

XVII. SUMMARY OF MITIGATION MEASURES

The preceding chapter covered the significant environmental impacts from oil, gas, solution mining and underground gas storage operations. This chapter summarizes the mitigation measures required for all phases of oil, gas, solution mining, enhanced recovery, and underground storage operations. Mitigation measures are made up of the following segments:

- Oil, Gas, and Solution Mining Law;
- Regulations in 6NYCRR Parts 550 to 558;
- Administrative procedures;
- Conditions contained in other environmental permits;
- Special conditions or guidelines issued by the DEC;
- Proposed regulatory changes and additions.

Existing and proposed mitigation measures will be presented as they pertain to the aforementioned operations.

A. ADMINISTRATIVE REVIEW PROCESS

1. Existing Mitigation

- a. Administrative Procedures. The regulatory program outlined in this GEIS is not restricted to Regulations 6NYCRR 550 through 558 and the Oil, Gas and Solution Mining Law. It also includes the following procedures necessary for ensuring regulatory compliance.
 - Conditions attached to permits requiring operators to undertake mitigation measures.
 - Inspections that can be conducted at any time during the life of a well.
 - Enforcement actions that can be taken including fines that can be levied against operators who fail to comply with regulations, permit conditions, or Department Orders.

- b. Pre-application requirements for drilling permits.
 - Organizational Report. This report must be filed with the Division before an operator can apply for a permit.
 - Financial Security. Operators must post a Well Plugging and Surface Restoration Bond or some other form of financial security that the Department can use to effectively plug and abandon a well, if necessary.
- c. Permit Application. A permit must be obtained from the Department in order to drill, deepen, plug back or convert a well. The permit application must be accompanied by the following:
 - A plat map that shows the proposed well location, the lease or unit boundaries, and other nearby wells.
 - A permit fee based on the depth of the well. Fees start at \$225 for a well less than 500 feet deep and increase by \$125 per 500 feet of well depth.
 - An Environmental Assessment Form (EAF) which details the physical setting of the proposed well and the procedures that will be followed in constructing the well site and developing the well.
- d. Application Fee. An application fee of ten thousand dollars for a new underground storage project or five thousand dollars for a modification of an existing facility is required.
- e. Application Processing. The following steps are taken as the permit application is reviewed.
 - The application is assigned a permit number and an API number.

- Drilling site inspections are conducted.
 - Technical reviews are conducted by DEC Division of Mineral Resources, DEC Division of Regulatory Affairs, and other government agency staff if needed.
- f. Environmental Significance. The Department makes a determination as to the environmental significance of the proposed well within 15 days.
- A "negative declaration" is issued when the proposed operations are determined not to have a significant effect on the environment.
 - A "positive declaration" is issued when the project may pose a significant environmental impact. An Environmental Impact Statement (EIS) must then be prepared by the operator.

2. Proposed Mitigation

- a. Permit Application. A proposed drilling program will have to be submitted for approval with the drilling permit application. The drilling program should include the proposed casing, cementing, completion, testing and stimulation procedures. These procedures are all considered part of the action to drill a well under SEQRA.

B. SITING OF WELLS

1. Existing Mitigation

- a. Statewide 40 Acre Spacing Rule. A well can be no closer than:
- 1320 feet from another well completed in the same formation;
 - 660 feet from any lease, pool, or unit boundary line unless the boundary line is the New York-Pennsylvania

border. In that case, the set back is 330 feet.

Exceptions to the 40 acre rule are those wells drilled for oil in oilfields discovered prior to 1981. The Department also grants variances and issues spacing orders as warranted.

b. Well Location Restrictions. DEC staff check to ensure that the well location is at least:

- 100 feet from a private dwelling
- 75 feet from the traveled part of a public road
- 150 feet from a public building or area.

c. Well and Access Road Restrictions. DEC staff check if the proposed well or access road location is:

- within 50 feet of a surface water body
- within a coastal zone area or a drinking water watershed
- within 1000 feet of a municipal water supply whereby a site specific EIS is required. If between 1000 to 2000 feet, an EIS may be required.
- in an area subject to erosion
- in or near a historic or archeologic site
- on State lands, State parklands, or other government properties.

d. Stream Disturbance Program. If the proposed well or access road is within 50 feet of a protected stream, a Stream Disturbance Permit is required. Typical permit mitigation measures are:

- restrictions on the location of stream crossings
- strict specifications for constructing access road and

