Permit

State of Arkansas
Department of Pollution Control and Ecology

ALBEMARLE CORPORATION
SOUTH PLANT — PERMIT 12-U
P.O. BOX 729
MAGNOLIA, AR 71753 — CSN 14-0028

Pursuant to the Arkansas Water and Air Pollution Control Act (Act 472 of 1949, as amended,(A.C.A. 8-4-101 et seq.) and the Arkansas Underground Injection Control (UIC) Code, This permit is reissued to ALBEMARLE CORPORATION (hereinafter called the Permittee) to construct three (3) new nonhazardous waste disposal wells at the following location:

Nonhazardous waste disposal wells WDW #3, WDW #4 and WDW #5 to be located at the ALBEMARLE South Plant in Sections 8, 17, and 18 Township 18 South, Range 20 West respectively. The ALBEMARLE South Plant is located approximately 3 miles south of the city of Magnolia, in Columbia County, Arkansas.

The Permittee must comply with all the terms and conditions of this permit. This permit shall consist of the conditions contained herein and all applicable standards and specific facility conditions developed in accordance with the Arkansas Underground Injection Control (UIC) Code and the provisions of Title 40, Code of Federal Regulations (40 CFR) Parts 144, 146 and 124, as specified in the permit. Applicable State and Federal Regulations are those which are in effect on the date of issuance of the permit, such Federal Regulations adopted by reference in Section 3 of the Arkansas Underground Injection Control (UIC) Code (See 40 CFR 144.52 (b)(2) and Attachment 1).

This permit is based on the condition that all information submitted in the original permit application dated December 7, 1983, and submitted in the new permit application dated August 6, 1991, is accurate and that the facility will be constructed and operated as specified in those applications. Any misrepresentations found in this information may be grounds for the termination or modification of this permit (see 40 CFR 144.39, 144.40, and 144.41) and possible enforcement action.

This permit is effective as of August 6, 1994 **and shall remain in effect until** August 6, 2004 **unless revoked and reissued, or terminated (40 CFR 144.39 and 144.40) or continued in accordance with the Arkansas UIC Code.**

Issued this 6th **day of** July, 1994

ARKANSAS DEPARTMENT OF POLLUTION CONTROL & ECOLOGY

by: Randall Mathis
Director

PART I

STANDARD CONDITIONS

I. A. EFFECT OF PERMIT

The Permittee is authorized to construct and operate three (3) new nonhazardous waste disposal wells, WDW #3 WDW #4 and WDW #5, in accordance with the conditions set forth in this permit. **Injection of any wastes not authorized under the conditions of this is strictly prohibited.**

Compliance with this permit constitutes, for purposes of enforcement, compliance with Part C of the Safe Drinking Water Act (SDWA) and the Arkansas Water and Air Pollution Control Act (Act 472 of 1949, as amended). Issuance of this permit does not convey any property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property; any invasion of other private rights, or any infringement of State or local law or regulations. Compliance with the terms of this permit does not constitute a defense to any action brought under the provisions of the Water and Air Pollution Control Act (Act 472 of 1949, as amended) or any other law governing protection of public health or the environment for any imminent and substantial endangerment to human health or the environment.

I. B. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person, including the Permittee, or upon the Director's initiative. However, modification, revocation and reissuance, or termination of this permit shall be allowed only under the conditions set forth in Part I, Section B.1. through B.3. below. All requests for modification (except for minor modifications as specified under 40 CFR 144.41), revocation and reissuance, or termination shall be in writing and shall contain facts or reasons supporting the request.

1. Modification or Revocation and Reissuance of Permit

   The Director may modify, or revoke and reissue, this permit either at the request of any interested person (including the Permittee) upon the Director's initiative or, if he or she determines, based upon receipt of any information, that one or more of the causes specified under 40 CFR 144.39(a) or 144.39(b) for modification, revocation and reissuance, or both, exists. If cause exists, the Director may modify, revoke or reissue this

permit accordingly, subject to the limitations of 40 CFR 144.41(c) and may request an updated application if necessary. **When a permit is modified, only the conditions subject to modification are reopened.** Except as provided by 40 CFR 144.41, modification or revocation and reissuance of this permit by the Director shall be in accordance with 40 CFR 144.39.

If a permit is revoked and reissued the entire permit is reopened and subject to revision and the permit issued for a new term. If cause does not exist then the Director shall not modify, revoke and reissue the permit. If a permit modification satisfies the criteria of 40 CFR 144.41 for minor modifications the permit may be modified without a draft permit or public review.

2. Termination of Permit

The Director may terminate this permit during its term or deny a permit renewal application for this permit for the following causes:

(a) Noncompliance by the Permittee with any condition of the permit;

(b) The Permittee's failure in the application or during the permit issuance process to disclose fully all relevant facts, or the Permittee's misrepresentation of any relevant facts at any time;

(c) A determination that the permitted activity endangers human health or the environment and can only be regulated to acceptable levels by permit modification or termination.

The Director shall follow the applicable procedures in 40 CFR Part 124 in terminating any permit under this section.

3. Minor Modifications to the Permit

Upon the consent of the Permittee, the Director may make minor modifications to the permit as specified in 40 CFR 144.41 without following the procedures of 40 CFR Part 124. Any permit modification not determined to be a minor modification under 40 CFR 144.41 must comply with the procedures of 40 CFR 124.5 and 144.39.

I. C. DURATION OF PERMIT

This permit is **effective for a period not to exceed ten (10) years** unless terminated for causes specified in 40 CFR 144.40 or Part I, Section B.2. contained herein.

I. D. CONTINUATION OF EXPIRING PERMIT

This permit and all conditions therein will remain in effect beyond the permit's expiration date if the Permittee has submitted a timely, complete application and through no fault of the Permittee, the Director has not issued a new permit as set forth in Act 472. Permits continued under the conditions in this section remain fully enforceable and are subject to those actions specified in 40 CFR 144.37(c).

