899-901, 12012; see Thayer: 12383-86; INT 193 at 3. He explained that IMC's larger operation and efficient mining methods allow it to mine lower grades of ore than Western Ag. Waugh: 11450-51. Waugh also described IMC's granulation plant that was under construction at the time of the hearing. Waugh: 11422-27. The plant's technology, however, does not seem to be new, although its application to langbeinite may be. See Waugh: 12070-72. In addition, Walter E. Thayer, another witness for the Intervenors, described changes made in IMC's hoisting system that had allowed it to increase tonnage.

Thayer: 12384-86.

In the course of testifying about a report, Bill Bessinger, one of the Appellants' witnesses, described various changes that have occurred over the years:

> Technological developments of which I am aware, since 1952, we went from drilling with post drills, that is to say they were on columns, the drills were mounted on columns and we used to have a platform for the drillers to stand up to drill in high faces. We went from those to drill jumbos, that's a machine you've probably seen. Normally they have two drill arms and they tilt and spread, and whatever. Drill jumbos.
>
> We went from drilling with what in hard rock mining is called a Stoper. It's like a jackhammer except it's built to drill straight up holes. It has a extinguisher that extends and pushes it up as this comes out.
>
> We used jackhammers to roof bolt. And now we have -- then we went to self-propelled mounted roof bolters. We've gone from dynamite to ammonium nitrate for explosives. We've gone -- we have some loading machines that are higher capacity than they were in those days. Heavy media was introduced by IMC in '68, and I think that probably was the most spectacular advent, as far as mixed ore is concerned.
>
> Now they have introduced the horizontal drum boring machine, which is obviously an improvement. But look at the numbers, it looks to me that overall, productivity has been increased something in the range of 15 to 20% since 1966. That's -- this is manpower in the mine.

Bessinger: 9850-51; see Griswold: 12796-97; YP 598, vol. 2 at IV-2.

Due to the limited evidence about changes in mining technology, for purposes of this decision the issue of the "thickness and quality" of potash ore which is "mineable under existing technology and economics" primarily concerns economics. In many respects, the economics of potash mining do not look good. Potash production in New Mexico has generally been declining since the mid 1960's, although quantities rose from 1987 to 1992, apparently as a result of an antidumping agreement with Canada. YP 456 at BLMCO55712; YP 748. Consistent with the declines, the number of mines operating in the Potash Area has decreased from seven to five at time of hearing, and the Eddy mine was expected to have a limited life. Herrell: 3755; Waugh: 11381; Foote: 12494; YP 575 at 1. The Horizon mine, formerly the Amax mine and before that the Southwest Potash mine, had closed in the early 1990's. Muncy: 7473. The Appellants claim that the reason the mines have shut down is that they were unable to economically mine the grades of potash present at the sites, but this has been disputed by the Intervenors who have suggested that more complicated economic factors were involved.

It is clear that Canadian mines in Saskatchewan and New Brunswick dominate the U.S. potash market. See Waugh: 11733-34; YP 746, YP 748. One obvious reason is that

they mine much richer ore. See Waugh: 11727-32; YP 451 at BLMCO22562. It is also significant that they are closer to the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin which consume over half of the potash used in the U.S. and benefit from lower transportation costs. See YP 743; INT 456; Waugh: 11732-33. The Intervenors, however, point out that Canadian mines are subject to considerably higher tax rates than mines in New Mexico, allowing the latter to mine lower grades of ore at the same rate of return. Int. PH Brief at 131; Waugh: 11314-15, 11716-23, 12041; INT 439. They also point out that the Canadian mines operate at a greater depth in a different geology which requires greater capital investment, and do not mine langbeinite. Int. PH Brief at 132; Waugh: 11330-31. It appears that Canadian mines are also subject to more stringent environmental regulation. Waugh: 12047. In addition, it seems that the international market for potash was affected by Canadian mines engaging in "dumping" during the 1980's until an agreement was signed in 1987 and additional "dumping" in the early 1990's by countries of the former Soviet Union. See YP456 at 1-2 (BLMCO55711-12) and attachment 1 at BLMCO55722. Whatever the reasons that Canadian mines continue to successfully compete in the U.S. market, it is clear that the New Mexico mines continue to sell their products throughout the United States and also export approximately 28% of their production. Waugh: 11306; INT 456, 457.

Some testimony and exhibits were devoted to looking at trends in potash production and the future of the domestic industry, particularly in relation to Canadian production. The Appellants portray a bleak future, while the Intervenors have pointed to recent improvements in production and prices. See Waugh: 11319, 11321-23; INT 108; INT 464. There is no need for this decision to engage in similar speculation. The subject of the hearing and this decision is the propriety of BLM's decisions denying the Appellants APD's. More broadly, the issue to be resolved concerns the "thickness and quality" of potash which is "mineable under existing technology and economics" as defined in the 1986 Order and the application of other provisions of the Order. For purposes of this decision, it is assumed that potash will continue to be produced by mines in the Potash Area, APD's will continue to be filed for well sites within the Potash Area, and the 1986 Order will continue to be applied by BLM in reviewing them. As pointed out in discussing the origin of the potash enclave section, the suggestions by USGS personnel that a "time element" for mining potash be adopted as part of the process of reviewing APD's did not become part of the 1975 Order. Whether provisions of the 1986 Order should be modified to reflect changes in the potash market or other economic conditions is a matter of policy which is not an appropriate subject for this forum to address. See Tr. 11756-59 (sustaining objection to questioning directed to elicit testimony related to issues of the "viability" of the potash industry and the "timing" of production). [63/]

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[63]/ The wisdom of not addressing such arguments in an administrative hearing when reviewing a limited record (however extensive in this case) is indicated by a May 2, 1973, letter submitted to the Department on behalf of the New Mexico Oil and Gas Association. It described a 1972 USGS open file report as showing "that the high grade commercial potash ore in the area is nearing depletion and that in 1972 most of the seven producing companies had less than a ten year supply of ore left" and indicating "that there are large low grade deposits in the area, but that their recovery is probably not competitive with Canadian production." YP 234 at 3 (BLMCO17493).

IV. D.2 Royalty Reductions

The Appellants raise a significant point that potash mining companies operate under reductions in the 5% royalty called for by their leases. By statute, potash lessees are required to pay "a royalty of not less than 2 per centum of the quantity or gross value of the output of potassium compounds and other related products, except sodium, at the point of shipment to market * * *." 30 U.S.C. § 282 (1994); 43 CFR 3531.2-2. The Mineral Leasing Act also provides that "for the purpose of encouraging the greatest ultimate recovery * * * and in the interest of conservation of natural resources," the Secretary:

> is authorized to waive, suspend, or reduce the rental, or minimum royalty, or reduce the royalty on an entire leasehold, or on any tract or portion thereof segregated for royalty purposes, whenever in his judgment it is necessary to do so in order to promote development, or whenever in his judgment the leases cannot be successfully be operated under the terms provided therein.

30 U.S.C. § 209 (1994); see 43 CFR 3503.2-4(a). Beginning in 1964, IMC, and perhaps some other potash producers, were allowed to pay royalties under a sliding scale rate which varied based upon the grade of the ore mined. YP 451 at 6 (BLMCO22554). The scale was periodically reviewed and modified and in 1982 it was extended to all producers based upon an industry wide royalty restructuring study. Id., YP 456 at 2 (BLMCO55712). In 1986, BLM rescinded the sliding scale rate and adopted a 2% minimum royalty for all potash lessees. YP456 at 2, BLMCO55712.

In 1987 the Director of BLM issued new "Royalty Rate Reduction Guidelines for the Solid Leaseable Minerals" (I.M. 87-552). YP 694; see 52 FR 24347 (June 30, 1987). [64/] The Appellants point out that the Guidelines state that a royalty rate reduction may be granted:

> to promote development by providing an incentive to extract resources not recoverable under current standard industry operating practices that would be bypassed;
>
> to promote development by providing an incentive to extract resources that would be foregone when a mine ceases operations permanently; and
>
> to grant temporary relief for leases that cannot be successfully operated

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[64/] In addition to the June 26, 1987, guidelines, exhibit YP 694 includes an eight page memorandum by the Assistant Director, Energy and Mineral Resources, discussing the Guidelines and public comments received in response to the publication of draft guidelines in the Federal Register. See 50 FR 6062 (Feb. 13, 1985). It also includes I.M. 87-552, Change 1 to the I.M. and 16 attachments, including attachment 12 titled "Checklist, Royalty Rate Reduction Application Content." Some of the Appellants' arguments fail to distinguish the documents.

> under the lease specific production royalty rate when it can be shown that the resource is not economic, i.e. that lease operating costs have exceeded lease production revenue and this condition is projected to continue.

YP 694 at 8; quoted, App. PH Brief at 129. The guidelines allowed applications to be filed under four categories: (1) expanded recovery, (2) extension of mine life, (3) financial test--unsuccessful operations, and (4) financial test--expanded recovery/extension of mine life. YP 694 at 9-10. A royalty reduction must "encourage the greatest ultimate recovery" of potash and "be in the interest of conservation of natural resources" and be necessary either "to promote development" or because "the lease cannot be successfully operated under the lease terms." YP 694 at 6-7.

As the Appellants also point out, in 1993, pursuant to notice from the Department, the companies operating each of the five mines then active in the Potash Area filed royalty rate reduction applications and BLM established a review team which issued a report titled "Potash Market Status, Discussion Paper and Recommendations, June, 1994." YP 456; see YP 450 through YP 455 (applications). The report's introduction states that "[b]ecause of recent Opinions by the Inspector General and the Assistant Solicitor, the BLM Washington Office determined that it was more appropriate to process company specific individual royalty reduction applications than to perform industry wide restructuring." YP 456 at 1 (BLMCO55711); see YP 451 at 4-5 (BLMCO22552-53). The report addressed each application and recommended a royalty reduction to 2% for each mine, with an additional recommendation that Eddy Potash receive a waiver of royalties to allow full recovery of marginal deposits within its leased area. YP456 at 1 (BLMCO55711), 5-6 (BLMCO55715-16). The State Director granted each of the requested reductions, but rather than granting Eddy Potash a waiver, made its royalty .5% retroactive to January 1, 1994, with a refund or credit for additional royalties already paid. BLM also requested that Eddy Potash contribute an amount equal to the .5 royalty to an interest-bearing special account to fund potential liabilities with respect to the final reclamation needs of its site and facilities.

The Appellants contend that the Guidelines:

> required a finding by BLM that the mineral resources underlying the potassium leases were not economically recoverable using current standard industry operating practices. Thus, BLM has found as a matter of law that the leases for which the royalty reductions have been granted contained potash mineralization which is not economically recoverable using current standard industry operating practices. BLM's finding applies to all mineralization underlying the leases for which royalty reductions have been granted, i.e. the royalty reductions cover the entire leases. Having thus found the potassium resources are economically unrecoverable, BLM may not now assert pursuant to the 1986 Order that those very same leases contain ore "which is known to exist in sufficient thickness and quality to be minable under existing technology and economics."

App. PH Brief at 129-130.

Needless to say, BLM and the Intervenors disagree. See BLM PH Brief at 37-42; INT PH Brief at 135-39; INT PH Reply at 15-17. The Intervenors explain that the guidelines were originally designed primarily for coal and that, as a consequence of the Inspector General's opinion, "potash lessees were left with the unenviable task of fitting their royalty reduction requests into the royalty reduction guidelines * * *." INT PH Brief at 137. They also claim that, except for Eddy Potash, the potash operators did not file royalty reduction applications because mining would be uneconomic without a reduction, "but, rather, because a royalty reduction would allow the potash operators to increase their efficiency, compete more effectively with foreign potash producers, extend lease life, and maximize potash recovery." Int. PH Brief at 137-38. They also state that "[r]educing royalties below lease rates to levels at or above statutory minimums would make more money available for investment in capital improvements which would ultimately enable the producers to recover more potash, providing greater revenue to the United States over the entire life of the mine." Id. at 138. They contend that "[t]he applications for royalty reduction were not filed because the remaining reserves were uneconomic", but were "requested to level the playing field for potash producers, enable them to produce additional reserves, and increase the money available for capital improvements to the mines." Id.

Although a number of statements the Appellants make in discussing the royalty reductions indicate that they do not fully understand the documents in their exhibits, [65/] only their fundamental point needs to be addressed. They construe the fact that the reductions were granted for all potash produced from the leases to mean that BLM determined that none of the potash within the leases was "economically recoverable using current standard industry operating practices." See App. PH Brief at 134; App. PH Reply at 61-62. This leads to their argument that BLM cannot also find that the leases contain potash ore "which is known to exist in sufficient thickness and quality to be minable under existing technology and economics." See App. PH Brief at 128, 134, 136; App. PH Reply at 65-67, 69; Pogo Sur-Reply at 18-20. Their position is based upon a misunderstanding of the grounds on which the royalty reductions were granted.

The phrase the Appellants rely upon is taken from the description and definition of the "expanded recovery" category under which IMC and New Mexico Potash filed their applications. A lessee must certify either that:

[65/] In addition to failing to distinguish among the documents in YP 694, questions asked at the hearing about exhibit YP 456 failed to distinguish between the recommendations of the three member royalty reduction review team and the attached "Potash Market Status Report" by Darwyn Pogue. See Hutchinson: 7765-66. The Appellants also misconstrue an illustration in IMC's initial royalty reduction application which identifies tonnages and grades of reserves as reporting "actual grades mined." App. PH Brief at 119; see YP 789 at 6 (IMC-00434). The two cannot be equated because the grade of ore mined from a specific portion of a lease may well vary from the grade calculated for ore reserves within a larger area. Nevertheless, the Appellants' basic point that the numbers reported in the application are higher than the average grades which have been reported by BLM is correct. App. PH Brief at 120; see YP 761.

> a) adverse geologic and engineering conditions make the solid leaseable mineral resources identified in the application economically unrecoverable at the lease royalty rate using current standard industry operating practices, or b) the lease royalty rate, all geologic and engineering conditions being the same or similar, makes the solid leaseable mineral resources identified in the application likely to be bypassed because they are less economically recoverable than resources on non-Federal leases that are part of the near-term mining sequence within the same operation.

YP 694 at 9 [emphasis supplied]; see YP 694 at 50. The Appellants adopt the language of the provision but overlook its focus on the royalty rate provided by a lease. As emphasized, review under the guidelines is directed to examining whether the mineralization identified in an application is "economically recoverable" under the royalty rate established in a lease when mined using "current standard industry operating practices." When BLM reviewed the applications, the question was not whether the potash within the leases was "economically recoverable using current standard industry operating practices," but more narrowly whether, using current standard industry operating practices, potash within the lease was "economically recoverable" when paying the royalty rate established by the lease.

The royalty reduction team looked at the specific geologic and mining engineering information provided by the applicants as well as measures taken to reduce costs. See YP 694 at 17, 19. Among other matters, the team noted that Western Ag Minerals Co. used commercial rail to transport ore from its mine to its milling facility and used a water intensive leaching process that required purchasing water, and it found that "[g]rade and seam thickness tends to be decreasing, and ore grade material is becoming more variable" and that large capital expenditures would be needed to develop sylvite and kieserite ores. YP 456 at 3-4 (BLMCO55713-14). The team concluded that a royalty reduction would allow mining additional quantities of langbeinite, extending the mine life by a number of years. YP 456 at 4 (BLMCO55713-14). The team stated that ore reserves at Eddy Potash's mine were "rapidly depleting," with only few years of reserves remaining, that the company had a "net income loss," that it was able to mine low grade sylvite ore from the 3rd ore zone because it was blending it with high grade ore it was removing from mine pillars left in the first ore zone during mining in the 1940's and 1950's, and that a royalty reduction would "expand recovery and extend the mine life" and allow mining marginal deposits. YP 456 at 4-6 (BLMCO55714-16).

The team found that the New Mexico Potash Corp. was incurring additional costs in mining sylvite from the 10th ore zone "primarily due to the depth of the ore and the high insolubles (clay) content in the ore," was limited to "an energy intensive leach crystallization milling process" due to the insolubles, was blending high grade ore "with lower grade ore from different working areas that otherwise may not be economic, and that a royalty reduction would allow recovery of marginal deposits. YP 456 at 6-7 (BLMCO55716-17). The team determined that Mississippi Chemical Corp. faced "numerous engineering challenges" in mining ore from the 5th and 7th ore zones "due to low height of the ore, the variable grade of the ore in the Fifth Ore zone," and the cost of developing access, and that a royalty reduction would allow the company to mine at a

lower cutoff and recover additional resources that otherwise would be bypassed and not recovered later because, using a modified longwall process, "once mining ceases in an area, access is lost." YP 456 at 8-9 (BLMCO55718-19). The team noted that IMC Fertilizer Inc. blended high and low grade ores from not only different working areas but three different ore zones and that the company estimated that payment of royalties at the 5% rate "would result in the potential loss of 40 to 80 million tons of ore" and "would effectively increase their cutoff grade by 0.8%." YP 456 at 10 (BLMCO55720); see YP 451 at BLM 22602-603.

Whether or not the potash mining companies considered, or correctly considered, all of their reserves to be such low quality as to qualify for a royalty reduction (see YP 451 at 9-10 (BLMCO22557-58); Thayer: 12426), and although the royalty review team looked at the overall structure of each company's mining operation, in each case the team recommended a reduced royalty rate to allow the company to mine lower grades of potash which would otherwise be "not economically recoverable." See also YP 451 at 10 (BLMCO22557) ("blending ores makes it possible to recover low-grade material which would otherwise be bypassed"). In other words, the team determined that royalty reductions would allow the "expanded recovery" of potash by "providing an incentive to extract resources not recoverable under current standard industry operating practices." Implicit in their recommendations is a recognition that the potash within each leased area varies as to grade. The Appellants err in reading the recommendations to mean that BLM determined that all of the potash within each leased area was not economically recoverable.

Nevertheless, the fact royalty reductions were granted not only by BLM but also by the State of New Mexico and the fact that overriding royalties have been reduced to 1% or less as required by 43 CFR 3503.2-4(b)(3) indicate that the New Mexico potash mines operate at a narrow margin. See e.g., YP 451 at BLMCO22580, BLMCO22586. Contrary to the Intervenors' claim, and consistent with the guidelines, the royalty reductions must be regarded as having been granted for the purpose of allowing the expanded recovery of potash grades rather than to allow investment in capital improvements. The Appellants' underlying logic is correct. By definition, the lowest grades of potash which are mined as the "expanded recovery" for which the companies were granted royalty reductions is ore that was "not economically recoverable" and, consequently, cannot be said to be ore that is "mineable under existing technology and economics." On the other hand, it is obvious that potash ore which can be mined and sold at a profit while paying the Federal government a 2% royalty is economically recoverable potash and may reasonably be said to be potash which is "mineable under existing technology and economics." BLM's report, however, is not explicit as to the grades or quantities of potash which were the object of the royalty reductions and does not offer a dividing line. The reductions were granted for all potash produced rather than just potash below a specified grade and, therefore, operate by allowing the companies to mine lesser grades of potash that otherwise would be "not economically recoverable" by granting lower royalties on higher grades of potash. Thus, the fact that royalty reductions were granted establishes that the lowest grades of potash being mined are “not economically recoverable” and are not “mineable under existing technology and economics.”

IV. D.3 Waugh's Analysis of IMC's Operations

David Waugh, testifying for the Intervenors, prepared and discussed a number of exhibits based upon information about IMC's leases and operations. Recognizing that the actual grades and quantities of potash produced by IMC and the financial information pertaining to its operation which Waugh presented in his testimony and exhibits are confidential, neither will be described in detail. Briefly stated, his testimony was directed toward establishing that the cutoff grades IMC currently mines support the continued validity of the numerical standards of 4 feet of 10% K_2O as sylvite and 4 feet of 4% K_2O as langbeinite defined in Van Sickle's April 5, 1974, memorandum and, consequently, those standards continue to identify the "thickness and quality" of potash ore which is "mineable under existing technology and economics." See Waugh: 11420, 11430-31; INT 117, table 4. His testimony and exhibits were, of course, challenged by the Appellants and their witnesses.

Waugh initially addressed a study he had prepared titled "Break-even Cutoff Grade Analysis." INT 117. A "break-even cutoff grade," he explained, "is the point at which a mineral is mined and processed that the cost to produce it equals the realization that the company gets by selling it." Waugh: 11421, 11429; see Waugh: 11807-08, 11812-15. His study similarly defined "cutoff grade" as "[t]he lowest average grade that can be mined and processed and break-even. Costs (operating, royalties, taxes, overhead) are equal to revenue (selling price)." INT 117 at 1. Subsequently, Waugh explained that costs included depreciation, taxation, and the amounts the corporation charges back to the plant as the corporate cost of the mining operation. Waugh: 11824. Using his exhibit, Waugh described the interrelationship of the supply of sylvite, langbeinite, and mixed ore IMC can produce, its three manufacturing processes, and the three products which could be produced. See Waugh: 11423-27, 11820; INT 117, fig. 1. He explained that, using figures obtained from IMC, he had analyzed the cutoff grade for each mineral by keeping the quantity of ores produced constant along with the grade of one mineral so that the grade of the other mineral could be reduced to the point at which the net income attributable to it was eliminated and the mineral was being produced at a break-even point. See Waugh: 11434-40, 11822-23, 11855-56, 12027, 12065-69; INT 117, tables 2, 3. The figures he arrived at are approximately the same as the cutoff grades used by BLM based upon Van Sickle's April 5, 1974, memorandum. Waugh also calculated break-even grades using the "simplified method" which had been used by the Mineral Land Classification Board in 1969. Waugh: 11440-41, 11847-48; see YP 555. Using its formula and cost figures he obtained from IMC, Waugh calculated break-even grades for sylvite and langbeinite, which he testified he was surprised to find were "almost the same numbers I had come up with." Waugh: 11441-42.

Appendix A of Waugh's cutoff grade analysis came under scrutiny during cross examination. It consists of three tables of information taken from IMC's records listing months in which the company mined "Mixed Sylvite Ore Near or Below 10% Cutoff" in the first ore zone, "Langbeinite Ore Mined Near or Below 4% Cutoff" in the fourth ore zone, and "Mixed and Sylvite Ore Near or Below 10% Cutoff" in the fifth ore zone. INT 117; Waugh: 11862. The tables for the first and fifth ore zones list a number of months, the tons mined, the ore grade of sylvite and langbeinite mined, and the equivalent grade of

sylvite. The table for the fourth ore zone identifies only the grade of langbeinite ore. Waugh explained that the tables had been prepared to show “that there are cases where IMC has mined at or near the cutoffs that I was talking about.” Waugh: 11862. Through questioning, it was pointed out that almost all of the months listed on the table for the first ore zone were prior to July of 1986, a period apparently when royalties were paid on a sliding scale with reduced rates for low grade ore. Waugh: 11864-65. It was also brought out that most of the entries on the table for the fourth ore zone were related to the development of a two entry access tunnel with a 12 foot ceiling. Waugh: 11866-86; YP 498.

Waugh addressed IMC's average grades of production using three exhibits which are bar graphs showing tons of mixed ore produced at different grades from January 1980 to June 1992, tons of langbeinite ore produced at different grades from January 1980 to November 1996, and tons of sylvite ore produced between July 1992 and November 1996. INT 440, INT 441, INT 442. He explained that the grades were average grades of ore produced from different areas at different times. Waugh: 11444-46. Using the same data, Waugh provided as another exhibit a line graph showing IMC's "Average Yearly Mine Grade Sylvite/Mixed Ore" for the years 1980-1997. INT 462. He explained that he had modified the data by eliminating the top 5% and the bottom 5% and showing in the middle blue line the average grade of the remaining 90% of the ore grades. Waugh: 11448-49. He used the same blue line in another exhibit to show the relation to the IMC’s cutoff grade for sylvite. INT 444. In addition, Waugh prepared an exhibit showing that, except for a period during the late 1980's and early 1990's, IMC had yearly mined average grades of sylvite and mixed ore below Hutchinson's minimum grade. Waugh: 11449-50; INT 443. He also testified that IMC was able to mine a lower grade of langbeinite than Western Ag because it produced about three times the tonnage of product and not only benefitted from economies of scale but also used more efficient mining methods. Waugh: 11450-51. Simply stated, the exhibits show that each year from 1975 to 1997 IMC produced ore at an average grade higher than the cutoff grade, which Waugh explained indicated a "very good profit." Waugh: 11456. As he more explicitly explained, the fact the blue line is above the break-even cutoff line every year "indicates that they should have been profitable," but there had in fact been one year IMC had "almost broke even, based on mining grades well above the cutoff, because of market prices." Waugh: 11456.

Waugh also analyzed various areas where the Appellants have filed APD's. He initially described the manner in which he had prepared some of his exhibits by entering core hole data into a computer modeling program and using the data generated on a cell grid by the computer to also generate contour lines. Waugh: 11499-511; INT 290, INT 369. After identifying the area which qualified as mineable reserves under what he had determined to be IMC's cutoff standard, Waugh prepared an economic analysis of a potential mining operation in a portion of the second ore zone, which showed a very high depreciated cash flow rate of return over a period of 20 years. Waugh: 11516-40; INT 368, INT 427. Based upon his analysis, Waugh testified that the five Pure Gold APD’s were in an area containing potash ore mineable under current economics. Waugh: 11540-41. In addition, he testified that most of the Mobil Federal and Federal 29 APD’s were within mineable ore in the seventh ore zone and that the Glow Worm APD’s were for sites over mineable ore in the fourth and tenth ore zones. Waugh: 11541.

