**Final**

# Environmental Technology Council
## PESTICIDE DRIFT REDUCTION TECHNOLOGY
## SECOND STAKEHOLDER TECHNICAL PANEL MEETING
## Final Meeting Summary
### July 13, 2006
### Portland, Oregon

The Environmental Technology Council (ETC) Pesticide Drift Reduction Technology (DRT) Stakeholder Technical Panel (STP) and other interested participants met July 13, 2006 at the Oregon State Building in Portland, Oregon. The list of attendees is included in Appendix 1. The agenda is included in Appendix 2. Presentation materials used to introduce each session are included in Appendix 3.

As introduction to the DRT program, U.S. Environmental Protection Agency (EPA) initiated the Drift Reduction Technology project, in partnership with leading government, industry, academic, and other stakeholders to identify and foster the use of pesticide application technologies that can significantly reduce spray drift in row crop agriculture. The ultimate goal is to achieve improved environmental and human health protection through drift reduction by accelerating the acceptance and use of improved and cost-effective application technologies.

EPA is developing a test/quality assurance plan (test/QA plan), in conjunction with the DRT STP, that can be used to test or verify the drift reduction capabilities of technologies. EPA's Office of Pesticide Programs and Office of Research and Development are co-leading this initiative and have collaborated during the past two years to develop a framework for this project. The DRT project is one of a number of environmental projects under EPA's Environmental Technology Verification (ETV) program that has as its operating principles high quality, peer-reviewed data, cost-sharing, and stakeholder involvement in planning technology performance verifications. During the past 10 years, EPA program offices and a variety of industry sectors have successfully used the ETV program for more than 340 technologies; the DRT project is the first pesticide spray project under the ETV program. Additional information about the ETV program is available at the following Web sites, http://www.epa.gov/etv/ and http://www.epa.gov/etv/este.html.

The goal for this project is to encourage the use of verified DRTs that significantly reduce spray drift from row crop agriculture. EPA envisions that verified DRTs will be included in pesticide risk assessments and in consideration of risk management decisions and application restrictions for pesticide product labels. For example, these DRTs could be identified on pesticide product labels as an alternate application method that would allow applicators greater flexibility in making pesticide applications, such as allowing shorter spray drift buffer zones. In order to quantitatively credit DRTs in risk assessments and on product labels, OPP must be assured of their performance in reducing off-target drift and thus must be confident that the test/QA plan used to evaluate DRT performance is adequate and scientifically sound.

The STP met previously on January 31, 2006 to discuss the DRT program and key issues related to verification testing of pesticide DRTs. Following that meeting, EPA developed a draft test/QA plan based on input received from the technical panel. A second meeting was held to discuss the draft test/QA plan developed by EPA based on input received from the technical panel, and the

discussions at this meeting are summarized below. After the plan is completed, EPA plans to solicit DRT vendors interested in performance verification of their technologies.

**Introductions**
*Dr. Harold Thistle, United States Department of Agriculture (USDA) Forest Service*
*Mr. Jay Ellenberger, EPA Office of Pesticide Programs (OPP)*

Mr. Jay Ellenberger and Dr. Harold Thistle welcomed the participants and explained that the purpose of the meeting was to follow up from the first meeting to plan the drift reduction technology evaluation program testing procedures and related items. The attendance at this second meeting was higher than at the first event, which took place in Beltsville, Maryland in January 2006.

Mr. Ellenberger explained that EPA OPP had responsibility in addressing drift of pesticides from the perspective of risk for exposure to humans and the environment. EPA routinely re-assesses the science and past regulatory decisions of products on the market for spray drift potential for products. Despite OPP efforts and responsibilities/ actions in working with chemical companies, applicators, state governments, universities, and others to encourage more education and training and improvements in equipment and procedures, spray drift issues continue to occur and be an issue for applicators, growers, state regulatory agencies, the public, and EPA. EPA OPP and Office of Research and Development (ORD) offices have partnered to develop a program to verify existing and new application technologies for pesticide application to reduce drift potential. Larger datasets help EPA make better decisions on labeling for products for drift management. Application data, technologies, toxicology, and product labeling are all closely related in the EPA decision-making. Around 2004, EPA started to discuss how drift reduction technologies (DRTs) could be explored for exposure reductions. The Environmental Technology Verification (ETV) program at EPA has been very successful in encouraging reductions of emissions in other industries, so it seemed a logical framework for the present effort. A series of draft test/QA plans had been developed by EPA and others to help test and verify drift reductions by specific equipment. ETV test/QA plans have also served as a model for the Environmental and Sustainable Technology Evaluation (ESTE) DRT effort. The primary goal of the present meeting was to review draft test/QA plan elements. The audience for the present meeting includes a stakeholder technical panel who were recruited to provide feedback to this project and have helped develop and review the proposed testing procedures, and a wide range of interested stakeholders from government, industry, academia, applicator interests, and other groups.

Dr. Thistle attributed the good attendance at the present meeting largely to its being held in conjunction with the annual ASABE conference.

Following the brief introductory remarks, Mr. Drew Trenholm asked the stakeholder technical panel and all participants to introduce themselves. It was noted that there was a very wide range of interests present at the meeting.

**Stakeholder Technical Panel Role—Plan for the Day**
*Drew Trenholm, RTI International (RTI)*

Mr. Trenholm outlined logistical matters for the meeting and explained that a stakeholder technical panel had been created for advice on devising a test plan. The test/QA plans and testing approach were being developed under the ETV ESTE program. The purpose of the plan was to guide the conduct of row crop drift reduction technology testing. The present meeting was aimed at getting input on a draft plan that had been previously distributed. Meeting participants who are not members of the STP also are welcome to provide comments about the draft test plan, and all comments were welcome after the meeting. The draft test/QA plan was distributed, along with the meeting agenda. There are three issues to be discussed today, along with other topics that would be open for discussion later in the day.

**Overview of the Test Protocol**
*Discussion led by Dr. Norman Birchfield, EPA OPP*

Dr. Birchfield explained that although he was on detail to another office until November, he is still working closely with OPP on the DRT program. He reviewed the test/QA plan in a brief overview summary to initiate the discussions. The test/QA plan actually includes three quality assurance test plans under the single umbrella of one document with testing plans for DRT evaluation. The document is comprised of the following main sections. The first part includes background to the project, testing organization roles, management approach, and project overview discussions. It was considered important to explain roles of participants in the project.

- Data generation and acquisition for three types of test: 1) low speed wind tunnel tests (essentially for ground boom application equipment), 2) high speed wind tunnel tests (essentially to mimic aerial application equipment), and 3) field studies (for any type of DRT application equipment).
- Data reporting (includes formats and critical measurements).
- Oversight responsibilities, including the roles of EPA, the testing organization, etc. For example, when registrants need to register products in the U.S., EPA OPP can audit and review the data package developed under the ETV ESTE test/QA plan.
- Data validation and usability, consistent with other types of test/QA plans within the Agency.

Key issues in the wind tunnel tests include droplet size measurements and flux assessments. Other measurements useful for understanding or confirming DRT performance will also be considered. For low speed wind tunnel testing, the critical measurements include droplet size and spray flux (volume). At low speed wind tunnel test conditions, the spray profile is measured within a few meters of the nozzle, at the downwind edge of the wind tunnel. The data collected in these tests would be input to a modified AGDISP model routine (called WtDISP) to extrapolate deposition to greater distances downwind (e.g., 200 feet) than covered in the wind tunnel tests. The high speed wind tunnel tests would cover aerial DRTs, where droplet size is the critical measurement, for subsequent input to drift models such as AgDRIFT and AGDISP to predict deposition rates and drift performance. The field studies would cover all application types, with the critical measurement being deposition. Deposition is the key component in exposure risk assessments at EPA. Airborne drift reductions would also be encouraged, but the focus is on deposition.

The results would be used to develop spray drift reduction factors relative to standard reference values. These spray drift risk reduction factors would be used in drinking water, aquatic organism ecosystem, and terrestrial plant assessments. Other specialized assessments include endangered species and other factors. If a product has spray drift risk that requires label regulation (e.g., buffer zones and wind speed restrictions), the goal would be to allow appropriate, validated DRTs to be included on labels for applications with reduced restrictions and greater flexibility to applicators.

Dr. Al Barefoot asked how drift reduction factors would be assessed, i.e., using a model or using raw data. Dr. Birchfield replied that baseline reference systems would be used to assess drift potential reductions relative to standard values run under the same conditions.