I. E. TRANSFER OF PERMITS

1. Transfers by Modification

   This permit may be transferred by the Permittee to a new owner or operator if the permit has been modified or revoked and reissued pursuant to 40 CFR 144.39(b)(2), or a minor modification made under 40 CFR 144.41(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Safe Drinking Water Act.

2. Automatic Transfers

   Any UIC permit for a well not injecting hazardous waste may be automatically transferred to a new Permittee if:

   (a) The current Permittee notifies the Director at least thirty (30) days in advance of a proposed transfer date referred to in Part I, Section E.2.(b).

   (b) The notice includes a written agreement between the existing and the new Permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them, and the notice demonstrates that the financial responsibility requirements of 40 CFR 144.52(a)(7) will be met by the new Permittee.

(c) The Director does not notify the existing and the proposed new Permittee of his or her intent to modify or revoke and reissue the permit. A modification under this condition may also be a minor modification under 40 CFR 144.41. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in Part I, Section E.2.(b) above.

I. F. DUTIES AND REQUIREMENTS

1. Duty to Comply

The Permittee shall comply with all conditions of this permit, except to the extent and for the duration such noncompliance is authorized by an emergency permit under 40 CFR 144.34. Any permit noncompliance which may constitute a violation of Act 472 may be grounds for enforcement action, permit termination, revocation and reissuance, modification, or for denial of a permit renewal application.

2. Duty to Reapply

If the Permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the Permittee must submit a new application for a new permit at least one hundred eighty (180) days before this permit expires.

3. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a Permittee in an enforcement action that it would have been necessary to halt or reduce plant operations and/or the permitted activity in order to maintain compliance with the conditions of this permit.

4. Duty to Mitigate

The Permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.

5. Duty to Provide Information

The Permittee shall furnish to the Director within a reasonable time, any relevant information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The Permittee shall also furnish to the Director upon request copies of records required to be kept by this permit.

6. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this permit. This provision requires the operation of a back-up or auxiliary facility or similar systems only when necessary to achieve compliance with the conditions of the permit.

7. Inspection and Entry

The Permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law to:

(a) **Entry**

Enter, at reasonable times, upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

(b) **Access to Records**

Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

(c) **Inspection**

Inspection, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit;

(d) **Sampling for Compliance**

Sample or monitor, at reasonable times, for the purposes of assuring compliance with this permit or as otherwise authorized by Act 472, any substances or parameters or any location covered by this permit.

8. Monitoring Records

(a) **Monitoring**

Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

(b) **Records**

The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original chart recordings for continuous monitoring instrumentation, copies of all reports and records required by this permit, and records of all data used to complete the application for this permit for a period of at least three (3) years from the date of the sample, measurement, report, or application. This period may be extended by request of the Director at any time and will be automatically extended during the course of any unresolved enforcement action regarding this facility. The Permittee shall also retain records on the nature and composition of all injected fluids until three (3) years after the completion of any plugging and abandonment procedures specified under 40 CFR 144.52(a)(6) and Part III, Section E.1. of this permit. The Director may require the owner or operator to deliver the records to the Director at the conclusion of the retention periods.

(c) **Content of Monitoring Records**

i) Monitoring Equipment Records

Records generated from continuous monitoring equipment shall include the following information:

(A) Injection pressure maximum, minimum; injection rate maximum, minimum; annulus pressure maximum, minimum, total injection volume and/or any other pertinent information monitored by the Permittee such as pH, temperature or any other parameter specifically required by the conditions of this permit.

9. Reporting Requirements

(a) **Notification of Facility Alterations or Additions:**

The Permittee shall notify the Director as soon as possible of any planned physical alterations or additions to the permitted facility.

(b) **Anticipated Noncompliance**

The Permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

(c) **Monitoring Reports**

Monitoring results shall be reported at the intervals specified in Part III, Section C. of this permit.

(d) **Noncompliance Reporting**

The Permittee shall report to the Director **all** noncompliance incidents including those that may endanger health or the environment, including any monitoring or other information which indicated that any contaminant may cause an endangerment to a USDW, or any noncompliance with a permit condition or malfunction of the injection system may cause fluid migration into or between USDWs. This information shall be provided orally within 24 hours of the time the Permittee becomes aware of the noncompliance circumstances. A written submission shall be provided within 5 days of the time the Permittee becomes aware of the circumstances surrounding the noncompliance incident.

The information to be included in the written submission should be as follows:

i) The exact nature of the noncompliance incident and the cause of the resulting noncompliance; the period of noncompliance, including exact dates and times and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

(e) **Other Noncompliance Reports**

The Permittee shall report all instances of noncompliance not reported under Part I, Section F.9.(d) of this permit at the time monthly reports are submitted. This notification shall contain the information listed in Part I, Section F.9.(d)(i) above, herein.

(f) **Other Information**

When the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information to the Director.

(g) **Requirements Prior to Commencing Injection**

The Permittee may not commence injection of waste into a new, recompleted or a modified portion of an existing injection facility until:

i) The Permittee has submitted to the Director by certified mail or hand delivery, a letter signed by the Permittee and a **Registered Professional Engineer** stating that the facility has been constructed, recompleted or modified in compliance with this permit and/or in compliance with any other modification approved by the Director; and

(A) The Director has inspected or otherwise reviewed the injection well and finds it is in compliance with the conditions of this permit; and/or

(B) The Director has either waived the inspection or has not, within 15 days of receiving the notice under Part I, Section F.9.(g)(i)(A) above, notified the Permittee of his or her intent to inspect the injection well, in which case prior inspection or review is waived and the Permittee may commence injection. The Director shall include, in any notification of intent to inspect, a reasonable time period in which he or she will inspect the well.

(h) **Notification of Conversion or Abandonment**

The Permittee shall notify the Director, in writing before the commencement of conversion, recompletion, modification and/or abandonment of a well.

(i) **Amendment of Permit Application and Reports**

Within 7 days after the Permittee becomes aware that relevant facts were not submitted or were incorrect in a permit application or in any report to the Director, Permittee shall submit such new or corrected facts or information.