Waugh also used his computer modeling program to produce a map of the areas he considered to be mineral reserve in a portion of the fourth and tenth ore zones northeast of the WIPP site and prepared an economic analysis and a mining plan. Waugh: 11541-58; INT 427; INT 366; INT 340. Based upon his findings, Waugh testified that there were economic reserves of potash in the areas of the Federal 23, the Martha, and the Dolores #4 APD's. Waugh: 11558-59. In addition, Waugh testified that in 1994 he had prepared an analysis of the tenth ore zone for the Noranda leases IMC had acquired and subsequently had reevaluated some core holes and found there to be an area of mineable ore in the fourth ore zone. Waugh: 11559-93; INT 129, INT 341, INT 370; INT 472. Based upon his economic analysis of the area, Waugh testified that the Lusk, Anise, and a majority of the Belco APD's were located over economically mineable ore. Waugh: 11603-04.

Finally, Waugh testified that, although he had not done an economic analysis of the area of the Okerlund and Wolf APD's, they "are very close to existing mine workings, and probably fall within economic ore, at least part of them do." Waugh: 11604.

IV. D.4 Potash Grades

The most important evidence of the grades of potash which are "mineable under existing technology and economics" is that which the mines in the Potash Area have in fact been mining in recent years. As described above, Waugh testified that his cutoff analysis shows that IMC's break-even grades are approximately the same as BLM's standards and, accordingly, his testimony tends to support those standards. In contrast, as more fully described in earlier portions of this decision, the Appellants' witness, Gary Hutchinson, concluded that both IMC and Western Ag mine langbeinite in the fourth ore zone at a minimum of 7 to 8%, that the "consistent limit of mining" for IMC was "somewhere between 16 and 18%" sylvite, a figure he also applied to Western Ag, and that New Mexico Potash mined "somewhere around 12% core hole grade information" at its operation on the southern side of its mine and that mining had stopped on the north end at 16% grade. Hutchinson: 7663, 7677, 7686-87; YP 727.

A third set of figures is provided by a series of bar graphs Tony Herrell and his staff prepared on behalf of BLM in response to the appeals to the IBLA using information from the monthly production reports which are filed by the mines. See Cone: 10652-53, 10656, 10949; Herrell: 3746; BLM Supp. Response to Prelim. SOR, attachments 8-10. Six graphs report the "average grade" of langbenite or sylvite, or both in the case of IMC, produced at each mine during the fiscal years 1987-1991, including the Amax mine which was not in operation at the time of the hearing, and two bar graphs show the overall "average grade" of each of the two minerals. YP 761; see BLM Supp. Response to Prelim. SOR, attachments 8-10. Because the figures shown on the bar graphs were derived from monthly production reports, they are not repeated here.

Each set of numbers has been subject to criticism and argument. For reasons which have been discussed, Hutchinson's method for analyzing potash enclaves has little bearing on the question whether BLM's standards of 4 feet of 10% K_2O as sylvite and 4 feet of 4% K_2O as langbeinite continue to identify potash "mineable under existing technology

and economics." Despite the Appellants' claims that he examined the economics of each mining operation, the grades of potash he identified are the consequence of his method of projecting mining operations onto his maps of potash deposits based upon adjusted core hole readings. They are only indirectly related to "existing technology and economics" in the sense that the areas he examined had in fact or would be successfully mined. His methodology seems to have been designed to allow him to testify that there are only very limited areas of potash enclave within the Potash Area and none where the Appellants seek to drill.

Although Waugh's analysis of IMC's operations was based upon financial information he obtained from the company and provides support for BLM's standards, his exhibits indicate that the company produced exceedingly small percentages of its ore at the grades which BLM has applied to identify potash enclaves. As brought out in his testimony, there are circumstances in which potash is intentionally mined below what would otherwise be a mine's cutoff grade. Such was apparently the case when IMC was creating an entry area in the fourth ore zone, although it is less clear whether the low grades of potash found in the report were primarily due to low quality ore or dilution resulting from mining an increased height needed for an entry into other areas. In other testimony, Waugh explained that mines also apply "incremental cutoff grades" based upon the variable or incremental costs of mining an area without regard to fixed costs. Waugh 11431-32, 12075-78. There is no indication as to how much low grade material was included in the tonnage used in Waugh's calculations, but other exhibits he prepared show that over the years IMC has mined exceedingly small quantities of ore at or below BLM's cutoff grades. See INT 441, INT 442. At the same time, they show that IMC has produced most of its ore at grades considerably above them. Even viewing the figures to represent average grades mined from a variety of areas, see Waugh: 11444-45, only a small portion of the tonnage reported for grades slightly above BLM's standards could have been mined at or below those standards without requiring considerable offsetting tonnage at even higher grades. Consequently, Waugh's broader conclusions may reflect the capabilities of IMC's processing plant rather than cutoff grades applied in conducting mining operations. See Waugh: 11437. Such a conclusion is also suggested by Waugh's exhibit which shows that IMC has produced a higher, although still small, percentage of ore near BLM's standard for sylvite when it has mined mixed ore. INT 440.

The Appellants maintain that BLM's bar graphs are inaccurate because they are based upon reports of total tonnages mined rather than the tonnage of ore which was processed for sale. See App. PH Brief at 118-21. Hutchinson prepared an exhibit tabulating the average grades of potash produced by IMC by using royalty reports the company submitted to BLM for the months of October, 1991 through August, 1992. YP 760; Hutchinson: 7821. The exhibit shows mixed ore production divided into tons of K_2O as sylvite, tons of K_2O as langbeinite, and tons of ore produced and also the categories of langbeinite ore production. YP 760. Hutchinson testified that, based upon his analysis, IMC had mined langbeinite at approximately the same grade as Western Ag, both consistent with his figures and both considerably higher than BLM's number which approximates its 4% standard for langbeinite. Hutchinson: 7823-24. Hutchinson also explained that there were only two producers of langbenite, Western Ag and IMC, which "produce, for general purposes, about the same amount per year," and that, given the

reported average grade for both mines and for Western Ag alone, IMC "must be mining around 2.0," a figure which wasn't "borne out in any of the information that IMC gives the BLM" and, consequently, the average grade of langbeinite "that went to the IBLA has to be wrong." Hutchinson: 7828; see YP 761 at RP 008991; Hutchinson: 7828-35, 8332-33, 8374-76; Bessinger: 9910-15. More particularly, he analyzed the figures reported for IMC as the result of separately and misleadingly dividing tons of langbenite and sylvite by the total tons produced for the year. Hutchinson: 8412-13.

Bessinger also testified for the Appellants that, based upon his review of monthly and yearly production reports which had been filed by IMC, BLM's bar graph for the mine "does not show the grades in the reports that were submitted." Bessinger: 9917, 10041-42. Likewise, he testified that the bar graph showing the average grade of langbeinite produced in the Potash Area by IMC and Western Ag, the only two producers, "does not represent the average grade mined by these two companies." Bessinger: 9918. In addition, he believed that, given the averages for sylvite shown for other mines, those shown for IMC must have skewed the average reported for all producers. Bessinger: 9921, 10039-42; see Hutchinson: 8455-56.

Hutchinson also testified about an exhibit prepared by BLM listing "Low Grade Tons Mined" by Eddy Potash from December 1991 through June 1992, Horizon Potash from July 1991 through June 1992, and New Mexico Potash for September and October 1991. INT 51; see Cone: 10655-56. The tonnage is reported for each mine in categories of less than 10 and less than 11% K_2O. Hutchinson pointed out that 2.1 million tons of the total of 2.5 million tons listed in the exhibit was for the Horizon mine which shut down not long after being sold by Amax in 1991. Hutchinson, 8326-27. Whether or not the closure was due to economic failure of the mine, as the Appellants contend, or for other reasons, the event makes it difficult to conclude that the exhibit supports finding that sylvite can be successfully mined at a 10% cutoff.

In general, the criticisms made by the Appellants' witnesses appear to have merit. Examination of the calculation of potash grades in IMC's monthly production reports the Appellants compiled as an exhibit, reveals that the "total mine" grades are calculated based upon the total ore produced. YP 775; see Martinez: 12665-75. For example, the report for January of 1996 shows that IMC's "total mine" production for the month consisted of sylvite mined at a grade below BLM's standard of 10% and langbeinite mined at a grade slightly above BLM's standard of 4%. YP 775 at BLMCO08872. Over 60% of the production, however, was sylvite ore which averaged less than 1% langbeinite. Indeed, the langbeinite came from only one of the six areas mined for sylvite and it was the source of less than a third of the tonnage of the primarily sylvite ore. Nevertheless, the other two thirds of production from which no langbeinite was obtained, amounting to over 40% of the total ore produced, was included in calculating the "total mine" grade of langbeinite. Likewise, the total ore produced as langbeinite, over 35% of total production, was used to calculate the "total mine" grade of sylvite even though over half of it was less than 1% sylvite and the total averaged less than 3% sylvite.

The obvious effect of calculating mineable ore grades using the total tonnage of ore mined is to lower the grade reported for each mineral. Whatever purposes the

calculation served for IMC's reports, Van Sickle's standards call for identifying potash enclaves not only at four feet of either 4% langbeinite or 10% sylvite, but also allow an "equivalent combination of the two." INT 19. Setting aside questions about the relation between the "thickness and quality" of potash in situ and figures for grades of ore produced, the relevant figures are for those for ore mined as langbeinite or as sylvite or as mixed ore. Lacking an analysis of the reported tonnages produced by ore type and grade, a review of the reports reveals little indication that ore was mined at grades approximating BLM's standards.

Although the method by which BLM calculated the numbers shown on its graphs was not explained at the hearing, to the extent they reflect the "total mine" numbers, as would most clearly seem to be the case for the bar graph for IMC, the graphs cannot be regarded as establishing the "thickness and quality" of potash which is "mineable under existing technology and economics." YP 761 at RP 008991. [66/] Indeed, accepting the grades of langbeinite and sylvite shown on the bar graph for IMC as the average grades mined during 1987 through 1991 would seem to require a conclusion that BLM's standards are far too high because IMC would have successfully mined deposits considerably below the standards in producing its average grades. The figures reported on the bar graphs as the average grade of langbeinite produced each year also must be regarded as having been heavily influenced by the figures for IMC. YP 761, RP 008989. However, IMC's production would have had less influence on the bar graphs showing the average grades of sylvite because more mines produced sylvite ore. YP 761, RP 008990.

A general difficulty with many of the figures found in the record is that they report averages and have limited bearing on the question whether BLM's standards continue to identify the grades of potash "mineable under existing technology and economics". Although averages would necessarily include lesser grades of ore, many of the numbers are sufficiently above BLM's standards that it is difficult to infer that any appreciable amount of ore was mined at or near them. Such reports include BLM's bar graphs for the average grades of sylvite produced by the Mississippi Chemical and Eddy Potash mines and to a lesser extent the bar graphs for the New Mexico Potash mine and the average grades of langbeinite produced by Western Ag. YP 761, RP 008992 to RP 008994, RP 008996. Likewise, testimony about the budgeted ore grades under which the mines operate offer little indication that ore would be mined at BLM's cutoff grades. See Foote: 12549, 12553-54; Morehouse: 12263-65, 12371. The same is true of the maps submitted by IMC

[66/] In a letter dated October 12, 1995, BLM District Manager Leslie Cone informed George Griswold that "during the last five years a significant amount of sylvite ore has been mined at or below the 10% minimum standard. This is also true for langbeinite, meaning that ore is being mined at or below that 4% minimum standard." INT 69, appendix C. Griswold relied upon the letter in a report he wrote as confirming that BLM's "minimum standards indeed are minable." INT 69 at 2. The record does not indicate the basis for Cone's statements, but the evidence discussed above suggests that the statement may have been based upon either calculations which included tonnages mined as mixed ore or material mined for reasons other than the production of economically viable ore. It is also notable that the letter was written after the APD's had been referred for a hearing. Similar statements in other documents are also questionable. See YP 456 at 10 (BLMCO55720) (identifying average grades at which IMC mines sylvite and langbeinite).

showing grades of potash mined in specific areas of its mine during 1991 to 1995. While the grades are averages, few are sufficiently near BLM's cutoff grades to suggest that some amount of ore may have been mined at those grades, other than those areas which appear to have been mined as a development tunnel or to otherwise provide access to other areas. YP 602 through YP 606, YP 608 through YP 611.

Although the record includes other documents which report the grade of potash mined during a period of time or in a particular area of a mine or both, there is little indication that any appreciable amount of ore has been mined at or near BLM's numerical standards of 10% K_2O as sylvite and 4% K_2O as langbeinite. The numerous mine inspection reports which have been included in the record identify the grades of potash being mined in the areas inspected. See YP 178 through YP 182, YP 458 through YP 513, YP 516 through YP 522, YP 527. The numbers are either reported as average grades or

appear to be so, but they rarely approach BLM's standards. In some instances, however, it is unclear what the numbers were meant to describe. For example, one inspection report which received considerable attention at the hearing states that in one area of a mine: "The run of mine ore grade for the month to date is 14.4%." YP 182 at BLMCO20048. The accompanying sketch that shows the ore body to consist of 3.1 feet of 18 to 20% sylvite, the mine back to be 1.9 feet above the sylvite, and that an additional layer of 1.5 feet of salt and mud was being mined below the ore bed. Id. A simple calculation reveals that the reported "run of grade" could not have resulted due to "dilution" of the ore by the 6.5 foot mining height. [67/] Also instructive are the series of cash flow projections Griswold performed for the WIPP site which fail to show that langbeinite and sylvite are economically mineable at grades of 4 and 10%. YP 598, vol. 2 at VI-18 through VI-31.

The minimal evidence that potash mining companies have recently mined potash at grades which meet or approximate the grades BLM uses to identify areas of potash enclave must be considered in light of the fact that IMC and other potash mining companies have received royalty reductions for the purpose of allowing them to mine grades of potash which would otherwise not be economically recoverable. Consequently, the fact that some amount of potash has been mined at low grades, even if not incidental to other operations, is not sufficient to establish that those grades were "mineable under existing technology and economics" for the purpose of identifying areas of potash enclave. The record does not support a conclusion that the standards of 4 feet of 10% K_2O as sylvite and 4 feet of 4% K_2O as langbeinite, or an equivalent combination of the two, as defined by Van Sickle in 1974, continue to identify the thickness and quality of potash which is "mineable under existing technology and economics" as required by the 1986 Order.

[67/] The exhibit is also notable because the illustration shows that the mud and salt above and below the ore bed contain low grades of potash (apparently as sylvite). Presumably, the potassium was recoverable if fed to a mill and processed. The value added by very low grades of material associated with richer potash beds was not addressed at the hearing.

V. Hazards to Mining Operations

V. A. Provisions of the 1986 Order

The other major factual issue the Appellants raise concerns those portions of BLM's decisions which indicate that their APD's could not be approved due to the dangers oil and gas wells pose for mining operations. From the outset, the Appellants have pointed out that their wells will be drilled under not only the general rules of the New Mexico Oil Conservation Division (NMOCD) but the casing and cementing requirements of what is now the New Mexico Oil Conservation Commission's (NMOCC) Order R-111-P. App. Prelim. SOR at 33-34, 41-42; Pogo Final SOR at 42-43, 49-51. Under those standards, as well as the standards for drilling equipment and drilling practices established by the American Petroleum Institute (API), they contend that their wells will not pose a hazard to mining operations. App. PH Brief at 99-105. In addition, the Appellants object to BLM's use of qualifying language in its decision rationales to state that oil and gas wells "may" or "could" result in the waste of potash or that they have the "potential" to make potash mining unsafe. App. PH Brief at 83-85; see App. Prelim SOR at 34; App. Reply to BLM Resp. to Prelim. SOR at 7, 21-23; Pogo Final SOR at 28; Yates Final SOR at 25, 34.

In discussing the testimony their witnesses presented at the hearing, the Appellants assert their case in no uncertain terms. They caption one of their arguments with the declaration that:

> The Laws of Physics Preclude Hydrocarbons from Migrating from a Delaware Oil Well Into a Mine in the Salado Formation Based on the Characteristics of the Salado Formation and the Characteristics of the Delaware Formation.

App. PH Brief at 88. More broadly, they claim that "The Application of the Laws of Physics Requires the Conclusion That Oil and Gas Operations Pose No Safety Hazard to Potash Mining." App. PH Reply at 20. Similarly, in regard to drilling technology the Appellants assert that:

> Subsidence Will Not Crush or Shear Casing Designed to Order R-111 Et. Seq., Specifications; Therefore, Subsidence Will Not Result in a Migration of Gas from a Delaware Wellbore into the Salado Formation.

App. PH Brief at 96. Elsewhere, they claim:

> BLM Either Knew and Willfully Ignored or Should Have Known About Available Information and/or Studies Attesting to the Safety of Oil and Gas Drilling in the Potash Area. The Studies Establish that Oil and Gas Drilling and Production in the Secretary's Area is Safe and that:
>
> > 1) In and of Themselves, the Characteristics of the Salado Formation, Coupled with the Characteristics of the Delaware Formation Prevent Gas from Migrating from a Delaware

Well Into a Potash Mine and no Additional Safeguards are Needed;

2) The Casing Requirements of Order R-111-P Provide Additional and Redundant Safeguards Against the Migration of Gas from a Delaware Well into a Potash Mine;

3) The Order R-111-P Casing Requirements are Sufficient to Prevent the Breach or Shearing of Casing by Subsidence; and

4) The Casing Requirements of Order R-111-P are Sufficient to Prevent Casing Leaks.

App. PH Brief at 105-06.

These claims by the Appellants solicit broad factual rulings that would have the effect of precluding BLM from relying upon its concerns about the dangers which oil and gas drilling may pose to mining operations as a basis for rejecting not only the Appellants' APD's but APD's throughout the Potash Area. [68/] However, issues concerning the possible dangers oil and gas wells may pose for potash mining are more narrowly focused under the 1986 Order. They expressly arise under two provisions of the oil and gas lease stipulations. The second stipulation prohibits drilling oil and gas wells when they would "constitute a hazard to * * * mining operations being conducted for the extraction of potash deposits." Appendix A, § III.A.2. As noted in discussing the identification of potash enclaves, "being conducted" refers to mining operations underway at the time an APD is reviewed. The Appellants correctly understand that information about the geology of the Salado and Delaware Formations, their relation to each other, the casing and cementing used for the well, drilling procedures, and other factual matters their witnesses addressed are relevant in determining whether a proposed well will constitute a hazard, but the stipulation requires BLM to determine whether the well will "constitute a hazard to" a specific mining operation rather than calling upon BLM to make a categorical judgment about the safety of drilling oil and gas wells within the Potash Area. [69/]

[68/] Along with more extensive arguments about the testimony and exhibits, the Intervenors claim that: "A presumption that oil and gas drilling can present a safety risk to potash mining which thereby leads to waste of potash is incorporated into the fabric of the 1986 Order. It is beyond the authority of this tribunal to question that presumption." Int. PH Brief at 94-95. No such presumption is stated in the words of the Order and it would be no more appropriate for this forum to find such a presumption in the "fabric" of the Order than it would be to adopt the underlying and unarticulated "maxims" of equal footing and first in time, first in right which the Appellants advocate.

[69/] At one point in her testimony, Leslie Cone incorrectly associated the concerns about hazards which are addressed in the oil and gas lease stipulations with the potash enclave policy. See Cone: 10567.

The fourth oil and gas lease stipulation allows BLM to impose requirements on drilling "as necessary to prevent the infiltration of oil, gas or water into formations containing potash deposits or into mines or workings being utilized in the extraction of such deposits." Appendix A, § III.A.4. In addition to identifying infiltration as the specific event of concern, the stipulation refers to both formations containing potash deposits and mines. Consequently the fourth stipulation has broader application than the second in that it recognizes the possibility that oil and gas drilling may allow substances to enter and contaminate potash deposits as well as pose a hazard to ongoing mining operations. Like the second stipulation, information about the presence of a potash deposit at or near a proposed well, the presence of mines or mine workings, the casing and drilling procedures to be used, and other facts will be important in determining whether the well may result in infiltration. The action the fourth stipulation calls upon BLM to take is different than the second stipulation. Rather than requiring BLM to deny approval of an APD, the fourth stipulation calls on BLM to prescribe measures necessary to prevent the infiltration it anticipates may occur if the proposed well is drilled.

Arguably, a concern that drilling an oil and gas well will allow oil, gas, or water to contaminate potash deposits which are not currently being mined also underlies both the first stipulation's prohibition of drilling that will "interfere with the mining and recovery of potash deposits" and the first portion of the second stipulation which calls upon BLM to deny approval of an APD if the well would cause an "undue waste of potash deposits." It seems obvious that mineable potash which has been rendered unmineable because it has been adulterated by oil, gas, or water as the result of oil and gas drilling has been wasted. Even if potash has not been rendered unmineable, the presence of oil, gas, or water in the vicinity of a mine would almost certainly require adapting mining methods and, accordingly, drilling could be said to have interfered with the mining and recovery of a potash deposit. As the Appellants point out, however, neither provision is absolute. See App. Prelim. SOR at 9; Pogo Final SOR at 29; App. PH Brief at 40, 83-84. The first stipulation is qualified in that it allows BLM to approve drilling which will "interfere" with mining when it determines that “the interest of the United States will best be served.” The second stipulation does not prohibit any waste of potash, but rather its “undue waste.”

The key terms have been part of the Secretarial orders since 1951 and their origin is not disclosed by the historical documents in the record. [70/] As previously analyzed, "interfere" in the first stipulation and "undue waste" in the second stipulation concern potash deposits and contrast with the subsequent portion of the second stipulation which addresses "mining operations being conducted." The first stipulation differs from the second in requiring an applicant to affirmatively persuade BLM that the proposed well will "not interfere," while the second calls upon BLM to review and determine whether the well “would result in undue waste." Both contrast with the "constitute a hazard" portion of the second stipulation which requires a finding that a hazardous condition will be present rather than a determination as to whether an event will occur.

[70/] The Appellants’ reply brief presents argument based upon the record of a meeting held February 27, 1951, which is among the documents attached to their post-hearing brief. App. PH Reply at 122-24. For reasons already discussed, those documents are not admitted to the record.

Analysis of the first stipulation indicates that it should not be construed to also address the possible contamination of potash deposits as the result of oil and gas drilling. When filing an APD, an oil and gas lessee may rely upon geological information about potash in the proposed drilling area in order to establish "to the satisfaction of the authorized officer" that the physical presence of the well will not interfere with the mining and recovery of potash deposits. Establishing that the well also will "not interfere" with mining by allowing oil, gas, or water to enter and contaminate any potash deposit is a much more complicated and difficult task. If an applicant were unable to establish to BLM's satisfaction that contamination will not occur because there is not a potash deposit in the vicinity of the proposed drilling site, there seem to be only two alternatives. The applicant could argue, as the Appellants do in this case, that oil, gas, and water cannot escape well casing and, if any does, it cannot migrate beyond the immediate vicinity of the well. If BLM is not persuaded by the information an applicant submits, the applicant could argue that drilling the well would best serve the interest of the United States even though contamination would interfere with mining a potash deposit or even render it unmineable. The Appellants have argued that approval of their APD's at issue in this case is in the best interest of the United States. See App. PH Brief at 78-82, 141, 143, 150-51, 175, 178, 184-85, 187. The difficulty with their position is that the reasons they offer would seem to apply to all applications to drill oil and gas wells within the Potash Area. If they are correct that drilling their wells bests serves the interest of the United States, the exception would seem to negate the prohibition on drilling which interferes with the mining and recovery of potash deposits.

Similarly in regard to the "undue waste" provision of the second oil and gas lease stipulation, BLM is certainly capable of determining, based upon geological information about potash in the area of a proposed well or the lack of a potash deposit in the area, whether the physical presence of the well will result in the waste or undue waste of potash because some amount of potash cannot be mined. However, reading the provision to require BLM to also determine whether drilling the well will result in the waste of potash because oil, gas, or water will contaminate a potash deposit would require BLM to undertake the same complicated and difficult task that an APD applicant would be confronted with under the first stipulation. If BLM were to conclude that fluids would escape the well under the drilling program proposed by an applicant, however, the fourth oil and gas lease stipulation would seem to require it to inform the applicant of the modifications needed to prevent infiltration. Consequently, questions about the extent of waste which will occur due to the migration of fluids through or to a potash deposit and whether such waste is "undue" or "due" would not arise. As under the first stipulation, applying the provision to address the possible contamination of potash deposits as the result of oil and gas drilling would seem to nullify the prohibition on the undue waste of potash deposits. Both provisions are more appropriately understood to address the question whether drilling a well at the location identified in an APD will physically limit or preclude mining a potash deposit.

As addressed at the hearing, the issue whether the Appellants' wells would pose a hazard to potash mining operations depends upon three interrelated factual issues. The first is whether oil or gas may escape from a well. The Appellants addressed the topic through witnesses who discussed the API's standards for drilling equipment and drilling

practices and the drilling technology they plan to use in drilling the wells at issue. The second issue is the potential for oil or gas to migrate to open mine workings through the Salado Formation. The issue was addressed by expert witnesses who had conducted studies of gas migration using computer models. The third issue, also addressed by experts, is the extent to which subsidence will occur over mined areas and whether the forces generated can crush or otherwise affect well casing and allow oil or gas to escape. The issues are significant and their consequences of the utmost importance. In R-111-P the NMOCC recognized that:

> Release of methane into potash mine workings would endanger the lives of miners and would render further mining activities uneconomic because of the additional, and more expensive safety requirements which would be imposed by the Mine Safety and Health Administration (MSHA) of the U.S. Department of Labor.