Dr. Dennis Gardisser asked for an overview of how a DRT product would be initiated, what testing would be involved, who would do the testing, and how did the process work. Dr. Birchfield said any testing facility that could follow the test/QA plan would be able to run the tests. The Project Manager, Mr. Michael Kosusko, would be involved in assuring that the test facilities and approaches were valid. A request was made from Lee County Mosquito Control District in Florida for a list of wind tunnels that EPA would consider credible for testing. It was suggested in response that a list of wind tunnels could be supplied; however, EPA will not inspect or "approve" the facilities and was also not presently prepared to comment on the facilities. Each facility would follow the test/QA plan and would need to provide its own specifications and documentation for quality assurance (QA) purposes.

Mr. Mark Ledebuhr suggested that there are approximately six wind tunnel facilities and that EPA could do a QA test/QA plan for these facilities. Mr. Dave Valcore suggested that there were only probably four wind tunnels that would meet QA criteria for this testing. He suggested that the work should not be required to conform to good laboratory practice (GLP)-type QA criteria as there would probably only be a single facility meeting those criteria. The cost of conducting tests under GLP-type conditions would be too high to make efficient use of funds. Some flexibility was needed in how GLP and QA issues were applied in the present work. The requirement for meeting good science and transparency in testing procedures applied to studies like those of the Spray Drift Task Force (SDTF) because the studies were being submitted by industry. However, in the current situation where there is EPA oversight, EPA funds are being included in the testing, and where some testing might even occur at government laboratories, such stringent standards should not be needed in all cases. Another participant mentioned that following the IR-4 is a good model or approach.

Mr. Trenholm explained that RTI has managed testing for other ETV programs and described the ETV process further. Typically, the vendor or equipment manufacturer provides a fee and signs a contract. RTI develops the test/QA plan, selects the testing facility, contracts out the testing, and manages conduct of the test. RTI then collects the data and conducts the QA; then EPA quality assures the data, prior to the EPA review process. The present project might take a similar approach or otherwise.

Mr. Kosusko explained that the ETV ESTE DRT management team would need to establish the approach for the present project. Laboratories might be contacted for information on capabilities and QA. Dr. Birchfield suggested that the current concerns seemed to focus a lot on issues of data quantity and data quality versus cost and effective use of limited resources. EPA would

review the test/QA plan to make certain it was not imposing more QA than is needed, and this would be addressed in the future as the process develops.

**Issue 1—Reference Technology Systems**
*Discussion led by Dr. Norman Birchfield,EPA OPP*

Dr. Birchfield explained that a baseline was needed for comparisons of DRT performance. The selection of reference systems would be essential in such validations. A working group had been formed at the previous DRT stakeholder meeting to address this issue. The spray drift reduction factor for a technology would be a function of the drift potential from the DRT relative to that of the reference system. Dr. Al Womac asked whether the categories would be similar to those of the ISO standard (e.g., 25, 50, 75, 90 percent reductions in spray drift potential). Dr. Birchfield suggested that it would be good to follow the ISO standard wherever possible.

Important features of a reference system include the need for it to be realistic but reasonably worse-case (i.e., high-end deposition values). It needs to be adequately available, that is, it could be purchased for use by the vendor or a specific set of nozzles could be used for "check out" for testing (i.e., everyone would use the exact same equipment to conduct the testing). The performance of the reference system needs to be consistent over time (i.e., the reference vendor does not change the reference design) and across different test methods (i.e., not give different results in wind tunnel and field studies). It should be internationally recognized or harmonized, if possible.

Reference systems could include nozzles. The selection of appropriate nozzles could include either a shared set of nozzles or a specified make and model or a specific manufacturer. There could be one or more reference systems. One good selection might be the boundary curve between the Fine and Medium droplet size categories in American Society of Agricultural and Biological Engineers (ASABE) S572 or British Crop Production Council (BCPC) system. Dr. Andrew Hewitt had previously suggested that the drift of the candidate DRT could be compared to the drift curve for the reference nozzle from the same droplet size category of the ASABE S572 standard (for example, a Coarse spray might be shown to have the drift potential of a Very Coarse ASABE nozzle, and thereby be classified as equivalent Very Coarse for drift potential).

The variables that should be fixed during testing and those variables that may vary during testing need to be determined. Dr. Birchfield suggested several variables that might be fixed (or held constant) during testing, including a constant reference nozzle angle, nozzle pressure, and spray material. He suggested that the reference nozzle may be the same as the DRT height or the height could vary, and the air speed could vary, as examples of variables that may not be constants during the testing.

Mr. Kosusko and Dr. Birchfield suggested that DRTs that could be tested in a wind tunnel included nozzles, adjuvants, or small shields and shrouds. We understand the effects on drift reduction of many issues that can already be addressed using models and existing data (such as spray release height, wind speed, etc.); the DRT focus for this program should be on things that we cannot readily address right now. The testing should be restricted to other techniques that affect drift by factors such as spray trajectories, velocities, and others.

Dr. Ken Giles asked if the scope of approval of the DRT needed to be in line with the test conditions. The registrant would therefore have a lot of the control in the application because the

DRTs could not be approved generically in all cases but rather would be tied to a product, given specific performance with specific application patterns. Dr. Birchfield replied that the class of DRT might be labeled on specific pesticide products (e.g., "DRT 1 Star"). An EPA website or a third-party website might list the DRTs that could be used to meet this option. There might be some limitations on conditions at which the X percent reduction in drift would apply (e.g., specific release heights, wind speeds), which would also be explained on this site. Dr. Giles indicated that a combined approach of registrant and DRT vendor would be needed to define the application conditions. Dr. Birchfield agreed that it would be advantageous for the registrants and vendor to work together to define the most appropriate application conditions.

Mr. Trenholm suggested that reference systems needed to be fair for specific technologies or applications, giving a level playing field across DRTs. Dr. Giles suggested that the wind tunnel data would be easier to address because those data would feed into models for drift exposure risk assessments. In field testing, this would be more difficult.

Mr. Valcore asked if the reference condition would be modified for different use patterns (i.e., niche markets). Dr. Birchfield replied that it is difficult to assess the performance of DRTs by comparing to a single reference (e.g., it is difficult to compare fine nozzle at 10 feet release height with a preemergent herbicide). Dr. Hewitt had suggested that multiple droplet size categories could be used for the process where appropriate. Mr. Valcore suggested that the reference should be identified for general markets, with subsequent refinements for specific applications. This fits in with the risk assessment issue and is built into the risk assessment standards (e.g., a label has medium spray for efficacy, but a new atomizer may create a medium spray that drifts more like a coarse spray). Dr. Barefoot clarified that the labeling need was for reducing spray drift exposure risk in assessments. Dr. Giles re-iterated that the wind tunnel studies would use a reference nozzle, but field applications would require more complex baselines for the reference conditions. Dr. Ted Kuchnicki suggested that the model used for risk assessments would logically form the basis of reference conditions. There was general agreement that the ASABE reference nozzles for defining different categories for different applications is a good idea. Dr. Clint Hoffman suggested that the testing could be chemistry specific (product category) because the toxicity element of the risk assessment process is an important issue. Mr. Ledebuhr suggested that there are some different perspectives. The chemical companies have specific needs. Manufacturers have specific needs and other stakeholders will have other interests. He suggested the process is not jelled enough. Mr. Valcore added that the ISO drift reduction testing standard was based around similar approaches being discussed at the present meeting, such as the reference nozzle definitions. Dr. Steve Pearson suggested that EPA accomplish reciprocity with that standard. Mr. Ledebuhr indicated that the ISO drift standard has a classification scheme for nozzles only but not for other full application systems. Perhaps a 2-page manual could be included in the test/QA plan to describe what you would choose as a reference system and identify the standards on how to make the decisions. Dr. Birchfield indicated that the reference system would be included in the test/QA plan. Dr. Gardisser suggested that the reference categories should be the same as those used by EPA in risk assessments for development of the current labels. Dr. Erdal Ozkan suggested that the European testing programs have already been underway for many years and review of this work should be done. Dr. Hewitt suggested that the U.S. approach would add aerial application and drift control adjuvants to the process, since these had not been addressed in the European tests. Mr. Valcore indicated they are still debating reference sprayers. Mr. Ellenberger suggested that there needs to be more cooperation through OECD and other collaborative efforts. Mr. Carmine Sesa noted that comparison of nozzle to nozzle is fairly straightforward, however

would use of an adjuvant as the DRT be included as it complicates the analysis. Dr. Birchfield suggested that the DRT would be a nozzle and adjuvant combination. Would you take the reference nozzle without the adjuvant, then the reference nozzle with the adjuvant, or would you take a nozzle combination with an adjuvant and a DRT? It was suggested that combinations of adjuvant interactions with nozzle type and additive effects of multiple DRTs should be considered.

