



The Guide to

Seed

Treatment

Stewardship



www.seed-treatment-guide.com





Disclaimer

The Seed Treatment Stewardship Guide is intended solely as an educational tool and as general guidance to assist product users in voluntarily developing and implementing stewardship practices related to the use of seed treatments and treated seed. This Guide is intended to serve as a reference document only. Entities may choose to refer to the entire Guide or specific sections of the Guide as appropriate. The guidance is intended to be flexible, and its application will differ according to the products involved and size, nature and complexity of the organization using the guidance. The Guide is representative and not exhaustive.

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Overview of Seed Treatment

Seed Treatments as a part of U.S. Agriculture

Seed Treatments are an excellent example of how the seed industry and crop protection industry are innovating for the future of modern agriculture. Seed treatments have significantly increased in importance as companies have worked to breed new, more productive varieties that are tailored to meet farmers' needs in coping with disease, insects and weeds prominent in their region. Seed treatments act as a delivery mechanism for pest management products to improve the production and yield opportunities of the crop.

Seed treatments are an effective tool for combating the negative impacts of diseases, insects, nematodes and other pests at the time of planting and thereafter, therefore helping America's farmers produce higher quality crops, while minimizing impact to humans, animals and the environment.

Definition of Seed Treatment

Seed treatment is the application of biological organisms and chemical ingredients to seed to suppress, control, or repel plant pathogens, insects, or other pests that attack seeds, seedlings or plants. Seed applied technologies such as inoculants, herbicide safeners, micronutrients, plant growth regulators, seed coatings, colorants, etc. may also be applied to the seed. Treated seed is intended for planting only and not for food or feed uses.





In Spring 2012, the American Seed Trade Association, in partnership with CropLife America, began aggregating research and safety information from a variety of seed industry sources. This is in response to an identified need for consistent communication of industry stewardship practices across all aspects and stakeholders of seed treatment. The following is an outline of this guide, which is intended solely as an educational tool and as general guidance to assist product users in voluntarily developing and implementing stewardship practices related to the use of seed treatments and treated seed.

The Guide is organized into seven sections:

- 1) Safe Use of Seed Treatment Products, and Safe Handling and Transport of Treated Seeds**
– Steps for safely engaging in each of these processes in order to maintain the integrity of the treated seed while minimizing exposure to humans, animals and the environment.
- 2) Environmental Stewardship** – Best practices for those who handle, transport and plant treated seed to help minimize exposure to non-target organisms, including pollinators that may be present at the time of planting.
- 3) Selection of Treatment Product** – Guidelines for ensuring the selection of seed treatment product(s), coating materials, micronutrients and/or other additives (“seed applied technology”) based on credible data related to performance, health, safety and environmental impacts.
- 4) Commercial Application of Seed Applied Technology (SAT)** – Listing of quality factors (e.g., composition of the treating mixture, application rate, process conditions and procedures, and application equipment) that must be selected and monitored to ensure a safe and effectively treated seed.
- 5) Treated Seed Labeling** – An overview of requirements for treated seed tags that allow seed consumers and handlers to make informed choices and to adhere to best management practices for use.
- 6) Storage of Seed Treatment Products and Treated Seeds** – Suggested guidelines for proper storage of seed treatment products and treated seeds as a key component to a comprehensive stewardship plan.
- 7) Planting of Commercially Treated Seed** – Guidelines for planting commercially treated seed and alternatives for disposing of leftover treated seed.

Ultimately the focus of the Guide is to provide an educational tool and resources for stewardship practices as they relate to seed treatment; including a brief review of legal and regulatory requirements for our stakeholders. Also included are a glossary of agricultural terms, defined in context to the Guide, and a key to acronyms.

ASTA and CLA plan to develop a corresponding education and outreach campaign with online and print materials and presentation packages that will target and can be utilized by member companies, grower groups, federal and state regulators, agribusiness and agrichemical groups, retailers and others

Safe Use of Seed Treatment Products, and Safe Handling and Transport of Treated Seeds

Summary: Instructions and requirements for the safe use of seed treatment products are detailed on the treatment product label, and, for safe handling and transport of treated seed, on seed tags for the packaged, treated seed. To ensure safety, proper training is required for individuals applying seed treatments and also is recommended for individuals handling and transporting treated seed. Taking steps to ensure the safe handling and transport of treated seeds is a key element of product stewardship to maintain the integrity of the treated seed.

I. General components of safe handling and use of seed treatments and treated seed.

- a. Follow product label instructions for applying seed treatments and instructions found on the treated seed tag.
- b. Minimize exposure to seed treatments, treated seed, and dust from treated seed.
- c. For your own safety and to protect the environment, the following precautions should be observed:
 - i. Signal Word (e.g., “Caution”);
 - ii. Seed treatment product use and disposal restrictions
 - iii. Treated seed plant-back intervals and grazing restrictions;
 - iv. Specific seed planting, storage, and disposal restrictions and recommendations; and
 - v. In the event of specific product questions or emergency, call the manufacturer’s number as provided.

II. Treating Seed

- a. Read, understand and follow product label instructions and Material Safety Data Sheets (MSDS).
- b. Use available engineering and system controls to minimize exposure to the seed treatment product and to ensure accuracy of application.
- c. Maintain and calibrate application equipment.
- d. Use specified Personal Protective Equipment (PPE).
- e. Ensure workers are adequately trained with training documentation.

III. Transporting Treated Seed

- a. Follow the safety precautions indicated on the seed tag. Avoid mechanical damage to treated seed and packaging.
- b. Transport seed in a way that no seeds are spilled during transit.
- c. Protect seed from heat and moisture.
- d. Be aware of storage requirements and limitations.
- e. Take precautions to avoid spillage when handling.
 - i. In case of spills, collect the treated seed immediately.
 - ii. Properly dispose of spillage to prevent exposure to humans, animals, or the environment.

IV. Handling Treated Seed

- a. Thoroughly read and follow seed tag instructions. Ensure that all seed tag requirements are met.
- b. Use specified PPE. Avoid exposure to dust when opening and/or emptying treated seed packaging.
- c. Ensure handlers are adequately trained with training documentation.
- d. Properly dispose of any spillage to prevent exposure to humans, animals, or the environment.