YP 262 at 3.

V. B. Drilling Equipment, Procedures, and Standards

As the Appellants point out, since 1951 orders issued by the NMOCC have included provisions governing the casing, cementing, and plugging of wells in the Potash Area. YP 219. Those orders have called for the installation of four "strings" of casing and cement, including an optional "intermediate string" between the "salt protection string" which runs through the Salado formation and the "production string." The NMOCC's current order, R-111-P, provides:

> (2) Surface Casing String:
>
> (a) A surface casing string of new or used oil field casing in good condition shall be set in the "Red Bed" section of the basal Rustler formation immediately above the salt section, or in the anhydrite at the top of the salt section, as determined necessary by the regulatory representative approving the drilling operations, and the cement shall be circulated to the surface.
>
> * * * * *
>
> (3) Salt Protection String:
>
> (a) A salt protection string of new or used oil field casing in good condition shall be set not less than one hundred (100) feet nor more than six hundred (600) feet below the base of the salt section; provided that such string shall not be set below the top of the highest known oil or gas zone. * * *
>
> (b) The salt protection string shall be cemented, as follows:
>
> * * * * *

(ii) For wells drilled to the deep zone [below the base of the Delaware or 5000 feet, whichever is less], the string must be cemented with sufficient cement to fill the annular space back of the pipe from the casing seat to the surface or to the bottom of the cellar.

* * * * *

(d) The fluid used to mix with the cement shall be saturated with the salts common to the zones penetrated and with suitable proportions but not less than 1% of calcium chloride by weight of cement.

* * * * *

(4) Intermediate String:

(a) In drilling wells to the deep zone for oil or gas, the operator shall have the option of running an intermediate string of pipe, unless the Division requires an intermediate string be run.

(b) Cementing procedures and casing tests for the intermediate string shall be the same as provided under sub-sections D (3) (c), (e) and (f) for the salt protection string.

(5) Production String:

(a) A production string shall be set on top or through the oil or gas pay zone and shall be cemented as follows:

* * * * *

(ii) For wells drilled to the deep zone, the production string shall be cemented with a volume adequate to protect the pay zone and the casing above such zone; provided, that if no intermediate string shall have been run and cemented to the surface, the production string shall be cemented to the surface.

YP 262 at 6-9.

Federal regulations do not include comparable drilling and casing requirements, but various provisions indicate that BLM has authority to establish standards governing the drilling of oil and gas wells. See 43 CFR 3161.2 (the authorized officer is to "approve, inspect and regulate" operations), 3162.1(a), 3162.5-1(a), 3162.5-3. Specific requirements governing oil and gas operations are provided by Notices to Lessees, but they have not been the subject of issues raised in these proceedings. See 43 CFR 3164.1, 3164.2. As has been noted, the fourth oil and gas lease stipulation specifically also allows BLM to impose requirements on individual wells drilled within the Potash Area "as necessary to prevent the infiltration of oil, gas or water into formations containing potash

deposits or into mines or workings being utilized in the extraction of such deposits." Appendix A, § III.A.4.

The Appellants state that "[t]he Delaware wells at issue will be cased and cemented pursuant to the requirements of NMOCD Order R-111-P." App. PH Brief at 99. They do not disagree that BLM has authority to also specify the drilling equipment and procedures they are to use in drilling the wells at issue. To the contrary, in arguing that their wells will be drilled and operate safely, they rely in part on the fact that "[t]he types and strengths of casing to be used in the proposed Delaware wells must be approved by BLM, and BLM may make more rigid requirements with respect to casing design than those proposed by an operator." App. PH Brief at 99; see id. at 103-04.

In contrast, the Intervenors state that "R-111-P does not apply directly to the APDs at issue in these proceedings, since they are on federal land" and they question whether the Appellants' wells will be drilled in accord with provisions of the state's order. Int. PH Brief at 20. Specifically, the Intervenors contend that the descriptions of the proposed casing in most of the APD's at issue indicate that the production casing will be "tied back" with cement to the salt string or that an "adequate" volume of cement will be used, but do not expressly state that the production casing will be cemented to the surface. Int. PH Brief at 20-21, 168-70; see Schoch: 13936-39. The difference, they explain, is that the space (annulus) between the production casing and the salt protection casing will be left open, including in the area of the McNutt formation. The Appellants have responded by stating simply that "All of Appellants' APDs are submitted in conformance with R-111-P." App. PH Reply at 142.

BLM's post hearing brief describes the series of R-111 orders as applying to "lands over which the state has jurisdiction" and explains that a portion of the Potash Area is private or state-owned land. BLM PH Brief at 13, n.2. Although BLM appears to agree with the Intervenors that the casing and cementing provisions of R-111-P do not apply to the APD's at issue, it does not discuss either the standards it applies when reviewing an APD or the specifications for casing and cementing set forth in the Appellants' APD's. The record also is not clear about the extent to which BLM reviewed the casing and cementing design for each of the APD's at issue. [71/] Armando Lopez testified that he relied upon the casing and cementing portion of the New Mexico order in making recommendations on APD's. Lopez: 1798-99; see Lopez: 1748-49. Similarly, Leslie Cone testified that BLM applied the state's standards, but also indicated that it did not do so for each APD. Cone: 10602, 10715-17. In particular, casing design for APD's under a program to expedite review of a backlog of applications appears to have been limited to exploratory wells, while casing design for development wells was only to be "compared to existing adjacent development wells." BLM 38 at 3; Cone: 10715-17.

[71/] The case files for some of the APD's at issue contain handwritten modifications which show that the casing and cementing identified by the applicant was reviewed by BLM personnel. In addition, some case files include a "Special Drilling Stipulations" form which sets forth specific casing and cementing requirements. These documents, however, suggest that review may have been limited to a few critical matters such as the size and weight of the casing to be used, the depth to which strings of casing are to be placed, and the quantity of cement to be used.

Whether or not BLM relied upon or applied Order R-111-P, it does not cover all aspects of drilling a well. It does not address grades of casing, qualities of cement, the use of couplings and centralizers, and the procedures and practices to be followed when drilling, except to require that casing tests be performed. Consequently, compliance with R-111-P may provide a minimum of assurance that a well has been designed to protect potash deposits, but cannot be regarded as sufficient to establish that it will not pose a hazard to mining operations and will not allow fluids to infiltrate into formations containing potash deposits.

The Appellants' primary witness to discuss drilling technology was Robert Fant, a petroleum engineer employed by Yates, who testified at length about the stages involved in drilling a well to the Delaware Formation and the strings of casing used. Fant: 5959-77, 5980-6123; YP 411. He also discussed the API's use of committees to establish standards for the manufacture of casing, couplings, pipe thread compounds, and other equipment, as well as recommended drilling practices and manufacturing processes. Fant: 5843-49, 5882-917; see YP 401 through YP 408. Thomas B. O'Brien, an oil and gas well drilling and completion engineer, also testified for the Appellants. Along with other matters, he discussed his experience serving on API committees. O'Brien: 10233-35.

While the testimony of both witness was very instructive in providing information about the stages of drilling a well, the equipment which is available, and the procedures which can be used, the relation of their testimony to the issues raised by application of the oil and gas lease stipulations to the Appellants' APD's is not entirely clear. There is no reason to doubt that the Appellants will use casing, cement, and other materials which are manufactured in accord with API standards and that they will follow API recommended drilling practices. See Tr. 10258. They provide such assurances in their briefs. In addition, the Appellants state that they "will follow industry practice and API specifications and recommended procedures for testing the mechanical integrity of each joint of pipe before it is installed in a well" and that, "[a]fter the pipe has been set and cemented, Appellants will test it again for mechanical integrity using API established practices." App. PH Brief at 102. As brought out at the hearing, however, the API provides standards for a variety of types of casing, couplings, and other equipment, and a variety of substances may to added to cement to achieve various results. See YP 401 at 3; INT 262; Fant: 5749-50, 5847-48, 5934-37, 5976; Schoch: 13820, 13871, 13880; Peterson: 14343-44. Consequently, the Appellants' assurances do not serve to fully identify the specific elements of the drilling plans they will follow when drilling the wells at issue.

It is also difficult to ascertain the extent to which Fant's and O'Brien's testimony describe the specific equipment and drilling procedures the Appellants will use if the APD's for the wells at issue are approved. Fant stated that he had reviewed the APD's and frequently framed his discussion using "we," but he was not explicit as to whether he was referring to Yates Petroleum, both of the Appellants, or general industry practices. See Fant: 5702, 5766-67, 5816-17. Of particular concern is that he used "we" throughout his description of the stages of drilling illustrated in his primary exhibit, YP 411. See, e.g., Fant: 5965-75, 5980-6018. The use of the term is important because both his testimony and the written descriptions accompanying his illustrations refer to specific API standards for casing, casing inspection, sealing coupling threads, and other matters. It is not clear,

however, that his testimony and exhibits were offered for the purpose of identifying the specific equipment and procedures which the Appellants are committed to use when drilling the wells at issue. An exception was Fant's table listing the "casing and tubing that we would run in these type -- in the Delaware wells, that are the subject of these appeals." Fant: 5917; see YP 409. The table, however, includes M-80 casing, which is not manufactured to API standards but apparently exceeds them. Fant: 5936-38, 6668.

Similarly, considerable portions of O'Brien's testimony were presented using "we." See, e.g., O'Brien: 10253-57, 10263-69. When asked to clarify his use of the term, O'Brien agreed that generally his references had been to API and industry standards and testing procedures rather than the Appellants' specific drilling methods. O'Brien: 10257-58, 10274. On cross-examination, he was again asked to clarify whether his references had been to the oil and gas industry, his work as a consultant, or the Appellants. Tr. 10366. He explained:

> For the most part, those things which would be directly applicable, applied to the Appellants. Those that were very general in nature would apply to the industry, particularly when we're talking about the standards and that sort of thing, and developments in the industry. Some of them applied to me, and some applied to all three.

O'Brien: 10366-67. Asked to identify the points applicable to the Appellants, O'Brien answered that: "Some of the drilling techniques and cementing techniques and this kind of thing, that would apply directly to an individual oil well." O'Brien: 10367. Asked, more specifically whether the techniques he had described for "cementing and that sort of thing" concerned "what was capable of being done" or "what the Appellants have done in the past," he responded:

> Some of them, at least a goodly number of them, and I guess I would have to say some of the better techniques applied to the Appellants. Some of the errors that I've talked about that had been corrected, were industry-related. Some of the testing and things of that nature that I did that, of course, I was involved in were before I ever knew anything about the Appellants, so I guess that was kind of divided. I don't know.

O'Brien: 10367. Thus, it is difficult to identify any specific portion of O'Brien's testimony as describing the equipment and drilling procedures the Appellants will use in drilling the wells at issue. Correspondingly, his statements that the wells will not present any problem of safety for mining must be understood as reflecting his knowledge of API standards and general industry practices rather than a conclusion based upon the specific equipment and procedures to be used by the Appellants. See O'Brien: 10348, 10449.

Other factors complicate the uncertainty about the manner in which the wells at issue will be drilled. As indicated by several witnesses, the casing, cement, and other materials and equipment used in drilling a well are selected and specified as part of a drilling plan individually designed for each well. See Fant: 5877, 5885-87, 5889, 5902, 5959, 6725; O'Brien: 10383, 10390-91. There are, however, no API standards for the

design of a well. Fant: 6724; O'Brien: 10391. In addition, the Appellants use contractors to undertake the actual drilling of wells and to conduct various operations associated with drilling. See Cooper: 217, 364-65; Patterson: 723-25; Fant: 5856-64, 6574-75, 6620-21, 6635-36, 6645, 6672-75, 6820-21. The use of contractors can assure that work is done by those with experience and expertise in each aspect of drilling, but it also makes specific components of the Appellants' drilling program dependent in part upon their selection of contractors and the quality of the work of others. The Appellants can assure that their drilling standards are satisfied only through provisions in their contracts, on-site inspection by an employee or a drilling consultant, and underlying expectation that contractors will properly perform their contractual obligations and will comply with API standards or lose future business. See Fant: 6579-80, 6673-77, 6680, 6822.

Nevertheless, it is clear that oil and gas drilling technology is exceedingly sophisticated and, as indicated at the hearing, the industry operates at a high level of professionalism. The record includes numerous references to conferences and the exhibits which have been introduced include papers which were presented in such forums or were published by professional organizations such as the Society of Petroleum Engineers. As described by Fant and O'Brien, the API's committees address the common needs within the industry to respond to problems which have been encountered in the past and identify reliable equipment and drilling procedures. Another of the Appellants' witnesses discussed some of the improvements in drilling technology which have occurred over the years. Stubbs: 8977-83. There is no reason to doubt that drilling equipment is designed and manufactured to high specifications and that extensive standards and practices are available regarding its installation and use. See YP 401 through YP 408. As has been pointed out, however, the API standards allow some variance in manufacturing and it cannot be assumed that every piece of equipment will perform at the stated standard. Mitchell: 14081-83, 14086-87, 14222-25.

The level of accomplishment of the oil and gas industry is reflected in several broad facts which were either mentioned at the hearing or are general knowledge. Whether looked at worldwide, within the continental United States, within the State of New Mexico, within Eddy and Lea Counties, or within the Potash Area, exceedingly large numbers of oil and gas wells have been successfully drilled in a variety of conditions and have operated for years without problems. See INT 145. The approximately eight to ten thousand foot depths to which the Appellants seek to drill their wells are not unusual. Elsewhere, wells have been drilled to depths of several miles. The Appellants, like all oil and gas companies, have a strong incentive to select and use reliable equipment and follow well established drilling procedures not only to protect their considerable investment in the cost of drilling by assuring that the wells will reach their target formations and be able to produce any oil and gas present, possibly for decades, but by doing so to provide a safe operation for their employees and contractors.

In simple terms, it can be said that the odds that something will go significantly wrong while drilling and operating an oil and gas well in the Potash Area in accord with API and other recognized practices are very small because considerable thought and effort have been expended to assure that nothing will. Contrary to the Appellants' assertions, however, it is not possible to say that compliance with API standards is sufficient to insure

that drilling will proceed as planned, that all work will be properly performed, and no component will ever fail or inadequately function. The hearing provided testimony concerning casing leaks, blowouts, and other events which have occurred over the years, some of which was introduced only for the purpose of indicating that various problems have been solved, but others continue to occur. See Fant: 6639-41; Stubbs: 9014; O'Brien: 10435-36; INT 167. Research continues to be conducted, conferences held, and papers presented because the technology is not perfect, problems occur in drilling wells, more difficult drilling projects are attempted, and events occurring thousands of feet underground are not fully understood. There is also a possibility of accidents, mistakes, or miscommunication. See Fant: 6477, 6481-82; Muncy: 7441; Cone: 10555; O'Brien: 10361-66; Schoch: 13609-11.

Ultimately, most of the testimony and argument which has been presented concerning drilling technology misses the issue defined by the 1986 Order. As discussed above, the second oil and gas lease stipulation prohibits drilling oil and gas wells at locations which will "constitute a hazard to * * * mining operations being conducted for the extraction of potash deposits" while the fourth stipulation directs BLM to impose requirements "as necessary to prevent the infiltration of oil, gas or water" into both "formations containing potash deposits" and mines extracting potash deposits. Appendix A, § III.A. The issue framed by the stipulations is not whether it is safe or unsafe to drill oil and gas wells within the Potash Area, but whether BLM should approve or disapprove drilling each well for which an APD has been filed because, for reasons which differentiate it from other wells, it will pose a hazard to mining operations. At the same time, the fourth stipulation calls upon BLM to identify and require measures which will protect both potash deposits and mining operations from infiltration from each well. Just as this forum cannot rule that the drilling technology described at the hearing is sufficient to establish that an oil and gas well will never pose a hazard to mining operations, it cannot rule that the possibility that oil or gas may escape a well is sufficient to preclude drilling. The effect of ruling that wells which are to be drilled in accord with the provisions of R-111-P using equipment and procedures meeting API and other industry standards would nevertheless pose a hazard to mining operations would be to require BLM to deny approval of APD's throughout the Potash Area, except perhaps on the periphery or in a large area which does not contain any potash deposit. Rather, the stipulations call upon BLM to make a determination about the specific casing, cementing, and drilling program to be used for each proposed well given the geology found at the location.

Finally, there is no need to resolve the specific dispute as to whether the Appellants' APD's in fact conform to Order R-111-P. The Intervenors correctly point out that Fant provided differing testimony about the subject. When initially discussing the proposed casing and cementing information found in examples of Yates's APD's, he explained that "tie back to eight and five-eighths" meant "bring enough cement to where it came up inside the eight and five-eighths inch" pipe, but he went on to state that, based upon his review of the records of the Delaware wells Yates had drilled "within the R-111-P area, * * * our intentions are to circulate the cement on these wells" to the surface. Fant: 5948; see Fant: 5928. Fant also stated that there had been instances when BLM had wanted cement circulated to the surface, but indicated that he understood R-111-P to require only that it be tied back to the prior string of casing, and he agreed that one of the

APD's described cementing the production string only to the prior string. Fant: 5903-904, 5948-49, 6649, 6844. In addressing his exhibit titled "Cementing the Third Stage of the Production Casing," however, Fant described the cement as "circulated out the top and to the pit" and, in response to a question, confirmed that the five and a half inch casing would be surrounded with cement from the bottom of the hole to the surface. Fant: 6050-52; YP 411, fig. 15; see also Stubbs: 8941; Teufel: 8701, 8725-26, 8729-30; O'Brien: 10239-40. As previously noted, BLM has authority to impose drilling requirements on applicants and, therefore, may require that wells be cemented to the surface, whether or not it is required by Order R-111-P.

V. C. The Salado Formation

V. C.1 Porosity and Permeability

The concepts of porosity and permeability are fundamental in understanding the migration of liquids and gases through rock. As explained by one of the Appellants' witnesses, Brent May:

> Porosity is actually the space within the rock, or the holes in the rock. That's the porosity. It's actually some -- well, some space within the rock that you can put some sort of fluid in, whether it be oil, gas, water, whatever. Such as in a sandstone, it would actually be the space in between each individual sand grain. So, it's not like a huge cavern or something like that. It's actually the space in between the different sand grains, in the case of a sandstone, or in the case of other rocks, it would be actual the space in between the crystals of the rock. And it's disseminated out throughout the rock.
>
> And the permeability is actually how well those pores are connected to each other. * * *
>
> If you have no permeability, than [sic] that porosity within the rock is not connected, and you cannot flow a fluid through that rock, because the porosity is isolated from each other.
>
> If you have poor permeability, that means you have some connections between the porosity pockets. If you have good permeability, then several or the vast majority of the porosity may be interconnected, and you can flow a fluid from one -- from one porosity -- maybe pocket, to another. And that's what we look for, because you want good porosity, because that tells you how much oil is there, but you have to have the permeability to be able to move the oil out of the rock into the bore hole, and get it up to the surface so you can sell it.

May: 4720-22; see Hoose: 5363-67. Another measurement, relative permeability, addresses the lower permeability which results when pore spaces are occupied by more than one substance, altering the ability of one substance to flow into the pore spaces

occupied by another. See Fant: 5826-28; Hazlett: 9434, 9531-35.

As described at the outset of this decision, and reflected in numerous documents and considerable testimony, the Salado Formation consists of the McNutt Member in which potash beds are found, an upper bed composed almost entirely of halite (NaCl) some 500 feet thick and a lower bed of almost entirely halite which ranges from 400 to 1500 feet thick. YP 801 at 14; INT 170 at 156. There are some 45 “marker beds” which vary from a foot to 20 feet thick. YP 801 at 14 (BLMCO44110). Those in the lower portion of the Salado Formation consist of anhydrite and polyhalite (hydrated sulfate of potassium, calcium, and magnesium) with accompanying seams of clay, while those in the area of the McNutt have been variously described as also composed of mud, mudstone, gypsum, dolomite, and sandstone. YP 801 at 14 (BLMCO44110); INT 170 at 156; YP 352; YP 598, vol. 2 at III-16; Griswold: 12835. Precise descriptions have been made for the air intake shaft of the WIPP facility. INT 489 at 52-55. Although the formations are generally uniform throughout the Potash Area, the beds tilt to the east. May: 4762; Foote: 12520. There are also variations in the thickness and elevations of the beds, some apparently due to folding. Griswold: 12840-42; INT 489 at 31.

It is well established, and the parties agree, that halite itself has such low porosity and low permeability that it is essentially impermeable. See INT PH Brief at 186-87; INT 170 at 157; May: 4835, 4892. In 1982, the six companies operating potash mines submitted a position paper to the Mine Safety and Health Administration (MSHSA) which was considering changes in the manner in which it would apply its classification standards that could have resulted in some potash mines being declared "gassy," requiring the expenditure of millions of dollars to install appropriate equipment. See YP 361 (INT 295) at 1, 18-19 (BLMCO42418, BLMCO42435-36); INT 170 at 154 (BLMCO53315). Twelve exhibits accompanied the paper, including "Geology of the Carlsbad Potash Mining District" by Dr. George B. Griswold (March 9, 1982). YP 361, ex. J at BLMCO42540. The companies relied upon Griswold's study to explain:

> In addition to the insulating layers of impermeable salt surrounding the potash deposits, the McNutt member where the deposits are found is overlain by a layer of halite ranging in thickness from 100 to 500 feet, and underlain with a layer from 400 to 1500 feet thick. These impermeable barriers prevent the migration of any other gases into the mining zones. Indeed, and as shown in Dr. Griswold's report that gases found within the Salado formation are indigenous to the formation and different from those found in oil and gas-bearing formations in the area.

YP 361 at 26 (BLMCO42443); see YP 361, ex. J at 5 (BLMCO42547) ("potash mining horizons are completely isolated from entry of gases from underlying oil-gas reservoirs"), 19 (BLMCO42463).

Griswold pointed out that halite is plastic under pressure and explained that during formation of the deposit, continual burial of crystals formed within saturated brine pools would have forced brine upward and packed the crystals close together and that brine would be ejected except for fluids trapped in “negative crystals” at the time of

crystallization. YP 361, ex. J at 18 (BLMCO42462). He explained:

> Thus halite becomes a true solid and possesses no porosity (except for the brine filled negative crystals) and therefore no permeability. Permeability tests performed on salt cores either yield results that are beneath the measurement capability of the test apparatus or if measurable can be accounted for by fractures induced into the sample.

YP 361, ex. J at 18-19 (BLMCO42462-63). Griswold also stated that:

> Other evidence of impermeability of halite lies in the fact that brine and gases trapped in the clay seams at the base of the marker beds have remained in position since deposition. The approximate age of Ochoan evaporites is 230 million years that the brine and gas remain in position is due to the halite immediately under and overlying the fluid bearing strata.

Notably, a report compiling and evaluating studies conducted at the WIPP site states:

> The permeability of the competent halite is so low that the halite can be considered to provide isolation of the waste during the required life of the facility (10,000 yr) if the very low permeability is not disrupted by a breach of the facility.

YP 801 ("Compilation of Hydrologic Data from Drilling the Salado and Castile Formations Near the Waste Isolation Pilot Plant (WIPP) Site in Southeastern New Mexico" (SAND 86-0954, Jan. 1987)) at 15 (BLMCO44111). The WIPP facility, however, is in the lower portion of Salado approximately 2150 feet below the surface rather than in the McNutt portion where the Intervenors' mines are located. YP 801 at 10 (BLMCO44106).

As indicated in Griswold's report, it also is not controversial that gases exist within the Salado Formation. In 1963-64 the Bureau of Mines conducted an "Investigation into the Occurrence of Gas Pressure above the First and Tenth Ore Zones in the Potash District, Carlsbad, New Mexico" during which it drilled 169 vertical holes and examined the gases released. YP 361, ex. H at 2 (BLMCO42419). The Bureau encountered 91 "blows," all but one from a hole drilled in an intersection and almost all from the mud seams or bands which lie between potash beds. YP 361, ex. H at 2-3 (BLMCO42419-20). It could not explain why some intersections contained gas and some did not, but believed that either the mud seams had very low permeability or permeability had been significantly reduced by changes in pressure due to mining. YP 361, ex. H at 3-4 (BLMCO42420-21). The Bureau concluded that "stress of the immediate roof strata due to gas pressure may be relieved by drilling 10 to 20-foot deep vertical holes in each intersection, as soon as practicable, after first mining while ventilation is still intact". YP 361, ex. H at 6 (BLMCO42423). It appears that potash mining companies subsequently adopted a practice of regularly drilling pressure relief holes, although IMC may have begun doing so after conducting a study during July of 1958 which found gas pockets in all but three of 26 holes drilled. INT 243 at i, 11, 21-22; see INT 170 at 157; YP 361 at 11-12

(BLMCO42428-29); RP 007685; Morehouse: 12223-28, 12326-37. In contrast to the Bureau of Mines study, at one time IMC's personnel attributed the gases to primarily the halite beds and only small amounts from clay beds, but another study identified mudseams as the source of gas. INT 170 at 156, 160; INT 243 at 18; see Griswold: 13011.

The gases released in the Bureau's study contained small quantities of methane but were primarily nitrogen and consequently there seems to be no reason to believe that they originated from oil and gas wells. YP 361, ex. H at 14-15 (BLMCO42429-30); see RP 007690; INT 243 at 10. Griswold believed that the probable source of the methane was algae which grew in the marine waters during formation of the potash beds. YP 361, ex. J at 20-21 (BLMCO42464-65); see RP 007693 ("composition of the gas shows that it was most likely derived from the original atmospheric air at the time of the deposition of the Salado").