Dr. Giles noted that some DRTs are affecting spray movements and that droplet size measurements alone may miss some of the DRT effects. Adding flux measurements would help assess some of these effects. Field testing is essential for a fully comprehensive evaluation for some technologies. Mr. Tom Bals noted that wind tunnels do take account of some effects of nozzles – hence their use in European DRT testing programs. Mr. Bals asked if the reference systems would comprise nozzles in wind tunnel and field sprayer conditions. Dr. Birchfield suggested yes, and asked Dr. Pearson and Ms. Carolyn Baecker about their perspectives from a nozzle manufacturer point of view. Dr. Pearson replied that there was a need for consistency across tests and, where possible, with international testing. A participant mentioned concerns regarding the droplet size measurement devices and indicated that instruments are important. There are differences between laser defraction and Doppler devices, and even from operator to operator. Dr. Birchfield acknowledged that there are limitations in field testing and some aspects that cannot be accounted for.

Dr. Womac was concerned about consistency between wind tunnel and field testing. In the wind tunnel, the fan axis might differ from the orientation in the field. Sprayer speed and other issues are important. Mr. Bals explained that international harmonization is important – as a manufacturer, he would not want to have to do a different test for each country to validate a DRT. Mr. Valcore suggested that a standard nozzle would be fitted to a standard sprayer, and the DRT would be tested at the same height as the reference. Dr. Womac suggested that the tops of boom sprayers in Europe are more consistent than in the U.S. Some technologies are not appropriate for testing in a wind tunnel. Reference nozzle height should be fixed, but the DRT could be tested at its optimal height of operation (i.e., manufacturer's recommended height), as applicable. Dr. David Miller suggested that a covariate analysis study approach and design would be best to avoid differences in meteorological conditions between field trials. A participant suggested that simultaneous reference and DRT tests be conducted as the variability between test runs in the field can be large. Dr. Womac suggested that there would be rigorous procedures in the test/QA plan to address any test differences. Dr. Gardisser indicated that ASABE suggests 25 replications. A participant indicated that if simultaneous runs were done, the testing field would need to be bigger. Another participant indicated that application to a bare field or 10-inch stubble is an option.

Mr. Valcore indicated that the test/QA plan has less flexibility than what pesticide registrants are allowed. Dr. Birchfield explained that the test/QA plan would be flexible in that where a specific technology required specific testing approaches, flexibility would be available through discussions with EPA and adding addenda to modify the test/QA plan.

In response to a question about airblast applications, Dr. Birchfield explained that the current test/QA plan and DRT project first phase was aimed at assessing row crop applications. Orchard applications would hopefully be covered in a subsequent program.

Dr. Heping Zhu explained that the current approach is focused on spray drift reductions. Issues such as groundwater runoff and other routes of pesticide exposure to the environment are not being addressed. Dr. Hewitt replied that these kinds of issues are not being ignored, but the current focus is on spray drift management. Other supplemental benefits of DRTs in reducing other exposure routes could also be noted but are not part of the present project.

Dr. Womac asked about a canopy versus no canopy; he suggested that a bare field would be the base case and a crop canopy could be added and the DRT would only be applicable to canopy application. Mr. Ledebuhr expressed concern about written documents being the framework for addenda. He asked how these might be written. Mr. Kosusko indicated that these have previously been done for non-pesticide technologies tested under the ETV program, and the addenda capture the specifics of the DRT test.

Mr. Bals was concerned that a canopy is needed for certain sprayer tests. We would need an intermediate way to conduct testing for these systems. The cost of field studies would be high (due to the costs of replication), so the wind tunnel provides a good option for testing at lower cost for nozzles and certain other components of sprayers. For other systems, the wind tunnel would not be good.

Ms. Elaine Hale asked about testing of actual products and tank mixes. Dr. Birchfield replied that the physical properties of the tank mix complicate the process. Adjuvants could complicate the process further. Droplet size also has issues related to these and other effects. The capture of high end conditions is important. The use of an emulsifiable concentrates (EC) blank and/or other surrogates is important.

Dr. Patrick McMullan asked whether the addenda would need to be published. Dr. Birchfield suggested that as much information as possible would be made available on the Internet to make the test approaches and associated materials available to the public and other equipment manufacturers.

Summing up the previous discussions, Dr. Birchfield suggested that there was good agreement to the idea of using multiple specific ASABE S-572 reference nozzles for different conditions.

**Issue 2—Data Quality Criteria and Statistical Analysis**
*Discussion led by Mr. Drew Trenholm, RTI*

Mr. Drew Trenholm covered the data quality and statistical issues for the project. He explained that there are data quality criteria, i.e., how good your number needs to be, and then there is the analysis of the data results, i.e., how good the data actually are. The data quality criteria are needed for measurements of droplet size spectra, spray drift, and other variables. Statistical issues were included in the process of assessing means, confidence levels, and other values for drift reduction categories. EPA would like to get feedback from the participants on what approach is best for the DRT testing.

Mr. Trenholm presented two basic approaches for statistical assessment of the data results. The first approach looks at from a “bin” standpoint, whether the drift reduction is more than X percent (a target value). Statistics are used to calculate how confident you are that the results are greater than 50 percent, or greater than 75 percent, what ever that value might be that you are looking for. This is a one-sided statistical approach for looking at the data. So basically you

determine that the null hypothesis to calculate whether the mean value from the results is greater than or equal to the "bin" or target value. The alternative hypotheses looks at performing a t-test, which is not indicative of the bounds of the confidence but indicates whether you are above the target value. Analysis of an example data set is shown in Appendix 3. This approach allows the user to test for a specific percent reduction relative to the reference technology.

The second approach does not have "bins" but rather looks at the confidence limits of the results. From the mean value of all test runs, look at the confidence around that number (e.g., 90 percent confidence that the number is between two values). The second approach is what is typically used in the ETV program. Report the mean and show how well we know that answer. Analysis of an example data set is shown in Appendix 3.

Dr. Womac suggested that a 95 percent confidence interval is appropriate for many types of studies, but for field testing studies is likely too rigorous given the variability in the data results. A confidence interval of approximately 70 to 80 percent is likely a better interval for field testing. Mr. Trenholm suggested that a decision must be made up front about what confidence intervals are appropriate and included in the test/QA plan. The number of test runs that are conducted is also a factor in the statistical analysis.

Mr. Kosusko and Dr. Hoffman discussed that the data set resulting from the testing must be useful for OPP's purposes in risk assessment. Dr. Birchfield explained that the test/QA plan was written for data development. The statistical analyses are somewhat separate from this process. Statistical issues are important in study design issues, such as required replication for DRT validation. Cost-benefit assessments fed into the process since additional replication required additional resources for data collection. Dr. Hoffman explained that repeatability in droplet size testing in wind tunnels is usually very good, while variation in deposition among field trials is typically relatively high. Because deposition is the critical data, Dr. Birchfield indicated that EPA would look at the data quality or variability of the deposition results from the model.

Dr. Barefoot asked whether a model is needed to make decisions on data use. If we are planning to use drift reduction bin categories (e.g., 75 percent), he suggested that the first statistical approach is likely better. Mr. Trenholm noted that with wind tunnel testing, deposition is not being measured but rather that droplet size measurement differences are measured. Model verification introduced issues into the process. Dr. Birchfield suggested that droplet size differences do not inform on risk; rather the droplet size must be tied to deposition happening farther away downfield. Dr. Birchfield explained that running data through AGDISP or AgDRIFT is a good approach because these models are commonly used in risk assessments; the models allow quantification of exposure. Dr. Barefoot noted that the model has its own variability, which adds to the variability in the risk result. He suggested that there may be a way to separate variability in the testing results and in the model. OPP focuses on the deposition downfield, and the models are well validated. Mr. Bals expressed concerns about the use of the models for ground-based assessments, given their value in aerial applications but limitations for ground application modeling. Dr. Birchfield suggested that some issues have been resolved where flux is measured away from the nozzle in its best operating area, i.e., using low speed wind tunnel data for example to indicate flux and droplet size away from the initial nozzle effects. Mr. Bals was still concerned about the attempt to get absolute risk data from the process, rather than relative information. Dr. Birchfield explained that there is a need in the U.S. to assess drift exposure risks at greater distances downwind than the standard European distances of concern in risk assessments. Dr. Hewitt asked why the U.S. buffer distances are typically 100

times greater than in Europe (e.g., 100, 200, 300, 400 meters rather than 1, 2, 3 or 4 meters in the U.K.). Dr. Birchfield replied that statutory differences seemed a likely reason for much of the discrepancy.