V. Personal Protection Equipment (PPE)

- a. When selecting PPE, always read and follow product label and/or seed tag instructions. This may include long pants, long sleeved shirt/coveralls, chemical resistant gloves, shoes and socks, etc.
- b. Additional PPE may be required for operation of equipment related to Safe Handling and Transport of Treated Seeds. Reference required or suggested PPE as indicated by the equipment manufacturer.
- c. Additional PPE may include such as foot, ear, respirator and head protection.

Environmental Stewardship

Summary: Environmental stewardship involves the management of treated seeds after they leave the seed treatment facility to minimize the risk of exposure to non-target organisms. This includes educational efforts to help ensure that users understand the importance of their activities in protecting the environment. It is essential to educate those who handle, transport and plant the seed to help ensure that seed treatment solutions result in success for everyone involved and to help minimize the potential for adverse effects on the environment. Sensitive environmental factors to be aware of include, but are not limited to, pollinators, pollinator hive locations, flowering habitats including weeds and other plants at field edges, aquatic habitats (e.g., streams/ponds/streams), wind direction, etc.

I. Environmental Stewardship

a. Storage of Seed Treatment Components and Treated Seed

- i. The Storage Facility must:
 1. *Have sufficient lighting and ventilation;*
 2. *Meet all applicable regulatory requirements;*
 3. *Keep seed and components dry and secure, out of the reach of children, animals, and unauthorized persons; and*
 4. *Shield seed and components from sunlight and extreme temperatures.*
- ii. Check local and/or state regulations for specific rules regarding storage facility requirements.

b. Handling and Transport of Treated Seed

- i. Ensure that proper label is attached to treated seed container/packaging.
- ii. Avoid undue abrasion and other mechanical damage to treated seed.
- iii. Protect treated seed from heat and moisture. Shield seed and components from sunlight and extreme temperatures
- iv. Take precautions to avoid spillage.

c. Planter Equipment

- i. Direct planter exhaust downward towards the soil surface, where possible.
- ii. Always plant at the recommended seeding rate.
- iii. Calibrate planting equipment properly.
- iv. Always clean and maintain equipment properly.

d. Dust Reduction

- i. Consider environmental factors, such as wind speed and direction, when opening seed containers, and during filling or emptying of the planting machine.
- ii. Follow planter manufacturer recommendations for use of seed flow lubricants (such as talc or graphite), and avoid excessive use.
- iii. Avoid shaking the bottom of the treated seed bag when filling planter. This reduces release of dust that could have accumulated during transport.

e. Planter Equipment Loading

- i. The planter should be filled at least 10 yards inside the field to be planted, avoiding proximity to apiaries, hedges, or flowering crops or weeds.
- ii. When opening seed bags or when filling and emptying the planter, position your back to the wind and avoid breathing released dust.

f. Planting Depth

- i. Follow planting depth instructions, if found on the seed tag, to protect birds, mammals and the environment.
- ii. At row ends and field corners, if indicated on the seed tag, incorporate treated seeds at suggested planting depth.
- iii. Cover all treated seeds in the field by incorporating into the soil at proper planting depth, in particular at row ends and field corners.

g. Disposal of Empty Treated Seed Containers-Dispose of seed packaging and/or containers in accordance with local requirements and container return policies.

h. Spills of Treated Seed

- i. If spills occur, treated seed should be securely covered or collected as soon as possible to prevent exposure to humans, animals or the environment.
- ii. Once treated seed is collected, choose an appropriate disposal option. See 'Disposal of Unused Treated Seed' section for disposal options.

i. Disposal of Unused Treated Seed

- i. Small amounts of leftover treated seed may be double planted within a portion of the field at an agronomically acceptable seeding rate.
- ii. Return leftover treated seed to its original seed lot containers, if treated seed is intended for storage and use at a later date.
- iii. If the treated seed no longer has acceptable germination or has been damaged, and if regulations and the treated seed label allow, possible options, include:
 1. *Fermentation in an authorized alcohol-production plant (mash or distillers grains must not be used as food or feed);*
 2. *Use as a fuel source for power plants or cement kilns;*
 3. *Incineration by a waste management facility; and*
 4. *Seeding to serve as wildlife habitat.*

j. Disposal of Rinse Water from Seed Treatment Equipment

- i. Do not discharge rinse water to ground, surface water or septic systems.
- ii. Minimize rinse water - wash out equipment only when necessary.
- iii. Re-use rinse water if possible to dilute the next batch of formulation. Be aware of the potential for cross contamination if the new formulation contains different active ingredients. Factor in the potential for increased concentration of active ingredient, if significant amounts of rinse water are used.
- iv. If possible, and will not result in an applied concentration above the label recommendation, re-apply excess rinse water as a pesticide application to a field site for which the active ingredient is registered.

k. Emergency Planning

- i. Have an emergency preparedness plan for unintended exposures, spills, or accidents.
- ii. Have any relevant emergency contact information easily accessible.
- iii. In the event of emergency, call the manufacturer's Product Emergency Number.

II. Off-Target Exposure

a. Environmental Factors of Consideration for Using Treated Seed

- i. Drift (wind speed/direction)
 1. *Drift is the physical movement of pesticide droplets or particles through the air, from the target site to any non-target site, which could result in Off Target Exposure.*
 2. *Avoid off-site movement of dust from treated seeds during planting by planning for wind speed and direction.*
- ii. Pollinators
 1. *Consider the presence of managed honeybee hives and flowering crops or weeds in or adjacent to the field which could attract pollinators.*
 2. *Consider the presence of flowering crops in or adjacent to the field which could attract pollinators. Take appropriate precautions to avoid contaminating them with dust from planting of treated seed.*
- iii. Waterways

Do not contaminate water bodies when disposing of planting equipment washwaters.
- iv. Spills of treated seed
 1. *If spills occur, treated seed should be collected and disposed of properly to prevent exposure to humans or the environment.*
 2. *Follow directions on treated seed label and/or seed tag.*
- v. Planting depths
 1. *Follow planting depth instructions, if found on the seed tag, to protect birds, mammals and the environment.*
 2. *Cover all treated seeds in the field by incorporating into the soil at proper planting depth, in particular at row ends and field corners.*
- vi. Dust drift
 1. *Always use high quality seed, free from excessive dust.*
 2. *For seed types that require that pesticides be coated onto the seed, use an appropriate coating system that keeps abrasion of the pesticide coating to a minimum.*
 3. *Avoid releasing dust from seed treatments into the air. When opening seed containers and during filling, emptying, or cleaning of the planting equipment, avoid dust exposure.*
 4. *To protect birds and mammals, cover all treated seeds in the field by incorporating into the soil at proper planting depth, in particular at row ends and field corners.*
 5. *Avoid off-site movement of dust from treated seeds during planting. Be aware of wind speed and direction.*

Selection of Treatment Product

Summary: The selection of the seed treatment product(s), coating materials, micronutrients and/or other additives (“seed applied technology”) is the key factor in affecting performance, health, safety and environmental impacts of seed treatment. Selection of products and combinations should be based on evaluation of significant data demonstrating their suitability for use as a seed treatment and on the application process to be used.

