Slide 1 These slides provide some review information that people need to be aware of to participate in chemigation.

Slide 2 The next set of slides can be used after the management section of the DVD or at the end of the program as a review of important items in related to chemigation management.

Slide 3 The biggest hazard related to using chemigation **when safety equipment is not present** is during a chemigation event the irrigation pump stops or fails and the injection pump continues to add concentrated chemical to the irrigation pipeline where it then flows by gravity back into the water supply.

Slide 4 The three routes that chemicals can be taken into the body are orally, dermally, and by inhalation. Pesticide labels list Personal Protective Clothing that should be worn when chemigating.

Slide 5 Research conducted by John Witkowski, Shripat Kamble, and Matt Byers found that during a chemigation event with wind speeds of 14 mph insecticide was collected on samplers up to 265 feet downwind from the center pivot.

Slide 6 In case of a spill or accident, the operator should control the leak, contain the spill to a small area, contact the local NRD and NDEQ and then be prepared to clean up the spill using recommendations from NDEQ.

Slide 7 Personal safety is important when chemigating and we should encourage people to as a minimum wear gloves to protect their hands since research conducted by John Witkowski, Shripat Kamble, and Matt Byers at the Haskell Ag Laboratory indicated that was the most likely route-of-entry for mixer-loader workers involved with chemigation with insecticides. The work involved attaching absorbent patches to people and have them perform duties related to chemigation including walking through the field, calibration, etc. Not a requirement, just a suggestion.

Slide 8 Reminder that water application rates increase linearly with distance from the center pivot. Shown here is a bar chart with the increase in water application rate that would be expected for a center pivot with a flow rate of 900 gpm and a wetted diameter of the sprinkler of about 45 feet. Thus as the DVD indicates the most likely place for runoff to occur is at the outer end of the pivot or near the end gun.

Slide 9 The DVD mentions the impact of soil texture on surface runoff. This bar chart shows the difference in surface runoff potential when applying one inch of water to different soil textures and also the impact of higher flow rates. Note that the potential for runoff is least for sandy soils.

Slide 10 The next series of slides deals with managing how much water is applied and when (Irrigation Scheduling or Irrigation Water Management) and the information available from UNL Extension.

Slide 11 The Agricultural Water Management Demonstration Network was started by Dr. Suat Irmak, Extension Educators and Dan Leninger with the Upper Big Blue NRD.

Slide 12 Soil water sensors are being used as part of the Agricultural Water Management Demonstration Network that is being promoted across the state. The sensor uses a combination of Gypsum and glass beads to allow water to enter and exit the block similar to a broad range of soil textures. Readings using a hand held meter or collected by attaching the lead wires using wire clips. The output from the meter is in units of soil water tension or kilopascals.

Slide 13 There are two manufacturers of data loggers that are made to work with the Watermark soil water sensors. This one is manufactured by the M.K. Hansen company. The LCD readout provides up to a 35 day history of each soil water sensor by pushing the toggle button on the front of the logger. With each push of the button a different sensor is displayed. Data can be collected several times per day and later downloaded to a PDA or computer for reporting purposes. The other manufacturer is Irrometer who makes the Watermark sensors.

Slide 14 An Extension Circular is available that discusses how to prepare, install, read, and schedule irrigation events using the Watermark soil water sensors.

Slide 15 There is a table in the EC that shows how to convert the meter readings to plant available water for a range of soil textures.

Slide 16 This graph displays a season's worth of soil water sensor readings for a field site. We would expect the readings to increase as the plant uses water and decrease when irrigation occurs. If lower depths are not moving at all, either the roots have not penetrated to that depth or the field may be over irrigated a bit. We would expect readings in the top three feet to move during high water use periods. If they do not, the operator should look more closely at the soil water readings and management steps to ensure that excess irrigation water is not being applied.

Slide 17 The second component of the Ag water management demonstration network is using the atmometer or ETgage to get a local estimate of potential crop water use based on the weather. The canvas cover on the top of the evaporation plate is designed to duplicate the crop water use of a well-irrigated alfalfa crop with about 12 inches of top growth. By reading the site gage on the side of the ETgage, the producer can calculate the potential water use rate for his area. The ETgage does a good job of representing the potential crop water use for an area of about 6-8 miles square.

Slide 18 A NebGuide was developed with instructions for installing, reading and using the results to estimate crop water use for corn, soybeans and wheat. The ETgage costs about $200.

Slide 19 Table 1 from the guide provides crop coefficient factors based upon crop stage of growth for converting the ETgage readings to actual crop water use.

Slide 20 Here is an example of how one would use the ETgage readings to estimate the gross irrigation requirement (GIR) for a field site planted to corn which is at the 12-leaf stage. IF the difference in ETgage readings is 1.3 inches. Table 1 shows a Kc value of 0.88 for corn at the 12-leaf stage. So we multiply 1.3 inches by 0.88 to get a corn water use of 1.1 inches. If no rainfall has occurred since the readings were collected and the water application efficiency is 85% we divide the 1.1 inches by 0.85 to get the gross water application required of 1.3 inches.

Slide 21 Some of the equipment considerations listed here are also covered in the DVD some not. Encourage all producers to check the operation of the sprinklers on their center pivots to ensure that all are rotating, all deflection pads are functioning properly and that the pressure regulators are not leaking out the side. They should replace the sprinklers and regulators with the equipment meant to be at that location. So they may need to check the original sprinkler package printout to be sure.

