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Evaluation of Dense Gas Dispersion Test Results

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EXECUTIVE SUMMARY

A national Spill Test Facility (STF) program dedicated to public safety in the use and transport of fuels and other chemicals was established by Congress. The program is charged with developing technology for spill prediction, prevention, and mitigation. The Spill Test Facility, located northeast of Mercury, Nevada, is to be used for research leading to the development of tools for the protection of workers, the public, and the environment in response to accidental spills of hazardous materials. Public laws, including the Clean Air Act Amendments (CAAA) of 1990, also require that the Secretary of Energy make the STF and STF test data available to industry, academia, and other governmental agencies.

Surveys of industrial spill accidents resulting in public injury and evacuations underscore the need for a national chemical spills program to communicate to state and local emergency response agencies. Shortcomings have also been identified in the use of air dispersion models to predict evacuation zones for public safety. Industry and governmental agencies have recognized that models used to predict atmospheric dispersion of vapor/gases from accidental releases of fuels and chemicals are not adequate for risk assessment either for planning purposes or for protecting the public. The need for vapor dispersion models that provide more accurate chemical source term definition and that account for variable terrain and obstacles affecting dispersion is particularly acute.

The objective of this Western Research Institute (WRI) subtask is to help ensure that publicly funded safety technology development is made available to the public. The past data and overall technology development from the national Spill Test Facility are useful for public safety and especially for current federal rule-making developments that will have billion-dollar impacts for the chemical and petrochemical industries of the U.S. Since 1983, the public has funded over \$50,000,000 of testing at this federal facility, not including the public cost of the California Lawrence Livermore National Laboratory, and the cost of cosponsoring testing from the private sector and other nations.

Experimental data developed at the Department of Energy (DOE) Spill Test Facility (also known as the Liquefied Gaseous Fuels Spill Test Facility) have not been readily available to the public. Congress determined that data and technology developed at the STF over the years related to the accidental release of fuels and chemicals should be made available for use by industry and the public.

In 1986, soon after the DOE synthetic fuels program ended, WRI began the development of technology to address the spill of fuels and other chemicals. The WRI program was an extension of the Office of Fossil Energy (FE) mission. WRI began chemical spill testing and evaluation of

technology development at the DOE Spill Test Facility in Nevada and laid the groundwork for a system to transfer this new public safety technology to the public. WRI thus applied the experience gained in public safety technology development for the DOE-FE synthetic fuels program in oil shale, tar sand, and coal gasification programs to the work needed to address the problems of fuel and chemical spills.

INTRODUCTION

The objective of this subtask is to produce a data base allowing the chemical and fuel accident responder to access emergency management information quickly and efficiently. The work has involved (1) archiving spill test facility results from the U.S. Department of Energy (DOE) Liquefied Gaseous Fuels Spill Test Facility (LGFSTF) at the Nevada National Test Site, hereinafter called the Spill Test Facility (STF), (2) updating the data base on spill control technology documents and data, and (3) transferring this information to the public.

Through PL 99-499, the Superfund Amendments and Reauthorization Act (SARA) of 1986, and PL 101-549, the Clean Air Act Amendments (CAAA) of 1990, Congress passed public safety legislation related to fuels and other chemical spills to develop technology to protect the health of the public and environment. These laws mandated:

- That the U.S. Department of Energy implement public safety for fuels and chemical spills
- Widespread use of the LGFSTF and data
- A role for Wyoming
- Collaborative programs for dense gas dispersion research.

The CAAA of 1990 laid out a program that took industry and regulators ten years to plan. The major provisions of Title III of the CAAA incorporate laws begun under the Emergency Planning and the Community Right-to-Know Act of 1986, also known as Title III of the Superfund Amendments and Reauthorization Act (SARA). Under the Emergency Planning and Community Right-to-Know Act of 1986 (SARA III) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), any spills of regulated chemicals exceeding threshold values must be reported to federal, state, and local governments, including the U.S. Environmental Protection Agency (EPA). This list of regulated chemicals is published in 40 CFR part 302, which is different from the list published as a requirement for developing risk management plans under the CAAA. Actual chemical spills to test hazardous substances and accident investigations provide a basis for regulations and are essential to the development of safety and health regulations.