Mr. Sesa indicated that the benefit of using specific reduction categories (e.g., 25, or 50 percent) is for facilitating the labeling process. Dr. Barefoot suggested that an approach where you can lay all the options for obtaining a drift reduction that will give an acceptable risk is best. Mr. Valcore suggested that there is a need for a discussion on statistical validation, given the large amount of noise in field trials. If the specifications are overly restrictive, testing of good DRT technology in the field may be impaired and OPP may miss opportunities to reduce risk in the environment. Dr. Womac suggested that it would be good to look at nozzles as DRTs. In his opinion, the number of testing combinations in the wind tunnel for possible application scenarios would be prohibitive, whereas droplet size data from wind tunnel testing are of greater value in many cases. Based on the SDTF data, we have a good understanding of atomizer effects on drift downwind. There is a need to use existing data with appropriate verification rather than retesting systems under a new test/QA plan. Mr. Kosusko suggested that there is precedent within ETV to use existing data to support the design of test plans. Mr. Trenholm indicated that existing data can be submitted for the verification process, and analysis would be conducted in the same manner as newly developed data. Dr. Gardisser indicated that there is an enormous amount of data available that should be usable under this program.

Mr. Ellenberger suggested that the premise of the DRT goal is valid for looking at the appropriate combination of using existing data, what is value-added in additional testing without "re-inventing the wheel." The question is how do we move forward to a better place for product labels and applications in the field for the best value. The DRT process is aimed at giving credit to application techniques that are verified that they can reduce drift. Dr. Barefoot agreed that there is a need for the use of existing data and technologies, and there is a need for this approach of developing test/QA plans for future testing of new products that do not have existing available data. He also suggested that a broader question is not how the test/QA plan will incorporate existing data but rather how existing data fits within the context of the program. Mr. Trenholm indicated that the data quality criteria that are written into the test/QA plan will apply to both existing data and new data that are generated under the program.

Dr. Womac and Dr. Gardisser noted that data quality control issues are addressed by the ASABE S572 standard, with specific criteria that users should meet in data collection; this is an internationally recognized standard and these data quality criteria should be incorporated into this test/QA plan. Mr. Valcore added that the Federal Biological Research Centre for Agriculture and Forestry (BBA) data [and Local Environmental Risk Assessment for Pesticides (LERAP)] include much of the information needed by the current DRT program. The BBA data meet the criteria of this test/QA plan; the next question is whether those data meet the modeling needs and criteria for OPP. Dr. Birchfield suggested that the best approach for the present project would be exploring the nature of a realistic, best-case data set for the U.S. system. After that, looking at using a LERAP-type of approach of allowing data to be submitted from other test methods to see how well they fit the existing data requirements. The existing data were not necessarily collected with EPA needs being covered. Dr. Womac suggested that much of the evaluation work could be done using droplet size analysis and specifically using the existing droplet size data. Mr. Valcore noted that the current modeling does not allow enough droplet size separations to give full credit to many DRTs. Mr. Bals added that size is not the only factor for ground application testing as LERAP has determined; the need for wind tunnel drift tests is

based on differences in drift other than just droplet size effects alone. He added that a huge amount of data exists in Europe. It should be determined whether it is adequate to serve the ETV and OPP purpose, and so should be used if possible.

**Issue 3—Need for Monofilament Measurement**
*Discussion led by Dr. Andrew Hewitt, University of Queensland*

Monofilament lines of collectors are used to measure horizontal deposition at 2, 3, 4, 5, and 6 meters in a wind tunnel. Some locations also measure vertically as well to assess airborne spray drift potential. The spraying is conducted with the spray nozzles at a fixed height. Spraying occurs for a known period of time, the amount of product sprayed is recorded and used to assess deposition (following analysis) on each sample line as a percentage of the applied product amount. All applications occur under controlled conditions in the wind tunnel. He suggested that different nozzles that haven't been tested could be tested and also that testing of adjuvants could be done. He noted that while the Europeans had already conducted extensive testing of ground application systems, no aerial drift reduction technology testing had been done in Europe. This was an area that the U.S. system could significantly extend.

The advantages of monofilament measurements include that it is a well-used measurement method, it allows high collection efficiency for most droplets, specifically for small droplets that are of most concern for drift; sample collection occurs by both impaction (droplets hit the string from the side) and sedimentation and is likely to collect more than with a flat card on a grid (sedimentation only); and is a rapid, easier measurement than even laser-based measurements. Measurement with monofilament is a standard measurement in Europe, and has been proposed in the draft ISO WT standard. String collection typically gives higher collection efficiencies than horizontal cards, which may be important for risk assessment activities.

The modified drift model uses the data (spray flux and droplet size) as inputs to extrapolate the spray drift potential downwind. Dr. Hewitt presented some preliminary data analysis from wind tunnel testing of the same spray nozzles used by Tom Wolf in field testing. Dr. Hewitt tested these nozzles at the same conditions in the wind tunnel as the field (temperature, wind speed, etc.) The data in the wind tunnel showed good agreement with the field testing data for the first 7 meters although slightly higher drift results in the wind tunnel. Mr. Ledebuhr commented that the log scale on the graph indicates that the wind tunnel data are much higher. Dr. Hewitt indicated that he has not yet normalized the data and noted that the field testing did use a canopy that could possibly have reduced the field drift data somewhat. He was encouraged that the shape of the curve was the same.

Dr. Hewitt reviewed several disadvantages of using monofilament measurements. The monofilament can be overloaded if sprayed longer than 10 seconds with some higher flow rate nozzles and may drip and lose some of the sample if this occurs. It may be considered an intrusive sampling method as it is placed directly in the spray line, whereas laser-based measurements are non-intrusive. There are also collection efficiency issues as not all droplet sizes are collected equally; smaller droplet sizes are more readily collected by narrower collectors. There are handling issues, which can be addressed by QA procedures to ensure that the strings are not contaminated. It is not clear how monofilament data from wind tunnels would be input to the drift models.

Dr. Barefoot noted that BBA makes the drift reduction determination for DRT based on the drift reduction demonstrated at the 2 through 7 meter distances in the wind tunnel, and asked whether that approach could be used here, without the modeling step. Dr. Hewitt indicated that BBA does make the drift reduction determination based solely on the wind tunnel data comparison of the drift from the DRT to the drift from the reference nozzle. LERAP looks at drift reduction at 4 meters. If you show drift reduction in the 7-meter distance in the wind tunnel, then you would still see drift reduction at 100 or 200 feet. Dr. Birchfield noted that there are droplet size spectra where there is higher deposition in the near field and lower deposition in the far field, or vice versa. Modeling helps to address these cases by characterizing what is in the air downfield based on the spray flux data at various heights in the wind tunnel. The German approach originally was to measure the droplet size; they saw very little differences in the droplet sizes from nozzle to nozzle and moved to measuring the spray flux.

A participant asked if the monofilament testing is conducted at the same time in Dr. Hewitt's tests. Dr. Hewitt indicated that they are tested at different times because an appropriate width is necessary not to affect the results. Mr. Bals indicated that ISO gives specifics but noted that he is not certain the EPA will accept these. Dr. Birchfield explained that the key issue is whether the standard provides the data that fits in with and supports the risk assessment.

A participant asked that Dr. Birchfield explain more about what exposure is because many participants may not be clear on this. The very fine droplet sizes, or respirable fraction, may not get collected in sampling and testing. Dr. Birchfield noted that in the majority of pesticide risk assessment cases, the most significant spray drift exposure route occurs via deposition, on plants that are eaten or from water bodies that people are drinking from or swimming in. While inhalation can be a very important route of exposure to pesticide spray, deposition tends to the bigger exposure concern.