(j) **Conversion or Abandonment of Well**

The Permittee shall notify the Director, in writing before the commencement of conversion or abandonment of the well.

10. Signatory Requirement

All applications, reports, or other information requested by the Director shall be signed and certified as required by 40 CFR 144.32.

11. Confidential Information

The Permittee may claim as confidential any information required to be submitted by this permit in accordance with 40 CFR 144.5, with the exception of the name and address of any applicant or Permittee, and information which deals with the existence, absence, or level of contaminants in drinking water.

I. G. ESTABLISHING PERMIT CONDITIONS

In addition to the conditions required in 40 CFR 144.51, the Director shall establish conditions, as required on a case-by-case basis under 40 CFR 144.36 (duration of permits), 144.53(a) (schedules of compliance), 40 CFR 144.54 (monitoring). Permits for operators of hazardous waste injection wells shall include conditions meeting the requirements of 40 CFR 144.14 (requirements for wells injecting hazardous waste), 40 CFR 144.52 (a)(7) and (a)(9), and Subpart G of Part 146. A permit for other wells shall contain the requirements of 40 CFR 144.52 (1) through (8) when applicable.

The Director shall impose on a case-by-case basis such additional conditions as are necessary to prevent the migration of fluids into a USDW, in addition to conditions required in all permits as required on a case-by-case basis, to provide for and assure compliance with all applicable requirements of the SDWA and 40 CFR Parts 144, 145, 146, and 124.

I. H. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

I. I. CORRECTIVE ACTION PLAN

The Permittee shall ensure that the requirements of 40 CFR 144.55 and 146.07 are met and carried out as specified therein.

I. J. CORRECTIVE ACTION PLAN FOR WELLS IN THE AREA OF REVIEW

For the purposes of Class I nonhazardous waste wells this section covering corrective action for wells in the area of review shall apply to the exclusion of 40 CFR 144.55 and 146.07.

If any information is received by the Director, such as in the Annual Report filed by the Permittee, that new artificial penetrations have been located within the area of review, the Permittee, shall be required to submit the following information:

(a) Determine whether the wells are properly completed or plugged;

(b) A description of each well or type of well and any records of its plugging or completion.

(c) For wells that the Director determines are improperly plugged, completed or abandoned or for which plugging or completion information is unavailable, the Permittee shall submit a plan consisting of such steps or modification as are necessary to prevent the movement of fluids into a USDW. This plan shall be submitted according to the guidelines in 40 CFR 146.64 (c)(1).

(d) The Director may require under 40 CFR 146.64 (c)(3) pressure limitations in lieu of plugging.

(e) The Permittee shall be required to comply with all other applicable conditions concerning corrective action for wells within the area of review in 144.64 (a) through (e).

PART II

SPECIFIC CONDITIONS

II. A. CONSTRUCTION REQUIREMENTS FOR NEW WELLS

1. Approved Plans and Specifications

All new Class I injection wells shall be constructed and completed to prevent the movement of fluids into or between USDW's or into any unauthorized zones.

Except as specifically required in the terms of this permit, drilling and completion of each new well (WDW #3, WDW #4 and WDW #5) shall be done in accordance with the plans and specifications submitted with the permit application. **Any proposed changes to the plans and specifications must be submitted in writing and be approved prior to implementation by the Director as providing protection equivalent to or greater than the original design criteria and standards.**

2. Commencement of Construction

No new well construction may commence until a permit has first been issued containing construction requirements. The well shall be in compliance with all the applicable State Permit provisions and with 40 CFR Part 146 prior to commencing injection operations.

3. Casing and Cementing

The new Class I wells to be constructed (WDW #3, #4, & #5) shall be designed for the life expectancy of the well including the post-closure care period. The casing and cementing program shall be designed to prevent the movement of fluid into or between USDW's and to prevent potential leaks of fluids from the well.

Surface casing - The Permittee shall set at least one surface casing string, which at a minimum, extends into the confining bed below the lowermost formation that contains a USDW. This surface casing string must be cemented by circulating cement back to the surface using a minimum of 100% of the calculated annular volume. The Director requires an additional 50% of the calculated cement volume be available for placement downhole if geologic conditions or other circumstances warrant it during cementing activities.

Long string casing - The Permittee shall set at least one long casing string, using a sufficient number of centralizers. This long string casing is to be cemented by circulating cement back to the surface in one or more stages using a minimum of a 100% of the calculated annular volume. The Director requires an additional 50% of the calculated cement volume be available for placement downhole if geologic or if other conditions warrant it during cementing activities. The longstring casing and casing cement shall be of a quantity and quality to withstand normal operation conditions, for estimated the life expectancy of that well.

(a) The permittee shall set and cement casings to minimum subsurface depths as follows:

Well #	Surface Casing	Long String Casing
WDW #3	to 1360 Feet <+->*	to 8670 Feet <+->
WDW #4	to 1385 Feet <+->*	to 8610 Feet <+->
WDW #5	to 1410 Feet <+->*	to 4670 Feet <+->

*surface casing shall be set and cemented at a minimum of 50 feet below the base of the lowermost USDW (Wilcox Formation).

(b) Cementing shall be by the following method with cement used to fill the annular space between the borehole and the casing to the surface:

Well #	Cementing Method	Type and Grade of Cement*
WDW #3 WDW #4 WDW #5	Surface Casing - Circulation to surface w/ 50% excess*	**Lead Cement:** Class H w/ 2% CaCl **Tail Cement:** Class H w/ 2% CaCl (not to surface)

Well #	Cementing Method	Type and Grade of Cement*
WDW #3 WDW #4 WDW #5	Long String - circulation to surface w/ Class H cement w/ 50% excess, in 2 stages*	**Lead Cement:** Class H **Tail Cement:** Class H (not to surface)

*(All cement volumes will be calculated after running an open hole caliper log. Excess cement may be required depending on borehole and geologic conditions present)

(c) Cement injection for both surface and longstring casing shall be from the bottom of the borehole upwards and shall continue until recirculated cement returns at the surface are equivalent in density to the cement injected.