I. Manufacturer / Consultant Recommendations

- a. Manufacturers of seed treatment products, colorants, polymers and other seed treatment/coating additives should be consulted for proper use and application of their products.
- b. In addition, consultants specializing in seed treatment compositions and applications may be used; or the application process and/or seed treatment component combinations may be developed by in-house expertise.
- c. Only reputable suppliers/consultants should be used.
- d. Manufacturers/consultants should provide to seed treatment facilities information to support the effectiveness of their product(s), including data on efficacy, seed safety, flowability, plantability, dust levels of treated seed, and temperature limitations/requirements for the treating process.
- e. At a minimum, treatment uniformity should be demonstrated with visual assessment of treated seed samples.

II. Efficacy

- a. Consult product labels for pests controlled and rates required and use products suitable for the pests of concern.
- b. Use recommended rates to control pests of concern as defined on the label.

III. Seed Safety

- a. Seed germination may be affected by “seed applied technology” and must be verified prior to using a specific product or combination of products.
- b. Verification of seed safety should include the determination of germination of treated seed over a period of time equivalent to commercial storage of treated seed.

IV. Treating Process Recommendations

- a. The application process must achieve accurate and uniform coating of the seed.
- b. Follow recommendations of suppliers or other experts.
- c. Use the appropriate slurry volume for the environment conditions at the time of seed treatment.
- d. Do not treat seed when the environmental or seed temperature is below recommended limitations.
- e. Keep accurate records of all seed treatment applications.

V. Ready-to-Use Products vs. Mixtures

- a. “Ready to Use” products are designed to treat seed effectively without use of additional components other than water.
 - i. Manufacturers should provide data to demonstrate the performance of these “Ready-to-Use” formulations.
 - ii. If other components are added to a “Ready to Use” product, the compatibility of the combination should be verified.

“Mixtures” include seed treatment product(s), coating materials, micronutrients, and/or other additives. The specific combination must be evaluated and verified to be suitable. Physical and seed safety compatibility of mixtures should be verified.

VI. Overtreatment

- a. Overtreatment is the application of Seed Applied Technology to previously treated seed. Such applications may be in addition to a base commercial treatment to provide protection against pests of concern in the local environment.
- b. In some cases, previously treated seed may be overtreated with other seed applied technology.
- c. The suitability of such overtreatments should be verified, including seed safety and dust levels.

VII. Label Directions for Use and Restrictions

- a. Comply with all product label requirements.
- b. When using a combination of products with the same active ingredient (AI), (such as when adding additional metalaxyl to a metalaxyl containing product, ensure that the total rate of active ingredient does not exceed the maximum allowable rate.
- c. When working with multiple registered products, comply with the most restrictive label requirements of the individual components.

VIII. Export Considerations

- a. Different countries have different rules for importing treated seed. When exporting treated seed, check regulations for the country to verify that the seed treatment is acceptable for import.
- b. Provide accurate documentation of any seed treatments applied to seeds for export.

IX. Assessment of Treating Properties

- a. Prior to using in a commercial process, the seed applied technology should be assessed in a small-scale process for treating properties including:
 - i. Uniformity of treatment; and
 - ii. Build-up of treatment material or any other adverse effects on application equipment.
- b. Alternatively, the treatment may be suitable if it has been used successfully in another similar commercial operation.

X. Assessment of Treated Seed Properties

- a. Treated seed from the commercial operation should be evaluated for suitability in the following parameters:
 - i. Uniformity of treatment coating of individual seeds (visual evaluation is acceptable);
 - ii. Presence and amount of treated seed dust;
 - iii. Field application rate of seed treatment; and
 - iv. Any other known pertinent qualities.

Commercial Application of Seed Applied Technology (SAT)

Summary: Commercial Application of SAT can include fungicides, insecticides, nematicides, plant health products, inoculants, micronutrients, herbicide safeners, plant growth regulators and other biologically functional materials to commercial seed. Compositions of SAT may include other materials such as colorants, polymers, drying agents, water and other additives (e.g. coating materials) to provide suitable appearance, physical properties, process performance, and other factors. Quality of treatment is dependent on the composition of the applied material (the “treating mixture”), the application rate to the seed, the process conditions (seed throughput, seed temperature, product temperature, etc.), treatment procedures and the application equipment. These quality factors must be selected, defined and monitored to ensure a safe, effective and high-quality treated seed, with properties that help ensure environmental stewardship. Quality of the seed prior to treatment (e.g., chipped seed, negligible dust) is also very important for ensuring the quality of seed treatment.

NOTE: Not all standards may apply to all processes, and some may apply only in a very limited way such as label verification or visual inspection.

I. Factors Affecting Product Integrity and Product Control

- a. Use of suitable SAT treating mixtures.
- b. Use of appropriate equipment in good operating condition.
- c. Use of suitable and consistent processes.
- d. Proper mixing of components.
- e. Application at correct rates.
- f. Use of correct materials.
- g. Use high quality seed.
- h. Purity of slurry mixture or components; e.g., avoiding contamination from previously used treating mixture.
- i. Use of unexpired components (if applicable) or treating mixture.
- j. Operation of treating processes within acceptable ranges; e.g., application to seed that is at the correct temperature as indicated by the process and/or treating mixture.

II. Determine Control Points

- a. Receipt of seed from third party or output from seed cleaning process.
- b. Receipt of slurry components.
- c. Preparation of treating mixture.
- d. Application Process (calibration and monitoring of application rate).
- e. Output from seed treating process.
- f. Packaging.