- gathering line crossings
 - erosion control requirements
 - reclamation requirements.
- e. Floodplains. If the proposed well or access road is within 100 feet of a floodplain, a Floodplain Permit is required. Possible mitigation measures include the following:
 - removal of brushy debris
 - well and access road location restrictions
 - permit conditions specifying size and number of culverts
 - anchoring of tanks.
- f. Freshwater Wetlands. If proposed well or access road is located within 100 feet of a freshwater wetland that is over 12.4 acres or has unique local significance, a Freshwater Wetlands Permit is required. Mitigation measures include:
 - special permit conditions covering seasonal construction, well site specifications, vehicle movement, brush disposal, pit location, and gathering line placement;
 - creation of replacement wetland on roughly an acre for acre basis.
- g. Agricultural District. If the planned well or access road is located within an Agricultural District, special permit conditions may be issued including:
 - total disturbance area limited to one acre;
 - adoption of erosion and siltation control measures;
 - relocation of the planned wells and/or access roads to reduce interference with farming operations.
- h. Significant Habitats. Specific mitigation measures may be required to prevent negative impacts on habitats by the

proposed well or access road. Permit conditions may include the following:

- relocation of the proposed well and access road to prevent disruption of the habitat;
 - restrictions placed on time of operation;
- i. Primary and Principal Aquifers. Siting of wells and access roads within these critical areas has prompted the special permit conditions that will be covered under drilling mitigation. The Department also requires that oil holding tanks in primary aquifer areas be surrounded by a dike capable of retaining $1\frac{1}{2}$ times the capacity of the tank.
- j. Erosion and Sedimentation. Erosion and sediment control programs are required as conditions to drilling permits for wells located within the watershed of a drinking water reservoir.
- k. Historic Landmarks. In the event a well is proposed in the vicinity of an historic site, the Department may attach specific conditions to the drilling permit which may include:
- visual screening of operations
 - setback requirements greater than existing minimums
 - restrictions on time of operation
 - landscape reclamation requirements.

2. **Proposed Mitigation**

- a. **Siting restrictions. New well setback distances are proposed as follows:**
- 150 feet from public and private buildings or dwellings
 - 150 feet from permanent surface water bodies and surface municipal water supplies.

- 150 feet from a private water well without written landowner approval.
 - 150 feet from springs used for a domestic water supply
- b. Plat Map. The plat submitted with the drilling permit application will show the proposed location of pits, tanks, and other well site facilities as well as the location of private or public buildings, roads, or areas, and all water wells of public record within 1,000 feet of the proposed well site.
- c. Reclamation Schedule. A drilling site reclamation timetable of 45 days is proposed.
- d. Topsoil Conservation. It is proposed that stockpiling and redistribution during site reclamation be required in all agricultural areas. The following specific procedures are recommended:
- strip-off and set aside topsoil during construction
 - protect stockpiled topsoil from erosion and contamination
 - cut well casing to a safe buffer depth of 4 feet below the surface
 - paraplow the area before topsoil redistribution if compaction has occurred
 - redistribute topsoil over disturbed area during site reclamation.
- e. Trash burial. It is recommended that the permit holder be required to have landowner approval to bury trash or the drilling pit liner.
- f. Dikes. Dikes will be required around all oil storage tanks, regardless of their location. The dike's capacity must be 1½ times the tank's total storage volume.

C. DRILLING PHASE: DRILLING, CASING, AND COMPLETION OPERATIONS

1. Existing Mitigation

- a. An operator holding a valid drilling permit must notify by certified mail any affected local government and any landowner whose surface rights may be affected by drilling operations.
- b. The DEC must be notified by telegram or by telephone prior to start-up of drilling operations.
- c. The drilling permit expires if operations are not undertaken within 180 days of issuance. The permit must be posted at the drilling site.
- d. Well locations, units or leases shall be kept free of all flammable material and waste oil shall be disposed of in a non-hazardous manner.
- e. Recently adopted regulations require that any loss or spill of oil or gas from pipelines and gathering lines, receiving tanks, storage tanks or receiving or storage receptacles must be reported to the DEC's Division of Water, Bureau of Spill Prevention and Response. Their Hot Line phone number is 1-800-457-7362.
- f. If oil or gas is lost during production, transportation, or storage in volumes exceeding 100 barrels of oil or 3 million cubic feet of gas, the DEC regional headquarters must be notified immediately. A complete report must be submitted within five days.
- g. Conductor Casing. If the conductor pipe is driven into the ground, the operator must grout cement from the top of the casing and form a protective pad sloping from the wellbore. If the casing is set into a drilled hole, it must be cemented in

place.

h. Surface Casing. The new cementing guidelines adopted on April 1, 1986 require the following:

- Surface hole must be large enough to allow running of centralizers.
- Surface casing must extend at least 75 feet below deepest fresh water zone encountered or 75 feet into bedrock, whichever is deeper. The surface pipe must be set deep enough to allow the BOP stack to contain formation pressures encountered before the next casing is run.
- Surface casing shall not extend into zones known to contain measureable quantities of shallow gas. Department approval is required for exceptions to this requirement.
- Surface casing shall be new pipe rated at a minimum of 1,100 psi. Exceptions must be approved by the Department.
- At least two centralizers must be run on surface casing. Minimum spacing is one centralizer per 120 feet. Cement baskets must be installed above major lost circulation zones.
- All gas flows must be killed prior to cementing any casing strings. The operator shall attempt to establish circulation with returns to the surface. If the hole is dry, the calculated volume would include the pipe volume and 125 percent of the annular volume. A flush, spacer or extra cement shall be used to separate the cement from the borehole fluids to prevent dilution. If cement returns are not achieved, the operator may be required to run a

log to determine the top of the cement.

- The pump and plug method must be used to cement surface casing. A minimum of 25 percent excess cement shall be used with appropriate lost circulation materials.
 - The cement mixing water must be tested for pH and temperature prior to mixing. The results must be recorded on the cementing ticket.
 - Preparation of the cement slurry must be according to specifications in order to minimize the free water content in the cement.
 - The casing must not be disturbed in any way until the cement achieves a calculated compressive strength of 500 psi. The WOC time shall be recorded on the drilling log.
 - The cement pad surrounding drive pipe (conductor casing) must be three feet square or, if circular, three feet in diameter.
- i. Intermediate casing string(s) and their cementing requirements will be reviewed and approved by Regional Minerals staff on an individual well basis.
- j. Production casing.
- Production casing cement must extend at least 500 feet above the casing shoe or tie into the previous casing string, whichever is less. It shall also extend at least 100 feet above any oil or gas shows prevalent in the area.
 - Centralizers are required at the base and at the top of the production interval if casing extends through that interval. One additional centralizer per 300 feet of cemented interval is also required.

- A minimum 25 percent excess cement must be used. When caliper logs are run, 10 percent excess will suffice.
 - The pump and plug method must be used for all production casing cement jobs deeper than 1,500 feet. If the pump and plug technique is not used, the operator shall not displace the cement closer than 35 feet above the bottom of the casing. If plugs are used, the plug catcher shall be placed at the top of the deepest full joint of casing.
 - The casing must be of sufficient strength to contain any expected formation or stimulation pressures.
 - The casing must not be disturbed in any way until the cement achieves a calculated compressive strength of 500 psi.
 - The cement mixing water must be tested for pH and temperature prior to mixing. The results are to be recorded on the cementing ticket and/or the drilling log. WOC time shall be adjusted based on the results of the test.
 - The annular space between the surface casing and the production string must be vented at all times. If the annular gas is to be produced, a pressure relief valve shall be installed and set at a pressure approved by Regional Minerals staff.
- k. Well Drilling Site Inspection. A routine inspection is conducted by Department staff at least once during the drilling of every well. The inspection usually occurs after surface casing is set but prior to cementing of the production string.

- l. Blowout preventers (BOP's) are required on most wells drilled in New York State.
- m. Flowback of well stimulation fluids onto the ground subjects the operator to enforcement actions and penalties.
- n. A Well Drilling and Completion Report must be filed within 30 days after completing a well.
- o. Drilling Pits. The Department requires as a permit condition that all well site earthen pits be lined with an impermeable material before they can be used. Pit condition is always checked during well site inspections.
- p. Waste fluids must be removed from pits and tanks and be disposed of in an environmentally acceptable manner within 45 days after the cessation of drilling operations.
- q. Primary Aquifers. Special permit conditions and orders have been formulated for operations conducted within primary and principal aquifer areas.
 - The surface hole must be drilled on air or freshwater fluids.
 - Specific casing and cementing criteria exist involving conductor pipe, surface casing and the production string. Use of cement baskets above known lost circulation zones, lost circulation material, centralizers and excess cement is also required.
 - State Inspectors must be present during surface and production string cement jobs. Remedial work such as cement grouting at the surface or running of cement bond logs may be ordered.
 - All fluids must be maintained on-site and properly

disposed of after drilling operations have ceased.

Holding tanks must be installed if the well is a producer for containment of brine and other produced fluids.