(d) Cementing of the long string casing will occur in two stages with the DV tool set at an optimum depth in accordance with caliper log estimations for required cement volumes.

(c) The long string casing cement shall include a tail slurry resistant to degradation and penetration by the injected waste, and of sufficient quantity to fill the annular space to the surface.

4. Well Construction Materials

Each well shall be constructed with materials designed with sufficient structural strength to withstand the design life of the well. In addition, the casing shall be able to withstand the maximum tensile stress which may be experienced at any point along the length of the casing during construction, operation and/or closure of the well. Each well shall be constructed using materials approved in this permit.

Well #	Casing and Tubing Specifications	Depth to be Set
WDW #3	**Surface casing** - 13 3/8" J-55, 54.5 lb/ft*	1360' <+->
	Long String - 9 5/8" N-80, 43 lb/ft*	0' to 8670' <+->
	Tubing - 7" N-80, 26 lb/ft*	8560' <+->
		(*or equivalent pipe)

Well #	Casing and Tubing Specifications	Depth to be Set
WDW #4	**Surface casing** - 13 3/8" J-55, 54.5 lb/ft*	1385' <+->
	Long String - 9 5/8" N-80, 43 lb/ft*	0' to 8610' <+->
	Tubing - 7" N-80, 26 lb/ft*	8500' <+-> *(or equivalent pipe)

Well #	Casing and Tubing Specifications	Depth to be Set
WDW #5	**Surface casing** - 13 3/8" J-55, 54.5 lb/ft*	1410' <+->
	Long String - 9 5/8" N-80, 43 lb/ft*	0' to 4670' <+->
	Tubing - 7" N-80, 26 lb/ft*	4475' <+->

(*or equivalent pipe)

5. Packer Specifications

All Class I wells shall dispose of fluids through tubing with a packer set at a point immediately above the injection zone as specified in Part IV, Section C.5. The packer shall be designed for expected service. The permittee shall utilize an extension packer on each well with a nipple and seal assembly or equivalent equipment approved by the Director. The packer and bottom of the tubing shall be set within 100 feet of the top of the designated injection interval.

II. B. DRILLING AND COMPLETION REQUIREMENTS FOR NEW WELLS

1. Prior Notification

The Permittee shall notify the ADPC&E UIC Coordinator, State Permits Branch, Water Division at least seventy-two (72) hours prior to beginning drilling, and again at least forty-eight (48) hours prior to beginning any new well cementing operations, casing or annulus pressure testing or any other mechanical integrity testing activities on any well permitted herein.

2. Logging Requirements

At a minimum, the following logs shall be run during the drilling and completion of the new wells. The Permittee shall ensure that a descriptive report interpreting the results of these logs and tests is prepared by a knowledgeable log analyst and submitted to the Director in the completion report.

(a) **Well Bore Deviation**

(i) The maximum point at which a well penetrates the injection formation shall not unreasonably vary from the vertical drawn from the center of the borehole at the surface. Deviation in excess of three (3) degrees from the vertical drawn from the center of the borehole at the surface shall require the Department be notified and approval granted by the Director prior to continuing well construction operations. Deviation checks on the hole shall be performed at sufficiently frequent intervals, depending on the lithology of the strata being penetrated, to assure that deviation of more than three (3) degrees does not occur and that vertical avenues for fluid migration are not created during drilling.

(b) **Log Requirements for Surface Casing:**

i) Resistivity, spontaneous potential and caliper logs before the casing is installed;

ii) Cement bond log, variable density log and/or a cement evaluation log, and a casing pressure test after the casing is set and cemented;

(c) **Log requirements for Intermediate and/or Longstring casings:**

i) Resistivity, spontaneous potential, porosity, and gamma ray before the casing is installed;

ii) Cement bond log, variable density log and/or a cement evaluation log, radioactive tracer survey and/or a noise and temperature log, and a casing pressure test after the casing is set and cemented.

(d) For either Part II, Section B.2.(b)(ii) or (c)(ii) above, if cement bond logs, or mechanical integrity tests indicate that the cement job is poor or inadequate in a particular zone or that fluid movement may occur behind the casing, then a squeeze job or other method approved by the Director may be employed to properly seal off this zone.

3. Cores and Core Analysis

Full-hole cores and/or sidewall cores shall be taken from selected intervals or formations of the injection zone(s) and the lowermost formation(s) comprising the confining zone(s). Sidewall cores shall be taken at sufficient intervals to yield representative data for selected formations of the injection zone(s) and the lowermost formation(s) overlying confining zone. Core analysis shall include a determination of permeability, porosity,and bulk density. Results of all core analysis, the subsequent compatibility testing and any adverse reactions related to the compatibility testing that was performed shall be reported to the Department within ninety (90) days of the date of well completion.

4. Compatibility Testing

Compatibility testing shall be performed by subjecting the core samples to a typical injection disposal waste stream at downhole formation temperature conditions for a period of time adequate to determine if any geochemical reaction products are generated that might adversely impact the receiving formation or well operations. Representative samples of injection formation fluids shall be obtained and tests shall be conducted that mix formation waters and waste stream fluids under conditions as near as possible to actual downhole formation fluid conditions. Results of all subsequent compatibility testing and any adverse reactions related to the compatibility testing that was performed shall be reported to the Department within ninety (90) days of the date of well completion as required under Part III, Section C.3.

5. Pressure Testing of Casing, Tubing and Packer

Casings, tubing and packer shall be tested as follows:

Well #	Surface Casing	Long String Casing	Tubing & Annulus
WDW #3 WDW #4	1400 psi for 1 hour	1400 psi for 1 hour	1400 psi * for 1 hour

Well #	Surface Casing	Long String Casing	Tubing & Annulus
WDW #5	1000 psi for 1 hour	1000 psi for 1 hour	1000 psi * for 1 hour

*(Casing, tubing, packer and the annulus for each well must be tested at 100 psi over the maximum permitted injection pressure for that well with <+ or -> 3% pressure variance during testing)

(a) The Permittee must successfully pass the required casing or annulus pressure test, for any well, prior to the commencement of injection disposal operations. In addition, casing and annulus pressure test results must be submitted or reported to the Department for review and approval prior to the commencement of injection disposal operations.