III. Establish Application Processes

- a. Read, understand and follow all directions on labels and Material Safety Data Sheets (MSDSs) for all components of the treating mixtures.
- b. Establish and use documented training procedures for seed treater employees, including mixer/loaders, seed treatment equipment operators, packagers, and fork lift operators. Include personal protective equipment and hazardous material handling, as specified on labels or MSDSs, where appropriate.
- c. Establish understanding and/or agreements with third-party providers of seed on standards for material to be used in treating process, including needed data.
- d. Treater: provide appropriate seed tag contents as per the seed treatment product label requirements and the Federal Seed Act.
- e. Test seed material using appropriate methodology to establish or confirm quality of seed used in treating processes.
- f. Establish appropriate protocols for assessment of process inputs (seed, formulated products which include active ingredients, coating materials, etc.).
- g. Establish and use documented slurry preparation procedures (including composition, sequence of addition, operator and preparation date).
- h. Establish and follow changeover procedures when switching from one slurry to another.
- i. Establish and use documented procedures for handling, control, and proper disposal of leftover and unused slurry components, packaging materials, wastes, and treated seed.
- j. Properly calibrate equipment and be sure to adjust equipment settings for lot changes, such as when applying products on a mg ai/seed basis.
- k. Establish and follow treater cleanup procedure.

IV. Establish Monitoring Procedures

- a. Treating Process Verification: Verify equipment is capable of accurately and uniformly applying the chosen product to seed, with acceptable physical properties of the treated seed including, but not limited to, acceptable process performance (e.g. lack of treatment build-up, etc.), treated seed dust levels, handling properties and plantability.
- b. Upon receipt of materials, confirm by documentation or verify using diagnostic methods (where appropriate) that material meets specifications.
- c. Verify application rate (options include calibration verification, mass balance of applied material and seed throughput, and analysis of treated seed).
- d. Periodically monitor physical properties (e.g. tackiness, visible dust off, flow) and appearance (e.g. uniformity, color) of treated seed during the treatment process.
- e. Re-verify treating process if key parameters change and on a periodic basis:
 - i. Slurry composition;
 - ii. Material suppliers;
 - iii. Treating process parameters such as throughput; and
 - iv. Treating application equipment.
- f. Verify shelf life of components where applicable and use only within approved use period.
- g. Verify shelf life of slurries where applicable and use only within approved use period.

V. Establish Verification Procedures

- a. Confirm and establish appropriate sign-off and administrative approval of verification procedures.
- b. Verify procedure for quality of treated seed.
- c. Verify procedures for periodic auditing and assessments through a checklist and inspection.
- d. Verify adequate feed-back to the supplier of the material.

VI. Establish Corrective Measures

- a. If seed or slurry components do not meet specifications, review use and disposition of the material.
- b. If sourced material does not meet established standard, review procurement practices with supplier.
- c. If treated seed does not meet application rate or required physical property specifications, review use and disposition of the treated seed.
- d. Review application equipment maintenance and calibration.

VII. Establish Record Keeping and Documentation Procedures

- a. Establish that information accompanying receipt of the treatment components (e.g., shipping documentation, lot numbers, MSDSs for treatment components) is accessible, secure and retained, internally and/or externally, as provided by third party.
- b. Maintain MSDS documents for hazardous components.
- c. Keep records of training certifications and administrative approval.
- d. Establish documentation requirements and retention policy for equipment calibration, treating records, seed treatment application rate analysis reports, and related documents.
- e. Maintain records of equipment maintenance and calibration.

Treated Seed Labeling

Summary: The Federal Seed Act (FSA) mandates that treated seeds have labels that provide information to allow seed customers and handlers to make informed choices and to adhere to "best management practices" for use. The information on seed tags is specifically described and enforced under the FSA by the U.S. Department of Agriculture. The US Environmental Protection Agency (USEPA) may specify additional information on the seed tag, via instructions on the labels of seed treatment products registered under FIFRA.

I. Treated Seed Tag Labeling:

- a. Every container of treated seed must be labeled per regulations promulgated under the United States Department of Agriculture (USDA) Federal Seed Act. The FSA requires treated seed to be labeled with the statement, "Not to be used for food, feed and oil," and the identity of the active ingredients used to treat the seed.
- b. Include all Seed Tag requirements as indicated on the EPA-approved seed treatment product label.
- c. All seeds treated with chemical pesticides, except for hopper planter box application, must be colored with an "EPA approved dye or colorant that imparts an unnatural color to the seed" [40 CFR §153.155(c)]. Additional local, state and federal requirements may apply. Refer to your local and state regulations.

Storage of Seed Treatment Products and Treated Seeds

Summary: Instructions for the proper storage of seed treatment products and treated seeds can be found on the pesticide label and treated seed tag. Proper storage of these products and seeds is a key component to a comprehensive stewardship plan.

I. Seed Treatment Product Storage:

- a. Follow product label instructions for storage and container disposal requirements.
- b. Pesticides should be stored in a secure facility.
- c. Use local and state regulations for facility construction requirements and notification for emergency response purposes.
- d. The facility should be well ventilated and equipped for adequate containment of seed treatment products in event of spills/leakage of containers.
- e. Appropriate documentation, including MSDS, should be readily available for all seed treatment products and/or other chemicals held in storage.
- f. Pesticides must be kept out of the reach of children, livestock, wildlife, and unauthorized persons.

II. Treated Seed Storage:

- a. Treated seeds should be kept in a secure storage facility with restricted access.
- b. The facility should be well ventilated/air-conditioned and protected from direct sunlight and rain/snow.
- c. The facility should have adequate lighting, ventilation, and temperature control.
- d. Treated seed must be kept out of the reach of children, livestock, wildlife, and unauthorized persons.

Planting of Commercially Treated Seed

Summary: Guidelines for planting commercially treated seed and alternatives for disposing of leftover treated seed. Taking the proper planting measures for commercially treated seed is a key practice to a comprehensive stewardship plan.

I. Environmental Stewardship for Planting

- a. Be aware of the presence of honeybee hives, or crops or weeds in the flowering stage within or adjacent to the field which could attract pollinators.
- b. Ensure that no blooming weeds are present in the field at planting, through use of weed control.
- c. Avoid off-site movement of dust from treated seeds during planting.
- d. Avoid off-site movement of dust from treated seeds during planting by observing wind speed and direction.
- e. Follow planting depth instructions, if found on the seed tag, to protect birds, mammals and the environment.
- f. Observe plant back restrictions found on the seed tag.