- All existing aquifer wells must be vented or produced with limited back pressure on the casing. New wells must have the production string cemented to the surface.
- Operators must complete the "Record of Formations Penetrated" and note the depth of all water producing zones on the Completion Report.

r. The Bass Island Trend. Special permit conditions which pertain to operations in the Bass Island trend are:

- detailed surface casing requirements;
- specific blowout preventer (BOP) requirements addressing the type of BOP, its installation and actuation source. Choke manifolds, flowlines, kill fluid availability, mud pumping capability, and testing procedures are also specified;
- safety requirements regarding the penetration of the Onondaga formation include providing the drilling company with a well prognosis indicating where problem formations such as the Onondaga may occur with appropriate comments and a list of emergency duties, requiring the presence of a company representative on-site, and providing for advance notification to local fire departments.

2. Proposed Mitigation

- a. The operator will be required to notify DEC by telephone 24 hours in advance of starting actual drilling operations.

- b. Notification to affected landowners and local governments will be required at least five business days prior to the beginning of drilling operations.
- c. The 180 day permit expiration date will be able to be extended to 12 months by application for extension.
- d. Amendments to existing safety regulations will be proposed to reinforce further the need to conduct operations in a safe, workmanlike manner and to keep equipment and facilities in safe condition.
- e. Installation and pressure testing of blow out preventers should be done prior to drilling out the shoe of the surface casing. It will also be recommended that operators routinely test their blow out preventers and conduct kick response training in order to better prepare their personnel in the case of an accident.
- f. Additional language for the regulations might also include that the owner or operator immediately take all necessary precautions to control, remove or otherwise correct any health, safety, environmental, or fire hazard. Also, only trained and competent personnel should be used to drill and operate wells.
- g. All future oil and gas wells drilled in primary and principal aquifers will have to be cemented from total depth to the surface.
- h. Inclusion of all information relating to casing weight and grade will be required on the drilling permit application form.
- i. Omission of surface casing will only be allowed in areas where it has been proven that no subsurface pressure control is needed and no freshwater exists.
- j. Enforcement actions will be increased against operators who

repeatedly file fraudulent or incomplete Completion and Well Drilling Reports.

k. Comprehensive pit liner requirements will include the following:

- minimum thickness = 10 mil.
- minimum tear strength = 50 lbs.
- minimum tensile strength = 65 lbs.
- low temperature cold crack = -15°F
- seam strength = 80 percent of original material. Seams must be factory installed.
- lining shall not begin until a proper base has been prepared to accept the liner. Base material shall be free from angular rocks, roots, grass and vegetation. Foreign materials and protrusions shall be removed and all cracks and voids shall be filled to make a uniform surface.

l. It is recommended that the drilling pit be oriented longitudinally to the flow line or that a flow line baffle be installed or that a plywood sheet or piece of heavy canvas be placed at the point of impact to reduce damage to the pit.

m. The Division of Mineral Resources will retain jurisdiction over spills and leaks at the wellhead. The appropriate Regional Minerals office must be notified immediately of any wellhead leak of more than one barrel of oil.

o. Notification and approval of the Regional DMN manager will be required prior to any significant changes or time extension of the originally proposed well testing program.

D. WELL COMPLETION AND PRODUCTION PRACTICES

1. Existing Mitigation

- a. The Department can place restrictions on a well's producing gas-oil ratio (GOR) if it is determined that the reservoir's production energy is being depleted too quickly.
- b. Annual Production Reports are required from operators which summarize the past year's activities.
- c. DEC staff may place restrictions on well site facility operations through permit conditions.

2. Proposed Mitigation

- a. It is recommended that surface restoration and disposal of drilling fluids commence within 45 days after the cessation of drilling operations for all wells.
- b. In primary and principal aquifer areas it is suggested that operators be required to have an approved brine disposal plan prior to drilling a well.
- c. If a history of storage tank overflow has developed, authority exists under SEQR to require that tanks located be equipped with fluid level monitors capable of shutting down producing wells to prevent overflow of the tank.
- d. A notice of intention and a permit will be required from the Department for any operation that will in any manner alter the casing, permanent configuration, or designated use and status of a well. This includes the following:
 - perforate casing in a previously unperforated interval for the purpose of production, injection, testing, observation or cementing
 - redrill or deepen any well
 - mill out or remove casing or liner

- run and cement casing or tubing
- drill out any type of permanent plug
- run and set an inner string of casing or liner
- run and cement an inner string of casing, liner or tubing
- set any type of plug (bridge, cement, sand, gravel, get, etc.)
- repair damaged casing by means of cementing, placing a casing patch, swaging etc.