One participant expressed concerns that if the test measures the drift from a product at 200 to 300 feet, the difference in deposition may not be detectable given the variability. Dr. Birchfield noted that Dr. Thistle is conducting research to model deposition at downwind distances of kilometers from the target site rather than feet. He is detecting deposition at these distances, and while at very low levels, they are detectable. These far downwind sites are important particularly for endangered species.

One participant asked how a single drift reduction percentage is estimated from the multiple data points collected in a test at different vertical heights and horizontal distances. Dr. Hewitt explained that there are equations that include all these measurements. Mr. Bals noted that there are many types of atomizers. Dr. Birchfield noted that the data (droplet size and volume) at these multiple measurement points are input to a model. The deposition measured from the horizontal samplers is a supplemental measurement (i.e., noncritical) but is important in conducting a mass balance. Dr. Hewitt noted that both the field testing and the wind tunnel testing show the relative changes in deposition.

**Other Issues—Open Discussion**

*Discussion*

Mr. Trenholm invited each of the STP members to discuss or address other issues that are pertinent. Mr. Bals noted that he was in favor of wind tunnel testing for nozzles, and field testing would be too expensive to justify the possible return. Something other than ASABE or

ISO standards are needed. For novel equipment, the costs for field testing are disproportionate to the benefits. Quality assurance costs could be unnecessary burdens to equipment verification. The aim of this program is to get DRTs accepted and to assist the world in reducing drift. ISO has discussed the QA issues, and he suggested that a simplified QA approach, similar to that of work currently being done in Italy (field track sprayer test developed in Italy) was worth some funding from this project if possible.

Mr. Valcore suggested that flexibility is needed in the use of quality assurance so that this could be contracted out separately from the test facility, especially for some smaller testing firms that may not have an in-house QA group. He suggested that much of the QA flexibility that is already accepted by OPP should be incorporated here. Mr. Kosusko suggested that the test plan needed to include a requirement that a quality assurance system is in place at the time the tests were done. A contractor QA group could meet this requirement. Mr. Trenholm suggested that each testing facility would show that quality procedures and quality systems are already in place and test firms often will have their own QA group. It might be possible for the test facility to provide its own quality assurance system. Ms. Baecker noted that this level of QA is another layer of expense. One participant noted that small university testing contractors would have to hire QA services; Dr. Barefoot suggested that there are many private firms that can provide this. Mr. Valcore noted that external QA services would only be necessary if a firm didn't have them internally; a firm can have good documentation of procedures without a separate person who conducts QA analysis specifically. Mr. Trenholm noted that the EPA QA procedures have many similarities with, but are not exactly the same as, GLP. Mr. Ellenberger mentioned that many studies had already been conducted. It is likely that the private testing firms, government labs, and universities that conducted these tests have a similar QA built into their program to ensure there is no bias and the data represent high quality science. There may be some differences in what each of them does with respect to QA and a standard of what the QA should be must be set. If EPA were to look through the existing data to assess suitability, the criteria of independence needs to be addressed. Dr. Hewitt explained that the European system included accredited laboratories which had criteria for quality assurance and independence from the companies whose DRTs were being tested. Ms. Baecker suggested that USDA-ARS laboratories where much testing has been conducted have good testing systems, and are credible and objective.

Mr. Ledebuhr suggested that a single national laboratory could be used for testing DRTs under this program. There are lots of complexities with this program and differences between laboratories. He noted that food safety and spray drift reduction are national concerns and should not be shouldered only by equipment manufacturers. He noted from agriculture statistics that sprayer equipment worth $829 million was sold 10 years ago; if 5 percent of this is profit and 10 percent of profits is spent on this program, that would be only $4 million. The spray drift reduction program is important because it affects every crop. He suggested that one laboratory could be identified for testing; for field testing, one single field would be used for all vendors. A dedicated laboratory, with dedicated staff, and dedicated equipment would work with EPA and tailor research to EPA's needs for drift models. One quality assurance system could be used, and one set of reference sprayers and other systems to assure compatibility and uniformity of testing would be used. Mr. Valcore suggested that this should be discussed in more detail within industry. Implementation was another issue of concern to Mr. Valcore, and a national education program may be needed, perhaps even an extension service, for national laboratories or other facilities that cover DRT performance evaluations. A line item budget could be established for funding this work. Dr. Barefoot suggested that this was one option among many, and that a separate group should explore this and other options for project management and execution. Mr.

Valcore and Dr. Barefoot would follow up with USDA. Mr. Kosusko explained that funding exists from the current EPA project that could help develop the scheme for whatever direction it ended up taking. Mr. Valcore suggested that ISO standards could impact issues as well. The main testing could include field testing.

Dr. Giles discussed the issue of data use in modeling. Relatively small changes in droplet size have an order of magnitude effect on drift results in models (i.e., could impact significantly on drift). The process of cooperation between equipment manufacturers and registrants needed to be established, since the success of the project depended in part on this process.

Dr. Pearson added that the reference system issue needed more attention as it is critical to the project success. Dr. Barefoot agreed that reference sprayers need more discussion, especially field sprayer conditions. He noted that EPA has current categories and while there are existing default values, they are different from default values used in other parts of the world. The model discussed by Dr. Birchfield for predicted deposition needs more attention. The need for a better ground model was partly driving many issues. Mr. Trenholm agreed that the reference system is a very important topic. He reiterated the need for comments and amplification from the panel and participants on some of the points made by Dr. Birchfield earlier regarding definition of the reference sprayer and what aspects need to be fixed and those that can be variable. Mr. Valcore noted that did not nail down what to do with aerial application; for ground application, use Tier 1 defaults. The nozzle droplet size is defined in the model along with the application conditions. Dr. Birchfield noted that the Tier 1 AgDRIFT curves are using an ASABE nozzle; the droplet size is not related to nozzle angle and the flight speed. This is not really a reference system for modeling and perhaps not directly analogous to a real application.

Ms. Baecker noted that she had a different perspective. She commented that manufacturer and vendor resources are limited and that we would not be good caretakers of what has been done in the past to not use data collected and the research investment already made. She suggested that the scope of the program has expanded beyond drift to economic impact (i.e., resources such fuel usage, waste disposal, and product usage). She sees these as entirely different, and the impacts have less pertinence to nozzles than the equipment it is put on. There is equipment that provides incremental improvement in spray drift reduction; verifying these slight improvements would not be cost-effective and could not be part of this program. It takes a long time to get new products to market; the resources for this program may not be worth it and a balance is needed between what EPA needs and feasible resources. Mr. Trenholm noted that the intent of including these other impacts is to provide additional data valuable to the purchases/users of the DRTs; as an example, if a technology that performs much better but causes other impacts such as increased energy use, this is information a purchaser/user may like to have. These are not critical measurements in the test/QA plan. Ms. Baecker commented that the purpose of this program is the assessment of DRTs in drift reduction, and should not be expanded beyond that to include other impacts. She is concerned that drift reduction testing laboratories may not have capabilities to measure these other impacts. Mr. Valcore noted that EPA should determine what these measures add to the testing effort.

A participant asked about previous testing being used in this program. Mr. Ellenberger indicated that work done in the past may be used for this program and will not be disregarded. EPA needs to consider how to use these existing data efficiently and effectively and put some definition on how the data can be used in the ETV DRT program. The DRT team will think through some of

these issues further based on the input received. One participant noted that the DRT program is a good project and agreed there are lots of issues for EPA to think through.

Dr. Gardisser noted that the purpose of the DRT program is to encourage applicators to use DRT and to allow the users certain advantages such as reduced buffer zones and increased wind speed. He heard a comment at the ASABE meeting that DRTs are not being utilized, however, he disagrees and believes they are being used. He does not believe that certification alone will increase their use. He noted that there is an incentive to look at the existing labels to broaden the window of opportunity of when applications can be made. With respect to the reference sprayer, the reference should be what equipment was used to generate data for the original label. New technologies that provide small improvements in drift may not generate enough economic returns to allow manufacturers to afford the involved testing. He commented on page 10 of the test/QA plan, that a clear flowchart be included on the schedule. He thinks the schedule presented here is not realistic. EPA should include additional information on the chart for each step: send the applicant or testing firm to a specific place in the document with details on the specific step, who are the potential laboratories that conduct the testing, who to contact at EPA for assistance, what documents need to be filled out, etc. The test/QA plan needs to be simplified. He noted that recognizing and encouraging use of DRTs is important.