II. Use of Seed-flow Lubricants

- a. Follow recommendations of planter manufacturer for use of talc or graphite.
- b. Avoid excess use rate of lubricants to minimize dust.
- c. Use proper lubricant rate to avoid buildup of unwanted residue, and to minimize dust

III. Planting Equipment

- a. Follow manufacturer's recommendations for operation, cleaning and maintenance as found in equipment manual.
- b. Direct planter exhaust downward towards the soil surface, if possible. (Use of downward deflectors may decrease off-site movement of dust.)
- c. Always plant at the recommended seeding rate
- d. Calibrate planting equipment properly
- e. Avoid using the same equipment for treated seed and for harvested commodity seed or grain, if the treated seed labeling states it is not for food, feed, oil, ethanol, or other commodity grain channel uses.

IV. Cleaning of Planting Equipment

- a. Clean planters and seed boxes away from sensitive environmental areas, especially those that are attractive to pollinators, such as field margins with flowering crops or weeds, or near hive locations.
- b. Use a broom or shop vacuum to minimize dust release. Do not use compressed air.
- c. Do not discharge rinse water to ground, surface water or septic systems.
- d. Minimize rinse water - wash out equipment only when necessary.
- e. If possible, and will not result in an applied concentration above the label recommendation, re-apply excess rinse water from the cleaning of planting equipment to a field site for which the active ingredient is registered.

V. Disposition of Unused Treated Seeds

- a. Small Quantities of Pesticide-Treated Seed
 - i. The best way to dispose of a small quantity of leftover seed that has been treated with a pesticide is to plant it in fallow or other non-cropped areas of the farm. Note that treated seed may be hazardous to wildlife and must be planted according to seed label and bag instructions.
 - ii. Use the same practices and precautions that you would use when planting treated seed to produce a crop.
 1. Use an agronomically acceptable seeding rate and normal practices for that crop (for example, local planting dates and soil temperatures) as recommended by your county agricultural extension agent.
 2. Plant treated seed at a depth greater than 1 inch (2.5 cm). If the seed is broadcast on the soil surface, incorporate it immediately. This will decrease the likelihood for bird or wildlife ingestion of the seed.
 3. Unless restricted by label language, you may double sow seed around the headland.
 4. Leftover treated seed may be double planted within a portion of the field at an agronomically acceptable seeding rate.
 5. Return leftover treated seed to its original seed lot containers, if treated seed is intended for storage and subsequent planting.
 6. If the treated seed no longer has acceptable germination or has been damaged, possible disposal options include (if not prohibited on the treated seed labeling):
 - a. Fermentation in an authorized alcohol-production plant (mash or distillers grains must not be used as food or feed);
 - b. Use as a fuel source for power plants or cement kilns;
 - c. Incineration by a waste management facility; and
 - d. Seeding to serve as wildlife habitat if allowed according to regulations and treated seed label
- b. Large Quantities of Pesticide-Treated Seed
 - i. Consult first with your state and local authorities to ensure that you are in compliance with appropriate regulations.
 - ii. There are a variety of facilities that may be able to dispose of treated seed. However, a definitive answer on whether a municipal landfill, power plant, cement kiln, waste management facility, or ethanol plant will take seed treated with a particular pesticide can only be obtained by contacting the specific facility.
 1. Disposal in an Approved Municipal Landfill
 - a. Disposal in approved municipal landfills is permitted in some states.
 - b. Handle seed treated with pesticides as normal solid waste or as hazardous waste, depending on the active ingredient.
 - c. Determine if the treated seed, and the resultant seed dust, are federally classified as hazardous wastes under Federal Regulation Title 40--Protection of Environment, Chapter I- Environmental Protection Agency, Subchapter I-Solid Wastes, Part 261 Identification and listing of Hazardous Waste (40 CFR.261). Note that states may have more stringent regulations. In addition, treated seed, and resultant seed dust, are subject to solid waste regulations at the state and local levels. Always check state and local regulations prior to disposing of treated seed or dust.
 - d. Check the status of each active ingredient regarding its waste classification status before committing to a disposal process.
 - e. The contacts for both solid and hazardous waste disposal in each state can be found at <http://www.epa.gov/epawaste/wyl/stateprograms.htm>

2. Use as a Fuel Source for Power Plants or Cement Kilns
 - a. There are a variety of power plants that utilize alternative fuels. This list of power plants utilizing biomass, municipal solid waste, or non-fossil waste as an alternative fuel is extracted from the EPA National Electric Energy Data System (NEEDS) v3.02 ARRA, available at: <http://www.epa.gov/airmarkets/progsregs/epaipm/docs/NEEDSv302ARRA.xls>.
 - b. Cement kilns can be located at <http://www.ckrc.org/index.shtml>.
3. High Temperature Incineration by a Waste Management Facility
 - a. Disposal in high temperature waste management facilities is permitted in some states.
 - b. Contact the waste management facility to determine if it can accept treated seed.
4. Fermentation in an Alcohol-Producing Process at an Ethanol Plant
 - a. Some ethanol plants may be able to use treated seed as an alternate power source.
 - b. A map and lists of ethanol plants in the US and Canada is provided by Ethanol Producer Magazine on its website at <http://www.ethanolproducer.com/plants/listplants/>.



Acronyms:

AI – Active Ingredients

ASTA – American Seed Trade Association

CIO – Center of Influencers

CLI – CropLife International

CLA – CropLife America

CSTA – Canadian Seed Trade Association

EPA – Environmental Protection Agency (also USEPA)

ESA – European Seed Association

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

FSA – Federal Seed Act

ISF – International Seed Federation

MSDS – Material Safety Data Sheet

NEEDS – National Electric Energy Data System

NGO – Non-Governmental Organization

PPE – Personal Protective Equipment

SAA – Seed Association of the Americas

SAT – Seed Applied Technology

USDA – United States Department of Agriculture



Disclaimer:

The external links provided in this guide are intended for use as additional, external supplementary resources for the reader. Neither the American Seed Trade Association nor CropLife America can be held liable for the information found outside the scope of this document.