Another study, "Occurrence of Gasses in the Salado Formation" (March, 1984), by Lokesh Chatuverdi of the Environmental Evaluation Group, Environmental Improvement Division, Health and Environment Department, State of New Mexico, was undertaken after several incidents at the Kerr-McGee mine (New Mexico Potash) raised concerns about the possibility of blowouts in excavations at the WIPP site. RP 007670. Among other matters, Chatuverdi concluded that "[g]as can be found at almost any level within the Salado Formation, generally near clay seams associated with the marker beds." RP 007695; see RP 007686 ("gases occur in the upper, middle and lower sections of the Salado Formation"). Of particular importance, he noted that the violent gas outbursts at the Kerr-McGee mine had occurred near a vertical fracture, as apparently was the case with other blowouts, but he was unable to state whether the fractures had been formed when a dike had intruded into the Saldado, or some other event had occurred, and "gas from the surrounding region migrated into them and later became pressurized, due to salt creep" or whether the fractures were the result of the release of pressure from the blowouts. RP 007693-94. “Salt creep” is a way of describing the tendency of halite to deform or “flow” under stress and, along with low porosity and permeability, was one of the reasons for selection of the WIPP site. Teufel: 8469; INT 434 at 2, 9. Another study by a private consultant, apparently hired by Kerr-McGee, attributed the gas filled vertical fissures the mine had encountered to lateral shifts in the earth's crust. YP 363 at 7 (IMC-00739), 9 (IMC-00741), 11 (IMC-00743).

It is also not controversial that water is present within the Salado, as well as the underlying Capitan and Castile Formations and the Delaware Formation from which the Appellants wish to produce oil. May: 4759, 5136, 5329-30; Fant: 5722-23, 6690; Stubbs: 9016-17; see YP 801 at 16 (BLMCO44112). As indicated in Griswold’s report, it seems to be understood that the Salado is saturated with brine trapped at the time of its formation. See Hazlett: 9441, 9450-53; Peterson: 14483-84. The summary study of the WIPP site states that the fluids found in boreholes drilled at the site and reported in potash mines “together with other hydraulic data, would indicate that (1) the evaporites do contain fluid and (2) may also possibly be generally saturated.” YP 801 at 7-8 (BLMCO44104).

However extensive the presence of fluids within the Salado, it is generally understood that “they are usually isolated for all practical purposes of mass transport (i.e.,

they are not part of a regionally active hydrologic system), and they have limited flow capacity." Id. The isolation of fluids in their natural state, however, is subject to changes in permeability resulting from excavation, boreholes, and, drilling oil and gas wells. See id. at 15 (BLMCO44111). The extent to which fluids may migrate due to pressure, because the pores within which they are held become interconnected, or because "fractures" develop was subject to testimony at the hearing and is disputed by the parties.

V. C.2 Fluid Flow

Whether the porosity and permeability of components of the Salado Formation are sufficient to allow gas escaping from a well to enter a potash mine was discussed by witnesses who had conducted computer simulation studies of fluid flow. Dr. William G. Hazlett addressed the issue for the Appellants. He was of the clear opinion that "there is no potential for fluid flow of gas or oil from a producing Delaware well through the formations that are near the potash mines, and into the mine." Hazlett: 9412; see Hazlett: 9436-37, 9447. He explained that "once you know something about the permeability and some of the other formation properties, you quickly realize that there's no potential for fluid flow in these formations. The properties are just such that it's not going to happen." Hazlett: 9412; see Hazlett: 9619, 9663-64.

For his study prepared for the hearing, Hazlett used a computer model of a producing Delaware well 500 feet from a mine 1529 feet deep, which he described as an average of the shallowest and deepest mines, and a two dimensional 500 foot by 500 foot grid of the area at the mine level with varying sizes of cells within the grid. Hazlett: 9432, 9474-76, 9480-84, 9491-92; see YP 616, YP 617, YP 619. The computer runs were designed to examine a variety of conditions under which gas flow might occur and migrate toward a mine. Hazlett: 9493-94, 9525-31, 9537-49. In various runs of his model, Hazlett assigned two sets of numerical values for the permeability, porosity, threshold pressure, and formation pressure of impure halite and anhydrite. YP 631; Hazlett: 9430-31. To be conservative, he lowered the pore pressure, which he understood to be equal to the lithostatic pressure by 10%, from 1600 psia to 1376 psia. [72/] Hazlett: 9434, 9460. He used two formulas for relative permeability because, he explained, "the permeabilities in these formations are so low, such that there basically is almost no possibility -- or there is no fluid flow through them in the labs, they can't measure the relative permeability curves" and two sets of equations had be developed for the Salado Formation using

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[72/] As explained by another of the Appellants' witnesses, Dr. Lawrence W. Teufel, the "lithostatic pressure" or "lithostatic stress," also referred to as the overburden stress or the vertical stress is the weight of the column of rock above a subsurface point and is calculated as "the weight of the overlying rock times the density of the rock, times the acceleration of gravity constant." Teufel: 8472. Measurements taken at the WIPP site found it to be approximately one psi per foot of depth. Id. In addition, studies found that the two other principal stresses, the maximum and minimum horizontal stresses which are usually less than the lithostatic stress, are the same for the Salado Formation so that the stress state at the WIPP site is isotropic and lithostatic. Teufel: 8473, 8610-13.

correlations and theoretical models. Hazlett: 9435-36. He also ran the model as though the well were an open hole, excluding any effect from casing and cement. Hazlett: 9457.

In addition to examining two rock types and using two formulas for relative permeability, Hazlett varied the wellbore, pore, and threshold pressures as the factors which would drive the movement of gas. YP 632; Hazlett: 9502-504. As he explained, "[i]n order for gas to get into this system, it has to overcome the sum of two pressures," the formation pore pressure, which was 1376 psia in his model, and the threshold pressure needed to move gas into the pore space occupied by water, which he assigned a value of 2175 psia for impure halite. Hazlett: 9443-46; see Fant: 5825-26. Hazlett considered the initial run of his model to be unnecessary because a well bore pressure of 3015 psia, which he considered to be the initial pressure of a Delaware well, does not exceed a combined threshold pressure of 2175 psia and pore pressure of 1376 psia. Hazlett: 9507-08. In order for the model to produce flow, Hazlett reduced the threshold pressure to zero and in some runs reduced pore pressure by half to 688 psia. Hazlett: 9509-10; YP 632. He found that, without any threshold pressure, gas would travel 27 feet over a period of 100 years if the wellbore pressure were 3015 psia and 17 feet at a wellbore pressure of 1278 psia. Hazlett: 9510-16; YP 632.

Hazlett conducted additional runs based upon a well in the middle of a mine pillar. Without any threshold pressure, the results were that gas would travel 37 feet at a wellbore pressure of 3015 psia and a pore pressure of 1376 psia and 29 feet at a wellbore pressure of 1278 psia and a pore pressure of 688 psia. Hazlett: 9528-30; YP 632. He regarded these results as deriving from unrealistic assumptions because the initial pressure of 3015 psia was a bottom hole pressure that would not be maintained and he had reduced threshold pressure to zero. Hazlett: 9446-47, 9465, 9499-9500, 9502, 9539.

Hazlett's subsequent runs of his model used the Brooks and Corey curves for relative permeability, which he considered to be "the way it really is with rocks" and "what is required." Hazlett: 9533, 9535. The change resulted in reducing the 37 feet that gas had traveled to 17 feet when the other variables were not changed. Hazlett: 9537-38. Hazlett then conducted a series of runs by varying factors which he described as adding "some semblance of reality," including a well life of 20 years and a minimum pore pressure of 1376 psia. Hazlett: 9538-40; YP 632. In various runs he allowed the pore pressure to decline from 3015 psia to 1376 psia at the end of one year and to operate in cycles, declining from either 3015 psia or 2000 psia at the end of a month to 80 psia for 23 months, repeated for 10 years and at 80 psia for the remaining 10 years. YP 632. For runs using his values for anhydrite, Hazlett added a threshold pressure of 343 psia. YP 632.

None of Hazlett's runs of his computer model produced gas movement of more than one foot. Hazlett: 9539-49. He explained that:

> it turns out that what really matters, in getting the gas to flow in the computer model from the well to the mine is the fact that the well has a particular pressure and the mine is at atmospheric pressure. * * * [T]he threshold pressure plus pore pressure in the Salado, you can change it quite

> a lot, as long as it doesn't overpower the well bore pressure, and it doesn't change the distance the gas migrates in the computer model. The controlling factors really are the well bore pressure, which is the 2000, 3000 range, that we're using for the runs, and the fact the mine is at atmospheric pressure. That pressure differential is what actually controls the gas movement.
>
> So, essentially, what I'm telling you is I could set the threshold pressure higher than this, I could set it lower than this, and as long as I don't overpressure – I could set it down to zero, and it turns out, it just doesn't make any difference on the answer.

Hazlett: 9546-47. Hazlett concluded his discussion of his computer model by restating his conclusion "that you will not get any gas migration from a well towards a mine." Hazlett: 9549-50; see Hazlett: 9612.

Dr. Edward W. Peterson, addressed the issue of fluid flow for the Intervenors. At one time, he conducted studies of conditions at the WIPP site, several of which are part of the hearing record. Peterson: 14344-50, 14361-62. An early study, authored by him and others, is titled "In Situ Permeability Testing of Rock Salt" (SAND81-7073, Apr. 1981). INT 238. It describes tests conducted in a bore hole in 1979 over 100 foot intervals at depths of 1870 and 2270 feet. INT 238 at 1-2, 29, 31. The results were surprising because the formation was found to be permeable when tested at a pressure of 100 psi, far below the lithostatic pressure and resulted in relatively high, for the WIPP site, measurements of permeability. INT 238 at 15, 36, 49, 52; Peterson: 14368-72, 14478, 14488. The analysis assumed an unsaturated homogeneous formation porosity of .001, which the report describes as "consistent with the measured data." INT 238 at 29-30, 48, 52; see Peterson: 14371, 14379, 14381.

Hazlett offered a variety of criticisms of Peterson's early study and considered the permeability numbers it identified to be "way too high." Hazlett: 9614, 9697. Peterson agreed that the permeability readings were higher than others later obtained at the WIPP site and stated: "I do not understand why those are the numbers that I've gotten. I've never understood them." Peterson: 14375, 14495. Nevertheless, he considered them to be relevant because they are measured data and stated that the permeabilities measured at the WIPP site varied by a factor of a million, those for salt having "very, very low permeability" and tests of marker beds giving "all sorts of answers." Peterson: 14376-78, 14495, 14560; see Hazlett: 9682-83. Peterson also testified that, when the study was conducted, they had looked at treating the formation as filled with brine and that the permeability would be 10 to 50 times higher than that reported in the paper. Peterson: 14378-80; see INT 238 at 48; YP 801 at 26 (BLMCO44122).

Although the obvious point of Hazlett's testimony about the early study was to challenge Peterson's testimony and the studies he had prepared for the hearing, Peterson testified that he did not take the values he used for his model directly from it but from a later WIPP document which, inter alia, reviewed the data developed in a number of studies, including his, and sets forth a range of values for use with the WIPP model

studies. INT 434 ("Systems Prioritization Method--Iteration 2, Baseline Position Paper: Salado Formation Fluid Flow and Transport Containment Group (Sandia National Laboratories, Mar. 17, 1995)); INT 240; Peterson: 14386, 14395-96, 14409-10, 14523. Hazlett also had reviewed the document and identified it, along with others not named, as the source of his numbers for porosity and permeability. Hazlett: 9613-15, 9624, 9682-83; but see Hazlett: 14968. The document provides values for various characteristics of three types of rock: impure halite, anhydrite, and "DRZ." The last stands for "disturbed rock zone" and is used to refer to the area where "the mechanical and hydrologic properties of rock have been changed in response to excavation." INT 434 at 14. The document identifies the porosity of impure halite and the initial porosity of both anhydrite and DRZ as the same, a range of 0.001 to 0.03, with a median of 0.01, and provides different measurements for the permeability of each of the three. INT 434 at 66-67.

Peterson described the study he prepared for the hearing as comparable to Hazlett's because, although he and Hazlett had used different computer models, both had been developed over many years and were sufficiently "mature" that they should produce the same results using the same input parameters. Peterson: 14408, 14411, 14417. His two dimensional model was different in that it looked at a mine depth of 1600 feet and a well 125 feet away from a mine, and maintained a constant well pressure of 2000 psi. Peterson: 14409; INT 240 at A, C. More significantly, Peterson used a porosity value of .001 and a different value for the permeability of anhydrite, apparently because his study was designed to model an anhydrite/polyhalite/clay bed. Peterson: 14409-10; INT 240 at A, C. He saw no need to use a three dimensional model, which would have included halite beds above and below the modeled bed, because their porosity and permeability would be "so low that it wasn't worth putting them into the calculation." Peterson: 14414, 14549. Under Peterson's model, gas was able to flow through the bed, displacing brine in pore spaces, and reach the mine within a year, although he believed that what would actually occur is that fractures would develop along a bedding plane when the gas pressure exceeded the lithostatic pressure. Peterson: 14111-17, 14434, 14444-45; INT 240 at D, E, F. Peterson also believed that gas could flow to a mine even when the well pressure was less than the lithostatic pressure because the mine opening would cause the pore pressure in the surrounding ground to decrease and, over time, allow a pressure wave to reduce the pressure near the well to less than lithostatic. Peterson: 14420-21.

Peterson testified about an additional computer analysis using an algebraic formula to calculate fracture growth rather than numerical values for porosity and permeability. INT 239, INT 433; Peterson: 14427; see Hazlett 9434-36. His study identified the relationships between fracture width and flow rate, between flow rate and pressure in the fracture in excess of the lithostatic pressure, and between distance of the gas flow and the quantity of gas released over time at various rates of flow. INT 433 at B, C, D; Peterson: 14429-34. In addition, he plotted the time required for a fracture flow to reach the mine as a function of the rate of flow. INT 433 at E; Peterson: 14440-41. Responding to testimony by one of the Appellants' witnesses, Peterson agreed that enhanced stress around a mine opening would tend to inhibit a fracture, but noted that gas could continue to flow through the permeable material constituting the bed, could flow in beds above the mine not subject to enhanced stress and be released by pressure relief holes, or could flow through a fracture which predated the mine and be encountered as the mine advances.

Peterson: 1442-43; see Teufel: 8802-04, 8813-16.

The computer simulation studies presented by Hazlett and Peterson have limited usefulness in addressing the APD's at issue due to differences in geology. The WIPP facility is located some 2150 feet underground in a portion of the Salado which is composed of 85 to 90% halite, while the McNutt portion of the Salado in which the mines operate contains a well known layering of potash and marker beds and does not seem to have been studied as part of the work undertaken for the WIPP site. YP 801 at 15. At the same time, computer models require assigning precise, selected values to the properties of the formation being studied and are limited as to the complexity of the formation modeled by the computer capacity and time which is available.

It appears that in this case the results of the computer studies are critically dependent upon the value used for a key matter at issue, permeability. See Peterson: 14448. Changing the permeability value changes the threshold pressure needed for fluid to flow. Fant: 5825; Hazlett: 9692; Peterson: 14395. The numbers used for porosity and permeability are also relational, so that raising one lowers the other. See Peterson: 14382-83, 14501-502. Peterson believed that "[t]he most sensitive factor in these type of analyses is the permeability. And it's the most sensitive because it has the widest range of uncertainty." Peterson: 14448-49; see Hazlett: 9629 (“It’s the permeability that matters, actually.”). Permeability, however, is not directly measured but calculated using other measurements and assumptions. Hazlett: 14918-19; Peterson: 14475.

Early in his testimony, Peterson described a variety of tests of permeability his company had performed at the WIPP site. He explained that, after the early study:

> The next set of tests were in the repository itself, and we did tests in the rib, in one of the ribs of the room. We did -- I don't know, a dozen tests, just to look at permeability in the rib as you move away -- the rib is just the wall. Just as you move in from the wall. In other words, they were just done at various depths from probably three feet into a depth of about 30 feet, just to look at the change in permeability as you go away from the wall.
>
> * * * * *
>
> So, that was probably the second one. We then did a whole series of tests on plugs that had been bored in the floor and in the rib of the mine, to see if the plugs themselves leaked, or if you leak around the plugs.
>
> We did a series of tests, and these were the start of people really looking at what is termed the free-field, the far-field permeabilities.
>
> In between when we were running the plug tests, since we wouldn't do anything, we would take and set some of our equipment in bore holes that had been drilled off the ribs in the form and so forth, and set it in and run a test that might last close to a year, just to see if there really was flow through the salt formation and the marker beds and things like that.

> We also did a whole series of tests in which we looked at the permeability in what is called the disturbed rock zone, or whatever you want to call it, where you get falling and roof sag. We did lots of tests there, both permeability tests, and in those cases, we did tracer tests, tracer gas tests, as well.

Peterson: 14346-48. Presumably, the tests Peterson described were part of those included in the modeling of the WIPP site. See INT 434 at 66-67.

Peterson also discussed conducting "what is termed the room Q tests." Peterson: 14348. In his view: "The data from the WIPP site, or not just the WIPP site. That particular geology or that particular setting, is extremely difficult to understand, * * * I mean I didn't understand it." Id. The room Q test was a project to create:

> something like a 10 or 12-foot diameter room that was -- I don't know. 100, 200 feet long.
>
> And prior to mining the room, numbers of bore holes were drilled out around the room, in order to measure what the permeabilities and so forth were in the rock around the room.
>
> Then the room was going to be mined, and you could see how that affected what the permeabilities were in these holes. So, you'd have the undisturbed characteristics of the formation, and then you would get the disturbed characteristics of the formation.

Peterson: 14348-49. The test did not occur as planned because after the room had been bored, delay in building a bulkhead to isolate it allowed air circulation and evaporation so for a couple of years there "there are no really good flow measurements of what went into the room" and "a lot of the very critical information was lost." Peterson: 14349-50. For purposes of this decision, the Room Q tests are notable because the project was undertaken after there had already been considerable testing of permeability, which was apparently deemed insufficient to provide reliable knowledge.

Hazlett's study utilized permeability measurements for impure halite and anhydrite which had been developed from studies at the WIPP site. Hazlett: 9425-26, 9439-40, 9495, 9517, 9546, 9682. He defined impure halite as including halite, polyhalite, argillaceous halite and clay seams to represent the various other components of the Salado. YP 631. Although this approach appears to be consistent with that utilized for the WIPP site, it also appears to incorporate the focus of WIPP studies on the underground area of the WIPP storage facility. For example, the numerical model for the WIPP site appears to treat the Salado Formation above marker bed 138 as consisting of halite, without regard for presence of potash or additional marker beds. See INT 434 at 18-19 (zone 15 as "intact halite"), 23. Relying upon the WIPP studies, Hazlett treated the portion of the McNutt Formation modeled in his study as having either of two sets of uniform values. Hazlett: 9622-23, 9675-77, 9681. During his rebuttal testimony, Hazlett declared that "ten to the minus fifth is the number you use for the undisturbed, saturated

low permeability, high threshold pressure region, which is what matters in this case." Hazlett: 14972. The general issue concerning fluid flow raised by the APD's, however, is whether, assuming that oil, gas, or water reaches the McNutt portion of the Salado Formation, the fluid can migrate through it so as to be a hazard to "mining operations being conducted for the extraction of potash deposits" and not whether fluid can flow through anhydrite, or impure halite, or the Salado Formation as a whole. More specifically, the issue concerns the composition of the McNutt in those areas where the Appellants seek to drill.

Tests conducted at the WIPP site clearly offer abundant information, but specific conclusions reached about permeability at the level of the WIPP storage facility may not correctly describe the permeability of the more complex bedding of the McNutt, let alone its composition throughout the 500,000 acre Potash Area. See May: 4850; Hazlett: 9451-54; INT 489 at 86. Even at the level of the WIPP site, determinations as to permeability have varied considerably, although all are apparently low. INT 434 at 34; YP 801 at 7-8, 17-23; see Hazlett: 9682-83; Peterson: 14376-77, 14543-44, 14559. The significance of the selection of permeability also appears to be reflected in a study by Griswold, who believed the marker beds in the McNutt have a relatively high permeability. INT 489 at 4-5; Griswold: 12850-60. Apparently due to the permeability measurement used in his model, he found that gas escaping from a well at low pressures would reach the outside of a surrounding pillar fairly rapidly. INT 489 at 6-19; Griswold: 12862-83.

In addition, although Hazlett understood that the issues concern the risks resulting from unnatural intrusions like mining and oil and gas drilling, his model was designed to portray in situ conditions as a uniform state and did not address matters such as fractures because he did not believe that rock would be fractured in its natural state. Hazlett: 9620-23, 9628-31, 9653, 9677-78, 9681, 9706, 9712-13, 9716, 9736-37. He considered some of the permeability values identified at WIPP to be "abnormally high numbers" because they had been obtained from disturbed areas and "not reality. Unless I want to model the disturbed zones." Hazlett: 9690. [73/] In contrast, Peterson's concern was the potential for gas to flow through or along the marker beds within the McNutt Formation which he understood to have different properties than halite. It appears, however, that the results of his study are dependant upon a constant well pressure higher than the lithostatic pressure to provide a constant flow of gas, but which did not have a defined basis. Peterson: 14409, 14412, 14471-72; INT 240 at G. It is also unclear whether the Delaware wells at issue would be capable of generating such a constant pressure. See Peterson: 14471-74.

The selection of a single low value for permeability fails to account for the evidence of interconnectivity within portions of the McNutt. As previously discussed, both

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[73/] Hazlett also appears to have regarded pore pressure in the Salado Formation as equal to the lithostatic pressure, but some measurements of pore pressure at WIPP appear to have found not only pressures which are less than lithostatic but also different pressures for areas of anhydrite. Peterson: 14401-404, 14516-17; YP 802 at 359, 361, 363 ("Interpretation of In-Situ Pressure Flow Measurements of the Salado Formation at the Waste Isolation Pilot Plant" (SPE 21840)); see INT 434 at 11.

brine and gases are present within the Salado, whether contained within isolated pore spaces or small “fractures” or “fissures” which are isolated as the result of the lithostatic pressure compressing beds and causing salt to creep. May: 4838-39, 4850, 4869, 4892-93, 4924, 4926, 5133, 5136, 5144, 5199, 5327; Hazlett: 9450-52. It also seems indisputable that larger interconnected areas are formed as a result of mining. YP 361, ex. H at 3-4 (BLMCO42520-21). The previously discussed practice of drilling pressure relief holes results from the recognition that deformation from mining allows gases within relatively impermeable material to form larger “pockets.” INT 243 at 11-15, 21; see also INT 232, INT 489 at 41-42; Griswold: 12898-903. Hazlett agreed that the fracturing which results from mining allows fluid flow, stating that: “You can more or less just assume that it offers no impediment to flow almost at all.” Hazlett: 14963-64.

V. C.3 Breccia Pipes

Given the extremely low porosity and low permeability of the Salado Formation, the subject of geological features which might allow oil, gas, or water to migrate within portions of the Salado has been the subject of dispute. One area of disagreement concerns the presence of oil “stains” or “seeps” within the Eddy and Mississippi Potash (Potash Company of America) mines. INT 213 at 5, INT 215 (video), INT 216, INT 217, INT 218, INT 221, INT 225, INT 227, INT 376. The occurrences are significant because oil does not naturally occur within the Salado and the deposits must have originated from somewhere else. May: 5153. In its 1973 submission to the Department and elsewhere, the potash industry suggested that the oil seeps may have originated from nearby oil wells. YP 235 at i (BLMCO42097), ex. F (BLMCO42126-29), ex. G (BLMCO42130); INT 213 at 5. The Appellants, however, claim that the oil stains result from a geological phenomena known as a “breccia pipe.” App. PH Brief at 92-95.

Breccia pipes have been the subject of several studies, some of which were discussed at the hearing by Brent May. One study was conducted by the USGS in conjunction with the WIPP site. INT 230 ("Evaluation of Breccia Pipes in Southeastern New Mexico and their Relation to the Waste Isolation Pilot Plant (WIPP) Site, with a section on Drill Stem Tests" (USGS Open File Report 82-968, 1982)). As May explained, the USGS found that water had dissolved and removed material in the Capitan Limestone Reef which underlies the northern portion of the Potash Area, resulting in caves or voids. May: 4934-35; see May: 4768-72; YP 354, YP 364; INT 230 at 1. Some time later, the ceiling of the caves began to collapse and the corresponding fall of each of the geologic formations above the Capitan Reef created broken rock, forming what is described as a pipe or chimney 600-800 feet in diameter. May: 4934-35, 4952; 4934-35; see YP 364; INT 230 at 1. May dated the events as occurring 400,000 years ago and explained that, although fluids had been able to move into spaces within the broken rock, eventually "this porosity, permeability, has been sealed up, either by clays or salt within it." May: 4935. He further stated that the USGS "felt that the breccia pipes were, at present day, no longer a path of migration" and that it "felt like since it was the cave or void that initiated the breccia pipe, that these can only form where the Capitan Reef is present. If you do not have the Capitan Reef, you do not have this type of a breccia pipe." May: 4936. Consequently, May testified, there would not be breccia pipes in the southern portion of the Potash Area where the Capitan Reef is not present. May: 4950.