E. PLUGGING AND ABANDONMENT OF OIL AND GAS WELLS

1. Existing Mitigation

- a. State law requires that well operators maintain financial security with the Department to ensure that the wells are properly plugged and abandoned. An owner cannot transfer plugging and abandonment responsibilities by surrendering a lease. They may be transferred by agreement of the parties involved only after approval by the department.
- b. Operators must submit a Notice of Intention to Plug and Abandon with the proposed abandonment program prior to initiating plugging operations.
- c. For all abandonments, the Department requires that plugs be placed at the following locations:
 - from total depth to a minimum of 15 feet above the deepest producing zone;
 - at least 15 feet above each potentially productive hydrocarbon bearing formation;
 - 15 feet at the bottom and the top of any casing left in the hole. Any unrecovered uncemented casing must also be

ripped or perforated and have cement squeezed into the annular space.

- d. All intervals between plugs must be filled with a heavy mud, gel or other approved fluid.
- e. Wells capable of commercial production cannot be shut-in for longer than one year without specific permission from the Department.
- f. Temporary abandonment of a well cannot exceed 90 days without a Department granted extension.
- g. The Department office that issued the permit must immediately be notified of any non-routine incident occurring during plugging operations.
- h. After the well has been plugged, the casing must be cut below plow depth in agricultural areas, the equipment and debris removed, and the site restored to its original condition.
- i. Within 30 days after plugging the well, the owner or operator is required to file a Plugging Report with the Department which includes a signed statement affirming the accuracy of the information provided.
- j. The Department may, if necessary, enter, take temporary possession of, plug or replug any abandoned well whenever the owner refuses to comply with the provisions of the regulations. The cost of the Department's abandonment operations will be the owner's responsibility.

2. Proposed Mitigation

- a. **When a Notice of Intention to Plug and Abandon is submitted to the Department, it will have to be accompanied by the complete proposed abandonment procedure.**

- b. The recommended plugging requirements apply not only to oil and gas wells but also to injection disposal, solution mining, geothermal, and stratigraphic test wells with modifications as appropriate.
- c. Cement plugs shall be placed in wells across all oil, gas and fluid zones, across all casing stubs, below the base of the freshwater zone or across the surface casing shoe, and at the ground surface. Intervals between plugs shall be filled with a heavy mud or other approved fluid.
- d. Intervals not occupied by cement shall be filled with gelled fluid as specified by Regional Minerals Manager. Gelled fluid minimum requirements are density equal to 8.65 ppg with a 10 minute gel-shear strength of 15.3 to 23.5 lbs/100 sq. feet. Abandonment fluid requirement can be waived in the shallow Devonian oil fields by Regional Manager if the operator submits documentation which verifies that the interval between producing zone and surface casing shoe is void of even minor fluid or hydrocarbon zones.
- e. Production zone plug in oil wells - Place either cement or sand/gravel through production zone or set in impermeable sealing bridge plug above the zone. An additional 50 feet of cement shall be set above with no tag required or place 25 feet of cement and tag.
- f. Production zone plug in gas wells -
 - Squeeze cement producing zone through cement retainer set above perforations or place cement from T.D. across producing zone.

- Cap with an additional 50 feet of cement.
 - For a lost circulation zone or other special circumstances, a cast iron bridge plug/sealing packer shall be set above the producing zone and capped with 50 feet of cement. Tagging of these plugs may be required.
- g. Injection zone plugs -
- A blind packer shall be set in the injection tubing at flood packer depth.
 - USEPA jurisdiction. Sever injection tubing above original cement and remove. Cement shall be placed in the wellbore 50 feet above point of tubing severance, including excess for tubing infill.
 - Non-USEPA jurisdiction option. Place 25 feet of cement in tubing. Sever tubing and remove. Place 25 feet of cement in wellbore above.
- h. All zones containing hydrocarbons or fluid must be sealed with cement.
- Zones in open hole - Place cement plugs across each zone to 50 feet above and spot gel in all inter-plug intervals or place cement from T.D. to 50 feet above shallowest zone.
 - Zones behind uncemented casing - Recover casing below the zone and place cement from 25 feet below the casing stub to 50 feet above the zone or perforate and squeeze the zone and place cement within the casing across the zone to 50 feet above.
- i. When the producing zone is isolated below junk-in-the-hole, a cement retainer shall be set above the junk and sufficient

cement shall be squeezed to seal the producing zone below. An additional 50 feet of cement shall then be placed atop the retainer.

j. Surface casing shoe plugs -

- Uncemented casing. For oil wells, the cement plug shall be 50 feet across the casing shoe or the former casing seat. This plug shall be set on top of a supporting bridge plug or impermeable sealing packer. For gas wells, a 100 foot cement plug across the shoe shall be placed.
- Cemented casing. For oil wells, a 50 foot cement plug shall be placed across casing shoe and shall be tagged if not set on a weight tested packer. For gas wells, a 100 foot cement plug shall be placed across casing shoe.

k. All attempts shall be made to recover uncemented casing. If uncemented casing cannot be recovered, it must be perforated or ripped and have cement squeezed or placed into the annular space.