EPA links

US EPA General:

<http://www.epa.gov/>

US EPA – Label Review Manual – Chapter 18: Unique Product:

<http://www.epa.gov/oppfead1/labeling/lrm/chap-18.pdf>

Pesticide Labeling Questions & Answers - Definitions of Terms:

http://www.epa.gov/pesticides/regulating/labels/labels_faq/lr_faq_6.html

Apply Pesticides Correctly, a Guide for Commercial Applicators:

<http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockkey=9100B9WC.txt>

Wastes-Hazardous Wastes:

<http://www.epa.gov/epawaste/hazard/index.htm>

Federal Insecticide, Rodenticide and Fungicide Act (FIFRA):

<http://www.epa.gov/oecaagct/lfra.html>

Federal Regulation Title 40--Protection of Environment, Chapter I- Environmental Protection Agency, Subchapter I-Solid Wastes, Part 261 Identification and listing of Hazardous Waste:

http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&tpl=/ecfrbrowse/Title40/40cfr261_main_02.tpl

USDA links

USDA Home page:

<http://www.usda.gov/wps/portal/usda/usdahome>

Agricultural Marketing Service-Seed Regulatory and Testing Services:

<http://www.ams.usda.gov/Seed>



Seed Law/Regulations

Federal Seed Act (FSA):

<http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=Template1&navID=Publications&rightNav1=Publications&topNav=&leftNav=FairTradingRegulations&page=SeedTestingPublications&resultType=&acct=lsgeninfo>

Recommended Uniform State Seed Law (RUSSL):

www.seedcontrol.org/pdf/russl.pdf

Stakeholder Resources

The Pesticide Environmental Stewardship (PES) Website:

www.pesticidestewardship.org

The American Association of Pesticide Safety Educators:

<http://www.aapse.org>

Ethanol Producers:

<http://www.ethanolproducer.com/plants/listplants/USA/>

<http://www.ethanolproducer.com/plants/listplants/Canada/>

<http://www.ethanolproducer.com/plants/map/>

Certification & Training Assessment Group -- National Partnership for Safe & Effective Pesticide:

<http://www.ctaginfo.org/>

Labeling links

CDMS:

<http://www.cdms.net/>

Agrian:

<http://www.agrian.com/labelcenter/results.cfm>

<http://www.agrian.com/home/>



Association Resources

- Ag Retailers Association: <http://www.aradc.org/>
Agribusiness Association of Iowa: <http://agribiz.org>
Alabama Crop Management Association: <http://www.alabamacrop.net/>
American Seed Trade Association: <http://www.amseed.org/>
Association of American Pesticide Control Officials: <http://aapco.org/>
Association of American Seed Control Officials: <http://www.seedcontrol.org>
Association of Equipment Manufacturers: <http://www.aem.org/>
Crop Protection Association of North Carolina: <http://nccropprotection.org>
CropLife Foundation: <http://croplifefoundation.org/>
CropLife America: <http://www.croplifeamerica.org>
Far West Agribusiness Association: <http://www.fwaa.org/>
Florida Fertilizer & Agrichemical Association: <http://ffaa.org/>
Georgia Agribusiness Council, Inc.: <http://ga-agribusiness.org/>
Georgia Plant Food Educational Society, Inc.: <http://www.georgiaplantfood.org/>
Illinois Fertilizer & Chemical Association: <http://ifca.com/>
Indiana Plant Food & Agricultural Chemical: [http://www.inagribiz.org /](http://www.inagribiz.org/)
Kansas Grain and Feed Association: <http://www.ksgrainandfeed.org/>
Kentucky Fertilizer and Agricultural Chemical Association: <http://kyretail.com>
Michigan Agri-Business Association: <http://miagbiz.org/>
MidAmerica CropLife Association: <http://www.maca.org/>
Minnesota Crop Production Retailers: <http://mcpr-cca.org/>
Missouri Agribusiness Association: <http://mo-ag.com/>
Montana Agricultural Business Association: <http://mtagbiz.org/>
National Association of State Departments of Agriculture: <http://www.nasda.org/>
Nebraska Agribusiness Association: <http://www.na-ba.com>
North Dakota Agricultural Association: <http://ndag.org>
Ohio AgriBusiness Association: <http://oaba.net/>
Oregonians for Food and Shelter: [http://ofsonline.org /](http://ofsonline.org/)
PennAg Industries Association: <http://pennag.com/>
South Dakota Agri-business Association: <http://sdaba.org/>
Southern Crop Production Association: <http://southcrop.org/>
Tennessee Agricultural Production Association: <http://eppserver.ag.utk.edu/Extension/TAPA/TAPA.html>
Texas Ag Industries Association: <http://www.txag.net>
Virginia Agribusiness Council: <http://va-agribusiness.org>
Western Plant Health Association: <http://www.healthyplants.org/>
Wisconsin Crop Production Association: <http://www.wiagribusiness.org/>
Wyoming Agricultural-Business Association: <http://wyag.net/>

Term	Definition
Active Ingredient	By EPA's definition, An active ingredient is one that prevents, destroys, repels or mitigates a pest. Products intended only to aid in the growth of desirable plants (such as giberrellins, auxins) are also consider active ingredients For seed treatment products, this typically includes fungicides, insecticide and nematicides but may also include bacteriocides or others.
Agronomic	Related to agronomy, the use of soil and plant sciences for the production of crops.
Application Rate	The application rate of Seed Treatments, Seed Treatment Products and/or Seed Treatment Components. For liquid Seed Treatment Products, rates are typically expressed in fl.oz product/cwt.; or in mg ai/kernel on the label. In Seed Treating Plants, units may be converted to more convenient units for the operation, such as gallons per ton of seed.
Calibration	The adjustment of seed treatment equipment to apply the target rate of slurry or Seed Treatment Product and the verification thereof.
Chaff	Thin dry bracts or scales, especially the dry bracts enclosing mature grains of cereal grasses, primarily removed during threshing but which may be present in low levels in commercial seed. More generally, seed debris.
Commercial Application	The application of Seed Treatments to seed in commercial facilities (as opposed to application on-farm and in planters.
Contact	Pesticides that act only on the surface of the applied plant or seed surface (as opposed to Systemic)
Control Points	Any point in a process where an input occurs that can be monitored, where an adjustment is present that effects the quality, or where a quality parameter is measured that can be used to help ensure the quality of the process output.
Diseases	Diseases of seeds, seedling and plants. Most commonly these are caused by fungi or fungus like organisms (such as oomycetes e.g. pythium); but may also be bacteria or viruses. Common diseases controlled by seed treatments are bunt, smuts, rhizoctonia, fusarium and phomopsis. Seed treatments are often used to control such diseases either directly (e.g. by killing the fungus) or indirectly (such as by controlling an insect that vectors a viral disease).
Drift	The physical movement of pesticide droplets or particles through the air from the target site to any non-target site (which could result in Off Target Exposure) http://www.epa.gov/pesticides/ppdc/2010/april2010/session6-spraydrift.pdf
Dust - field	This refers to dust generated from the soil. Such dust may be picked up and dispersed in the air by the planting equipment during the planting process.
Dust - treated seed	Fine particulate matter contained in or easily dislodged from treated seed. It consists or both the naturally occurring Untreated Seed Dust as well as components of the Seed Treatment. Treated seed typically contains less dust than untreated seed.
Dust - untreated seed	Fine particulate matter contained in or easily dislodged from untreated seed. It primarily consists of naturally occurring components of the seed such as chaff and the seed coat but may also contain some level of dust from soil.

