



**Natural Resources Conservation Service**  
**CONSERVATION PRACTICE STANDARD**  
**ANIONIC POLYACRYLAMIDE (PAM) APPLICATION**

**CODE 450**

**(ac)**

**DEFINITION**

Application of water-soluble anionic polyacrylamide (PAM) to the soil.

**PURPOSE**

This practice is used to accomplish one or more of the following purposes:

- Reduce soil erosion by water or wind.
- Improve soil surface infiltration rate and minimize soil crusting to allow for uniform plant growth.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to—

- Irrigated lands susceptible to irrigation-induced erosion where the sodium adsorption ratio (SAR) of irrigation water is less than 15.
- Critical areas where the timely establishment of vegetation may not be feasible or where vegetative cover is absent or inadequate.
- Areas where plant residues are inadequate to protect the soil surface from wind or water erosion.
- Sites where disturbance activities prevent establishment or maintenance of a cover crop.

This practice does not apply to soils with peat or organic surface horizon soils. This practice does not apply to the application of PAM to flowing, nonirrigation waters.

**CRITERIA**

**General Criteria Applicable to All Purposes**

All application rates listed in this standard are based on the amount of the active ingredient of PAM in the product. Apply commercially available formulations of PAM products according to the actual amount of PAM contained in the product.

The PAM will—

- Be free of nonylphenol (NP) and nonylphenol ethoxylates (NPE), often used as surfactants.
- Be of the anionic type meeting acrylamide monomer limits of  $\pm 0.05$  percent.
- Have a charge density of 10 to 55 percent, by weight.
- Have a molecular weight of 6 to 24 mg/mole.
- Be mixed and applied in accordance with Occupational Safety and Health Administration (OSHA) Material Safety Data Sheet requirements and the manufacturer's recommendations.
- Be used with proper personal protective equipment (e.g., gloves, masks, and other health and

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safety precautions) in accordance with the label, industry, and other Federal, State, and local chemigation rules and guidelines.

- Conform to all Federal and State chemigation standards when applied to irrigation water.

Totally mix and liquefy PAM mixtures prior to injection into the irrigation system.

Inject only on the downstream side of all screens and filters.

### **Safety and health**

- PAM dust can cause choking and difficulty in breathing if inhaled. Persons handling and mixing PAM shall use a dust mask of a type recommended by the manufacturer.
- PAM solutions can cause floors, other surfaces, tools, etc., to become very slippery when wet.
- Clean liquid PAM spills with dry absorbent material (sawdust, soil, cat litter, etc.) and sweep/collect dry PAM material without washing with water.
- To prevent slick conditions, avoid applying irrigation water that contains PAM to roads..

### **Additional Criteria for Reducing Soil Erosion by Water or Wind**

#### **Surface irrigation**

Use PAM during the first irrigation and after any soil disturbance (e.g., cultivation). Apply PAM during later irrigations if soil movement is observed. Preirrigation is considered irrigation.

Add mixed concentrations of PAM to irrigation water only during the advance phase of a surface irrigation. The advance phase is the time from the start of irrigation until water has advanced to the end of the field.

Place dry or patch treatments of PAM over an area of the first 5 feet of furrow.

The resulting concentration of PAM in irrigation water must not exceed 10 parts per million of pure form polyacrylamide, applied on a total product basis.

#### **Sprinkler irrigation**

The maximum application rate of polyacrylamide active ingredient must not exceed 4 pounds per acre, per single application event.

Totally mix and liquefy PAM mixtures prior to injection into the irrigation system.

Inject only on the downstream side of all screens and filters.

#### **Critical areas**

The maximum application rate of pure form polyacrylamide must not exceed 200 pounds per acre, per year.

Ensure uniform application coverage to the target area, minimizing drift to nontarget areas.

## **CONSIDERATIONS**

### **General Considerations**

When planning this practice consider the following items:

- PAM application rates may need to be adjusted based on soil properties, slope, and type of resource concern targeted.
- Where reasonably possible, tailwater or runoff containing PAM should be stored for reuse or recycled on other land areas.

- Control of erosion can be improved by combining the use of PAM with other conservation practices.
- If water containing PAM leaves the field and mixes with a sediment-laden stream of water, it may increase downstream or offsite deposition of sediment.
- PAM products without PE and NPE are safe for aquatic organisms at the concentrations recommended in this standard. To minimize residual sediment and PAM leaving the field, consider applying herbaceous buffer or tailwater recovery practices between the treated field and any receiving water bodies. See Kerr et al., 2014, and Weston et al., 2009, for further detail regarding impact to aquatic organisms.