Dr. Hoffman noted that basic decisions need to be made by EPA on what the metrics will be and how they will be used. If a goal is the reduction of buffer zones, does that imply that all labels have buffer zones? Until we know what the goals are, it is difficult to design the method to answer the question. He thinks EPA needs to answer some basic questions for the manufacturers. He has concerns with some of the wind tunnel test conditions (e.g., a relative humidity of 95 percent is impossible) and the range of conditions. In label language, when you conduct the test, the range of variables under which you test basically draw the boundary of conditions under which you can apply that pesticide. For example, testing must cover wind speeds of 2 to 15 miles per hour; to cover the whole range in order to allow operations under the condition can take weeks of testing. With only a few variables that need to be conducted under a range of values, a field test quickly becomes fairly large. It is not clear whether the model will replicate all of these conditions, but testing these conditions will be expensive. The test/QA plan document should undergo more public review. Testing firms will need a major retooling of resources and personnel for this program.

Mr. Ledebuhr asked what the benefits for manufacturers are and what other support will be there for selling this program to users; for some customers drift reduction is not a big selling point. Mr. Ellenberger noted that EPA needs to understand how what a label says about use conditions can influence the sale of that product and competitive products or does it have a minimal effect. Mr. Valcore and Dr. Barefoot indicated that the label requirements do have an effect. Dr. Gardisser noted that State regulators should have authority regarding the DRT label's interpretation and use.

Mr. Ledebuhr asked manufacturers what they might pay to conduct DRT testing. Testing costs include the time to travel to and from the testing site, a week of time to attend the testing, and the evaluation cost. The draft test/QA plan will result in several hundred hours of billable time. The BBA typically charges $40,000 to evaluate spray equipment. Mr. Bals noted that the cost varies with the type of equipment or the type of testing (e.g., from $1,000's to $10,000's), and he noted that half of the cost typically is getting agency approval. One participant agreed that the cost for testing is related to the equipment type. This participant noted that they had a vested interest in

demonstrating their products' drift reduction capabilities and noted that any edge is significant in the marketplace. The size of the manufacturer is key; there are hundreds of companies that make a few dozen pieces of equipment each year, and a handful of companies that make hundreds or thousands of pieces per year. He indicated that a $5,000 testing cost for a smaller company is prohibitive. Another participant indicated that testing is expensive. With respect to BBA, the participant frequently lumps innovations together and goes to BBA once because of the costs. He indicated that equipment companies work hard to get even a 2 to 5 percent cost reduction; it is just as difficult to get incremental drift reductions.

Another participant is concerned that label changes add one more layer of liability for the formulators and applicators when drift incidents occur. The formulator is required to put the application limits on the label; financial responsibility and liability are not always clear for the pesticide producer, the formulator, or the applicator. Frequently, it is the applicator who is sued and the applicator is simply following instructions on the label. This change in labeling may add another hole in the financial responsibility and liability when drift occurs. Mr. Valcore disagreed and suggested that it puts a bit more "complication" on the label, but the label guidelines will simply include one more possible application instruction, similar to any of the other instructions. It adds flexibility. He provided some possible examples of label guidelines: "use X feet buffer," or "use X miles per hour wind speed."

Ms. Baecker suggested that all the participants at the meeting should receive the same information as the panel members are receiving (draft test/QA plan, meeting summaries, etc.).

Mr. Kosusko asked how it is dealt with internationally when there are small companies and the equipment provides incremental improvements. Mr. Bals noted that for nozzles and wind tunnels, the cost of testing is approximately $2,000 to $3,000. For smaller market items, such as air-assisted sprayers for orchards where field testing must be conducted, the market is not large enough to justify testing costs (could be up to $20,000). None of these have been tested under LERAP. The BBA is testing every model of sprayer. All costs are borne by the vendor for U.K.'s LERAP. Mr. Valcore noted that Germany's BBA, Spain, and Italy are heavily subsidized.

Mr. Sesa asked about the role of adjuvants versus equipment in the DRT program. He noted that the DRT panel includes equipment manufacturers and pesticide manufacturers but should also include adjuvant manufacturers. Dr. Birchfield and Mr. Trenholm noted that they tried to include adjuvant manufacturers and it was their intent to include representatives from all possible interests. One participant asked if multiple drift reduction components are used. For example, if a mechanical sprayer reduced drift by 90 percent and an adjuvant reduced drift by 90 percent, how would the overall reduction be determined? EPA needs to consider this.

One participant asked if funding was available to help with DRT testing costs. Dr. Birchfield explained that OPP and ORD won an internal grant from the ESTE program and part of that funding is for developing the test/QA plan and part is for helping the testing process. There are a number of issues with how to legally subsidize testing, and EPA is now working through what these limitations are.

One participant noted that testing costs discussed today of $5,000 for nozzles and of $40,000 for field tests and asked how much funding might be available to support testing. Mr. Kosusko indicated that funding available would be at most a few hundred thousand dollars.

This participant also asked whether EPA was keeping track and noting the number of good ideas being discussed. Dr. Birchfield indicated that a summary of this meeting would be provided, and a summary of the first DRT STP meeting is available on EPA's ETV ESTE web site at http://www.epa.gov/etv/este.html. The draft test/QA plan is not on the website but the invitation email to all the participants included a contact name to request a copy of the draft test/QA plan (Ms. Christine Vincent, RTI).

Mr. Trenholm indicated that EPA is beginning to think about the testing phase and would like to hear from vendors who may be interested in participating. A vendor list is being started for those who may be interested in early verifications. One participant asked who would come to EPA first, i.e., whether the list was for equipment vendors, formulators, or chemical companies. Mr. Trenholm indicated that the verifications are for the equipment and the owner of the equipment, although the equipment vendor can work with a chemical company and bring them to the table as well. Another participant asked how they could present their thoughts on the DRT program and the test/QA plan. Mr. Trenholm asked that participants email their comments to Dr. Birchfield or to him.

**Labeling Process/ Changes**
*Mr. Jay Ellenberger, EPA OPP*

Mr. Ellenberger discussed elements of the labeling process and changes and how the DRT program fits into this process. He discussed three basic steps in the draft DRT labeling program: nominating a pesticide or use compatible with drift reduction technology, conducting risk assessments at EPA or by a pesticide manufacturer for applications using DRT inputs proposed by the pesticide manufacturer, and developing the label language that would give credit for DRT use. The pesticide manufacturer could collaborate with equipment vendors to verify the DRT and for a product label change. The label change would give the pesticide applicator instructions or guidelines for using the DRT with the pesticide product.

He reviewed labeling principles, including (1) a pesticide product's uses and directions/restrictions for use are well-grounded in supporting scientific data, (2) more robust database enables greater confidence in scientific and regulatory decisions and more precise estimates of potential risks and use restrictions (this is reflected in registration decisions including product labeling), and (3) adoption of DRTs on labels starts with a request by the pesticide product registrant. The ETV DRT program will generate validated studies of DRTs based on the test/QA plan that enable pesticide registrants and EPA to consider DRTs in risk assessment and risk management decisions of pesticides. EPA wants to make defensible decisions based on the good data generated during DRT testing. The QA and QC in the test/QA plan and at the testing facility help EPA assess the data and provide confidence in the data. Vendor companies make claims that their product reduces drift or is low drift; EPA relies on data that can be integrated into its risk assessment. EPA then uses differential risk estimates to compare risk assessment for standard or reference application equipment with risk assessment for drift reduction technologies. The results may be reflected in the risk management decisions or the restrictions appropriate to keep drift as low as possible for that product via the product label. He presented a drift curve figure with the amount of pesticide drift and potential risk versus the distance from the application site. The "largest" curve represents standard or reference application equipment technology. Based on the toxicity data submitted by pesticide manufacturers or registrants for a product, a particular amount of drift is related to the toxicity of

the product for the most sensitive species. Risk management restrictions, such as buffer zones or maximum wind speeds, would be needed for application of this product by standard application technology. With DRT that achieve better levels of drift reduction, the drift and risk decrease; with those technologies where drift and risk drop below the level of concern for the most sensitive species for that product, application of this product using the DRTs may need few if any application restrictions.

Adoption of DRTs on pesticide labels really begins with a request from the pesticide manufacturer or registrant, whether for a new product or an amendment to an existing product label. One of EPA's responsibilities is to reevaluate older pesticide compounds under the registration review program, to confirm that older pesticides meet current standards. As part of this program, pesticide manufacturers could include DRT on labels. Mr. Ellenberger reviewed some possible DRT incentives. For example, on a product label with a "1-star" DRT inclusion, restrictions related to release height and droplet size would remain however the buffer size might decrease from 100 feet or 50 feet for using standard application equipment to a buffer size of 25 feet. For including a "2-Star" DRT that further reduces drift, perhaps use restrictions for release height, droplet size, and a buffer zone might not be necessary.