6. Additional Requirements

(a) After completion of the well, an annulus pressure test of the casing, tubing and packer shall be performed and mechanical integrity demonstrated. This testing shall be conducted in accordance with Part II, Section B.5.

(b) Injectivity testing shall also be performed to determine optimum well injection capacity and injection interval reservoir characteristics.

(c) Prior to performing the injectivity tests above, bottom-hole pressure, bottom-hole temperature, and static fluid level shall be determined and a representative composite sample of formation water from each of the proposed injection formations obtained and analyzed. This analysis shall, in part, consist of pH, specific conductivity, total chlorides and total dissolved solids.

PART III

SPECIFIC CONDITIONS

III. A. OPERATIONAL REQUIREMENTS FOR EACH NEW WELL

1. Waste to be Injected

Injection wells WDW #3, #4 and #5 will be dedicated to the disposal of nonhazardous wastestreams generated at the South Plant. These wastestreams can include wastewater generated from extraneous water treatment system, miscellaneous nonhazardous process wastewaters, contaminated rainwater that falls on process areas which cannot be physically separated from industrial waste waters, debrominated waters and some debrominated spent brine which does not go down Class V brine disposal wells.

Typical wastestream analysis is as follows:

TOC.....310 to 770 mg/l
TOX.....1 to 200 mg/l
TDS.....3,000 to 28,400 mg/l
Cl.....200 to 3,100 mg/l
pH.....3 to 12
Temperature.....160^0 F to ambient
Specific Gravity.....1.0 to 1.22

The chemical composition of extraneous wastewater can vary significantly During periods of high intensity, short duration rainstorms, for example, the majority of the wastestream to be disposed may be rainwater.

*Wastes not authorized to be stored, processed, disposed or otherwise handled as stipulated herein or stipulated in any State Permit issued by this Department, relative to this permit are not authorized for injection at this time. This analysis does not reflect a permit limitation contained herein.

2. Formations Permitted For Injection

Injection must be into a geologic formation which is beneath the lowermost formation, containing, within 1/4 mile of the well bore, an underground source of drinking water. Permitted injection intervals shall be confined to the formation intervals noted below:

WDW #3	Injection Zone	Injection Depths*
	Smackover Fm	8660' to 8830' + or -

WDW #4	Injection Zone	Injection Depths*
	James Limestone	4440' to 4495' + or -
	Smackover Fm	8600' to 8710' + or -

WDW #5	Injection Zone	Injection Depths*
	James Limestone	4575' to 4630' + or -

*(Estimated depths provided, actual depths to be provided in completion report)

3. Authorization of Specific Injection Intervals

The Permittee shall receive authorization from the Department to inject fluids into specific injection intervals within permitted injection zones at each well permitted herein. Not all permitted intervals within each injection zone, for each well, will be authorized for injection at the same time. The Permittee will receive authorization from the Department to utilize specific injection interval(s) within a permitted injection zone, on a well by well basis, at the discretion of the Department.

WDW #3	Injection Interval	Injection Depths*
	Smackover Fm	8860' to 8830' + or -

WDW #4	Injection Interval	Injection Depths*
	Smackover Fm	8600' to 8710' + or -

WDW #5	Injection Interval	Injection Depths*
	James Limestone Fm	4575' to 4630' + or -

*(Estimated depths provided, actual depths to be provided in completion report)

Waste fluid disposal into a permitted injection interval other than those authorized by the Department shall be considered an unauthorized injection violation under 40 CFR 144.11 and subject the Permittee to possible enforcement action.

III. B. SPECIFIC OPERATIONAL REQUIREMENTS

The Permittee shall assure that the injection pressure at the wellhead does not exceed a maximum which shall be calculated to assure that the pressure in the injection zone, during injection does not initiate new fractures or propagate existing fractures in the injection zone.

The Permittee shall operate the WDW #3, #4, #5 according to the following criteria:

OPERATIONAL PARAMETERS WDW #3

pH.....3 to 12
Maximum Injection Rate (Smkover)....400 (gal/min)**
Maximum Surface Injection Pressure..1300 (psig)
Maximum Injection Volume.....400 gpm X 1440
X days month

Minimum Annulus Pressure..Grter than Inject Press

OPERATIONAL PARAMETERS WDW #4

pH.....3 to 12
Maximum Injection Rate (Smkover)....100 (gal/min)*
Maximum Injection Pressure(Smkover)..1300 (psig)
Maximum Injection Volume (Smkover)...100 gpm X 1440
X days month

Maximum Injection Rate (James).....100 (gal/min)**
Maximum Injection Pressure (James)...900 (psig)
Maximum Injection Volume (James).....55 gpm X 1440
X days month

Minimum Annulus Pressure..Grter than Inject press

OPERATIONAL PARAMETERS WDW #5

pH.....3 to 12
Maximum Injection Rate (James).....100 (gal/min)*
Maximum Injection Pressure (James)..900 (psig)
Maximum Injection Volume (James)....100 gpm X 1440
X days month
Minimum Annulus Pressure..Gtr than Inject Press

*The Maximum Injection Rate into the Smackover Fm through WDW #3 and WDW #4 shall not exceed a combined total of 400 gpm.

**The Maximum Injection Rate into the James Limestone Fm through WDW #4 and WDW #5 shall not exceed a combined total of 100 gpm.