- Surface casing - partial recovery. The surface casing stub shall be sealed with 50 feet of cement, 25 feet in and 25 feet out or shall be capped with a sealing bridge plug/packer with 25 feet of cement on top. Excess cement shall be used to account for annular fill-up and all water bearing or fluid loss zones above the stub shall be sealed with cement. All inter-plug intervals shall be filled with an approved fluid.
- Surface casing - no recovery. Surface pipe shall be ripped or perforated and fluid shall be circulated through

the annulus. If circulation can be established, cement shall be squeezed into the surface casing annulus. When squeezing cannot be accomplished due to annular restrictions or the wellhead configuration, either the entire wellbore from the shoe plug to the surface shall be filled with cement or cement shall be placed from the surface casing shoe plug to 25 feet above the ripped or perforated joints, and a tag of this plug shall be required.

- Production casing with cemented surface pipe. Uncemented production casing shall be recovered no higher than 25 feet below the surface casing shoe or perforated below the surface casing shoe and sufficient cement squeezed to fill the annulus. If the casing is recovered, a 50 foot cement plug shall be placed across the stub, 25 feet in and 25 feet out. As with all stub plugs, excess cement shall be placed to account for annular fill-up.

- Production casing with uncemented surface casing. Every effort shall be made to recover the production casing below the shoe of uncemented surface casing, including milling out the pipe. Gas wells with uncemented surface casing shall be plugged according to procedures outlined in 4(a)(b) with the exception that a 100 foot cement plug across the former surface casing shoe will be required.

1. Minimum cement plug lengths shall be as follows:

- 15 feet for oil wells.

- 50 feet for gas wells.

m. The DEC may require the location and hardness of any required

plug to be checked by re-entering the well and tagging the plug.

- n. In agricultural areas, the casing must be cut off below plow depth (approximately 4 feet). Topsoil cover must be replaced and the site must be seeded to re-establish vegetation.
- o. It is recommended that the temporary shut-in regulations be amended to include all wells regardless of commercial potential.

F. ENHANCED OIL RECOVERY OPERATIONS

Injection and production wells utilized for all enhanced oil recovery operations must conform to the existing and proposed mitigation measures outlined previously for primary recovery oil and gas wells. The following addresses those mitigation measures specific to enhanced oil recovery operations.

1. Existing Mitigation

- a. A permit must be obtained from the Department prior to initiating any secondary recovery or pressure maintenance operations. The permit application must be accompanied by, or contain the following:
 - a statement summarizing the proposed operation;
 - the name, description and depth of the targeted formation;
 - information detailing the geologic sequence of adjacent formations;
 - the casing program for the existing or proposed input wells including the proposed method for testing the casing;
 - a plat map showing the lease or unit containing the project;

- a tabulation of recent gas-oil ratios and oil and water production tests for each of the producing wells;
 - a list of names and addresses of offsetting operators including a statement that each has been sent a copy of the permit application;
 - if the operations will involve the unit operation of a pool or any part of a pool subject to integration and unitization, the application must also contain graphs or statements detailing expected oil and gas production and estimates of additional oil and gas revenue. The Department order providing for unit operations shall become effective when at least 60 percent of the owners and royalty interests, respectively, have approved of the proposed operations.
- b. Unless sufficient cause can be demonstrated otherwise, oil field operators are required to cement surface or freshwater protection casing to the surface.
- c. An annual statement is required from waterflood operators showing injected and produced fluid volumes and injection pressures.
- d. Flaring of annular gas is approved on a temporary basis only. Operators must find an acceptable method of use or cease operation of their wells.
- e. Earthen pits used for storing separator waste must be percolation tested and lined with an impervious material to prevent fluid infiltration into groundwater. A moratorium has been placed on future separator ponds and existing ponds are to be phased-out.