May believed that the process of formation described by the USGS could account for the oil stains found in the mines because the initial porosity and permeability would have allowed oil to migrate from the Yates formation above the Castile into higher formations and open fractures, but that later “the breccia pipe, the porosity and permeability have been sealed off, including any radiating fractures out, and entrap that oil." May: 4937. May testified that the USGS had identified four breccia pipes and that an additional one was known to exist at the Eddy Potash mine. May: 4939-40; YP 368. He discussed a study in which the USGS had taken three samples from an active oil seep in the Mississippi mine and two samples of hydrocarbons from core holes drilled into breccia pipes and tested them against samples of seven crude oils from producing wells in the vicinity. YP 365, INT 229 ("Geochemical Analysis of Potash Mine Seep Oils, Collapsed Breccia Pipe Oil Shows and Selected Crude Oils, Eddy County, New Mexico" (USGS Open File Report 82-421) at 16-17. May explained that the composition of organic chemical compounds in oil varies among formations and because the USGS had found a match, and they "felt like that oil came from the Yates formation." May: 4947; see YP 365 at 8, 13-14. He believed that, rather than migrating long distances, the oil stains found in the mines had come from additional, undiscovered breccia pipes. May: 4999-5000, 5033-35, 5046.

During cross-examination it was brought out that the USGS's study had not been limited to the four breccia pipes but had looked at southeastern New Mexico and May clarified that his testimony had been limited to the four breccia pipes which had been identified in the report as forming over the Capitan Reef. May: 5201-02; see May: 5035. A number of questions were directed at the relation between the location of the breccia pipes and the oil stains which had been found in the mines. Notably, May acknowledged that the additional breccia pipe at the Eddy Potash mine had been identified as only “possible” and that he was relying upon the information provided by the document. May: 5208-10; YP 368. He also acknowledged that there were oil stains in a core hole drilled near the Eddy Potash mine not located near a known breccia pipe, although he later explained that they could be accounted for by an undiscovered one. May: 5217-18, 5276-78; INT 220.

May's testimony that breccia pipes were the source of the oil stains in the mines is supported by the studies but cannot be regarded as conclusive. The USGS was concerned with the more limited question of whether a breccia pipe could “develop under the repository and cause a breach in the system that will allow access of fluids to the waste canisters?” INT 230 at 61 (BLMCO43151). It concluded that, the formation of breccia pipes is "limited to areas over the buried Capitan reef" and that “[n]o examples of breccia pipes that could lead to breaching of a repository at the WIPP site have been found to date and are not likely because the Capitan Limestone is not present beneath the site." INT 230 at 65-66 (BLMCO43155-56). The USGS's other study found that a comparison of the oil samples from breccia pipes and those from the mines “strongly suggests that they belong to the same family of oils and hence are derived from similar sources” and that “the most likely source” was oil in the Yates Formation “or from the same source rocks that produced the Yates oils.” INT 229 at 8 (IMC-04779) see also INT 213 at 9-10. The study also concluded:

> The breccia pipe and mine seep oils were probably emplaced at

> their present sites during or sometime after the brecciation, fracturing, and faulting of rocks in response to the dissolution of the Capitan Limestone, a reef facies, and subsequent caving of the overlying rocks. Partial leakage from disrupted Yates oil reservoirs probably accounts for the above oil shows.

INT 229 at 14 (IMC-04785). May acknowledged that his testimony on the subject was entirely based upon the documents he had read. May: 5154-56, 5199. While they support his understanding that other oil stains within the mines could be the result of additional, undiscovered breccia pipes, the existence of such pipes is speculative. See May: 5033-35, 5211-13, 5217-18. Likewise, it is not known whether oil stains which have not been sampled and tested and are not near a breccia pipe have the same composition as those which the USGS sampled because they were near a breccia pipe. See Foote: 12539-40; INT 227. May's testimony does not sufficiently support the Appellants' claim to have "established that the oil seeps were the result of breccia pipes." Nor does his testimony resolve questions raised by the active oil seep in the Mississippi Potash mine where oil had traveled along a crack or fault line apparently created by the collapse of the breccia pipe. YP 365 at 2, 14; Foote: 12512.

V. D. Subsidence

As a geological term, "subsidence" refers to the well known phenomena of the ground surface sinking in response to the removal of gas, liquids, or solid material from underneath. INT 193 at 2. More formally:

> Subsidence is a time-dependent process, either natural or man induced, in which there is a lowering of the ground surface in response to the removal of gas, liquid, or solid matter. Deformation of the rock mass may be either elastic, plastic, or brittle processes or by any combination of these processes. Subsurface deformation leading to surface subsidence includes the local lateral and upward displacements of rock above unmined areas (near mine boundaries or barrier pillars) caused by the downward movement of overburden into mine cavities. Strains induced by mining and transmitted through intervening strata to the surface may be compressive or tensile and may have both horizontal and vertical components.

INT 309 (F.T. Lee and J.F. Abel, Jr.,"Subsidence from Underground Mining: Environmental Analysis and Planning Considerations," (Geological Survey Circular 876, 1983)) at 2. The term "subsidence," however, is also used more generally, including at times at the hearing, to refer to the movement of material into the void created by mining (part of the process of "convergence" or "room closure") and the lowering of the strata between the void and the surface. See, e.g., Teufel: 9114-15; Abel: 13410-11. Other changes can occur beneath and around a mine, such as the mine floor rising, but not to an extent which creates a concern in this proceeding. See Able: 13449. Rather, the factual issues presented at the hearing concern the nature of the changes which take place over an area where potash mining has been conducted, the size of the surface area affected, and,

most significantly, whether the corresponding geologic processes which occur between the surface and the mine may result in damage to oil and gas well casing and allow oil and gas to enter the surrounding strata and migrate toward and enter a potash mine. See Foote: 12499-500.

V. D.1 Subsidence Studies

Despite the obvious importance of the question, apparently only a few field studies examining the effect of subsidence on well casing have been published and there is little direct information upon which to draw a conclusion, particularly in relation to subsidence resulting from mining. See O'Brien: 10400-401; Abel: 13259-63; Teufel: 9098-99, 14882-85. Witnesses for the Appellants and the Intervenors addressed the subject by studies which calculated the amount of stress placed on well casing when subsidence occurs. While it is not surprising that they arrived at different conclusions, the difficulty their testimony poses for this decision is that they addressed the issue using quite different methods.

Dr. Lawrence W. Teufel testified for the Appellants. He did not prepare a formal report but presented his analysis through a series of exhibits. As described by Teufel, he had been:

> asked to do a geomechanics or rock mechanics analysis of the effect of subsidence and deformation around mines, how that deformation would affect changes in stress around the mines, as well as the effect of subsidence on stress, and if that change in stress was sufficient to compromise the integrity of a well bore casing.
>
> We [he and Dr. Hazlett] were asked, in this particular case, to design the study so that we would look at a well ahead of an advancing mine front, so that mine front could pass by the well, so the well was already in place or, if the mine was being advanced, what would the stress state inside a pillar be, and would that stress state be sufficient to cause failure of the casing.

Teufel: 8511-12; see Hazlett: 9411. Teufel conducted his analysis using the ABAQUS computer simulation program to model a three dimensional area 10,000 by 10,000 feet and a depth of 8000 feet with mine areas of 2000 by 2000 feet located at depths of either 1000 or 2000 feet. Teufel: 8601; YP 635. He modeled the Salado Formation as 500 feet thick above a 1000 foot deep mine and 1000 foot thick above a 2000 foot deep mine, the Rustler Formation as 200 feet thick above a 1000 foot deep mine and apparently 350 feet thick above a 2000 foot deep mine, and the remaining distance to the surface for the Dewey Lake Red beds. Teufel: 9147-49. Based upon results of tests of the Salado Formation conducted by Sandia Laboratories, Teufel used a vertical stress and maximum and minimum horizontal stresses of one psi per foot of depth. Teufel: 8472-73, 8610-13.

He assigned an elastic modulus [74/] and a Poisson's ratio value to each of the Dewey Lake Red Beds, Rustler, Castile, and Delaware Formations and for the Salado Formation assigned values for yield stress, compressive strength, tensile strength, an inelastic modulus, and a creep rate. YP 674; Teufel: 8758-59, 8905, 9153. He used the elastic properties and the time-dependent creep properties for argillaceous halite for the Salado Formation. Teufel: 8624.

Teufel ran his model using a variety of room and pillar sizes to generate illustrations of the distribution of stress around the rooms and pillars because he understood that the maximum stress on well casing would occur near the mine face or within mine pillars. Teufel: 8634, 9150. He prepared a series of exhibits for a 1000 foot deep mining operation using rooms 40 by 40 feet and 8 feet high, separated by pillars also 40 by 40 feet and ran the model to show the results after five years. Teufel: 9160, 9166. Teufel calculated that the vertical stress at the mine and pillar faces to be about 3100 psia, to decrease to near the lithostatic stress of 1000 psia at about 100 feet, and to clearly return to the lithostatic stress at 150 feet. Teufel: 8658-59, 8668; YP 646, YP 647; cf. YP 658 (about 4000 psia at center). As stated on his exhibits, he found that:

> Stress locally increases from in situ conditions near the mine face and within the pillars because of localized compression needed to support the additional loading caused by mine excavations. Stress is highest immediately adjacent to the mine face and pillar face and rapidly decreases away from the openings.
>
> Stress locally decreases from in situ conditions above and below the rooms because of localized extension within the roof and floor of each room. Stress is lowest immediately adjacent to the mine roof and floor and rapidly increases away from the openings.

YP 644, YP 645. Teufel understood his exhibits to show that 100 feet away from a mine "the vertical stress on that well bore will be no different than it was before the mine was created." Teufel: 8660, 8668-69.

In addition, Teufel explained that mining produces an arch effect:

[74/] An elastic modulus is the ratio of the stress divided by the strain. INT 193 at 18. As explained by Teufel, the number is important because:

> if you know the modulus of the material and you know what the strain deformation is, that is, how much strain has occurred because of some process, like subsidence, you can go back and calculate the magnitude of the stress from that strain. Vice versa, if you're still within the elastic regime, and you basically import a stress onto a pillar, you can determine what the elastic strain is within that pillar.

Teufel: 8772-73.

> The entire mine acts as a void space with respect to the deformation, and a stress arch is formed. Basically, there's a reduction in stress above the mine itself. And again, the overall bulk response is the stress is increased adjacent to the mine to account for all that additional stress.
>
> And basically what this does, the stress arch itself basically reduces the applied normal stress or vertical stress onto the mine itself, and that is a mechanism that reduces the amount of deformation that you're going to actually see in the surface.

Teufel: 8670. During cross examination, Teufel identified the load transfer distance as roughly 100 feet when pillars and rooms are 40 by 40 feet. Teufel: 9226, 9230.

Using the same room and pillar configuration with a large central pillar of 120 by 120 feet, Teufel found the stress on the face of the large pillar to be about 3200 psia and to be about 1700 psia at the center. Teufel: 8679; YP 651. He believed that because stress at the edge of the pillar would be higher than lithostatic and the stress state is less toward the surface, a fracture would propagate vertically rather than laterally. Teufel: 8677-78. Looking at the stress profile of the pillar itself, Teufel explained that “there's an altered stress state around the mine itself with the highest stress being in the center of the pillar itself, and then going back to initial conditions below the mine.” Teufel: 8681; YP 652. Increasing the size of the central pillar to 200 by 200 feet resulted in stress of about 3200 psia at the pillar face, about 1600 to 1700 psia 50 feet into the pillar, and about 1400 psia at the center. Teufel: 8699-8700; YP 654. Increasing the pillar size to a 320 foot square, the stress of 3200 psia at the pillar face reduced to about 1200 psia at 150 feet. Teufel: 8704; YP 656. The same size pillar at a 2000 foot mining level resulted in stress of 4200 psia at the pillar face and about 2500 psia 150 feet away from the face. Teufel: 8709; YP 657.

Teufel also calculated horizontal stress and found it to be about 1700 to 1800 psia at the center of a 40-by-40-foot pillar and by increasing the size of the central pillar to decrease to close to the lithostatic stress state in the center of a central pillar of 100 feet square. Teufel: 8712-13; YP 658. He did similar calculations beginning with a 40 by 40 foot pillar and 30 by 30 foot rooms at the 1000 foot level and a 60 by 60 foot pillar and 30 by 30 foot rooms at the 2000 foot level, again finding the horizontal stress in the center of the pillar to reach the lithostatic stress with approximately a 100 by 100 foot pillar. Teufel: 8718, 8721; YP 659, YP 660. Based upon his exhibits Teufel concluded that a 100 foot pillar would provide a safe mining environment. Teufel: 8722-23, 8730. In particular, Teufel understood there to be no threat to well casing integrity because neither the vertical nor horizontal stresses exceeded the 4800 psia horizontal stress placed on casing at the 7800 foot depth of the Delaware Formation. Teufel: 8724-30; YP 660, YP 661.

Dr. John Forrest Abel, Jr., testified for the Intervenors about two studies. In the first he applied what he termed the "simplistic subsidence prediction method" found in the Subsidence Engineers Handbook issued by the British National Coal Board. Abel: 13161, 13470-71. He examined the impact of room and pillar mining a 1320 foot wide panel,

leaving 50 x 50 foot pillars which are then split down the middle during second mining, resulting in approximately 85% extraction, and an oil and gas well a 150 feet from underground mine workings at depths of 1400 and 2100 feet. INT 193 at 3-4; Abel: 13158-60. The 150 foot distance to the well was based upon the standard the Mine Health and Safety Administration has established for coal mining. Abel: 13157. Abel determined that at a depth of 1400 feet the average pillar stress on advance mining is approximately 3900 psi and after second mining the average stress on the remaining pillars is approximately 9700 psi and at a depth of 2100 feet the respective stresses are approximately 5900 psi and 14,600 psi. INT 193 at 3; Abel: 13162, 13166. His results were reached by calculating the "tributary load area" of the overlying material from halfway between adjacent pillars up to the surface. Abel: 13163. Abel also used 3510 psi as the unconfined compressive strength of potash ore, as established based upon standard testing procedures. INT 193 at 3; Abel: 13166-67. He examined two angles of draw: 35 degrees used by the National Coal Board as the limit of subsidence and 51 degrees which was the maximum reported by a field study conducted at the Mississippi Potash mine. Abel: 13171, 13173-74; INT 193 at 2, INT 197. An angle of draw is the angle formed by a line extending vertically from the edge of underground mine workings to the surface and another line drawn from the same point underground to the point of zero subsidence on the ground surface. See INT 309 at 25; YP 640.

As explained by Abel, as material is removed underground the load of the overburden transfers to the unmined ground and to mine pillars, but when a panel has been mined to a sufficient width the arch effect can no longer bridge across the space and the area becomes "supercritical" because the pillars cannot support the additional load. Abel: 13178-80. He explained that there is a disagreement among geologists as to the width at which a panel becomes supercritical and will produce the maximum possible vertical subsidence and stated that the answer really depends upon the site-specific geologic conditions. Abel: 13183-84; see Abel: 13208-09 (variable closure at Kerr McGee mine). He also testified that the load transfer distance at the Mississippi Potash mine had been measured as 345 feet at a 1060 foot depth and that the distance increases with depth. Abel: 13180-81, 13190. Abel noted that the National Coal Board used a standard that a panel is supercritical when its width exceeds 1.4 times its depth and that he had used a conversion factor from the Board's Subsidence Engineer's Handbook to reduce the amount of maximum subsidence because under that standard his 1320 foot panel was sub-critical. Abel: 13184, 13190-92, 13217-19; INT 193 at 11.

After arriving at prediction factors for the maximum tilt, extension, and compression at the surface, Abel calculated the maximum vertical subsidence, ground surface tilt, and vertical and horizontal strains over the width of the 1320 foot panel which would occur both upon pillar failure and long term. Abel: 13220-29; INT 193 at 12-13. He then calculated the surface effects for a well located 150 feet from the underground mine workings. Abel found, for example, that using a 35 degree angle of draw for a 1400 foot deep mine with a 4 foot mining height would result in about two inches of vertical subsidence, 2.75 minutes of tilt, approximately .7 foot of horizontal displacement at the well site upon initial pillar failure. Abel: 13231-42; INT 193 at 15-16. According to his calculations, maximum subsidence would result in horizontal displacement at the surface of about 1.5 feet. INT 193 at 16. More dramatically, Abel calculated that a 6.5 foot

mining height in a 1400 foot deep mine would eventually result in 2.5 feet of horizontal displacement at the surface upon completion of subsidence and mining 2100 foot deep with a 6.5 foot mining height would eventually result in over 4.5 feet of horizontal displacement. Abel: 13242-44; INT 193 at 16-17. As portrayed by his exhibits, the amount of displacement diminishes underground to the point where the well bore intersects the angle of draw 214 feet above the mine level for a 35 degree angle of draw. INT 193 at 2, 16.

Next, Abel calculated the horizontal tensile strain and the vertical compressive strain at every 100 feet of the wellbore axis for both mining depths and both angles of draw. INT 193 at 18-22. He found that the maximum compressive strain occurs just above where the wellbore intersects the angle of draw. Abel: 13263-64; INT 193 at 21-23. He believed that the strain in the rock was sufficient that:

> if the well casing is anchored to the rock and the rock moves, you're down to one of three things: Either the well casing moves with the rock, the well casing debonds from the rock, or the well casing, if there's enough compression, it will actually -- well, it may try to hold up the ground -- it will. It will try to hold up all that rock, and there are millions of tons. It couldn't possibly.

Abel: 13264; see Abel: 13454-56. Abel's report describes the possible consequence:

> The potential opening of joints in the rock adjacent to the wellbore under subsidence induced horizontal tensile strain and possible debonding of the well casing under subsidence induced vertical compressive strain provides potential paths for gasses and(or) liquids to move vertically through the rock adjacent to the wellbore, from the ground surface to the limit of [the] subsidence line.

INT 193 at 23; see INT 204 at 12. Finally, Abel calculated the tilt on the wellbore, which also reached maximum near the intersection of the wellbore and the angle of draw. INT 193 at 27-28. In describing his conclusions, Abel stated that he believed that "you're going to get offsets, significant offsets in the well bore" which "could be very hazardous to the people working in the mine." Abel: 13279. Based upon what he had seen in mine shafts, Abel predicted that:

> You would get breaks, offsets, every -- where you had very strong and weak layers in contact, the weak -- and the strong layer was on top, the weak layer would move away, in the process of subsiding, would move away from the one above, both downward and providing a shear between -- at the two bedding surfaces.

Abel: 13279.

In response to Teufel's testimony, Abel undertook additional analysis using a computer program the Bureau of Mines had developed for mining multiple seams in large

flat or inclined ore bodies of relatively uniform thickness, which Abel considered sufficiently similar to potash deposits. Abel: 13299-300. His initial model used a 1200 foot deep mine, a 1500 by 1500 foot mining area within a total area of 2500 by 2500 feet, a seven foot mining height, and an 89% extraction rate. INT 485 at 1. Some of the data used came from measurements made at the Mississippi Potash Mine. Abel: 13303-304, 13354. In different runs of the program he looked at the effect of total convergence of the mined area on levels 150, 300, 600, and 900 feet above the mining level. Abel: 13326, 13331. At the 1050 foot level, 150 feet above the mine, Abel found that the maximum compressive strain occurs 150 feet away from the mined area, resulting in a 45-degree angle. Abel: 13342; INT 485 at 4. He calculated that, if steel casing was subjected to the strain generated at that point, it would be subject to 377,000 psi of stress. Abel: 13344. Looking 300 feet above the mine, Abel found the maximum compressive strain to occur 240 feet outside the mined area, forming an angle of 39 degrees, and would result in about 168,000 psi of stress. Abel: 13346-48; INT 485 at 5.

After conducting a series of runs of his program to see the results produced without any mining and also after 72 inches of closure after mining, Abel ran a series using different pillar sizes. He found that 40 by 40 foot pillars with 75% extraction would be capable of supporting the load they would be carrying when the material was assigned an elastoplastic character, but that there would be 65 inches of closure under yield conditions. Abel: 13377-80. Looking at a 120 foot central pillar surrounded by 8 by 12 foot stump pillars remaining after second mining, Abel found that, as the latter crushed during closure, the load transferred to the central pillar , it would loose over 10 inches when the material was assigned an elastoplastic nature and would loose 50 or more inches when assigned yield material condition. Abel: 13383-85; INT 486 at 69, 75. Changing the surrounding pillars to 40 by 40 foot, Abel found that the central pillar would also shorten about 10 inches upon closure under elastoplastic condition but would be unable to withstand the load under yield material condition and shorten more than 50 inches. Abel: 13386-87; INT 486 at 81, 84, 87. Using physical properties measured in the seventh ore zone at the Mississippi Potash Mine, Abel also calculated that “at 1200 foot depth, a 120 foot pillar is not strong enough to carry the load” and at a depth of 2000 feet a 320 by 320 foot pillar would be needed. Abel: 13388-91; INT 488 at 125-29.

V. D.2 Points of Difference

In many respects it is difficult to evaluate Drs. Teufel's and Abel’s testimony and exhibits. There is no reason to doubt the sophistication of the computer programs they used, but the results reached appear to depend upon the data or assumptions put into them. See Teufel: 14886-87. In addition, Teufel questioned Abel’s adaption of the method described in the Subsidence Engineer’s Handbook published by the British National Coal Board. He believed that the method was suitable to use in the Potash Area to “approximate and characterize the surface subsidence” but could not be appropriately used to calculate subsurface stress and strain. Teufel: 8765-66. Teufel explained that “the method is based on simple geometric considerations, and does not take into account elastic-plastic or brittle fracturing processes that go on in the subsurface,” “doesn't take into account changes in lithology which will affect the elastic and plastic deformation characteristics as you go into the subsurface,” and “does not take into account the

variations in the deformation around the * * * mines themselves." Teufel: 8766, 8885-86. Abel agreed with Teufel that the method "produces stresses which are higher than would be anticipated," but pointed out that it was empirically based, while computer models depend upon the data put into them "and our problem is, we don't have sufficient data at intervening levels between the surface and underground to produce the same kind of model the British produce * * *." Abel: 13273-74; see Abel: 13257-58.

As repeatedly pointed out at the hearing, Teufel used data collected from studies conducted at the WIPP site. Teufel: 8512-13, 8602-603, 8624, 8758-59; YP 674. Abel thought that the elastic constraints Teufel used looked like they were based upon specimen tests rather than field studies and for this reason believed they were too high. Abel: 13302, 13309-14. He seems to have been correct about their origin. See Teufel: 8568, 8774-75, 8898-99, 8906-907. It appears, however, that Teufel did not simply adopt specific numbers from the WIPP studies but interpreted the results of a variety of experiments to derive the numbers he used. Teufel: 8607-08, 8902-906, 8916-18. In particular, Abel disagreed with Teufel's use of an elastic modulus of over 2 million psi for the Salado formation. Abel: 13307-308. For his study derived from the Subsidence Engineer's Handbook, Abel used an elastic modulus of one million psi based upon his experience and laboratory testing of samples from the Mississippi Potash Mine, but in his computer models he used considerably lower numbers because the higher number did not produce mine closure and subsidence as had been measured at Mississippi Potash. Abel: 13246-48, 13520, 13547-48, 13564-65, 13574-75. Teufel was critical of Abel's numbers. Teufel: 14849-52.

The record offers no clear basis on which to resolve such differences, nor is it apparent how this forum might do so. For purposes of this case, the disagreements indicate the limited usefulness of studies based upon generalized properties when making decisions about proposed wells to be drilled at sites with varying lithology and through the more complex McNutt portion of the Salado Formation. See YP 351, YP 352, YP, 353, INT 384 at 9. Teufel assigned a single value to each formation, including the Salado, which he treated as consisting of argillaceous halite. Teufel: 8623-24, 9150-51, 9195; see YP 638, YP 674. Polyhalite, anhydrite, halite, and argillaceous halite, however, apparently have somewhat different properties. See Teufel: 8746, 9058-59, 9109-9110. It also seems that langbeinite is harder than sylvite and would have a higher modulus. Abel: 13469. In addition, Teufel used standard thicknesses for each formation, although he knew that they vary both as to thickness and composition throughout the Potash Area. Teufel: 9149-51, 9211. As explained at the hearing, such an approach was necessary because his computer model required a large number of calculations and adding further complexity would have required the use of a supercomputer. See Teufel: 8921, 9152.

Similarly, Teufel did not model for fractures because the ABAQUS program does not allow it and he did not model for slip surfaces or parting between bedding planes or shear failure due to the extensive computer power which would be needed. Teufel: 9152, 9160, 9368. The conditions under which the various layers which make up the Salado will fracture, however, will vary with the type of rock. Teufel: 9190-93. Abel believed that the greatest stress on wells would occur at the conjunction of bedding planes composed of rock of differing strength where shearing between beds could occur. Abel: 13175-76,

13279, 13570-74. Teufel agreed that the beds could separate but regarded the effect as localized around the mine and did not model individual beds. Teufel: 8569, 9196-202, 9211.

Differences in testimony about the arch effect is another matter which cannot be resolved based on the evidence submitted. During cross-examination, Teufel relied upon his exhibits to estimate that the load transfer distance at a 1000 foot deep mine with 40 by 40 foot rooms and pillars is 100 feet. Teufel: 9225-26, 9229-30. Abel testified, however, that the load transfer distance at the Mississippi Potash Mine had been measured as 345 feet at a depth of 1060 feet. Abel: 13180, 13427. The arch effect itself seems to be a well known phenomena. Simply stated, it is that the weight or load which had been carried by the material which has been mined, transfers to the remaining solid ground, including the mine pillars. Teufel: 9224. The effect appears to be dependant upon a number of factors:

> Field measurements and theory support the concept that there is a stabilizing compression (or pressure) arch in the solid rock above and below the mined-out area. The duration of this arching effect is controlled by the height, width, and length of the mined opening, and subsidence will not begin until a critical void size is exceeded at which the arch will no longer span the excavated area. Consequently, there is often a delay between the onset of a change in state underground and the first appearance of land subsidence at the ground surface. The arching effect may be limited, however, by very weak overburden rocks or by poor mining practice that significantly weakens the overburden. Geologic conditions, mining depth, and seam thickness also affect arching behavior.