Mr. Ellenberger discussed several labeling considerations. The DRT approach is a new, innovative approach that has not been tried before. There will likely be a lot of questions and issues to be answered. There is some risk involved in participating in this program, for equipment vendors, pesticide manufacturers or registrants, pesticide educators, and OPP. One issue is how many levels of drift reduction will there be. Linking to the ISO standards certainly makes sense. Another issue is how do we effectively communicate with applicators on pesticide product labels. Is a star system (1-star, 2-star, 3-star), or a program ID (e.g., Energy Star or EPA gas mileage) best. Another question is what the participation level will be for equipment vendors and pesticide manufacturers. Will it be cost effective and efficient enough to encourage participation? One question is whether EPA should recommend DRT product labeling.

Mr. Ellenberger explained the next steps for the DRT program. EPA would like to get comments from participants on the draft test/QA plan, complete the test/QA plan, and make it available. Part of completing the test/QA plan is to select the reference technology, define the number of and levels of drift reduction (e.g., 25, 50, 75, 90, 95, 99 percent), and to select qualified testing facilities (e.g., government facilities, private sector facilities, domestic facilities, or international facilities). Equipment manufacturers will use the test/QA plan to conduct testing of the DRT equipment, including use of existing data. EPA will review the completed studies and post the results on the ETV ESTE web site. Then, pesticide registrants submit product labels with the DRT claim for EPA consideration.

Mr. Ellenberger highlighted some of the feedback he has heard today. He heard comments that indicated that drift reduction is complicated and that attempting to get more approval of DRTs is the right direction. The ETV ESTE program path is not the only path. EPA has been working with the private, public, and nonprofit sectors for many years on drift issues; the issue of drift is large in magnitude, and the number of participants at this meeting is proof that there is much concern. The goal is to reduce drift and to reduce the incidents that growers, applicators, enforcement agencies, and the public have to deal with.

Mr. Bals noted that there is a fundamental disconnect between the chemical companies and the equipment vendors although he hopes they can work together; if the focus is on classes of

equipment and not specific vendor models identified, there is limited incentive for individual equipment manufacturers to participate. The wait for product label changes is also often lengthy; his recommended approach is the LERAP approach where the information delineating use guidelines is fairly quickly posted on a web site for all applicators to use.

One participant asked about stand-alone labels and supplemental labels that are required for endangered species. A 1-star or a 2-star DRT would show a reduction in drift of so much, but multiple species may be in the application area or downwind of the application area in a particular geographical area or concern, each with different drift reduction concerns. Mr. Ellenberger noted that was a good point that has not been considered yet. Recently, EPA has ramped up requirements for dealing with the interface of pesticides and endangered species across the U.S. Detailed risk assessments (biology of each species, pesticide toxicities, risks, exposure for species) for multiple species protection have been conducted in collaboration with the Fish and Wildlife Service. There are also temporal restrictions (nesting season restrictions), distance prohibitions, and buffer zones for endangered species.

A participant asked if one pesticide registrant gets a DRT label change and there are multiple registrants who make that single active ingredient, can the other pesticide registrants also adopt the DRT label change? Mr. Ellenberger indicated that if pesticide registrant A pays for DRT testing for a particular equipment vendor technology, and pesticide registrant B then wants to too, it is up to the parties involved to develop any additional financial relationships. If the equipment vendor pays for the testing, they would control which pesticide registrants can adopt the label changes and make relationships with whom they choose. Dr. Barefoot noted that a pesticide company may do a study for their own label, as they may see it as an advantage for them or as a response to a restriction. In general, the pesticide manufacturers or registrants would want to apply the same label to all the products at once. The participant indicated that for the same active ingredient there are many different restrictions and that applicators would like to see the same use guidelines for all products using the same active ingredient. Mr. Valcore noted that a government-funded, center-of-expertise approach may have some merit because the information would be publicly available for anyone to use, and chemical companies may not be likely to sponsor DRT testing for their own label, when that data can freely be used by others. Mr. Ledebuhr agreed and indicated that equipment technology is universal. Mr. Valcore noted that it would be difficult to update all labels simultaneously without a unique way to do this. One participant thought that the equipment vendor needs the pesticide chemical company first, then they can proceed because if a vendor tests their equipment but no pesticide manufacturer is willing to put the DRT on their changed product label, then it has no use or value to the vendor.

Mr. Sesa indicated that another approach could be that EPA set out the use restriction level for a particular pesticide product using DRTs of varying effectiveness, i.e., if you have a DRT of X percent, your buffer is Y feet. EPA would define these restrictions prior to testing and this would put in place the incentive for applicators, and technology vendors would not have to rely on chemical manufacturers to come forward. Any number of equipment vendors could test, but then it is the applicator that has the financial incentive to use the DRT. Mr. Sesa explained that EPA would choose pesticide formulations nominated by pesticide registrants, pesticide distributors, DRT manufacturers and distributors, other interested parties, or by EPA, and then re-assess them prior to actual performance tests. A label could state that if used without a DRT, the drift related use restrictions are the current given label restrictions. If used with a DRT that provides the following performance when tested with this pesticide, the new use restrictions would be the re-assessed values.

Mr. Sesa continued to explain the process in the marketplace would then follow that a DRT manufacturer or distributor would now have the financial incentive to test its DRT with various pesticides either independently, or in collaboration with the pesticide registrant or distributor. In fact any interested party could choose to test a DRT, or even combinations of DRTs used together, with a pesticide that has the new label language. Mr. Sesa noted that the approach might use a test protocol in which a DRT was tested in different classes of pesticides, and the performance values would be used for the pesticide class, thereby avoiding the high cost of testing for each pesticide formulation. A simple method could be developed by which the test information would be certified by a particular testing entity that utilizes the EPA methodology. This data could then be used by the DRT manufacturer, distributor, or interested party to promote the DRT to be used with the pesticide. The pesticide applicator would then choose between various DRTs, that choice depending on performance data compared to the use restrictions on the new label. Mr. Sesa indicated that he believed this approach would provide a greater degree of participation which is open to the entire stakeholder community, a larger number of choices to the pesticide application community, and ultimately a more significant commercial use of DRTs.

Mr. Bals noted that in LERAP they don't put all the information on the label, the information is on separate stand-alone labels, and the approach is simple. Under this idea, Dr. Barefoot indicated that if you have these DRT statements on the label, then a DRT could substitute for or reduce a restriction.

A participant pointed that the discussion has focused on the active ingredient so far, however he thinks the formulator is the most significant player. The formulation will affect the droplet size and other drift factors. Mr. Ellenberger noted that pesticide product risk is based on studies of active ingredients. Spray and other components evaporate and the active ingredient is what is left and has toxicity effects. The participant noted that different formulations give different spray droplet sizes. If an applicator is going to select a given DRT for active ingredient A, another formulation is affected by the DRT differently. Dr. Birchfield indicated that formulations do get complicated and that tank mix and formulation effects are real. There are issues with using an EC blank or oil to represent a class of formulations and there are issues with using an EC with an active ingredient. Dr. Gardisser suggested that EPA choose blank formulations and not a brand. The participant suggested that EPA formulate its own blank.

Dr. McMullan asked whether EPA has taken the DRT program idea to pesticide manufacturers yet, such as Crop Life America (CLA). The real costs are on equipment vendors not on pesticide manufacturers (the pesticide manufacturers have the risk assessment costs). Dr. McMullan indicated that there is no impetus from pesticide manufacturers to change labels and no incentive for equipment vendors to do testing. He asked whether a company should spend $10,000 on a program that never takes off. EPA should get information on what pesticide manufacturers want. Mr. Ellenberger noted that EPA has discussed this project with the major U.S. pesticide manufacturers and received positive inputs. Mr. Valcore volunteered that he and Dr. Barefoot have made a commitment and broached with CLA to set aside funding for DRT support. From the chemical manufacturer's perspective, there are increasing restrictions due to endangered species and there is incentive to adopt DRT to maintain market share and to reduce drift incidences. Dr. Barefoot noted that when there is an existing buffer restriction or other instance where it is important to reduce liability, a chemical company is willing to support DRT testing. Risk reductions are needed.