Petroleum and chemical industries in particular must be aware of emissions and air toxic control technology requirements. Of the current list of 189 air toxics, many are present in fossil energy products and associated chemicals in production, transportation, upgrading/preparation and refining. Section 112(r) of CAAA mandates that facilities that have on site or handle quantities of regulated substances exceeding thresholds submit a risk management plan to federal, state, and local entities and that they have a risk management program in place. The list of 77 regulated toxic substances, 63 flammable substances, explosives, and thresholds for each category is published in the *Federal Register*, Jan. 31, 1994.

New information was to have been developed to meet compliance schedules to protect the public with improved predictive and mitigative technology for fuels and chemical spills. Examples of public safety technology needed by U. S. emergency response teams relative to fuel and other chemical spills and fires include:

- Chemical protective clothing information
- Respirator recommendations
- Protective action distances (PADs) for toxic concentrations under the weather conditions and terrain of the incident.

The informed public, knowing of risk management planning regulation, is concerned whether available models accurately predict "what-if" air toxic dispersion at the fixed facilities fencelines and whether chemical spill source term expressions can be used with some degree of confidence. States that have mineral industries have a large stake in how to comply with the CAAA.

Additional needs in the interest of public safety have been identified in this project, because publicly funded emergency safety technology has not been used in real emergency response incidents. WRI has observed that emergency response data systems needed to be designed to provide industry with fast, easy-to-use information for chemical spill and fire emergencies.

BACKGROUND

Safety technology to prevent, respond to, and mitigate spills of fuels and other chemicals includes gas dispersion modeling. The need for improved dispersion models has also been recognized, however, this has historically been reserved in the domain of the National Oceanographic and Atmospheric Agency (NOAA), EPA, and national laboratories doing DOE research, together with other departments in government and industry, not to be made available for general use by the public because of the technical complexity involved.

The need to make these models available to the public has not been a priority with public safety leadership in either government or industry. Dispersion modeling is best improved by comparing actual field data on the dispersion of toxic materials with mathematical predictions. Dense gas dispersion modeling under low wind speed and stable atmospheric conditions usually represents a "worst-case" chemical spill. EPA has been directed by the CAAA to issue standards to control emissions, to evaluate dense gas dispersion of chemical spills and air emissions, and to assess the potential threat to human health and the environment. Currently, no two dense gas models provide

the same prediction, even when using the same input conditions. They are cumbersome to use, and their accuracy when compared to field data is typically no closer than a factor of two.

The need for fast-response dispersion models for chemical spills has long been recognized by WRI. The CAAA and SARA laws also direct EPA to work with the U.S. Department of Energy to test and evaluate model technologies that may be used to respond to spills of liquefied gaseous fuels and other hazardous substances threatening public health or the environment. The 1986 Title III SARA language also directed DOE to develop a data base transfer system as part of the technology transfer of the National LGFSTF-related activities. The SARA-directed data on spill technology also includes the DOE STF data base.

Accidental chemical dispersion occurs as a result of mishaps during transportation, storage, and use of fuels and chemicals, natural events such as hurricanes or earthquakes, and sabotage or terrorist activity. Examples of specific substances of concern are large volumes of high-pressure CO₂ used in oil production, hydrofluoric acid used in alkylation for gasoline refining, and chlorine use for purification of water supplies.

In some chemical spills, the local emergency planning committees (LEPC) have had personal computers with ALOHA™ or CAMEO™ (developed by NOAA) spill model software, but the models were not used at the time of the spill. In 123 chemical spill incidents surveyed by WRI, it was observed that emergency responders did not use any of the available gas dispersion models to predict evacuation distances at the time of the spill. After the events took place, information about the spill and cloud dispersion was gathered and sometimes compared with cloud dispersion models. The problems were (1) basic information such as the chemicals spilled and the volume were often not known, (2) models were not structured to apply to many real-world situations (e.g. fires and releases during no-wind situations), and (3) incidents occurred during times when people familiar with the software were unavailable.