Dust - lubricant	Lubricants are powdered materials that are added in the planter box to improve seed flow in the planter. This can potential create air borne dust during planting.
Dust drift	See Drift. Specifically, dust drift is drift of dusts such as Treated Seed Dust and Lubricant Dust
Efficacy	The effectiveness of a pesticide product for controlling the target pest(s).
Emergency Preparedness Plan	A documented, trained and implemented plan for actions to be taken in the event of anticipatable emergencies. Examples of emergencies include tornadoes, earthquakes and chemical spills.
Engineering and System Controls	Engineering and Systems Controls are equipment, measurement systems, and operating systems designed to allow safe and effective operation of equipment such as seed treating processes. Such equipment includes calibration devices for applying the correct rate of seed treatment product and ventilation system to reduce dusts in the seed treating operation.
Ethanol By-products	All products from the production of ethanol excluding ethanol and water. Includes distillers dried grains, and distillers wet grains.
Ethanol production	The conversion of biological matter into ethanol and ethanol by-products using fermentation and physical-chemical processes.
Export	The shipment of treated seed to commercial points outside the country of origin.
Exposure – Occupational	The physiological exposure of people working with seed treatments through contact with the Seed Treatment Products or Treated Seed. Skin contact and inhalation of dusts or mists are typically the most significant routes of exposure.
Federal Seed Act	"A USA legislation that defines labeling and purity standards for seeds in commerce, and prohibits the importation and movement of adulterated or misbranded seeds. See http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&tpl=/ecfrbrowse/Title07/7cfr201_main_02.tpl "
Flowability	See Seed Flow. The lack of resistance to flow for seed and treated seed.
Flowering plants	n. A plant that produces flowers, fruit and seeds. As used in this document, it refers to such plants that are in bloom (i.e. when flowers are present).
Germination	There are numerous definitions of germination, one practical one being ""
Handlers	"Handlers" can refer to Handlers of Seed Treatment Products" (e.g. loaders, mixers or Seed Treater Operators) or "Handlers of Treated Seed" (e.g. Baggers, sewers, stackers, planter operators). Personal protective equipment may be specified for individual or groups of "handlers".
Handling	Handling includes the movement or products and treated seed, including but not limited to loading, unloading, weighing, bagging, sewing, stacking, and planter loading and operation.
Hazardous components	Components which present health, safety or environmental hazards.
Headland	A strip of land left unplowed at the end of a field.

Insects	Scientifically, an insect is any animal of the class Insecta, comprising small, air-breathing arthropods having the body divided into three parts (head, thorax, and abdomen), and having three pairs of legs and usually two pairs of wings. For the purpose of this document, "insect" may also mean any small arthropod, such as a spider, tick, or centipede, having a superficial, general similarity to the insects. Insects may be harmful to a crop; or beneficial to the crop or the environment. Seed treatment are used to control harmful insects.
Lubricant	A material added to seed to aid in Seed Flow in a planter. Such products are added when the seed is loaded into the planter, or may be metered in during planting. Lubricants are generally powders, with talc and graphite being the most common. New lubricants are under developments.
Manufacturer	The producers of products for application as Seed Applied Technology and equipment.
Material Safety Data Sheets (MSDS)	The MSDS is a detailed informational document prepared by the manufacturer or importer of a hazardous chemical. It describes the physical and chemical properties of the product, and is a tool for communicating safe handling and environmental protection requirements for chemical products. For pesticide products such as Seed Treatment Products, the information on the label takes precedence over the information on the MSDS.
Maximum Allowable Rate	The maximum allowable rate of application (typically specified in fl.oz product/cwt. of seed or oz. active ingredient/cwt. of seed) for a given product on a given seed type (crop) as specified on the EPA approved label.
Mixture	See "Slurry"
Nematodes	Any of several worms of the phylum Nematoda, having unsegmented, cylindrical bodies, often narrowing at each end. Certain parasites attached the roots of crops and can cause significant plant damage ranging from negligible injury to total destruction of the plant.
Non-target organisms	Those organisms (normally plants, animals and aquatic organisms) that are not intended to be mitigated or controlled by a pesticide. For example, seed treatment insecticides are applied to control certain pests such as wireworms or aphids, and not intended to impact the health of honeybees or other pollinators, so honey bees would be non-target organisms.
Off Target Exposure	For seed treatments, the seed is the target application location for the Seed Treatment. Anything other than this would a "off target". Off target exposure therefore refers to things (such as other plants or animals) in the environment which may be contacted with the seed treatment or seed treatment dust during application or planting; or in the case of animals by ingestions of treated seeds.
Overtreatment	The application of Seed Applied Technology to previously treated seed. Such applications may be in addition to a base commercial treatment to provide protection against pests of concern in the local environment.
Packaging	The container holding the untreated or treated seed or holding Seed Treatment Products or other seed treatment components.
Personal Protective Equipment (PPE)	Equipment that is worn by employees to mitigate hazards of a process. For seed treating operations, PPE is typically means to reduce exposure of operators to seed treatments and treated seed dust. Such PPE includes but is not limited to long-sleeved shirts; long pants; shoes; socks; goggles; chemical resistant gloves; and respirators.