One participant asked whether drift reduction is specific for a chemical. Mr. Valcore explained that drift reduction is not chemical specific. The SDTF tested a wide range of tank mixes. Approximately 80 percent of formulations fall in a narrow range of physical properties. EPA should choose an EC that represents 80 percent of all ECs, solutions, etc. The SDTF determined that "formulation" type or active ingredient type was not a significant factor in drift.

Mr. Ledebuhr volunteered to lead a participant ad-hoc group. He asked that participants email ideas to him. Mr. Kosusko asked that participants identify sites, equipment needs, and field study needs. Mr. Ledebuhr may set up a list server and bulletin board for discussions. A list of testing facilities exists now, and he will narrow the list of possible facilities. Mr. Ledebuhr will consider selection criteria, such as what throughput might be needed to support a facility like this (two or three times per year). A facility that required less interaction from the equipment vendor would likely be used more. Mr. Trenholm indicated that the ETV DRT project will continue to proceed, parallel to Mr. Ledebuhr process.

A participant asked what chemicals CLA may be specifically targeting for this program. The ETV DRT program is an original equipment manufacturer issue, not a pesticide chemical manufacturer issue. Have CLA or the chemical pesticide manufacturers targeted funds to foster drift reduction and provide opportunities to innovate more to reduce drift? Dr. Barefoot indicated that they have not targeted funds specifically for DRT research and development but have encouraged development of this EPA DRT process/project. A John Deere participant indicated that they design equipment to a droplet size specification and flux to meet the application needs for products.

Dr. Ozkan indicated that the educational aspects of this program are significant. He deals with farmers day to day who adopt these technologies, and funding should be available for educational implementation for the end user and applicators. Thousands of farmers attend the demonstrated use show each year, and when you demonstrate four nozzles on the same boom, farmers understand the differences and make the switch. When you educate farmers so that they understand the issues and benefits, they will make the best choice. If EPA uses labels with stars, the farmers should know what they mean. Some farmers are quite sophisticated in their understanding of the issues. Mr. Ellenberger agreed that the potential of reducing drift must be communicated to applicators and users to take full advantage of the reductions that can be achieved.

**Summary/Wrap-Up/Next Meeting**
*Mr. Drew Trenholm, RTI*

Mr. Trenholm indicated that the meeting summary would be shared with all the participants on the sign-in list. He asked that participants send in their comments to EPA.

Mr. Trenholm, Dr. Birchfield, and Mr. Ellenberger thanked the participants for attending the meeting and encouraged participants to share their ideas.

# APPENDIX 1:

# Meeting Participants and Attendees

**Final**

## Meeting Participants

**Stakeholder Technical Panel Members present:**

Carolyn Baecker
CP® Products Co., Inc.

Tom Bals
Micron Sprayers

Aldos C. Barefoot
DuPont Crop Protection

Dennis Gardisser
University of Arkansas
Division of Agriculture, Cooperative Extension Service

Ken Giles
University of California at Davis

W. Clint Hoffman
USDA-Agricultural Research Service

Ted Kuchnicki
Pest Management Regulatory Agency

Stephen Pearson
Spraying Systems Company

David Valcore
Dow AgroSciences
Spray Drift Task Force

Alvin Womac
The University of Tennessee

**EPA Pesticide DRT Team:**

Norman Birchfield
U.S. Environmental Protection Agency
Office of Pesticide Programs

Kerry Bullock
U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory

Jay Ellenberger
U.S. Environmental Protection Agency
Office of Pesticide Programs

Andrew Hewitt
University of Queensland

Michael Kosusko
U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory

Karen Schaffner
RTI International

Drew Trenholm
RTI International

**EPA ETC Staff Support:**

Paul Shapiro
U.S. Environmental Protection Agency
Office of Research and Development
National Center for Environmental Research

**Participants:**

Bill Bagley
Will-Ellis Company

Roberto Barbosa
LSU Agricultural Center

Mark Bartel
Wilger Inc.

Jim Bennett
Hardi® West Coast

## Final

Loren Bode
Department of Agricultural and Biological Engineering

Bruce Bollinger
Intec Agro Products

Scott Bretthauer
Pesticide Safety Education
University of Illinois
Department of Agricultural and Biological Engineering

Dave Bridgwater
USDA-FS

Norman Burgeson
Lechler, Inc.

Deborah Carter
Northwest Horticultural Council

Richard Derksen
USDA-ARS

John Eastin
Kamterter LLC

Timothy Ebert
LPCAT-OSU

Jane Patterson Fife
Battelle

Byron Fitch
Washington State Department of Agriculture
Pesticide Management Division

Derek François
Pest Management Regulatory Agency

Brad Fritz
USDA-ARS

John Garr
Garrco Products Inc.

Gary Groves
Rhodia Inc.

Elaine Hale
Pesticide Applicators Professional Association

Sandra Halstead
U.S. EPA Region 10

Mark Hanna
Iowa State University

April Hiscox
UCONN-NRME

Jeff Jenkins
ALF OR State

Charles Krause
USDA, Agricultural Research Service

Yubin Lan
USDA-ARS

John Latting
Intec Agro Products, LLC

Mark Ledebuhr
Ledebuhr Industries, Inc.

Patrick McMullan
Agro Technology Research

Dave Miller
University of Connecticut Education

Mark Mohr
Hypro Corporation

Andrew Moore
National Agricultural Aviation Association

H. Erdal Ozkan
Food, Agricultural and Biological Engineering, Ohio State University

Ken Pfeiffer
USDA

Mike Powers

Murray Purvis
ABJ AGRI PRODUCTS

Nagarajan Ramalingam
Oregon State University

Randy Renze
John Deere

Lee Richey
Jacto, Inc.

Masoud Salyani
University of Florida
Citrus Research and Education Center

Sergio Sartori
Jacto Inc.
Brazil

Bob Schoper
Agriliance/Croplan Genetics

Carmine Sesa
Rhodia Inc.

Will Smart
Turbodrop/Greenleaf Technologies

Francis Smith
Rhodia Inc.

Howard Stridde
Huntsman

Russ Stocker
Arena Pesticide Management

Tim Stone
Pesticide Applicators Professional Association (PAPA)

Harold Thistle
USDA Forest Service

Steven Thomson
USDA-ARS

Paola Tiricola
Tecomec

George Wichterman
Lee County Mosquito Control District of FL

Terry Witt
Oregonians for Food and Shelter

Robert E. Wolf
Kansas State University

Heping Zhu
USDA/ARS-ATRU

# APPENDIX 2:

# Meeting Agenda

**AGENDA**
**Pesticide Spray Drift Reduction Technology Project**
**Environmental and Sustainable Technology Evaluation Program**
**Stakeholder Technical Panel – 2nd Meeting**
**Oregon State Office Building, 800 NE Oregon Street - Room 140**
**Portland, OR - July 13, 2006**

| | |
|---|---|
| 8:30 am | **Introductions/Updates**<br>Harold Thistle, USDA Forest Service<br>Jay Ellenberger, EPA/OPP |
| 8:50 am | **STP Role – Plan for the Day**<br>Drew Trenholm, RTI |
| 9:00 am | **Overview of the Test Protocol**<br>Norman Birchfield, EPA/OPP |
| 9:15 am | **Issue No. 1 – Reference Technology Systems**<br>Brief Introduction by Norman Birchfield, EPA/OPP<br>Discussion |
| 10:15 am | **BREAK** |
| 10:30 am | **Issue No. 2 – Data Quality Criteria and Statistical Analysis**<br>Brief Introduction by Christine Hartless, EPA/OPP<br>Discussion |
| 11:30 am | **Issue No. 3 – Need for Monofilament Measurement**<br>Brief Introduction by Andrew Hewitt, University of Queensland<br>Discussion |
| 12:00 pm | **LUNCH** (self service, cafeteria in building) |
| 12:45 pm | **Issue No. 3 cont'd** |
| 1:15 pm | **Other Issues – Open Discussion**<br>Discussion |
| 2:15 pm | **BREAK** |
| 2:30 pm | **Labeling Process/Changes**<br>Jay Ellenberger, EPA/OPP<br>Discussion |
| 3:15 pm | **Summary/Wrap-Up/Next Steps**<br>Drew Trenholm, RTI |
| 3:45 pm | **ADJOURN** |

# APPENDIX 3:

# Meeting Presentations