### **Additional Considerations for Irrigation-Induced Erosion**

When planning this practice for irrigation-induced erosion consider the following items:

- Use other conservation treatments such as land leveling, irrigation water management, reduced tillage, reservoir tillage, crop rotations, etc., in conjunction with this practice to improve control of irrigation-induced erosion.
- On fine-to-medium-textured soils, PAM may result in an increase in surface irrigation infiltration of up to 60 percent, with 15 percent being typical on medium-textured soils. Infiltration increases can be expected to diminish or be eliminated in succeeding treated irrigations if there is no soil disturbance between applications. Use of higher than recommended application rates will usually decrease infiltration rates, rather than increase them. PAM use on coarser textured soil is more likely to decrease infiltration.
- Adjustments in flow rates, set times, and tillage practices may need to be considered to compensate for PAM changes in infiltration.
- Consider reducing application from maximum PAM rates and volumes if no visible erosion occurs.
- Sprinkler systems will likely need multiple applications to achieve a significant erosion reduction.
- Applications at the end of the season are discouraged, unless the field has been recently tilled.

### **Additional Considerations for Wind/Precipitation Erosion and Dust Emissions**

When planning this practice for wind or precipitation induced erosion and dust emissions consider combining seed with the PAM mixture to provide vegetative cover after the life of the PAM material.

## **PLANS AND SPECIFICATIONS**

Prepare plans and specifications for PAM that describe the requirements for applying the practice to achieve its intended purpose. As a minimum, include the following:

- Location of each field or treatment unit.
- What PAM product will be applied.
- Location of application within the treatment unit.
- How product is to be applied.
- Quantity of product that will be applied.

## **OPERATION AND MAINTENANCE**

Prepare an operation and maintenance plan for use by the landowner or operator responsible for PAM application. The plan will provide specific instructions for PAM applications to—

- Reapply PAM to disturbed or tilled areas, including high traffic-use areas.
- Monitor advance phases of the irrigation to assure applications are discontinued when runoff begins.
- Operate and maintain equipment to allow uniform application rates.
- Maintain screens and filtering facilities.

- Clean all PAM mixing and application equipment thoroughly with water to avoid the formation of PAM residues.
- For sprinkler systems, flush injection equipment (PAM injection pump, tubing, valves, etc.) with crop oil before and after injecting concentrated liquid PAM (30-to-50-percent active ingredient). Crop oil provides a buffer between PAM and water so nonflowing PAM does not contact water and form a gelatinous mass that can plug valves and tubing.
- For sprinkler injection, the PAM injection pump should be started after water is flowing in the sprinkler system. To flush PAM from sprinklers stop injection pump before the irrigation pump stops.

## REFERENCES

Kerr, J.L., J.S. Lumsden, S.K. Russell, E.J. Jasinska, G.G. Goss. 2014. Effects of Anionic Polyacrylamide Products On Gill Histopathology In Juvenile Rainbow Trout (*Oncorhynchus Mykiss*). *Environmental Toxicology and Chemistry*, Vol. 33, No. 7, pp. 1552–1562.

Lentz, R.D. and R.E. Sojka. 2000. Applying polymers to irrigation water: Evaluating strategies for furrow erosion control. *Trans. ASABE* 43(6): 1561-1568.

McNeal, J. 2016. Application of polyacrylamide (PAM) through lay-flay polyethylene tubing: effects on infiltration, erosion, N and P transport, and corn grain yield. MS Thesis, Mississippi State University. In review for *Journal of Environmental Quality*.

Sojka, R.E., D.L. Bjorneberg, J.A. Entry, R.D. Lentz, and W.J. Orts. 2007. Polyacrylamide in agriculture and environmental land management. *Advances in Agronomy* 92:75-162.

Wei, X., Y. Xuefeng, L. Yumei, W. Youke, 2011. Research on the Water-saving and Yield-increasing Effect of Polyacrylamide. *Procedia Environmental Sciences* (11), Elsevier, 573-580.

Weston, D.P., R.D. Lentz, M.D. Cahn, R.S. Ogle, A.K. Rothert, and M.J. Lydy, 2009. Toxicity of Anionic Polyacrylamide Formulations when Used for Erosion Control in Agriculture. *American Society of Agronomy*. Published in *J. Environ. Qual.* 38:238–247 (2009).

Zejun, T., L. Tingwu, Z. Qingwen, and Z. Jun, 2002. The Sealing Process and Crust Formation at Soil Surface under the Impacts of Raindrops and Polyacrylamide. 12th ISCO Conference, Beijing, China.