<p>Pesticide</p>	<p>As defined by the USEPA, pesticides are defined as follows. For seed treatments, these are generally covered by definition 1, and in particular fungicides, insecticides and nematicides.</p> <ol style="list-style-type: none"> 1. any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest; 2. any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant; and 3. any nitrogen stabilizer. <p>http://www.epa.gov/pesticides/bluebook/chapter1.html</p>
<p>Pests of concern</p>	<p>The specific pest(s) causing agronomic impediments that are sought to be controlled.</p>
<p>Plantability</p>	<p>The ability of seed or treated seed to flow through planting equipment in the absence of build up on equipment to allow uniform and consistent planting of seed.</p>
<p>Planter Equipment</p>	<p>Equipment used to plant seed, of which there are many types. Examples include Box drills, mechanical meter planters, air seeds, and positive air pressure planters (with and without central commodity systems).</p>
<p>Planting Depth</p>	<p>The depth below the seed surface where the seed is placed during Sowing. The depth used can depend on crop, moisture conditions, restrictions on treated seed tags, and other factors.</p>
<p>Pollinators</p>	<p>Animals that carry pollen from one seed plant to another, which aids the plants in their reproduction. Common pollinators include insects, especially bees, butterflies and birds.</p>
<p>Product label</p>	<p>Product Label refers to the EPA approved "Seed Treatment Product" label, as opposed to the "Seed Tag".</p>
<p>Product Stewardship</p>	<p>Product stewardship is the practice of making health, safety and environmental protection an integral part of the life cycle of chemicals. It is an integral component of the global chemical industry's Responsible Care® initiative and includes evaluations of risks and the development of actions to protect human health and the environment commensurate with those risks.</p> <p>Product stewardship is a shared responsibility between chemical producers, their suppliers and their customers. It requires the development of close, sustained dialogue and working relationships with suppliers, customers, and others in relevant value chains. These parties should share information up and down the value chain to ensure that chemicals are used and managed safely throughout their life-cycle.</p> <p>Extracted from Responsible Care(R)'s Stewardship Guidelines .</p> <p>http://www.icca-chem.org/ICCADocs/Product%20Stewardship%20Guidelines%20-%20Final.doc</p>
<p>Ready to Use Products</p>	<p>Products which may be applied as is without further dilution to provide the required pesticides, color and treatment retention while coating uniformly onto the seed. May also be used in combination with other Seed Treatment Components or water.</p>



Glossary:

Seed Applied Technology	All materials applied to seed including any combination of Seed Treatment Products, Seed Treatment Polymers, Seed Treatment Colorants, inoculants, micronutrients, biologicals and other Seed Treatment Components.
Seed Flow	The uniformity and freedom of flow of seed through a system, generally through a seed conditioning or treating plant; or through a planter. Poor seed flow may be slow or inconsistent seed flow, or plugging of auger or conveyors or other handling equipment. Seed treatments may positively or negatively impact seed flow.
Seed Moisture	The free water content of seeds, typically measured as a percentage.
Seed Safety	The lack of negative effects on the germination of the seed including maintenance of the percent germination and lack of phytotoxic symptoms from Seed Applied Technology in comparison to an untreated control.
Seed tag	"Seed tag" refers to the wording applied to a container of treated seed or found on a tag/label attached to the container of treated seed including as a minimum the EPA specified requirements specified on the "Product Label". It is typically found in the "TREATED SEED LABELING" section. The minimum requirement is normally "This package or bag contains seed which has been treated with specified active ingredients. Do not use for food, feed or oil purposes. Store away from feeds and foodstuffs." Other information such as planting restrictions or personal protective equipment required for seed handlers may also be specified.
Seed Treater	Equipment designed to apply seed treatments to seed. Such equipment should be designed so it can be calibrated to accurately and uniformly apply the product to seed. Numerous types of seed treaters exist.
Seed Treatment	Seed treatment is the application of biological organisms and chemical ingredients to seed to suppress, control, or repel plant pathogens, insects, or other pests that attack seeds, seedlings or plants. Seed applied technologies such as inoculants, herbicide safeners, micronutrients, plant growth regulators, seed coatings, colorants, etc. may also be applied to the seed. Treated seed is intended for planting only and not for food or feed uses.
Seed Treatment Colorants	Products whose primary function is to impart coloration to seed treatments and in turn color to treated seed. Treated seed is colorized or otherwise adulterated in appearance to allow visual identification that it is treated so as to identify as unfit for human consumption and to identify the possibility of other hazards associated with treated seed. May contain other additives such as polymers or other dust reducing agents.
Seed Treatment Components	Seed Treating Components are products and ingredients found in "Slurries" including but not limited to Seed Treatment Products, Seed Treatment Colorants, Seed Treatment Polymers, water, micronutrients, inoculants and other products.
Seed Treatment Polymers	Products added to seed treatments whose primary function is to reduce dust of treated seed and to improve retention of seed treatment active ingredients on the seed
Seed Treatment Product	In this document, "Seed Treatment Product" refers only to pesticide containing seed treatment products that are EPA registered for such use and bear an EPA registration number. These typically include fungicides, insecticides and nematicides but also may contain other pesticide types or combinations such active ingredients. It excludes colorants, polymers, micronutrients and other products that do not contain active ingredients.



Glossary:

Seeding Rate	The amount of seed planted per unit area; typically expressed in bushels, pounds, or number of seeds per acre.
Slurry	The combined treating composition for application to seed. It may be as simple as a single ready to use product, or a combination of several Seed Treatment Components and water.
Sow	To plant seed into the ground for the purpose of growing a crop.
Spills	An unintended and uncontrolled release of a product (namely Seed Treatment Products, Seed Treatment Components or Treated Seeds in this document).
Storage Facility	A building or other area where seed treatments and their components are stored prior to use.
Suppliers	The commercial provider of a product, which may or may not been a manufacturer and includes dealers and distributors.
Systemic	Pesticides that are taken up and translocated within a plant in sufficient quantities to provide protection from the pest of interest.
Transport	The movement of products or treated seed from one location to another in the commercial chain normally by trucks, boat or rail. It also includes movement of product within a plant or on a farm, such as by augering, conveying, or elevating through elevators.
Treated seed	Seed that has been treated with a "Seed Treatment Product".
Wastewater	Any water contaminated with Seed Treatment Products or other Seed Treatment Components, such as from washing equipment.
Waterways	Any pathway of water that is constantly moving such as approaches, aqueduct, arroyo, beck, bed, bourn, braided stream, branch, brook, brooklet, burn, canal, channel, creek, creek bed, crick, culvert, donga, dry bed, fairway, flowing stream, flume, fluviation, fresh, freshet, gill, gulch, gully, gullyhole, headrace, irrigation ditch, kill, lazy stream, meandering stream, mid-channel, midstream, millstream, moving road, navigable river, nullah, race, racing stream, river, river bed, riverway, rivulet, road, run, rundle, runlet, runnel, sea lane, seaway, ship route, sike, sluice, spill stream, spillbox, spillway, steamer track, stream, stream action, stream bed, streamlet, streamway, subterranean river, swash, swash channel, tailrace, wadi, water carrier, water channel, water furrow, water gap, water gate, watercourse, and waterworks