The responders to chemical spills in an accidental fire, explosion, or container breach have to reach the incident quickly and make decisions on safe evacuation distances for the worker and public. Sometimes evacuations have been overly conservative, and sometimes there has been criticism that more people should have been evacuated, as in the case of the hydrogen fluoride spill on October 30, 1987 at Texas City, Texas. Sometimes there have been problems communicating evacuation orders to the affected neighborhoods, as in the case of the chlorine release at the City of Commerce, California, on September 3-4, 1988.

Because of the hazards of testing real chemical spills, chemical spill behavior and scaling laws affecting safety calculations are not known. A unique location, with trained personnel and data are

necessary to bring about improved technology in the management of air toxics or hazardous air pollutants. The Nevada STF facility was designed at the direction of Congress to collect information on effects, behavior, mitigation, and cleanup of accidental spills of hazardous materials. The STF is the only facility of its kind for either large-scale or small-scale spill testing of hazardous fluids and gases and provides the added capability of large-scale wind tunnel testing. The data collected during previous projects at the STF are also needed to aid in the experimental test designs of the CAAA STF program to conduct chemical hazards testing and data acquisition. In the national interest, the public and industry will use these data to test control technology cost effectively. Industry needs these data on chemical behavior because testing of the chemical hazards must be performed in an isolated location. As with many of the chemicals, these may be the only data existing for the spills of interest to help define safety for fuels and other chemical commerce.

This subtask is also an extension of original work that was started under contract between WRI and DOE in the Liquefied Gaseous Fuels Spill Test Facility program. This task also had as its purpose to convert the STF data base to a form that would be interactive and readily accessible by the public, business, the SARA and CAAA programs, and other federal agencies. Stakeholders in the STF program are public safety officials in state and local government, the DOE, EPA, Department of Transportation (DOT), Department of Defense (DOD), industry, and the public at large. The STF data base has limited application because it is not available to industry and the public at large and is not in a format that is easily usable or understood.

NEED FOR A NATIONAL CHEMICAL SPILL DATA BASE

Congressional mandates of technology development for prevention of environmental and public health damage, as well as public response to major chemical-related accidents, such as those in Bhopal, India, Mexico City, and Flixborough, U.K., have created demand for a national chemical spill data base.

Table 1 presents the quantities of major chemicals spilled in a given year (1990), arranged in descending order of amount spilled (source: *Chemical and Engineering News*, Nov. 16, 1992). The three chemicals released in the greatest amounts (ammonia, hydrochloric acid, and sulfuric acid) also require risk management plans under the CAAA.

Table 1. Quantities of Chemicals Spilled in 1990 and Reported to EPA

Chemical	Total 1990 Releases in U.S., million lb
ammonia	274.4
hydrochloric acid	160.4
sulfuric acid	107.9
acetone	78.9
methanol	65.5
carbon disulfide	34.6
ammonium nitrate	33.7
nitric acid	32.4
ethylene	30.6
toluene	25.5
acrylic acid	21.9
acetonitrile	20.6
dichloromethane	18.7
carbonyl sulfide	16.8
propylene	14.1
formaldehyde	11.1
phosphoric acid	11.0
ethylene glycol	10.7
acetaldehyde	8.0
acrylonitrile	7.9
chromium compounds	7.9
methyl chloride	7.5
manganese compounds	7.2
chlorine	7.0

The number of chemical spill incidents has been increasing, and many have resulted in dense gas dispersion, including 425 incidents of vapor or gas dispersion. The most common chemicals causing injuries were flammable liquids, anhydrous ammonia, corrosive liquids not otherwise specified, sodium hydroxide, sulfuric acid, ethylene oxide, chlorine, paint or paint related liquids, dichloromethane, and hydrochloric acid. Chlorine hazard assessment has been investigated for the purpose of emergency response contingency planning, (Nordin et al. 1994).

The U.S. Department of Transportation reported 6,190 hazardous material transportation incidents in 1988, 12,819 incidents in 1993, and 14,690 incidents in 1995. The number of incidents by rail has

remained about the same each year since 1988, but highway incidents have significantly increased. In 1995, 87% of transportation-related incidents reported were highway-related, 8% were railway related, and 5% were related to air transportation. There were also 12 water transportation incidents. Human error played a role in 83% of the 1995 incidents. In terms of hazard class, in 1995 40% of incidents involved flammable/combustible liquids, 36% involved corrosive materials, 8% involved poisonous materials, and 16% involved other classifications, such as compressed gas, poisonous gas, oxidizers, and other miscellaneous hazardous materials.