2. Proposed Mitigation

- a. For new waterfloods and new tertiary recovery projects, an additional site specific environmental assessment and SEQR determination will be required. A supplemental site specific environmental impact statement may be required for any new enhanced oil recovery operation or major expansion of an existing project.
- b. Detailed geologic and engineering studies will also be required with the permit application. Casing inventories of all existing and planned wells, monitoring data, and the results of any injection tests shall also be included.
- c. Well conversions and recompletions for enhanced recovery purposes will be subject to more explicit regulations.
- d. Spacing criteria will be established by regulation for all new fields which could be influenced by future enhanced oil recovery operations.
- e. Fluids from flowback operations shall be contained in a watertight tank.
- f. Injection wells will be monitored as stipulated by the Federal UIC program.
- g. Injection pressures shall be such as to not propagate fractures. Pressures are limited by the UIC regulations and must also be approved by DMN. The maximum reservoir injection pressure shall be verified by a step-rate pressure test on at least one injection well in each new project in an area where the maximum injection pressure has not been verified to the satisfaction of the DEC. This requirement parallels the UIC requirements and contributes to groundwater protection.

- h. Any unlined earthen ponds or pits designed to hold enhanced oil recovery system byproducts must be eliminated if it is determined that environmental damage is occurring. This includes those pits belonging to peripheral operators under the influence of the flood. For new projects, such fluids shall be stored temporarily in watertight tanks or lined impermeable ponds or pits for subsequent disposal.
- i. Plugging and abandonment methods, cement requirements, and disposal methods in the old oil field areas will be required to adhere to those regulations set forth for oil and gas operations.
- j. Documentation of produced fluids will be required on the Annual Production Report.
- k. A chemical analysis of at least one sample of injected and produced water, respectively, will be required on an annual basis for each project. The minimum analysis shall consist of the following parameters: ph, sodium, chloride, specific conductivity, calcium, magnesium, iron, sulfates, and total dissolved solids.

G. SOLUTION SALT MINING

All of the previously discussed proposed mitigation measures for siting, drilling, completing, and abandoning oil and gas wells shall also apply to solution salt mining wells. The following addresses those mitigation measures specific to solution salt mining operations.

1. Existing Mitigation

- a. The fee for a solution mining permit is the same as for oil and gas wells, ranging from \$225 to \$2725 depending on the depth of

the well.

- b. Metering or measurement of brine produced by solution mining and the maintenance of the records from a cavity or group of cavities is required until wells penetrating the cavities have been plugged and abandoned.
- c. Brine disposal by subsurface injection must be approved by the Department and all offsetting lease holders and operators must be notified. The disposal application is held for ten days.
- d. Disposal of salt impurities such as chlorides and sulfates into abandoned salt cavities must be approved by the Department.

2. Proposed Mitigation

- a. For new solution mining projects or major modifications to existing projects, an additional site-specific environmental assessment and SEQR determination will be required and a supplemental EIS may be required.
- b. The oil and gas regulations, 6NYCRR Parts 550 to 558, will be revised to include solution mining wells, where appropriate. Certain requirements specific to solution mining will be added.
- c. Solution mining well plat maps will be required to include the following:
 - a scale of one inch equals 600 feet or less for wells that are spaced at least 1320 feet apart or one inch equals 400 feet or less for wells that are less than 1320 feet apart;
 - property boundaries under the owner's control;
 - the area proposed to be affected by solution mining operations;
 - location and API well number of each well on the property;
 - location of roads, surface water, buildings, significant

landmarks and topographic features in the affected area.

- d. Regulations will prohibit siting of solution mining wells within 150 feet of the lease boundary line. Exceptions may be allowed on a case-by-case basis.
- e. Partial surface restoration of the drilling site will be required after the cessation of drilling operations. Drilling fluids will be disposed of within 45 days.
- f. Regulations will specify that brining operations be conducted in such a way to prohibit extension of the cavity beyond the boundary line of the lease, integrated lease or unit in which solution mining is being developed.
- g. Operators will be required to maintain a spill contingency plan in the event a pipeline leak occurs.
- h. Regulations and permit conditions will require monitoring of wells, pipelines, and storage tanks.
- i. Subsidence monitoring will be required for all operations. Operations will be suspended if adverse environmental impacts result from subsidence.
- j. The Department will exercise its authority to require monitoring wells when solution mining operators are adjacent to large freshwater aquifers.
- k. Sheds protecting wellheads and pumps will have to be vented if methane gas has been encountered by the solution mining wells.
- l. The brine injection application holding period will be increased to 15 days.
- m. The Department will aggressively pursue those operators that do not properly plug and abandon their solution mining wells.

- n. Solution mining well plugging and abandonment regulations will require that a cast iron bridge plug or bridge of other approved material be set in the wellbore above the solution cavity with 50 feet of cement on top. In all other ways plugging and abandonment shall be in accordance with the plugging procedures required for oil and gas wells.
- o. Surface restoration requirements will be stipulated by regulation.
- p. A final map shall be submitted with the plugging report which details the location and extent of the salt cavity, any subsidence, sink holes, or mud boils.
- q. Plugging responsibilities will not be transferrable without the agreement of the parties involved and the approval of DEC.