III. C. REPORTING REQUIREMENTS FOR EACH WELL

1. Monthly Reporting Requirements

The Permittee shall submit **Monthly Reports** (within 20 working days after the end of the month) to the Director containing the following information:

(a) Results of continuous monitoring for each well including **injection pressure** maximum, minimum; **injection flow rate** maximum, minimum; **annulus pressure** maximum, minimum; **pH** value of injected fluids and the **injection volume** totals for the month;

(b) **A description of any event which exceeds the operating parameters for annulus pressure or injection pressure as specified in this permit. A description of any event which triggers an alarm or shutdown device and the action taken. Any significant change in the annular fluid volume.**

(c) Documentation of **all noncompliance incidents, excursions, workovers, mechanical integrity testing, well stimulations or any other pertinent information concerning well operations for that month**, for each well;

2. Annual Reporting Requirements

The Permittee shall submit to the Director an **Annual Report** (by March 1st of the following year) containing the following information:

(a) Results of continuous monitoring for each well including **injection pressure** maximum, minimum; **injection flow** rate maximum, minimum; **annulus pressure** maximum, minimum; **pH** of the injected fluids and **injection volume** totals for the reporting year and to date;

(b) **A description of any event which exceeds the operating parameters for annulus pressure or injection pressure as specified in this permit. A description of any event which triggers an alarm or shutdown device and the action taken. Any significant change in the annular fluid volume.**

(c) Documentation of **all noncompliance incidents, any violations, excursions for that reporting year; documentation of workovers, well testing, well stimulations or any other pertinent information concerning well operations for that reporting year,** for each well;

(d) The Permittee shall **analyze injected fluids annually according to the guidelines approved in the Waste Analysis Plan** (Part III, Section C.8). This analysis shall include the physical, chemical and other relevant characteristics of the injection fluids and be submitted in the Annual Report.

(e) Included in the Annual report shall be **a discussion covering all aspects of well operations for the preceding year. Discussions of and reasons for any excursions from permitted operational parameters, any violations and action taken to correct the violation(s).**

(f) Discussion of the types of **tests done to insure the mechanical integrity of each permitted well during the preceding year, including the dates and times of those tests and certification by the Permittee that each well has demonstrated mechanical integrity for the preceding year;**

(g) The results and dates of **any other tests performed on each well such as workovers or stimulations, or corrosion monitoring for the preceding year;**

(h) The Annual Report shall include a **direct measurement of bottom-hole pressure (see Part III, Section B.3. herein) and/or in accordance with 40 CFR 146.68 (e)(1) or a calculation of bottom-hole pressure using the specific gravity of the fluid in the well bore and the static fluid level. A discussion of pressure effects of disposal operations upon the injection zones and specific injection intervals and the calculation of pressure build-up within the injection interval(s).**

(i) **An estimation of the distance of the injected fluid front from the wellbore.**

(j) To the extent such information is reasonably available, the report shall also include:

i) Locations of newly constructed and discovered wells within the area of review, if such wells were not included in the technical report accompanying the permit application or in later reports;

ii) A tabulation of data for all newly constructed and discovered wells within 1/2 mile of each nonhazardous injection well that penetrate through or to within 300 feet of the top of the injection zone.

iii) Wells found to be located within the area of review must be addressed with appropriate Corrective Action under Section II.D. herein.

(k) The Permittee shall notify the Director within twenty-four (24) hours of any change in well operations or in well equipment monitoring parameters which could reasonably be attributed to a leak or other failure in well equipment.

3. Completion Reports

(a) Within ninety (90) days after new well completion, the Permittee shall submit to the Director a report on the drilling and completion history for WDW #3, #4, & WDW #5 including casing and cementing records and copies of all well logs run. The drilling history shall include a complete and accurate record of the depth, thickness, and character of strata penetrated. The Permittee shall integrate data obtained into adjusted formation pressure increase calculations, fluid front radius calculations and cross-sections of the disposal zone.

(b) The results of injectivity tests performed on the well and the results of compatibility tests performed with formation fluid samples and core samples obtained during the drilling operations. All fluid compatibility tests are to be included in the completion report.

(c) The following well logs shall also be submitted with the completion report:

i) Surface casing - SP, Caliper, Dual Induction Resistivity, CBL/VDL logs with cement log analysis. Noise and temperature or Oxygen Activation logs may be required in some instances by the Department;

ii) **Long String Casing** - SP, Caliper, Dual Induction Resistivity, CBL/VDL with cement log analysis;

iii) Radioactive Tracer Survey log;

iv) Core Analysis information including injection formation porosities, permeabilities and any other information relative to the injection zone formation properties.

4. Certification of Construction

The Permittee shall include in the completion report for each new well or recompleted well, certification by a **Registered Professional Engineer** that WDW #3, #4 & #5 have been constructed according to the plans and specifications contained in this permit and in accordance with existing State and Federal regulations governing Class I waste disposal well construction activities. This construction certification shall be presented to and approved by the Director, prior to the commencement of injection operations.

III. D. TESTING AND MONITORING REQUIREMENTS FOR EACH WELL

1. Parameters to be Measured by Continuous Recorders

The following parameters shall be measured with an appropriate continuous recording device housed in a weatherproof enclosure:

(a) **Injection tubing pressure, annulus pressure, injection tubing flow rate, injection volume, pH**

(b) **Any other parameters as requested by the Permittee or as specified in this permit.**

2. Instrumentation

The Permittee shall ensure that the instruments required to meet the continuous recording and other monitoring requirements under this permit be selected for expected service, be properly installed and maintained at all times during the life of the well.

3. Instrument Calibration

All instruments used for monitoring well injection systems shall be calibrated quarterly. The Director may require more frequent instrument calibration if it is deemed necessary.

4. Monitoring of Injected Wastes

Testing and monitoring of the injected wastes shall, at a minimum include:

(a) The Permittee shall be required to monitor the injected wastes. The Permittee shall within 180 days of the effective date of this permit submit an ADPC&E approved Waste Analysis Plan (Part III, Section D.10.) that describes the procedures to be carried out to obtain a detailed chemical and physical analysis of a representative sample of the waste, including the quality assurance procedures used. Such waste analysis shall be conducted annually.