INT 309 (F.T. Lee and J.F. Abel, Jr., "Subsidence from Underground Mining: Environmental Analysis and Planning Considerations," (Geological Survey Circular 876, 1983)) at 3; see Teufel: 8654-55, 8669-70.

The obvious implication of the measurement made at the Mississippi Potash Mine is that mining induced stress extends much further than found by Teufel's model. See Abel: 13429-30, 13434; YP 646, YP 647. More generally, the difference suggests that some aspect of the data entered into Teufel's model does not accurately reflect the geology of the Potash Area where the mine is located. On the other hand, the difference may simply reflect Teufel's use of a room and pillar mining method which results in a lower rate of extraction than longwall or modified longwall mining operations. Teufel: 9126-28, 9226, 9352-53, 9359. Although his 75% extraction rate is higher than the 63% or 65% he understood to be the amount of extraction needed to produce more than minimal subsidence, it is much smaller than the 85% mined by IMC and the 90 to 94% removed by Mississippi Potash without second mining. Teufel: 9117, 9175; Abel: 13132, 13140, 13158.

Additional uncertainty about the usefulness of Teufel's computer studies arise from other portions of his testimony. Among other matters, he calculated that a maximum of 4 feet of surface subsidence equated to a vertical strain of four-tenths of a percent and would be insufficient to cause permanent deformation of a bore hole and would be within

the elastic property of well pipe. Teufel: 8683-86, 8692-93, 8779. If this analysis were sufficient, it is unclear what purpose was served by his computer simulation of stress states in varying sizes of pillars. In regard to his computer run using a 200 foot square pillar in the middle of 40 by 40 foot rooms and 40 by 40 foot pillars, Teufel explained that "the reason that we were looking at this very large pillar is basically to go through and see the effect of changing pillar size on the amount of stress that will be transmitted through that pillar in the vertical direction." Teufel: 8694-95. More generally, he explained that his study of pillar size was needed because:

> Well, if you're going to be concerned about the safety of the mines, et cetera, and what the casing is going to be, you want to make sure that you're not going to have a situation where the stresses are sufficiently high to compromise the integrity of that casing.
>
> What we'd like to be able to do is design a pillar of a certain size such that we're not creating significant changes in stress in the rock mass that will be imparted onto that casing.

Teufel: 8697-98. Addressing his plot showing the stress within the 200 foot pillar, Teufel testified that, like his more simple analysis, "[t]he stress here in the rock mass that will be imparted onto the casing itself is not sufficient to cause any problems with casing integrity." Teufel: 8700.

Teufel, however, seems to have been unaware of any published tolerances for well pipe and his conclusions appear to derive from the fact that wells drilled to 7800 feet deep in the Delaware Formation withstand 7800 psi of vertical stress and 4800 psi of horizontal stress. Teufel: 8700-01, 8713-14, 8725-32, 9304, 14879-80; see YP 639. Based upon this standard, 40 by 40 foot pillars would also seem to be sufficient, suggesting that his additional computer runs using a large central pillar were primarily for the purpose of identifying the size for which the stress state would approach the lithostatic. See Teufel: 9287-88, 9302-304, 9326-27; YP 658. On this basis Teufel testified that a potash mining operation could safely mine through an area where there was a preexisting oil and gas well by planning and leaving a 100 by 100 foot pillar around the well along with the smaller pillars normally left during first mining. See Teufel: 8822, 8834-36.

On the other hand, Teufel's testimony that insufficient stress will be generated seems to be at odds with his analysis, presented primarily during his rebuttal testimony that the stress resulting as pillars deform will lead to a loss of the bond between the halite and the casing. The subject first arose near the close of his recross examination. Teufel explained that the vertical compressive strain would produce a difference in the compressive stress on the rock constituting a pillar and the well casing within it which, in the example he calculated:

> far exceeds the strength, shear strength of the halite or potash. It exceeds the strength of the casing -- cement, and what's going to happen is that as you deform this pillar and it increases, you're going get a failure of the interface between the halite and the casing. It's going to debond, and

> therefore, any subsequent strain or deformation will not be imparted onto the casing itself. Basically, the casing, at that point, is sitting free inside the pillar. It's debonded, there's no more load being applied.

Teufel: 9369-76. Abel described the situation somewhat differently, explaining that the compressive strain was in the rock and:

> if the well casing is anchored to the rock and the rock moves, you're down to one of three things: Either the well casing moves with the rock, the well casing debonds from the rock, or the well casing, if there's enough compression, it will actually -- well, it may try to hold up the ground -- it will. It will try to hold up all that rock, and there are millions of tons. It couldn't possibly.

Abel: 13264.

During his rebuttal testimony, Teufel described Abel as having discussed vertical compressive stress or strain due to subsidence, horizontal tensile strain or stress resulting from subsidence, and horizontal shear stress or strain during subsidence. Teufel: 14855. In regard to vertical compressive strain, Teufel again explained that the difference between the modulus of the casing and that of the surrounding salt would result in a stress difference between the rock and the casing which would result in debonding and "the rock will basically slide down around the casing, past the casing, as continued deformation goes on." Teufel: 14856. Similarly, Teufel understood that, as tensile strain formed, the difference in the tensile strength of the rock and the casing would result in either the rock debonding from the casing "or the tensile strength of the rock itself is exceeded, and you'll basically create a local tensile crack within a material itself, and it will move with that deformation." Teufel: 14858. On the subject of horizontal shear strain, Teufel did not believe that Abel's study showed sufficient displacement to cause problems with the integrity of casing. Teufel: 14859. Moreover, he explained that all three processes would be occurring at the same time and:

> what happens is that either the compressive strains and stresses, the stress difference between the casing and the rock, debonds the material, forms a temporary gap around the pipe, the evolution of the horizontal tensile strain and associated stresses do the same thing.
>
> They either form a gap around the -- between the rock and the casing or cause tensile failure of the rock very near the casing. Those allow a gap to form, a void space, if you like, which can accommodate any sort of shear displacement that you might have during this shear deformation, that might actually occur there.

Teufel: 14860.

Teufel may be correct that debonding will result in a void that precludes the load from transferring to casing and crushing it, but if debonding necessarily occurs, there

seems to have been no need for either his or Abel's computer models examining the amount of stress which might result from subsidence. See Teufel: 14878-80, 14883-85, 14898-99. On the other hand, it does not appear that Abel agreed that debonding would occur, only that it might. See INT 193 at 23.

V. D.3 Plane of Draw

Complicating differences in computer models, the Appellants frame part of their argument brief based upon a mischaracterization. They argue in their post hearing brief that:

> Although there is some downward flexing movement of the earth associated with subsurface deformation caused by potash mining, no movement has ever been documented along the plane of draw. It is undisputed that there is no slippage or shear plane along the plane of draw. Inasmuch as no slippage or shearing occurs along the plane of draw, subsidence will not shear or crush oil well casings or collars.

App. PH Brief at 98. The Appellants next assert that Abel "agreed that there would not be slippage along the plane of draw," and they quote the following portion of his testimony as establishing the point:

> Q. In that case. And I think you had told us that the slippage -- that there is not going to be slippage along the angle of draw, correct?
>
> A. I told you I do not believe there is going to be slippage --
>
> Q. That's right.
>
> A. -- along the angle of draw. And I've tried to find it.
>
> Q. And you've never found it?
>
> A. I know people that said they have. I just -- I don't believe it exists because I haven't seen it, and a lot of other people haven't.

Abel: 13585. The Appellants conclude: "Thus, surface subsidence and subsurface deformation will not damage, by shearing and/or crushing, oil well casings and collars." App. PH Brief at 99. In their reply brief, the Appellants assert that BLM and:

> the Potash Industry have consistently and routinely claimed that mining induced subsidence will result in subsurface movement of rock masses along the angle of draw sufficient to cause well bore casings to shear or crush. The sole basis for any claim that mining induced subsidence can create a potential hazard is the claim of subsurface rock movement along the angle of draw. * * * The speculation that subsidence could shear or otherwise damage well casings and collar, resulting in a gas leak is

> predicated upon the universally rejected idea that slippage occurs along the plane of draw. The evidence presented by both Appellants and the Potash Industry in this case is undisputed that no slippage will occur.

App. PH Reply at 22-23; see Pogo Response to Int. Sur-reply at 23. The Appellants again quote Abel's testimony and conclude that based upon it "this tribunal is required to reject the Potash Industry's assertion * * * that, `subsidence can potentially affect any portion of the oil and gas well casing that is located within the angle of draw.'" Id. at 23. [75/]

Whatever "the Potash Industry" may have stated in some other forum, the Intervenors in this case do not argue in this proceeding that the angle of draw and plane of draw identify a line along which depositional beds will shear. To the contrary, they agree that "the angle of draw itself does not operate as a shearing plane, and there is no evidence that slippage actually occurs along the angle of draw" and they explain that "the effects of subsidence will be felt inside of the angle of draw but will not be measurable outside of it." Int. PH Brief at 208.

The subject of the plane of draw was brought up repeatedly during the hearing. The Appellants' contention appears to originate in the misdescription of drawings which illustrate geological processes during subsidence. See INT 201, INT 309 at 3, BLMCO42141. Early in his testimony Teufel described one of the Intervenors' exhibits, titled "Convergence After Completion of Second Mining" as showing:

> a mine with a room and pillar, apparently after second mining, there is deformation of the -- of the mine itself with closure of the mine, convergence, and basically, you see the deformation of the rock mass above the line, you see a very straight line with arrows indicating shear displacement or movement down that -- those lines, and I suspect that is the angle or plane of draw indicated there. In the rock mass above it, you see that the rock mass is -- appears to be highly fractured.
>
> * * * * *
>
> What is being portrayed here, in my opinion, is that they're suggesting or indicating that this plane of draw, or this line, is basically a shear fault or a shear fracture, where you have displacement and deformation along the plane of draw, with deformation on the side inside

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[75/] Despite the Appellants' conclusion quoted above, the paragraph continues by pointing out that the Intervenors' post hearing brief cites Abel in stating that "the ground movements caused by such shearing along bedding planes are likely to be significant and could lead to shearing or debonding of oil and gas well casings." App. PH Reply at 23-24 (quoting INT PH Brief at 210). The Appellants next state that Abel addressed "this matter" during cross examination, quote 12 pages of his testimony, and state that it "reveal[s] three possible conditions." Their subsequent discussion, however, does not address statements by Able appearing on the 12 pages. Rather, it is based upon Teufel's description of Abel's testimony presented during rebuttal. See Teufel: 14854-61.

the disturbed area, above the line itself, and basically, undeformed rock on the opposite side, or away from the plane of draw away from the mine.

Basically, it's suggesting or portraying that this plane of draw is, in fact, a shear fault.

* * * * *

The representation of the plane of draw is a very straight line of shear deformation or shear fault, is a total misrepresentation of what the plane of draw is supposed to be.

Again, it's an imaginary line that connects the subsurface mine locations or where second mining is to the surface. It does not and never has been defined as a line of process that it would indicate shear deformation. This is a total misrepresentation of its response.

* * * * *

The plane of draw and the angle of draw have -- do not indicate physical process. Again, they are reference lines from the mine to the surface, and they should be treated only as that. They do not denote what deformation processes are going on in the subsurface.

Teufel: 8541-43; see 9330-33. Despite his criticism of the exhibit, however, Teufel seems to have understood that such drawings are simply a "descriptive and visual, conceptual model." Teufel: 8671, 9199, 9259.

Abel's testimony which the Appellants quote was not an affirmative agreement that there is no slippage along the plane of draw, but a more limited statement that he did not believe there is slippage because he had never seen evidence of it. More fundamentally, Abel disagreed with the portrayal of the plane of draw as a straight line. When later discussing how subsidence is portrayed on conceptual drawings, Abel was asked: "But what we know is that there isn't a straight line that goes straight down from the edge of subsidence down to the edge of the mine, is it? Like you draw an angle of draw?" and he responded that the "Coal Board, and people who draw in a straight line, angle of draw are fundamentally wrong." Abel: 13490. Indeed, in relation to his own drawing Abel stated: "I do not believe you have a plane where the ground is moving -- sliding down that plane." Abel, 13495. When directly asked: "But again, there is no plane where there's movement along either side of it, correct?" -- Abel answered: "I do not believe there's a plane." Abel, 13496. Instead, Abel understood the angle of draw to vary with the lithology, steeper in more competent rock and flatter in less competent rock, but without forming an actual plane within the strata. Abel: 13476; see Abel: 13177, 13495-96; INT 488 at 2; INT 193 at 5.

The shearing of concern to the Intervenors, which was discussed by Abel, is not along the plane of draw but within the area of subsidence. Abel regarded the strata in the

potash basin as consisting of relatively weak types of rock, with exceptions including anhydrite, polyhalite, and dolomite. Abel: 13176. He explained that:

> Well, what you get when you have differentially stiff, strong bands, is when the beds deflect downward, the softer bed, a softer bed below a stronger bed will actually leave. You get bed separations, and you get shears between -- on the bedding contacts.

Abel: 13176, 13584. Abel further explained that shearing could occur at the contacts between the beds because their deformation characteristics are different and, when the same stress is applied to both, the lower competency rock has more displacement. Abel: 13177, 13279. He also discussed instances of studies which measured displacement during subsidence that indicated slippage between beds. Abel: 13284-98, 13497-99; INT 488 at 7, 26, 30.

Abel also discussed an illustration he had included in one of his exhibits showing horizontal offsets in a shaft lining in Germany that had been mapped while sinking the shaft. Abel: 13284-88; INT 488 at 7. Another illustration showed offsets measured in beds as longwall mining approached and passed an instrumented bore hole. Abel: 13289-93; INT 488 at 30. In a third case, measurements made in bore holes found horizontal displacement associated with sulfur mining on the top of a salt dome. Abel: 13294-97; INT 488 at 26-27. Abel understood the results to show shearing. Abel: 13298.

Ultimately, the Appellant's error is logical rather than factual. Accepting that Teufel and Abel are correct that the plane of draw is not a plane of shear, it does not follow that shearing cannot occur between beds. Nor does it preclude the possibility that movement within the plane of draw will generates sufficient stress to damage well casing.

V. D.4 Angle of Draw

An additional concern about Teufel's computer model arises from his finding that surface subsidence above a 1000-foot deep, 2000 foot wide mine, with an eight foot mining height, pillars of 24 by 24 feet, and an extraction rate of 90% would result, after one year, in maximum subsidence of 3.47 feet, subsidence extending 306 feet away from the mine, and an angle of draw of 17 degrees. Teufel: 8631, 9172, 9176; YP 641. Teufel testified that, when he later obtained the measurements of subsidence taken at the Southwest Potash Mine (later the Amax Mine and even later the Horizon Mine), the data "was consistent, reasonably consistent with the observation that we observe in our calculations." Teufel: 8631-32, 9174; YP 642. The measurements, he believed, showed that his model was able to calculate a good approximation of what the surface subsidence would actually be. Teufel: 8632-33, 9179-80, 9274-76.

The exhibits showing measurements taken at the mine, however, show that the surface actually subsided a maximum of four feet and that the angle of draw measured at various locations was 9, 13, 22, 28, and 36 degrees. Teufel: 9177-78; YP 642; see INT 194, INT 195. Teufel did not discuss the fact that his model had yielded a maximum subsidence of 3.47 feet rather than the four feet which occurred at Amax. Nor is it clear

how his 17 degree angle of draw relates to the data from the Amax mine other than that it falls within the range of what was measured there. See Teufel: 9179-80, 9205-06, 9275. In both instances, the differences suggest that either the data Teufel entered into his model or the model itself is insufficient to predict the extent of subsidence which may occur.

Other documents in the record also indicate a variation in the angle of draw in subsidence above potash mines in New Mexico. A report on room and pillar mining at the U.S. Potash Company Mine which had removed a potash bed varying from 5 to 15 feet at a depth of 1000 feet leaving pillars generally 58 by 58 feet which were then second mined, reported subsidence to extend as much as 700 feet beyond where final mining had reached the limit of the ore body and up to 1200 feet where mining had stopped in a first mined area, found major surface subsidence of approximately eight and a half feet, and the angle of draw to range from 30 to 51 degrees. INT 197 at 1-2. See INT 291 at 14; INT 289 at 20a (47 to 58 degrees). Apparently based primarily on the data from the Mississippi Potash Mine, a study on the closure of the Wills-Weaver Mine conducted under contract to the U.S. Geological Survey states that:

> the regions of the surface liable to experience movement as a result of high recovery mining will correspond roughly to an angle of influence of 45 to 55 degrees. More severe movements and strains will occur within a zone characterized by an approximate 30 to 35 degree influence angle.

YP 597 (INT 203) at 63. The report also states that the "data from the southeast New Mexico potash fields suggest that a reasonable limit for defining this zone of disturbance would be an angle of 45 degrees from the vertical." Id. at 73. Even the NMOCC recognizes that "secondary mining causes subsidence of the overburden the effects of which tend to expand beyond the mined out area a distance approximately equal to the depth of the mined area." YP 262 at 3.

Several studies state that, as a general rule, the depth of surface subsidence will be two-thirds of the underground mining height. INT 198 at 7; INT 202 at 18. The one prepared for the Wills-Weaver Mine states that the extent of vertical surface subsidence at potash mines in New Mexico varies with the degree of extraction and for 100% extraction would be close to the thickness of the mined orebody because "[t]here appears to be very little "break-up and bulking of the overlying strata." INT 203 at 64, 72. Correspondingly, it notes that mining 50 to 100 feet above earlier mining found no generally uniform subsidence of the overlying strata. Id. at 64, 72. The report on the Mississippi Potash Mine identified a maximum subsidence of eight and a half feet over 12.5 to 14 feet of mined ore and concluded that "[a]s a general rule it may be stated that near the center of the subsidence basin the average subsidence appears to be about 55 to 60% of the thickness of the ore mined." INT 291 at 13-14; cf. INT 193 at 10, 13; see also INT 196 (7 foot vertical subsidence).

As both Teufel and Abel recognized, the wide range of measured angles of draw likely reflects local variations in geology, the amount of material extracted, the mining method used, the shape of the area mined, and the extent to which adjoining areas had

been mined. See Teufel: 8870-72, 9118, 9178-79, 9275, 9354-55; Abel: 13395-96, 13408; INT 203 at 64. Accepting that they are correct, the conclusion to be drawn for purposes of this proceeding is that decisions about whether an oil and gas well will pose a hazard to potash mining operations, or more specifically the distance from a mine at which a well may be drilled without constituting a hazard to mining, must be decided based in part upon specific information about the geology of the proposed drilling site.

At the same time, the Intervenors' apparent argument that oil and gas drilling should be prohibited within the angle of draw cannot be accepted. See Int. PH Brief at 207-208; Abel: 13439-40. By definition, the angle of draw is measured using the point which is the limit of detectable surface subsidence. The Intervenors are correct that "[s]ubsidence can potentially affect any portion of the oil and gas well casing that is located within the angle of draw." Int. PH Reply at 207. They do not argue, however, that all subsidence within the angle of draw can generate sufficient forces to damage well casing. Even assuming that a small amount of subsidence will place some amount of stress upon well casing, the amount of stress which may be produced will vary within the angle of draw and in some portion of the area the amount will be minimal. Consistent with this understanding, Abel found the maximum compressive strain to occur just above where the wellbore at 150 feet crosses the angle of draw. Abel: 13263-64; INT 193 at 21-23. see Abel: 13419, 13525-26. By implication, the amount of strain on a wellbore further away from a mine would be less, even though located within the angle of draw.

Something similar seems to be the point of the comment in Dr. Syd S. Peng's book that the angle of draw is "more or less of academic interest." INT 488 at 38. Although the Appellants have used the phrase to dismiss the Intervenors' reliance upon the concept of an angle of draw (see Teufel: 8528-29), Peng went on to explain that the reason was that "the subsidence profile levels off and subsidence becomes very small far before it reaches the edges of the subsidence basin, and from surface structural damages point of view, it is in practice meaningless." INT 488 at 38. Rather than rejecting the use of angles to analyze subsidence, Peng considered what he termed the angle of critical deformation and the angle of break to be "more useful." Id. It has also been noted that the value of using an angle of draw depends upon the accuracy with which surface subsidence is measured. See INT 289 at 18.

VI. Review of the Decisions Denying APD's

It has been many years since this case was referred for a hearing by the Interior Board of Land Appeals (IBLA). It also has been a number of years since the hearing was held. As stated at the outset and should be obvious at this point, whatever the IBLA may have contemplated as the factual issues to be addressed by a hearing, the case has become considerably broader and more complex. A substantial portion of this decision has been devoted to the Appellants' various claims and arguments about the meaning and application of provisions of the Secretary's 1986 Order and the related testimony and exhibits they have presented. Even issues which may have appeared to be wholly factual have become largely or partially dependent upon interpretation of provisions of the Order, sometimes overshadowing the importance of evidence presented at the hearing. There are even a few provisions yet to discuss.

It appears that by 1973 the four oil and gas lease stipulations, which were the key feature of the Secretary's 1951 Order, revised in 1965, allowing "concurrent operations" for oil and gas and potash within the Potash Area, no longer provided a sufficient basis for the USGS to make decisions about whether and where to approve oil and gas drilling, or at least allow it to make decisions which did not engender further disputes between potash mining companies and oil and gas drilling interests. The 1975 Order set forth a procedure for identifying areas of potash enclave and declared, as a matter of Departmental policy, that it would "deny approval of most applications for permits to drill oil and gas tests from surface locations within the potash enclaves * * *." 40 FR 51486, 51487 (Nov. 5, 1975). The strong limitation on oil and gas drilling established by the policy was eased by two "exceptions" which allowed drilling "to take place from barren areas within the potash enclaves" and, when no barren area was available or drilling could not be allowed from any barren area for other reasons, the establishment of "a drilling island located within a potash enclave." Id. Areas which lack any appreciable amount of potash, also referred to as "salt horses," have long been known to exist within the Potash Area. See INT 1 at 8-10. The concept of using drilling islands within the Potash Area originates in the previously discussed September 6, 1973, memorandum by the Central Region Conservation Manager. YP 237.

Although neither industry may have been fully satisfied, the resolution arrived at by the Department in the 1975 Order appears to have worked reasonably well and the Order was reissued in 1986 without significant modification of the provisions which govern decisions on oil and gas drilling. [76/] Clearly, however, the 1986 Order is not satisfactory to the Appellants who seek to drill oil and gas wells in areas which have been designated as potash enclave and have undertaken considerable effort and expense in challenging the State Director's decisions denying approval of their APD's. Although the Appellants seek a ruling on not only every matter mentioned in those decisions but also in the decision rationales and category II forms that were prepared when reviewing their

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[76]/ The record provides little information about the reasons the 1975 Order was revised and reissued in 1986 except for the need to incorporate the change in administrative responsibility for the Potash Area from the USGS to BLM. There is no indication of the reason the 1986 Order was published in the Federal Register with numerous errors requiring correction. See Appendix A.

APD's (see App. PH Brief at 137-88; YP 147, YP 166), consistent with the response to their arguments which has been presented in this decision, there are only a limited number of subjects to be addressed in ruling on the decisions which denied approval of their APD's. [77/]

The earliest decisions by the New Mexico State Director which are at issue in this proceeding are dated June 29, 1992. He denied approval of Pogo's APD's for the Mobil Federal wells numbers 2 and 3 (IBLA 92-614), stating that:

> The physical characteristics of the ore body and the feasibility of economically mining potash in the subject area have been evaluated. The ore zone in the vicinity of the proposed well site is currently being mined to the northwest of the area in question. This, combined with a mineralogical evaluation of the ore zone, leads us to conclude that the fourth ore zone constitutes a "Potash Enclave." Therefore the drilling of this well may result in undue waste of potash.