H. UNDERGROUND STORAGE

All of the previously discussed existing and proposed mitigation measures for siting, drilling, completing, and abandoning oil and gas wells also apply to underground storage wells. The following addresses those mitigation measures specific to underground storage operations.

1. Existing Mitigation

- a. If test wells are converted for storage or pressure monitoring operations, a permit must be obtained from the Department.
- b. A permit must be obtained from the Department with approval by the State Geologist for any operation devoted to the storage of gas or liquefied petroleum gas.
- c. Operators must give notice to persons engaged in underground mining operations of the commencement of any phase of oil or gas well operations which may affect the safety of such

- underground mining operations.
- d. Operators must submit an affidavit when applying for a storage permit that attests to the acquisition of at least 75 percent of the storage rights in the reservoir and buffer zone. The operator then has up to two years after the first injection of gas to secure the remaining 25 percent storage rights.
 - e. If the remaining 25 percent storage rights cannot be acquired after reasonable effort within the two-year period, the operator is required to secure such rights under provisions of the eminent domain procedure law.
 - f. Before filing a suit for acquisition proceedings, a map must be filed with the Department detailing the location, boundaries, and surface acreage of the reservoir and buffer zone.
 - h. In addition to the storage value of any property being leased, the value of any commercially recoverable native oil and gas must also be considered.
 - i. The Department may revoke or suspend any storage permit for failure to comply with any of its provisions.
 - j. The Department requires that every operator file a yearly report detailing the status of each storage project.
 - k. Operators are required to reclaim the premises of terminated storage operations so as not to cause a health hazard or a decrease in the value of the property. The Department may act to place the premises in satisfactory condition and the operator is liable for the cost should he fail to meet his obligations.

2. Proposed Mitigation

- a. When applying for a state storage permit for a new underground gas storage project, a copy of the EIS submittal to FERC will be required.
- b. Regulations will specify the definition of a storage project modification. A major modification to an existing project will require a SEQR determination and a supplemental EIS may have to be prepared.
- c. Test well drilling will be subject to the permitting requirements governing oil and gas wells.
- d. Potential earthquake dangers are to be addressed in the environmental assessments made prior to approval of a new storage field.
- e. New regulations will reflect the amended definition of a storage reservoir buffer zone as detailed in the Environmental Conservation Law.
- f. The distance from underground mining operations within which notification will be required shall be specified via permit conditions.
- g. Regulations will address technical data submission required in the application for an underground storage permit. Additional data will be required involving reservoir properties, geologic conditions, production history, etc.
- h. A detailed well review will be required at an application for an underground storage permit. This review should summarize well status, downhole conditions, well pressure histories, and test well disposition.
- i. A listing of the mud system ingredients for drilling a mined cavern main shaft and the proposed disposal method will be

- required with the underground storage permit application.
- j. Seeding and/or mulching of the waste rock pile in conjunction with the application of lime or fertilizer will be required when appropriate by permit conditions.
 - k. Permit conditions will specify provisions for diminishing significant visual impacts associated with compressor location.
 - l. Muffler devices will be specified via permit conditions for compressor exhaust when noise levels are deemed excessive. Screens or vegetation may also be required.
 - m. The yearly operators storage report will have to be submitted by March 1 to allow operators time to assemble and assess storage data.
 - n. Regulations will identify specific infractions concerning routine storage project operation. Mitigation techniques to rectify or alleviate any problems will also be specified.
 - o. Specific abandonment procedures will be formulated for wells in mined storage caverns or abandoned salt cavities.
 - p. An operational report summary will be required when operations are terminated at a storage facility.
 - q. An underground storage abandonment permit will be required. The application will be in the form of an abandonment summary report detailing the final status of the reservoir and storage equipment.

I. SUMMARY

The main objective of the DEC's mitigation program is to ensure the safe, efficient, and environmentally sound development of the State's energy resources. While both the short and the long term environmental effects of

this energy development are considered when formulating mitigation measures, it is the elimination of long term effects that is given the most emphasis. The preceding mitigation summary exemplifies this. Of primary concern are the contamination of the State's surface and groundwater resources by drilling and production activities and the correlative rights of landowners.

Continued successful energy development is essential for maintaining the social and economic stability of New York State. A sound regulatory program will guarantee the rights of the State's citizens and protect the environment while promoting continued exploration and development of the State's energy resources.