5. Corrosion Monitoring

The Permittee shall demonstrate that the waste stream will be compatible with the well materials in which it will be in contact and submit to the Director the methodology used in making that determination. Compatibility for the purposes of this requirement is established if contact with the waste fluids will not cause the well materials to fail.

(a) The Permittee shall be required to initiate continuous corrosion monitoring of the construction materials used in the well for wells injecting corrosive waste. Such a test may include the following:

i) Placing coupons of well construction materials in contact with the waste stream; or

ii) Routing the waste stream through a loop of well construction materials; or

iii) Using an alternate method approved by the Director.

(b) The Permittee **shall monitor the materials for loss of mass, thickness, cracking, pitting or any other signs of corrosion on a quarterly basis** to ensure the well components meet the minimum standards for material strength and performance set forth in 40 CFR 146.65 (b). Results of corrosion monitoring shall be submitted to the Department as a part of the Mechanical Integrity Testing section in the Annual Report.

6. Mechanical Integrity Testing

The Permittee shall maintain mechanical integrity of each injection well at all times. An injection well has mechanical integrity if there is no significant leak in the casing, tubing or packer and/or there is no significant fluid movement into an underground source of drinking water through vertical channels adjacent to the wellbore.

Mechanical integrity shall be demonstrated for each nonhazardous waste disposal well once every five years for the life of the well. The demonstration of mechanical integrity shall consist of running the following tests:

Annual Testing Requirements for Class I Nonhazardous Waste Wells

(a) Pass a yearly annulus pressure test to be witnessed by a representative of the Department. Testing may also be witnessed by any other individual approved in advance by the Department and the Permittee.

(b) Once each year, the Permittee shall monitor the pressure buildup in the injection zone which includes a shut down of the well for a time sufficient to conduct a valid observation of the fall off pressure curve;

(c) The Director may require such tests whenever the well is worked over, the well tubing is removed, packer is replaced or based on any information received by the Director which may indicate such tests may be warranted.

Tests to be Conducted Every Five Years for Class I Nonhazardous Waste Wells

(a) An approved Radioactive Tracer (RAT) log shall be run and passed at least once every five years to determine the presence or absence of fluid movement behind well casing.

(b) An approved Noise or Temperature or Oxygen Activation or other approved log shall be run at least once every five years to test for fluid movement along the borehole;

(c) Casing Inspection logs shall be run at least once every five years unless the Director waives this requirement due to well construction or other factors which limit the tests reliability;

(c) Any other test approved by the Director in accordance with the procedures used in 40 CFR 148.8(d) may also be used. The results of these tests, including interpretive analysis for each test shall be submitted to the Department within sixty (60) working days of completion of any required mechanical integrity testing;

7. Loss of Mechanical Integrity

If a loss of mechanical integrity occurs or is indicated during mechanical integrity testing, annulus pressure testing or during well operations the Permittee shall do the following:

(a) Immediately cease injection of waste fluids;

(b) Take all steps necessary to determine whether or not there has been a release of hazardous waste or hazardous waste constituents into any unauthorized zone;

(c) Notify the Director within 24 hours after the loss of mechanical integrity is discovered;

(d) Notify the Director when injection is expected to resume; and

(e) Restore and demonstrate mechanical integrity to the satisfaction of the Director prior to resuming the injection of waste fluids;

(f) The Permittee shall notify the Director and obtain approval prior to conducting any well workover.

Whenever the Permittee obtains evidence that there may have been a **release of injected waste into an unauthorized zone** they shall:

(a) The Permittee shall immediately cease injection of waste fluids, and;

i) Notify the Director within 24 hours of obtaining such evidence;

ii) Take all necessary steps to characterize the extent of any release;

iii) Comply with any remediation plan specified by the Director;

iv) Implement any remediation plan approved by the Director, and;

v) Where such a release is into a USDW currently serving as a water supply, place a notice in a newspaper of general circulation.

(b) The Director may allow the Permittee to resume injection prior to completing clean-up action if the Permittee can demonstrate that the injection operation will no longer endanger a USDW.

8. Annulus Pressure Monitoring System

Unless an alternative to a packer has been approved under 40 CFR 146.12 (c) the annulus between the tubing and protection casing for each Class I well shall be filled with a fluid approved by the Director and the Permittee **shall be required to maintain a minimum annulus pressure greater than the injection pressure throughout the tubing for each Class I nonhazardous well in operation.**

Each well shall be required to pass an annulus pressure test as follows:

(a) Annulus pressure testing for each Class I nonhazardous well shall be conducted upon recompletion, after each workover involving tubing removal and/or packer placement and after each well shut-down in excess of thirty (30) days;

(b) In addition, each Class I nonhazardous well must also pass an annulus pressure test at least once a year;

(c) An approved annulus pressure test shall consist of pressuring the annulus to 100 psi above the permitted injection pressure for that well and holding that pressure for one hour with a maximum allowable pressure variation plus or minus 3% of the initial recorded pressure.

9. Bottom-Hole-Pressure Testing

The Permittee shall submit to the ADPC&E results of bottom hole pressure surveys for each Class I nonhazardous well. These surveys shall be performed after shutting in each well for a period of time sufficient to allow the pressure in the injection interval to reach equilibrium, in accordance with 40 CFR 146.68 (e)(1) and in accordance with the Falloff Pressure Test Guidelines developed by the EPA.

10. Waste Analysis Plan

The Permittee shall monitor the injected wastes **annually** according to an approved Waste Analysis Plan (40 CFR 146.68) that describes the procedures to be carried out to obtain a detailed chemical and physical analysis of a representative sample of the waste fluid, including the quality assurance procedures used.

At a minimum the plan shall include the following:

(a) The parameters for which the waste will be analyzed and the rationale for selection of these parameters;

(b) The test methods that will be used for these parameters, and;

(c) The sampling method to be used to obtain a representative sample of the waste fluid to be analyzed;

The Permittee shall repeat the analysis of the injected wastes as described in the waste analysis plan, and when process changes occur that may significantly alter the characteristics of the waste stream. The Permittee shall make sure the plan remains accurate and the analysis remains representative.