YP 1, RP 001166; YP 2, RP 001308. The case files include the decision rationales BLM prepared, but do not otherwise provide documentation of a "mineralogical evaluation" of the area. YP 82, RP 001279-80; YP 83, RP 001325-26. The decision rationales correctly note that BLM had identified portions of several ore zones in the area as potash enclave, but do not expressly state that the proposed well sites are within one of them. The copies

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[77/] Although the decisions denying approval of the APD's were signed by or on behalf of the State Director, the applications were reviewed and the decision rationales, and later the category II forms, were prepared by personnel in the Carlsbad Resource Area office, whose work was reviewed by the Rosewell District Manager as well as personnel in the state office. Herrell: 1907-12, 1915-18, 3736-37; Jordan: 2557-58, 2575-76, 2614-18; Manus: 4407-11, 4636-37; Cone: 10680-87, 10696-98. Monte Jordan, who signed some decisions for the State Director when he was Associate State Director and had others signed on his behalf when he was Acting State Director, explained that he relied upon not only the staff within the state office but also the fact that the documents had been reviewed and signed or initialed by personnel in the district and area offices. Jordan: 2557-58, 2575-77, 2614-18, 2665, 2672, 2683-90. Other BLM supervisors similarly indicated that they had relied upon the substantive review conducted by the staff and generally accepted their recommendations. Cherry: 3098-99; Manus: 4384; Cone: 10681-83, 10695-97. Other testimony establishes that there were instances when BLM personnel raised questions about a number of applications, discussed them, and sometimes returned the review documents for further work. Herrell: 1918-24; Manus: 4410-11, 4634-36; Cone: 10683-84, 10687-94, 10821, 11215. There was also testimony, however, that the various signatures and initials which appear on the decision rationales and the category II forms did not always mean that the person concurred in the analysis and recommendation, or even had read the document, but only that the person was aware of it. Lopez: 1740-41, 1746-47, 1754-56, 1780-82; Herrell: 1913-14, 1985, 2289-90; Jordan: 2682-92; Cranston: 4289-92. The review process resulted in decisions for which the signatory could not be questioned about the reasons for denial and frequently the reasons set forth in the decisions do not clearly reflect the findings indicated in the underlying decision rationale and category II forms and their accompanying maps. Nor do the documents allow a conclusion that the State Director's signature represents agreement with every statement made in recommending that the APD be denied.

of two maps which are attached to each rationale also do not show the well sites to be within an area of potash enclave, the fourth ore zone in particular, although they differ in their portrayal of the ore zone boundary. See YP 82, RP 001281-82; YP 83, RP 001327-28. Nor does the State Director's decision expressly find that the well sites are within a potash enclave. Absent such a finding, the decisions are not supported by the potash enclave policy. The applications are remanded to BLM for further review consistent with this decision. [78]/

Prior to the State Director's decisions on the two Mobil Federal wells, the Carlsbad Resource Area Manager had issued decisions denying approval of APD's for Pogo's Federal 23 wells numbers 4 and 6 through 16 and Yates's Martha wells numbers 7 through 9 and its Dolores well number 4. The State Director's July 20, 1992, decisions upholding the Area Manager's decisions respond to the arguments and evidence presented by the Appellants in their presentations to him, but set forth limited reasons for his conclusions. His decisions indicate that he understood the Area Manager to have denied approval of the APD's because the well sites are within an area of potash enclave and he agreed with the Area Manager "that there are economical potash reserves in the subject area." He did not, however, explicitly uphold the Area Manager's decisions based upon the potash enclave policy. Instead, he concluded that the wells "have the potential to make the mining of potash unsafe and ultimately uneconomic, therefore constituting undue waste of potash" and that, based upon the estimate that mining would begin in the area in 10 or 15 years, "drilling would create a situation where active mining and oil and gas operations would exist in the same space simultaneously" and constitute "an unsafe condition, creating [generating] unnecessary hazards to both industries." YP 80 at RP 001050; YP 81 at RP 009615.

The reasons set forth by the State Director are not in accord with the 1986 Order. The second oil and gas lease stipulation calls for a determination whether a proposed well would "constitute a hazard to * * * mining operations being conducted for the extraction of potash deposits." Appendix A, § III.A.2. It requires a determination that a well would present a hazard to mining operations, not simply the "potential" to make mining potash unsafe. Indeed, if the Intervenors are correct, all oil and gas wells within the Potash Area have the potential to allow fluids, methane in particular, to enter and migrate through the McNutt portion of the Salado Formation. Finding a "potential" to make mining unsafe to be a sufficient basis to deny approval of an APD would have the effect of prohibiting oil and gas drilling within most or all of the Potash Area, possibly allowing wells to be drilled only on its periphery or in large barren areas. Significantly, at the time of the decisions were issued, the closest potash mining operation was at least several miles to the north. The State Director's decisions lack any indication that he believed that the proposed wells

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[78]/ The Appellants request rulings on the merits of their applications. App. PH Brief at 199; Tr. 115-16; see Int. PH Brief at 295-97. This decision, however, addresses the propriety of BLM's decisions denying approval of their APD's, not the merits of their applications. As stated by the IBLA, "the primary focus of the hearing will be on whether BLM's denial of the APD's accords with the provisions of the 1986 Order." Yates Petroleum Corp., 131 IBLA 230, 235 (1994). The hearing is not a substitute for review of each APD by BLM personnel to determine whether it satisfies each provision of the 1986 Order.

would "constitute a hazard" to those operations and his concern that drilling would lead to hazards when mining began an estimated 10 or 15 years later was not addressed to "mining operations being conducted" as called for by the stipulation. [79/]

The State Director was further mistaken in concluding that a "potential" to make potash mining unsafe constitutes an "undue waste of potash." Not only does the undue waste provision of the second oil and gas lease stipulation pertain to potash deposits rather than mining operations, it calls for a determination that drilling "would result" in undue waste. Even if, as has been discussed, it were construed to address concerns about safety, a finding that there is a "potential to make the mining of potash unsafe" is insufficient to conclude that drilling "would result" in a waste of potash, whether due or undue. In addition, the State Director's use of the term "potash reserves" fails to distinguish whether, in the terminology appearing on the large potash enclave maps, he was concerned with measured reserves (i.e. potash enclave) or indicated reserves. Accordingly, the decisions do not provide sufficient reason to deny approval of the APD's and the applications are remanded to BLM for further review consistent with this decision.

The State Director's decisions on Yates's APD's for the additional Martha wells, which constitute the remainder of the Livingston Ridge sites, were issued on August 21 and 28, and November 6, 1992. Unlike the earlier decisions, the APD's were denied because, as more fully quoted previously, the fourth and tenth ore zones were found to constitute potash enclave and drilling "may result in undue waste of potash." YP 9a, RP 002138; YP 12a, RP 002249; YP 14a, RP 002232; YP 16a, RP 002395; YP 18a, RP 002493. The decision rationales suggest that BLM's evaluation of "the physical characteristics of the ore body and the feasibility of economically mining potash" and its "a mineralogical evaluation of the ore zone" primarily consisted of an examination of its ore zone maps. Each states that the proposed well site is within an area of potash enclave and the fact is illustrated by maps showing the boundary of potash enclaves for the fourth and tenth ore zones and the locations of the proposed well. YP 90, RP 002142; YP 93, RP 002255; YP 95, RP 002335; YP 97, RP 002398; YP 99, RP 002496.

Although the State Director apparently understood that the proposed well sites are within areas BLM had designated as potash enclave, the record does not allow a ruling that the applications were properly denied on that basis. As has been discussed, it does not allow a conclusion that the standards of 4 feet of 10% K_2O as sylvite and 4 feet of 4% K_2O as langbeinite, or an equivalent combination of the two, as adopted by Van Sickle in 1974 for the purpose of identifying areas of potash enclave, continue to identify the thickness and quality of potash which is "mineable under existing technology and

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[79/] The determination may have been based solely on the fact that the wells would be drilled in areas BLM understood to contain mineable potash. Of the group of wells, only the casefiles for the Federal 23 number 6 well and the Dolores number 4 well include a "Special Drilling Stipulation" form on which casing and cementing requirements have been added in the blanks provided. The Form 3160-3 applications for those wells also bear handwritten notes which appear to require modification of the proposed drilling plan. Similar notes appear on a number of applications.

economics." As has also been discussed, the Appellants have failed to offer a meaningful alternative to his standards. Notably, there also is no indication that either the USGS or BLM has reviewed the standards subsequent to their adoption. The analysis of the Mineral Land Classification Board has merit in its use of a simple ratio of market price and production costs, but the figures it used are from 1969-70. The record provides more current information about both, but is insufficient to allow an economic analysis as to the appropriate figures, a matter better addressed in the first instance by specialists within the Department.

It is also apparent that a systematic review of the core hole data from which the ore zone maps were prepared would be beneficial. The designations of "B" and "M" may have been adequate for the purpose of preparing maps of potash enclaves in 1974, but, as noted in discussing Gary Hutchinson's testimony, BLM apparently has available more detailed information for a number of core holes. Information from core holes was to be filed with the USGS, and later BLM, and more complete data may be available from the potash mining companies. See Waugh: 11914-15. There are indications that review of the data could lead to a different analysis of some core holes and reinterpretation of areas of potash enclave. See e.g., Waugh: 11560-62. Although the exhibits David Waugh prepared for the Intervenors using core hole information held by IMC portray LMR's rather than areas of potash enclave as defined in the 1986 Order, they show areas of mineable potash which are conspicuously different from the corresponding areas of BLM's ore zone maps, further suggesting that an evaluation of the underlying data might more accurately identify areas of potash enclave. Very few core holes seem to have been drilled from the surface in recent years other than in the area of the WIPP facility, but presumably additional information can be obtained from well logs for many of the approximately 2,000 oil and gas wells which have drilled within the Potash Area. They may provide only limited information about potash grades, but could allow BLM to develop, and make decisions based upon, a more detailed understanding of the geological structure of the McNutt Formation in various portions of the Potash Area.

In addition, the methods used to produce geological maps have significantly changed since the ore zones maps were drawn in 1974. There is no reason to believe that the methods used to interpolate core hole data and draw the ore zone maps in 1974 were not in accord with contemporary methods of geological analysis. The more recent geological maps which have been introduced into the record are strikingly different, however, because they were generated using computer mapping programs which allow a more sophisticated presentation of data. See Waugh: 11498-501. For example, the Appellants' maps of the Livingston Ridge field and other areas they seek to drill portray the projected thickness of the targeted pay zone, a feature not found on the potash ore zone maps. See, e.g., YP 377, YP 384, YP 385.

Improved ore zone maps would not only provide a better picture of areas of mineable potash and aid application of the potash enclave policy, but could identify barren areas and assist the location of drilling islands. The Appellants do not challenge the portions of the State Director's decisions identifying alternative sites from which they

might directionally drill wells. [80/] Indeed, they do not wish to directionally drill the wells at issue; nor would they want to do so elsewhere within the Potash Area. App. PH Brief at 43, 165. They maintain that directional drilling is not economically viable within the Potash Area. App. PH Brief at 80; App. Prelim. SOR at 44; Pogo Final SOR at 54; see Hoose: 5442-44, Fant: 5770-75, 6170-6205.

Nevertheless, the Appellants have argued that BLM has failed to properly implement the drilling island provisions of the 1986 Order and they assert that it, and the 1983 Directive and Instructions, require BLM to establish drilling islands "consistent with present directional drilling capabilities" as stated in the Order. App. PH Reply at 111-15. They contend that, properly interpreted, the drilling island portion of the 1986 Order entitles then to drill vertical wells from locations within potash enclaves. See id. at 81, 113-14; Yates Resp. to Int. PH Sur-Reply at 16-17, 67-69; App. Prelim. SOR at 43-44; Pogo Final SOR at 53-54; Yates Final SOR at 38-39. As referred to in the State Director's decisions, at one time Pogo petitioned BLM to establish 16 five-acre drilling islands within a 640 acre section in an area of potash enclave, but identified a single well to be drilled within each island, apparently mimicking 40-acre state spacing requirements for oil and gas wells. RP 006341-50. Taking a different approach, Yates proposed that BLM establish 600 foot wide "drilling corridors" in both the north half and the south half of a section along the boundary of the quarter sections for some of its Martha and Dolores wells and disallow potash mining within the corridors. YP 268 at IMC00471-72; see App. PH Reply at 113.

The Appellants fail to understand the extent to which both drilling islands and directional drilling are fundamental components of the resolution reached by the 1975 and 1986 Orders. The exceptions for both barren areas and drilling islands, set forth in terms of drilling "vertical or directional holes," establish that multiple wells are to be drilled from a single island. See YP 237 at BLMCO17410, YP 238 at BLMCO17426. Even more clearly, the Order speaks of BLM establishing "an island within the potash enclave from which the drilling of that well and subsequent wells will be permitted." Appendix A, § III.E.1.b (emphasis supplied). As stated in the Instructions which accompanied the 1983 Directive: "A drilling island is a location from which multiple holes can be drilled to maximize the recovery of oil and gas and minimize the loss of potash." YP 249 at RP 006306; see YP 237 at BLMCO17410 (one pillar to support a number of wells).

A drilling island is established by identifying a site within which wells may be

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[80/] For purposes of the 1986 Order, "directional drilling" primarily refers to vertically drilling through the McNutt portion of the Salado Formation until a designated depth is reached and then either drilling at an angle to reach a bottom hole location or, after drilling a distance at an angle, returning to vertical to reach a targeted area. See YP 249 at RP006308, YP 383. In addition, a well might be drilled vertically until reaching a targeted depth and then drilled laterally in one or more directions. Although drilling a well at an angle from a surface location to a target can also be termed "directional drilling," such wells would not satisfy the 1986 Order because they would intersect the McNutt Formation at an angle, placing drill pipe through larger portions of the potash beds. See YP 249 at RP 006308 ("Each well shall be drilled vertically until it has completely penetrated the potash interval after which it may be deviated").

drilled and designating the distance from the site, or the surface area surrounding it, within which APD's for wells can be drilled from the site under the exception to the enclave policy. The distance, or the surface area affected by a drilling island, is to be "consistent with present directional drilling capabilities" and, when a barren area is not available, the drilling island site is to be selected to "minimize the loss of potash ore." Appendix A, § III.E.1.b. The 1983 Instructions identified "[t]he maximum horizontal displacement from a drilling island" at that time as "three-fourths of a mile, based on current technology." YP 249 at RP 006308; see O'Brien: 10446; Schoch: 13657, 13852-53; Mitchell: 13975. If, for example, BLM were to apply this distance when designating a drilling island in the center of a section, an admittedly unorthodox location, all "subsequent" wells that might be vertically drilled within the area, which would include the 40-acre spacing units within the section and most or all of those bordering the section, would be drilled from the island. Positioning the initial well and island at an orthodox location within a 40-acre spacing unit would alter the specific spacing units which fall within the three-quarter mile range. The size of the area designated as the drilling island site would depend upon the number of wells which might be drilled from it as well as the need for surface facilities. See YP 249 at RP 006308 (wells to be not less than 120 feet apart). By implication, when BLM has established a drilling island, APD's for subsequent wells within the affected surface area which do not originate from the island are to be denied under the potash enclave policy.

As described by the Instructions accompanying the 1983 Directive, when BLM cannot approve an APD, it "will seek to establish a drilling island from which the lease can be developed" and, if one is established, return the APD "to the operator with instructions for developing the lease from the drilling island." YP 249 at RP 006307; see YP 244 at BLMCO35818-19. [81/] Thus, the selection of a drilling island does not depend upon BLM receiving an application requesting one. Instead, the Instructions provide that, when BLM is considering establishing a drilling island at a site, it is to contact "all affected lessees" and give them an "opportunity to participate in the establishment of the island" (id. at RP 006308), indicating that the location of a drilling island and the specification of the surface area for which wells must be drilled from the island are administrative decisions to be made by BLM. Neither the Instructions nor the 1986 Order include language suggesting that the economic success of directional drilling is a criteria for identifying the site of a drilling island or the affected surface area for drilling wells, although presumably an oil and gas lessee would undertake an economic analysis when deciding whether the value of the estimated production of oil and gas justifies the expense of drilling.

The 1986 Order also requires that drilling within potash enclaves occur under a unitization agreement. It states:

> In order to protect the equities between oil and gas lessees while at

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[81/] It appears that BLM did not attempt to formally designate any drilling islands because oil and gas companies did not wish to undertake directional drilling and potash mining companies did not want groups of wells drilled through potash beds. See Herrell: 2387-90, 2842; Int PH Brief at 64. Some of the decisions at issue, refer to suggested alternative drilling locations they identify as a drilling island. See, e.g., YP 32, RP 003711; YP 43, RP 004398.

> the same time reducing the number of oil and gas wells which operators propose to drill in the Potash Area, the authorized officer shall make greater use of his/her prerogative to require unitization pursuant to the regulations in 43 CFR 3180. Unitization shall be mandatory in those cases where completion of the proposed well as a producer might result in the drainage of oil and gas from beneath other Federal lands within a potash enclave. Thus, unitization will be a prerequisite to the approval of any well which is * * * to be vertically or directionally drilled from a barren area or island within an enclave.

Appendix A, § III.E.2 (emphasis supplied). BLM has authority under the third oil and gas lease stipulation to require unitization when it "is necessary for orderly oil and gas development and proper protection of potash deposits * * *." Id. § III.A.3. Not only would drilling multiple wells from a barren area or drilling island limit the effect of oil and gas development on potash enclaves and potash deposits, but the Appellants' argument that solution gas drive reservoirs are subject to pressure depletion supports unitization because, assuming they are factually correct that each group of wells they seek to drill would produce from a hydraulically connected reservoir, there would be "drainage of oil and gas from beneath other Federal lands within a potash enclave." The placement of multiple wellheads within a limited surface area and the likely sharing of pipelines and other facilities also suggests a practical benefit from unitization.

Accordingly, BLM's decisions denying approval of the APD's for the Martha wells numbers 10 through 14 (IBLA 93-44, IBLA 93-53, IBLA 93-90, IBLA 93-92, and IBLA 93-94) due to their location within an area of potash enclave cannot be sustained and the APD's are remanded to BLM for further review consistent with this decision.

As previously noted, the State Director's July 13, 1992, decision denying approval of Yates's APD for the Lusk number 8 well (IBLA 92-622) incorrectly stated that the nearest ore zone was five miles south of the proposed well site and incorrectly identified the fourth ore zone as constituting a potash enclave. YP 3, RP 001779; Herrell: 2162-64. Although the decision rationale correctly identified the tenth ore zone as the relevant one, it was not sent to Yates. On its face the decision was in error. The APD is remanded to BLM for further review consistent with this decision.

The State Director's July 7, 1993, decisions addressing the APD's for the Lusk number 15, 16, and 17 wells (IBLA 93-571, 93-572, 93-573) correctly identified the tenth ore zone as the relevant potash bed and found it to constitute potash enclave. YP 31a, RP 003651; YP 32a, RP 003711; YP 33a, RP 003773. The maps accompanying the decision rationales show the proposed well sites to be within an area identified as potash enclave. YP 112, RP 003655; YP 113, RP 003715; YP 114, RP 003777. Because the standards by which BLM has identified areas of potash enclave cannot be sustained, the APD's are remanded to BLM for further review consistent with this decision.

The State Director's decision of the same date addressing the Lusk number 12 well (IBLA 93-596) does not mention the tenth ore zone, but states as the reason for denying the application that "[a] mineralogical evaluation of the various ore zones in the area

leads us to conclude that the well site is located adjacent to a 'Potash Enclave'." YP 44a, RP 004432. The decision rationale shows the tenth ore zone to be present in the area and the attached ore zone map shows the proposed well site to lie just outside the potash enclave. YP 125, RP 004433, RP 004439. The decision is not supported by the potash enclave policy which requires denying applications for "surface locations within the potash enclaves" but does not apply to adjacent areas. There is some question, however, whether the map correctly positions the proposed well. The possibility is raised by a statement in the decision that an alternative drilling site 800 feet to the north would place the well approximately one-fourth mile from the potash enclave. YP 44a, RP 004432. The maps accompanying the decision rationale also vary slightly in their placement of the enclave boundary. See YP 125, RP 004437, RP 004439. The APD is remanded to BLM for review consistent with this decision. Whether within or adjacent to a potash enclave, the well may be subject to unitization. Appendix A, § III.E.2 (unitization "prerequisite to the approval of any well which is * * * located adjacent to a potash enclave").

The State Director's decisions dated August 12, 13, 21, and 28, 1992, denying Yates's APD's for the Belco number 2, 3, 4, 8 and 9 wells (IBLA 92-623, 92-624, 93-34) do not identify a specific ore zone but state that BLM had concluded "that the well site is located within a 'Potash Enclave'." YP 4a, RP 001830; YP 5a, RP 001854; YP 6a, RP 001877; YP 7a, RP 001910; YP 8a, RP 002088. The subsequent July 6, 1993, decision addressing the APD for the Belco number 6 well (IBLA 93-568) identifies the tenth ore zone as constituting a potash enclave. YP 30a, RP 003460. Although the earlier decisions were not informative, based upon the maps accompanying the decision rationales, all six decisions were correct that the proposed wells sites are located within an area which BLM had identified as a potash enclave. Nevertheless, for reasons which have been discussed, the maps which accompanied the decision rationale cannot be regarded as defining areas which are mineable under existing technology and economics. Accordingly, the APD's are remanded to BLM for further review consistent with this decision.

The State Director's July 27, 1993, decision denying approval of the Belco number 5 well (IBLA 93-595) does not identify the presence of a potash enclave as a reason for his decision. Instead, he explained that the proposed well was denied because: "Drilling at the proposed location would likely interfere with potash mining and result in undue waste of known enclaves reserves. It could also prove hazardous to the health and safety of potash miners." YP 43a, RP 004398. The same statement appears in the decision issued on the same day addressing Yates's Anise well in the same portion of the Potash Area (IBLA 93-594). YP 42a, RP 004361. Neither decision provides a further explanation of the statements and the category II forms used to review the APD's do not list interference with mining, undue waste, or hazards as possible reasons for recommending denial. Instead, the forms are marked to show that the proposed well sites are in areas of potash enclave and handwritten notes in the comment sections identify the 10th ore zone. YP 123, RP 004362; YP 124, RP 004399.

The statements in the decisions are adapted from the first and second oil and gas lease stipulations. As analyzed in this decision, the "interfere" provision of the first stipulation and the "undue waste" portion of the second stipulation pertain to potash deposits, while the "unduly interfere" and "hazard" provisions in the second stipulation

concern "mining operations being conducted for the extraction of potash deposits." Although there are mine workings within a few miles of the well sites, mining operations were not being conducted at the time the decisions were issued and the reason BLM believed that the wells would affect mining operations is not apparent. The State Director's statements appear to be based upon the fact reported on the category II forms that the proposed well sites are within an area of potash enclave. That fact is sufficient to have denied approval of the APD's under the potash enclave policy, but without additional information does not support a conclusion that the applicant had failed to establish that the interest of the United States would be best served by allowing drilling to interfere with mining the deposit or would result in its undue waste. The APD's are remanded to BLM for further review consistent with this decision.

The State Director's October 20, 1992, decisions addressing Yates's Wolf number 3 (IBLA 93-51) and number 10 wells (IBLA 93-52) denied approval because the proposed drilling sites were within an area of potash enclave for the 10th ore zone. YP 10a, RP 002172; YP 11a, RP 002206. The maps accompanying the decision rationales show the findings to be correct. YP 91, RP 002175; YP 92, RP 002209. Likewise, the State Director's July 9, 1993, decision on the Wolf number 11 well (IBLA 93-574) identified the tenth ore zone as the relevant potash enclave and the map accompanying the decision rationale shows the proposed well site to lie within the designated area of potash enclave. YP 34a, RP 003836; YP 115, RP 003840. The decisions for the Wolf wells numbers 12 (IBLA 93-603) and 13 (IBLA 93-604) dated July 16, 1993, also identify the tenth ore zone and the maps attached to the decision rationales show the well sites to be within an area of potash enclave. YP 51a, RP 004835; YP 52a, RP 004889; YP 132, RP 004839-40; YP 133, RP 004893-94. The factual determinations were correct, but the standards by which BLM has identified the area of potash enclave cannot be sustained. The APD's are remanded to BLM for further review consistent with this decision.

The State Director's subsequent decisions of October 28 and November 6, 1992, denying the APD's for the Wolf wells numbers 1 (IBLA 93-91), 2 (IBLA 93-93), and 8 (IBLA 93-89) differ in identifying both the tenth and third ore zones as constituting potash enclave. YP 13a, RP 002290; YP 15a, RP 002358; YP 17a, RP 002440. Each of the decision rationales, however, states that the area "is classified as indicated ore since the core holes do not meet the measured ore criteria of three data points no more than 1 ½ miles apart" and that "[t]he tenth ore zone is present in the area at mineable grades," but "depending on the interpretation of the information, the APD may fall in a subeconomic zone." YP 94, RP 002293-94; YP 96, RP 002361; YP 98, RP 002442-43. Along with other reasons, the decision rationales recommended that the APD's not be approved because "the proposed well site falls within the indicated potash reserves." YP 94, RP 002294; YP 96, RP 002362; YP 98, RP 002443. Consistent with those statements, one of the maps attached to the decision rationales shows the well sites to lie to the south of an area which is apparently the area of potash enclave. Another map has lines which are marked as showing portions of the third and tenth ore zones, apparently the areas of indicated reserves referred to in the decision rationales. YP 94, RP 002296-97; YP 96, RP 002364-65; YP 98, RP 002445-46.

The decisions denying approval of APD's for the Wolf number 14 (IBLA 93-576),

15 (IBLA 93-577), 16 (IBLA 93-575), 17 (IBLA 93-578), 18 (IBLA 93-579), 19 (IBLA 93-580), and 20 (IBLA 93-581) wells, issued July 9, 1993, also identify the tenth and third ore zones as meeting "the leasing criteria in this area" and constituting a potash Enclave. YP 35a, RP 003898; YP 36a, RP 003964; YP 37a, RP 004027; YP 38a, RP 004096; YP 39a, RP 004174; YP 40a, RP 004238; YP 41a, RP 004297. The decision rationales, however, provide the same statements about indicated ore which appear in those for the Wolf number 1, 2, and 8 wells, and the same or almost identical maps are attached. YP 116, RP 003900-3904; YP 117, RP 003066-70; YP 118, RP 004029-33; YP 119, RP 004098-4102; YP 120, RP 004176-80; YP 121, RP 004240-44; YP 122, RP 004299-4303. Likewise, the July 16, 1993, decision addressing the Wolf number 6 well (IBLA 93-601), states that both the tenth and third ore zones "meet the leasing criteria in this area" and constitute a potash enclave, while the decision rationale indicates that the proposed well site is within an indicated reserve. YP 49a, RP 004710; YP 130, RP 004711-12. [82/]

By definition, indicated reserves are areas where core holes or other data points are too widely spaced to identify an area of potash enclave based upon three qualifying data points within a mile and a half. INT 19. The potash enclave policy does not preclude approval of an application to drill within an indicated reserve. Accordingly, the APD's for the Wolf number 1, 2, 6, 8, and 14 through 20 wells are remanded to BLM for further review consistent with this decision.