Slide 22 Research conducted in Nebraska and Kansas has documented that the crop canopy intercepts water distribution patterns when the sprinkler is placed in the 0-9 foot distance from the soil surface. If the sprinklers are placed at heights less than 4 feet, insecticides aimed at pests in the upper portion of the canopy may not be controlled by a chemigation application. Due to the interception of the sprinkler pattern, the water application pattern can be reduced from over 40 feet to less than15 feet. This increases the water application rate and the potential for surface runoff to occur. To maintain good application uniformity, the spacing between sprinklers placed in-canopy should be no greater than 7.5 feet. Remember that nonuniform water application also results in nonuniform chemical application when chemigating.

Slide 23 Inspectors across the state have indicated that the most prevalent equipment that is not meeting the inspection criteria is the mainline check valves and in particular those valves that are coated with epoxy paint. Galvanized models do not appear to be failing at the rate epoxy coated valves are so I would recommend that if a valve needs to be replaced, the replacement be a galvanized model that has received state approval.

Slide 24 I have received feedback that rodents have been getting into the irrigation pipeline via air relief valves and low pressure drains. Most likely the old bridge style low pressure drains would provide more opportunity than newer plunger style valves. Anyway if the producer is having problems with rodents getting into the pipeline, these outlets could be covered with screen.

Slide 25 Another reminder about different types of systems with or without endguns or with corner systems. For corner systems as the corner arm extends, the parent portion of the system is slowed down resulting in a greater amount of water application when the system is in the corner. Thus, even if the chemical concentration changes to reflect the change in irrigated area per hour, the amount of water applied is still different which over several applications may result in an increased leaching risk in the field corners. Each manufacturer has a different way of handling the system control as the corner arm is extended or retracted. These are covered in the Chemigation Manual.

Slide 26 The DVD mentions inaccuracies in chemical applications due to lack of calibration. Research conducted at Clay Center has shown that the injection rate changes with the operating pressure of the irrigation system or the system the chemical is being injected. In addition, injection pumps with the same make and model produced different injection rates at the same setting. Both of these factors provide support to the recommendation that injection equipment must be calibrated for each system in order to provide accurate injection rates.

Slide 27 Many of the original mainline check valves were equipped with bridge type low pressure drains that require about 25-30 psi to close completely. With new lower pressure systems, these valves may not close completely or at the very least require a long time to close which discharges water as the system is pressured up or after shutdown. Newer plunger type valves require less than 5 psi to close which limits discharge. I am recommending the plunger style valve for valves that need to be replaced. Due to the way the bridge style valve is installed, plumbing changes will be necessary when switching from bridge style to plunger style low pressure drains.

Slide 28 Salt buildup on the seal of the chemical injection line check valve continues to be a problem and the main reason why that particular valve fails the inspection process. Encourage producers to take the valve apart and clean the seal to ensure that the valve functions properly.

Slide 29 Encourage shorter replacement times for delivery hoses that tend to degrade due to UV light and are often not replaced until they break causing a spill. This is not addressed in the law or rules and regulations.

Slide 30 Chemical labels were updated a number of times since the chemigation act was passed. One change involved the requirement of a normally closed solenoid valve placed between the chemical supply tank and the injection pump. The idea of this is to prevent a spill at the site caused by the delivery line failure. The Nebraska Chemigation Act specifies a chemical injection line check valve with a 10 psi cracking pressure. This check valve is an alternative method specified by the EPA to be used in lieu of the normally closed solenoid.

Slide 31 Subsurface Drip Irrigation systems do fall under the jurisdiction of the Nebraska Chemigation Act or Title 195 of Nebraska Law. As such these systems must have all the necessary safety equipment, chemigation permits, inspections and certified applicators that are required for other types of irrigation systems.

Slide 32 In addition, SDI systems will need to apply for a Underground Injection Control permit since the systems are treated by NDEQ the same as leach fields for septic systems. I suggest those individuals consult with their local NRD's to get information about how to be in compliance.

Slide 33 Now we will review definitions from the Nebraska Chemigation Act.

Slide 34 Definition of Chemical. Check to be sure their old manuals have the correct definition.

Slide 35 The one thing that has changed in the rules and regulations of the Nebraska Chemigation Act is the wording on the sign required when applying a restricted use chemical. The DVD covered the new wording. **Keep out, chemical application through irrigation system.**

Slide 36 Injection Location and Chemigation Permit information.

Slide 37 Permit Holder and Applicator definitions

Slide 38 Permit expiration date and duration. Applicator Certification duration.

Slide 39 Notification requirements when Permit information changes.

Slide 40 Safety equipment requirements

Slide 41 Notification requirements for accidents or spills with contact information for NDEQ.

Slide 42 Review examples in the Appendices for Calibration

Slide 43 Example 1 from the appendix. Found in the Workbook on page 11.

Slide 44 Example 1 to calculate the system revolution time.

Slide 45 A slight variation of the Example 1 system giving length to the end tower, overhang and throw of the last sprinkler. Calculate the revolution time first.

Slide 46 Then calculate the irrigated area.

Slide 47 Use the irrigated area and the revolution time to determine the injection rate in gallons per hour and ounces per minute.

Slide 48 Information about the chemigation training program training dates and the law can be found on the internet at these locations.