III. E. PLUGGING AND ABANDONMENT

1. Proper Plugging and Abandonment Procedures

Upon final abandonment of a well, the Permittee shall ensure that the well is plugged in accordance with the approved plugging and abandonment plan submitted with the application, and hereafter made a condition of this permit.

Prior to plugging, the Permittee must give the Department written notification of intent to plug at least seventy two (72) hours prior to beginning plugging operations. Mechanical integrity of the well shall be verified prior to plugging by a program approved by the Director. Any proposed changes to plugging and abandonment plans must be approved by the Director after the Permittee demonstrates that the changes will provide protection equivalent to or greater than the original plugging design criteria and standards. A change to a plugging and abandonment plan shall be treated as a minor modification of the permit under 40 CFR 144.41(g).

III. F. Financial Assurance

The Permittee shall secure and maintain in full force and effect at all times a performance bond in a form acceptable to the Director, to provide for proper closing, plugging and abandonment of the permitted waste disposal well(s) in the amount set forth below. The amount of financial assurance may, upon approval of the Director, be altered at a future date to provide for plugging subject to prevailing general economic conditions. This permit does not authorize underground injection of fluids unless the Permittee has in effect a performance bond acceptable to the Director.

Well #	Amount of Financial Assurance
WDW #3	$25,000.00
WDW #4	$25,000.00
WDW #5	$25,000.00

PART IV

VARIANCES, COMPLIANCE SCHEDULES, AND OTHER CONDITIONS

IV. A. VARIANCES

No variances were requested by the applicant and none were granted by the Director in this permit.

IV. B. COMPLIANCE SCHEDULES

The Permittee shall, within 180 days of the effective date of this permit submit a Waste Analysis Plan for approval by the Department according to Part III, Section D.10.

IV. C. OTHER CONDITIONS SPECIFIC TO THIS PERMIT

1. Modification of Operational Parameters

   The Permittee, using the information gathered during the well construction phase such as core samples, injectivity tests, and well logs, shall justify to the satisfaction of the Director that the operational parameters as submitted in the application are technically sound and appropriate for the requested system. The Permittee shall determine using computer models or other appropriate calculations, the accuracy of the projected fluid front radius and pressure build-up calculations within the injection interval based on the additional information gathered during well construction and testing.

   If the aforementioned information indicates that the operational parameters for this system should be lowered, the Director may do so as specified in Condition I.B.1. of this permit. If the information gathered during well testing indicates the operational parameters for the system could be modified upwards, the Permittee may request the Director modify the permit under 40 CFR 144.39 or Condition I.B.3. of this permit.

The Permittee shall not commence injection operations until an evaluation based on the completion report, well testing and/or an examination of computer models has been completed, by the Department, to assist in determining the optimum operational guidelines for this system and written authorization to commence injection has been granted by the Department.

2. Formation Intervals Authorized For Injection

Fluid disposed into each well shall be injected into the following specific permitted injection intervals. **No other injection intervals, unless specified herein, shall authorized for fluid disposal at this time.*** The injection intervals approved for disposal, at this time are listed as follows:

WDW #3	Injection Interval	Injection Depths*
	Smackover Fm	8660' to 8830' + or -

WDW #4	Injection Interval	Injection Depths*
	Smackover Fm	8600' to 8710' + or -

WDW #5	Injection Interval	Injection Depths*
	James Limestone Fm	4575' to 4630' + or -

*(Estimated depths provided, actual depths to be provided in completion report)

3. Modification of Authorized Injection Intervals

The Permittee, using information gathered during the new well construction phase such as core samples, injectivity testing, well logs or any other relevant information, may request the Director grant approval to modify and/or include the use of other injection formations authorized by this permit (see Section IV.3.C.(2) above). Such a change shall be considered a minor modification of this permit and shall be submitted as a formal request under the guidelines of Section I.B. herein, and 40 CFR 144.39. If the information supplied by the Permittee indicates the use of an additional injection interval(s), previously authorized by this permit is warranted, the Director may, at his discretion, assign or modify which injection intervals are authorized to receive injected wastes.

4. Maximum Allowable Surface Injection Pressure

The maximum allowable surface injection pressure for each injection interval shall be as follows:

Well #	Injection Interval	Injection Depth	MASIP**
WDW #3	Smackover Fm	8660' to 8830'	1300
WDW #4	James Limestone Fm	4440' to 4495'	900
	Smackover Fm	8600' to 8710'	1300
WDW #5	James Limestone Fm	4575' to 4630'	900

**Maximum Allowable Surface Injection Pressure for this injection interval to be determined based on testing and/or information provided by the Permittee under Part II, Section B. of this permit.

5. Placement of Packer

The packer and bottom of tubing for WDW #3, #4 and #5 shall be set within 100 feet of the top of the designated injection interval. The discharge point in the injection interval shall be from the bottom of tubing placed below the packer.

6. Placement of Perforations

Selected units of the Smackover Formation for WDW #3 and #4, and selected units within the James Limestone, WDW #4 and #5, within the designated disposal intervals will be the primary zones selected for perforation at this time. Additional strata within each permitted injection interval, may be authorized by the Department, at a later date.

STATE OF ARKANSAS
DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY
8001 NATIONAL DRIVE, P.O. BOX 8913
LITTLE ROCK, ARKANSAS 72219-8913
PHONE: (501) 562-7444
FAX: (501) 562-4632

July 8, 1994

Clarice Hanusz
Senior Environmental Engineer
Albemarle Corporation
P.O. Box 729
Magnolia, AR 71753

RE: Issuance of UIC Permit 12-U

Dear Clarice:

Enclosed is the original signature copy of UIC Permit 12-U. Please feel free to contact me if you have any questions or comments concerning this permit.

Sincerely,

Gerald Delavan, P.G.
UIC Coordinator
Senior Geologist
Water Division

cc: Bruce Kirkpatrick, Manager, State Permits Branch, Water Div.