The additional Wolf well at issue in this proceeding stands in a different posture (IBLA 93-602). By letter dated July 22, 1993, the State Director informed Yates that BLM had previously received an APD for the same location at which Yates proposed to drill the Wolf number 9 well and had denied the application by a decision dated October 9, 1992, "because drilling of the well may result in undue waste of potash." YP 50, RP 004748. BLM returned the APD "unprocessed." The Appellants have included the Wolf number 9 well when discussing the merits of the denial of their applications, but have not separately addressed the reason BLM declined to review the APD. In addition to an APD form 3160-3 dated June 18, 1993, the case file contains an APD form dated March 26, 1992, a decision rationale dated October 1, 1992, other documents reflecting BLM's review of the application at the time, and a decision by the State Director dated October 9, 1992. YP 50, RP 004749, RP 004758, RP 004804; YP 131, RP 004752-57. It does not contain a notice of appeal of the 1992 decision or proof of service of a notice of appeal. See 43 CFR 4.411, 4.413(d). A comparison of the "Well Location and Acreage Dedication Plat" forms reveals both APD's were for the same drilling site. The State Director correctly concluded that BLM's previous decision had become final for the Department. Yates's application for the Wolf number 9 well is denied.

The State Director's decisions issued between March 2 and June 18, 1993, denying

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[82/] The maps accompanying the decision rationales show the Wolf number 6 well on the boundary of what is apparently the area of potash enclave and the Wolf number 15 well to be just outside the boundary. YP 118, RP 004032-33; YP 130, RP 004714-15. As the Intervenors note, however, another map shows the Wolf number 6 to be within the potash enclave and the Wolf number 15 well to be on the boundary. RP 006042.

approval of Pogo's APD's for the Pure Gold number 9 (IBLA 93-333), 10 (IBLA 93-273), 13 (IBLA 93-432), and 14 (IBLA 93-465) wells identify the second ore zone as constituting a potash enclave. YP 19a, RP 002798; YP 20a, RP 003123; YP 21a, RP 003145; YP 22a, RP 003172. The maps attached to the decision rationales show the proposed well sites to be within an area of potash enclave. YP 100, RP 002883; YP 101, RP 003127; YP 102, RP 003150; YP 103, RP 003192. While the factual basis of the decisions appears to be correct, the standards upon which BLM has identified the area of potash enclave cannot be sustained and the APD's are remanded to BLM for further review consistent with this decision.

In contrast to most of the decisions at issue in this proceeding, the State Director's July 16, 19, and 22, 1993, decisions denying approval of the APD's for Yates's Okerlund number 1 through 4 wells (IBLA 93-597 through 93-600) do not expressly identify an ore zone as constituting potash enclave, but state that:

> Drilling at the proposed location would likely interfere with potash mining and result in undue waste of known enclave reserves. It could also prove hazardous to the health and safety of potash miners.

YP 45a, RP 004518; YP 46a, RP 004567; YP 47a, RP 004622; YP 48a, RP 004669. The category II form for the Okerlund number 1 well was erroneously marked to indicate that it "is in the measured ore potash enclave." Herrell: 2430-31; see YP 126, RP 004519-20. None of the three criteria for denying an APD are marked on the forms for the other three Okerlund APD's, but the comment section for each contains a note that "[t]he New Mexico Potash LMR extends into inferred ore in section 7." YP 127, RP 004568; YP 128, RP 004623; YP 129, RP 004670. The comment was correct, but did not pertain to the Okerlund number 4 well site which is in an area of measured reserves. See Herrell: 2350. The maps attached to the decision rationales show the proposed drill sites for the Okerlund number 1, 2, and 3 wells to be within an area of inferred reserves.

As has been discussed, the first oil and gas lease stipulation places the burden on the applicant to establish that drilling "will not interfere with the mining and recovery of potash deposits" while the second stipulation allows BLM to deny an APD which would "unduly interfere" with ongoing mining operations. The State Director's decisions are unclear as to which provision was being applied, but neither is satisfied by a determination that drilling would "likely" interfere with potash mining. Nor is a finding that drilling is "likely" to result in undue waste sufficient under the second stipulation. Similarly, the statement that drilling "could * * * prove hazardous" fails to address the standard of the second stipulation which requires a finding that a well would "constitute a hazard" to mining operations. Moreover, the decisions do not provide any indication of the reasons the facts noted in the decision rationales support application of the provisions of the stipulations. The decisions addressing the Okerlund number 1, 2, and 3 wells cannot be sustained and the APD's are remanded to BLM for further review consistent with this decision. The statement in the decision addressing the APD for the Okerlund number 4 was unnecessary because the APD could have been denied under the potash enclave policy. The APD is remanded to BLM for further review consistent with this decision.

The statement found in the decisions for the Okerlund wells also appears in the State Director's September 3, 1993, denying Yates's APD for the Nancy well (IBLA 93-680). YP 55a, RP 005065. The map attached to the category II form, however, shows the well site to be within an area of potash enclave. YP 136, RP 005066. The APD is remanded to BLM for further review consistent with this decision.

The State Director's July 12, 1993, decision denied approval of the APD for Yates's Glow Worm number 3 well (IBLA 93-631) because the tenth ore zone meets the "leasing criteria" and constitutes a "Potash Enclave" and for this reason drilling "may result in undue waste of potash." YP 54a, RP 005011. The category II form notes that the tenth ore zone is present at the proposed well site and the accompanying map shows the well site is within an area that appears to be potash enclave. YP 135, RP 005012-13. The State Director's decisions of July 6 and 27 and October 28, 1994, addressing the APD's for the Glow Worm numbers 5 (IBLA 94-751), 6 (IBLA 94-749), and 8 (IBLA 95-193) wells do not identify a specific ore zone but provide the same statement as the decisions on the APD's for the Okerlund and Nancy wells. YP 56a, RP 005727; YP 57a, RP 005778; YP 58a, RP 005806. None of the three findings listed on the category II forms are marked, but comments added at the bottom of the forms note that the Glow Worm number 5 "is within IMCF's LMR," that the Glow Worm number 6 "is within IMCF's ½ mile buffer zone," and that the Glow Worm number 8 "is within IMCF's LMR buffer zone." YP 137, RP 005728; YP 138, RP 005779; YP 139, RP 005807. The comments for the Glow Worm number 6 also note that it is located within an area of potash enclave for the 10th ore zone, while those for the Glow Worm number 5 state that it is within a potash enclave, but does not identify an ore zone. YP 137, RP 005728; YP 138, RP 005779.

As discussed earlier in this decision, LMR's and their quarter and half mile buffer zones are defined by the NMOCC's Order R-111-P. Although they were also included in the Department's proposed 1991 Order, it was not finally promulgated and, consequently, the fact a proposed drilling site falls within one of the areas is not a proper basis for denying an APD. Nevertheless, BLM cannot be faulted for noting on its category II forms that the proposed well sites are within an LMR and its buffer zones, and the State Director's decisions do not expressly refer to the LMR or its buffer zones. However, they also do not state whether the applications were for drill sites within a potash enclave and, like the decisions on the Okerlund wells, deny approval of the APD's using terms taken from the oil and gas lease stipulations. As discussed in regard to those applications, the statements do not reflect the context in which the terms appear in the stipulations. Nor do the decisions indicate the basis upon which the provisions were applied to deny the APD's, other than the facts noted in the category II forms and, as shown on the accompanying maps, their apparent location within an area of potash enclave or in the case of the Glow Worm number 8 well, on the boundary of a potash enclave or just outside of it. The APD's are remanded to BLM for further review consistent with this decision.

The State Director's decisions dated June 24, 1993, denying approval of Pogo's Federal 29 number 1 (IBLA 93-488) and 5 (IBLA 93-489) wells, his decisions dated July 1 and 6, 1993, addressing the Federal 29 number 2 (IBLA 93-535) and 6 (IBLA 93-538) wells, and his July 6, 1993, decision on the Mobil Federal number 5 well (IBLA 93-534) each finds the fourth ore zone to constitute a potash enclave. YP 23, RP 003210; YP 24,

RP 003253; YP 25, RP 003291; YP 26a, RP 003325; YP 29a, RP 003448. The July 6, 1993, decisions on the Federal 29 number 3 (IBLA 93-537) and 7 (IBLA 93-536) wells also identified the second ore zone as constituting potash enclave. YP 27a, RP 003353; YP 28a, RP 003417. The handwritten notes on the category II forms are consistent with the respective decisions. YP 104, RP 003213; YP 105, RP 003255; YP 106, RP 003292; YP 107, RP 003326; YP 108, RP 003354; YP 109, RP 003418; YP 110, RP 003449. The maps attached to the category II forms show each proposed well site to be within an area of potash enclave. They do not, however, distinguish those portions of the area which are potash enclave based upon the second ore zone, those which are based upon the fourth ore zone, and those where the ore zones overlap.

Subsequently, Pogo filed APD's for the Mobil Federal number 9 well (IBLA 95-194) and the Federal 29 number 9 through 12 wells (IBLA 95-195 through 95-198). YP 59a, RP 005848; YP 60a, RP 005881; YP 61a, RP 005914; YP 62a, RP 005950; YP 63a, RP 005987. In reviewing the applications, BLM noted that they were within the same 40-acre spacing units as those filed for the Mobil Federal No. 5 and the Federal 29 numbers 2, 3, 6, and 7 well sites. YP 140, RP 005849; YP 141, RP 005882; YP 142, RP 005915; YP 143, RP 005951; YP 144, RP 005988. The Appellants acknowledge that the applications are for well sites within the same spacing units, stating that the later APD's provide the "preferred alternative locations for the given spacing units to which they apply" and that "those locations replace the Mobil Federal #5 & Federal 29 #'s 2, 3, 6 & 7." App. PH Brief at 186. Accordingly, Pogo's applications for the Mobil Federal No. 5 and Federal 29 numbers 2, 3, 6, and 7 wells are denied as having been constructively withdrawn. The proposed drilling sites for the Mobil Federal number 9 and the Federal 29 numbers 1, 5, and 9 through 12 wells lie within an area BLM had identified as potash enclave and are remanded to BLM for further review consistent with this decision. See YP 140, RP 005850.

Accordingly, the APD's for Yate's Wolf No. 9 well and those for Pogo's Mobil Federal No. 5 and Federal 29 numbers 2, 3, 6, and 7 are denied for the reasons stated. The remaining APD's are remanded to BLM for further consideration, as discussed.

Any party may file notice of appeal within 30 days of the date of service pursuant to 43 CFR 4.410 - 4.414.

Done at the City of Albuquerque, New Mexico this 7th day of July, 2003.

//original signed
Patricia McDonald
Administrative Law Judge

I hereby certify that the above Order together with the accompanying attachments, were mailed to the following:

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on July 7, 2003.

By: // original signed
Patricia McDonald

APPENDIX A

APPENDIX B

Appeals by Devon Energy Corporation were disposed of as follows:

Dismissed by order of October 17, 1995:
IBLA 93-692 (lease no. NM-0418220A, Todd "27L" Fed. Well No. 12).

Remanded to BLM by order of June 28, 1996:
IBLA 93-31 (lease no. NM-0405444, Todd 23 Federal No. 5)
IBLA 93-33 (lease no. NM-0405444, Todd 23 Federal No. 7)
IBLA 93-221 (lease no. NM-0405444, Todd 23F Federal No. 13)
IBLA 93-237 (lease no. NM-0405444, Todd 23K Federal No. 12)
IBLA 93-238 (lease no. NM-0405444, Todd 23N Federal No. 11)
IBLA 93-272 (lease no. NM-0405444, Todd 23B Federal No. 10)
IBLA 93-274 (lease no. NM-0405444, Todd 23A Federal No. 9)
IBLA 93-275 (lease no. NM-0404441, Todd 13M Federal No. 1)
IBLA 93-317 (lease no. NM-0404441, Todd 14P Federal No. 2)
IBLA 93-318 (lease no. NM-0404441, Todd 13N Federal No. 2)
IBLA 93-685 (lease no. NM-0405444, Todd 15M Federal No. 13)
IBLA 93-686 (lease no. NM-0405444A, Todd 22D Federal No. 4)
IBLA 93-687 (lease no. NM-0405444A, Todd 22E Federal No. 5)
IBLA 93-688 (lease no. NM-0405444A, Todd 22L Federal No. 12)
IBLA 93-689 (lease no. NM-0405444A, Todd 22M Federal No. 13).

Severed and held in abeyance by order of July 24, 1996:
IBLA 93-244 (lease no. NM-0418220-A, Todd "26C" Fed. Well No. 13)
IBLA 93-690 (lease no. NM-0418220A, Todd "27D" Fed. Well No. 4)
IBLA 93-691 (lease no. NM-0418220A, Todd "27E" Fed. Well No. 5).

APPENDIX C

Appeals by Yates and Pogo were dismissed as follows:

Dismissed by separate orders of October 13, 1995:
IBLA 94-250 (lease no. NM-883068, Yates Zinnia "AMZ" Fed. Well 1)
IBLA 94-748 (lease no. NM-81852, Yates Llama "ALL" Fed. Well 3)
IBLA 94-750 (lease no. NM-81942, Yates Llama "ALL" Fed. Well 2).

Dismissed by separate orders of March 4, 1996:
IBLA 93-569 (lease no. NM-81952, Yates Llama "ALL" Fed. Well 8)
IBLA 93-570 (lease no. NM-70334, Yates Jasmine "AJI" Fed. Well 6).

Dismissed by order of April 23, 1996:
IBLA 93-163 (lease no. NM-40655, Pogo Fed. Amax No. 4).

Dismissed by order of August 12, 1996:
IBLA 93-617 (lease no. NM-40659, Pogo Pure Gold "D" Fed. Well 15).

Dismissed by order of January 16, 1998:
IBLA 93-662 (lease no. NM-77054, Yates Anise "ANI" Fed. Well No.1)
IBLA 94-137 (lease no. NM-06783, Yates "ANX" Fed. Well No. 1).

In addition, by order dated August 12, 1996, proceedings on Pogo's subsequent appeals docketed as IBLA 95-653 through 95-665 (Pure Gold “A” Nos. 5 through 17) and IBLA 95-672 through 95-682 (Pure Gold “B” Nos. 7, 8, 10 through 13, and 15 through 19) were stayed until the conclusion of proceedings in the consolidated appeals addressed in this decision.

APPENDIX D

APPEALS AT ISSUE

IBLA	APPELLANT	LEASE NO.	WELL/APD
92-612	Yates Petroleum Corp.	NM-65417	Martha "AIK" Fed. No. 7,8,9
		NM-65418	Dolores "AIL" Fed. No. 4
92-614	Pogo Producing Co.	NM-0281482-	Fed. Mobil No. 2,3
92-615	Pogo Producing Co.	NM-62589	Fed. 23 Nos. 4,6-16
92-622	Yates Petroleum Corp.	NM-59392	Lusk AHB Fed. No. 8
92-623	Yates Petroleum Corp.	NM-63016	Belco AIA Fed. No. 9
92-624	Yates Petroleum Corp.	NM-63016	Belco AIA Fed. Nos. 2,3,4
93-34	Yates Petroleum Corp.	NM-63016	Belco AIA Fed. No. 8
93-44	Yates Petroleum Corp.	NM-65417	Martha "AIK" Fed. No. 10
93-51	Yates Petroleum Corp.	NM-61358	Wolf "AJA" 24 No. 3
93-52	Yates Petroleum Corp.	NM-61358	Wolf "AJA" 24 No. 10
93-53	Yates Petroleum Corp.	NM-65417	Martha "AIK" 11 Fed. No. 11
93-89	Yates Petroleum Corp.	NM-61358	Wolf "AJA" Fed. No. 8
93-90	Yates Petroleum Corp.	NM-65417	Martha "AIK" 11 Fed. No. 12
93-91	Yates Petroleum Corp.	NM-61358	Wolf "AJA" 25 Fed. No. 1
93-92	Yates Petroleum Corp.	NM-65417	Martha "AIK" 11 Fed. No. 14
93-93	Yates Petroleum Corp.	NM-61358	Wolf "AJA" Fed. No. 2
93-94	Yates Petroleum Corp.	NM-65417	Martha "AIK" 11 Fed. No. 13
93-273	Pogo Producing Co.	NM-40659	Pure Gold "D" Fed. Well 10
93-333	Pogo Producing Co.	NM-40659	Pure Gold "D" Fed. Well 9
93-432	Pogo Producing Co.	NM-40659	Pure Gold "D" Fed. Well 13
93-465	Pogo Producing Co.	NM-40659	Pure Gold "D" Fed. Well 14
93-488	Pogo Producing Co.	NM-545035	Federal 29 Well No. 1
93-489	Pogo Producing Co.	NM-545035	Federal 29 Well No. 5
93-534	Pogo Producing Co.	NM-281482-A	Mobil Fed. Well No. 5
93-535	Pogo Producing Co.	NM-545035	Federal 29 Well No. 2
93-536	Pogo Producing Co.	NM-545035	Federal 29 Well No. 7
93-537	Pogo Producing Co.	NM-545035	Federal 29 Well No. 3
93-538	Pogo Producing Co.	NM-545035	Federal 29 Well No. 6
93-568	Yates Petroleum Corp.	NM-63016	Belco "AIA" Fed. Well No. 6
93-571	Yates Petroleum Corp.	NM-59392	Lusk "AHB" Fed. Well No. 15
93-572	Yates Petroleum Corp.	NM-59392	Lusk "AHB" Fed. Well No. 16
93-573	Yates Petroleum Corp.	NM-59392	Lusk "AHB" Fed. Well No. 17
93-574	Yates Petroleum Corp.	NM-61358	Wolf "AJA" Fed. Well No. 11
93-575	Yates Petroleum Corp.	NM-51358	Wolf "AJA"-25- Fed. Well 16
93-576	Yates Petroleum Corp.	NM-61358	Wolf "AJA" Fed. Well No. 14
93-577	Yates Petroleum Corp.	NM-61358	Wolf "AJA" Fed. Well No. 15
93-578	Yates Petroleum Corp.	NM-61358	Wolf "AJA" Fed. Well No. 17
93-579	Yates Petroleum Corp.	NM-61358	Wolf "AJA" Fed. Well No. 18
93-580	Yates Petroleum Corp.	NM-61358	Wolf "AJA" Fed. Well No. 19
93-581	Yates Petroleum Corp.	NM-61358	Wolf "AJA" Fed. Well No. 20

93-594	Yates Petroleum Corp.	NM-77054	Anise "ANI" Fed. Well No. 2
93-595	Yates Petroleum Corp.	NM-63016	Belco "AIA" 14 Fed. Well 5

IBLA	APPELLANT	LEASE NO.	WELL/APD
93-596	Yates Petroleum Corp.	NM-59392	Lusk "AHB" Fed. Well No. 12
93-597	Yates Petroleum Corp.	NM-64505	Okerlund "ALI" Fed. Well 1
93-598	Yates Petroleum Corp.	NM-64505	Okerlund "ALI" Fed. Well 2
93-599	Yates Petroleum Corp.	NM-64505	Okerlund "ALI" Fed. Well 3
93-600	Yates Petroleum Corp.	NM-64505	Okerlund "ALI" Fed. Well 4
93-601	Yates Petroleum Corp.	NM-61358	Wolf "AJA" Fed. Well No. 6
93-602	Yates Petroleum Corp.	NM-61358	Wolf "AJA" -24- Fed. Well 9
93-603	Yates Petroleum Corp.	NM-61358	Wolf "AJA"-24- Fed. Well 12
93-604	Yates Petroleum Corp.	NM-61358	Wolf "AJA"-24- Fed. Well 13
93-631	Yates Petroleum Corp.	NM-81953	Glow Worm "ALX" Fed. Well 3
93-680	Yates Petroleum Corp.	NM-88158	Nancy "ALH" Fed. Well No. 1
94-749	Yates Petroleum Corp.	NMNM-81953	GlowWorm "ALX" Fed. Well 6
94-751	Yates Petroleum Corp.	NMNM-81953	GlowWorm "ALX" Fed. Well 5
95-193	Yates Petroleum Corp.	NMNM-81953	GlowWorm "ALX" Fed. Well 8
95-194	Pogo Producing Co.	NM-281482-A	Mobil Federal Well No. 9
95-195	Pogo Producing Co.	NM-0545035	Federal 29 Well No. 9
95-196	Pogo Producing Co.	NM-0545035	Federal 29 Well No. 10
95-197	Pogo Producing Co.	NM-0545035	Federal 29 Well No. 11
95-198	Pogo Producing Co.	NM-0545035	Federal 29 Well No. 12

APPENDIX E

As captioned by the parties and in the approximate order in which they were received, the briefs filed by the parties are:

1. Appellants' "Preliminary Statement of Reasons and Brief" (App. Prelim. SOR)
2. "Agency Response to IBLA Order of September 14, 1993, Response to the Preliminary Statement of Reasons" (BLM Resp. to Prelim. SOR)
3. BLM "Supplemental Response to Preliminary Statement of Reasons" (BLM Supp. Resp. to Prelim. SOR)
4. "Response of Intervenor IMC Fertilizer, Inc. to Appellants' Preliminary Statement of Reasons" (IMC Resp. to Prelim. SOR)
5. "Appellants' Reply to Solicitor's and BLM Responses to Appellants' Preliminary Statement of Reasons and Brief" (App. Reply to BLM Resp. to Prelim. SOR)
6. "Appellants' Reply to IMC Fertilizer, Inc. Response" (App. Reply to IMC Resp. to Prelim. SOR)
7. IMC "Supplemental Exhibits and Response to Statement of Reasons" (IMC Supp. Resp. to SOR)
8. "Appellants' Response to Intervenors Supplemental Exhibits; Motion to Strike Supplemental Response to Statement of Reasons, and Alternatively, Reply to Supplemental Response to Statement of Reasons" (App. Reply to IMC Supp. Resp. to SOR)
9. "Memorandum in Support of a Motion for Partial Summary Judgment by Yates Petroleum Corporation" (Yates Summ. J. Brief)
10. "Brief in Support of Pogo Producing Company's Motion for Partial Summary Judgment" (Pogo Summ. J. Brief)
11. "Intervenors' Opposition to Appellants' Motions for Summary Judgment" (Int. Opp'n to Summ. J.)
12. "Agency Response to Appellants' Motions for Summary Judgment" (BLM Resp. to Summ. J.)
13. "Devon Energy Corporation's and Pogo Producing Company's Final Statement of Reasons" (Devon & Pogo Final SOR)
14. "Yates Petroleum Corporation's Final Statement of Reasons and Brief" (Yates Final SOR)
15. "Reply in Support of Pogo Producing Company's and Devon Energy Corporation's Motions for Summary Judgment" (Pogo & Devon Summ. J. Reply)
16. Yates "Reply to BLM's and Intervenor's Responses to Yates' Motion for Partial Summary Judgment" (Yates Summ. J. Reply)
17. "Agency Answer to Appellants' Statement of Reasons" (BLM Ans. to SOR)
18. "Answer of Intervenors to Appellants' Final Statement of Reasons" (Int. Ans. to Final SOR)
19. Pogo and Devon "Reply to Agency's and Intervenors' Answers to Appellants' Statements of Reason" (Pogo & Devon Reply to Ans. to SOR)
20. Yates "Reply to the Agency's and Intervenors' Responses to the Final Statement of Reasons" (Yates Reply to Resp. to SOR)
21. "Intervenors' Reply to Appellants' Replies on Final Statement of Reasons" (Int.

Reply to Replies on Final SOR)

22. "BLM's Reply to Appellants' Reply to the Answers to Appellants' Statement of Reasons" (BLM Reply to Reply to Ans. to SOR)
23. "Intervenors' Motion for Partial Summary Judgment" (Int. Motion Summ. J.)
24. Pogo and Devon "Response to Intervenors' Motion for Partial Summary Judgment" (Pogo & Devon Resp. to IMC Motion Summ. J.)
25. Yates "Response to Intervenor's Motion for Partial Summary Judgment" (Yates Resp. to Int. Motion Summ. J.)
26. "Intervenors' Reply in Support of their Motion for Partial Summary Judgment" (Int. Reply Motion Summ. J.)
27. "Pogo Producing Company's Final Statement of Reasons and Brief" (Pogo Final SOR)
28. "Appellants' Opening Post-Hearing Brief" (App. PH Brief)
29. "Agency Post-Hearing Brief" (BLM PH Brief)
30. "Intervenors' Post-Hearing Brief" (Int. PH Brief)
31. "Appellants' Joint Reply to the Agency Post-Hearing Brief and Intervenors' Post-Hearing Brief" (App. Reply to BLM & Int. PH Briefs)
32. "Trona Industry Committee, Wyoming Mining Association Post Hearing Brief" (WMA PH Brief)
33. "Intervenors' Sur-Reply to Appellants' Joint Reply to the Agency Post-Hearing Brief and Intervenors' Post-Hearing Brief" (Int. PH Sur-Reply)
34. Yates "Response to Motion for Leave to file Sur-Reply," including "Yates' Response to Intervenors' Sur-Reply" (Yates Resp. to Motion for Sur-Reply)
35. "Pogo Producing Company's Response to Intervenors' Sur-Reply" (Pogo Resp. to Int. Sur-Reply)