NATIONAL SPILL TEST FACILITY DATA BASE

Sponsors of fuel or chemical spill tests at the STF have identified issues relating to U.S. products and have pursued experiments that simulate the accidental release of toxic and hazardous materials. The results of testing, which will benefit the public safety, are contained in the National STF Data Base, as shown in the following table.

Table 2. Tests Conducted at the National Spill Test Facility

Year	Test Sponsor	Fuel or Chemical
1986	AMOCO	Hydrogen Fluoride
1987	Gas Research Institute	Liquefied Natural Gas (LNG)
1988	Chubb National	Foam Bromine, Chlorine, Hydrogen Fluoride, Monomethylamine, Phosphorous Trichloride, Phosphorous Oxychloride, Sulfur Dioxide
1988	Mobile Oil Alkylation Unit	Hydrogen Fluoride
1990	ANSUL	Chlorosulfonic Acid, Oleum, Sulfur Trioxide
1990	Silicon Health Council	Silicon Tetrachloride, Trichlorosilane
1990	Dow Chemical	Chlorine
1990	CCPS	Chlorine, Cyclohexane, Monomethylamine
1991	LLNL	Suit Tests, Hydrogen Fluoride

The importance of having access to the DOE STF data base is illustrated by the steady activity of industry, which has conducted research for accident prevention reference manuals, process design, physical plant design, procedures and practices such as hazardous release response/leak plugging, secondary containment, steam curtains, spray and foam control technology. For example, using foams to control vapors from hazardous spills is of high interest to Industry.

The National Spill Test Facility data currently in the WRI data base have been divided into three categories for purposes of describing testing that has been conducted at the DOE STF.

- (1) Pre-1988 DOE projects
- (2) Post-1988 DOE and user-sponsored projects, and
- (3) Current CAAA testing program data.

WRI has placed this data base into a consistent format with explanation of how data were taken and has provided outside access to this information. The data processing outlined in Figure 1 includes activities under a separate contract with the DOE to convert the DOE data base to an interactive form that can be accessed by the public on an electronic bulletin board system or the Internet.

A Chemical Hazard from Atmospheric Releases Research (CHARR) steering committee, consisting of representatives from industry, DOE and EPA, has acknowledged that experimental CAAA data bases should be developed that can be compared to existing STF data base. Consistent formatting will mean that the public will have improved access to the STF data base and that the STF data base will be more useful for industry, state, and local management applications. A compatible data base also means that acquisition of software and hardware will be more cost effective.

In the overall scope of this evaluation of dense gas dispersion work, WRI has used the STF data to compare with model data such as that provided by the dense-gas model called SLAB. These data are used to evaluate the dense gas dispersion predictive emergency response and prevention models. Data gaps can be identified when modeling results are compared to "real" chemical spill field test data.

WRI has identified the activities that are needed for the STF program to accomplish efficient access to the data base. WRI has also used the data base to assemble information for use by industry and the EPA in the STF program. Related work being carried out nationally and in the U.S., including that occurring in the private sector and in limited efforts at the DOD and DOT, points to a continued use of the STF testing data. As the use of data and information from former taxpayer-funded work at the STF becomes more frequent, technology development will accelerate funding commitments for new testing at the STF.

Figure 1. Spill Test Facility Data Base Project Development

RELATED RESEARCH

WRI has worked to implement the Clean Air Act Amendments PL 101-549, section 103 (f) through the U.S. Environmental Protection Agency, EPA Contract Number 68D30018 "Research Program for the Development of Emergency Response Technologies" with its cosponsor, the Petroleum Environmental Research Forum (PERF), and other federal and state agencies, and HazMat teams. The field tests conducted with WRI under a Cooperative Research and Development Agreement (CRADA) with EPA at the STF and experiments conducted in a wind tunnel simulated a typical industrial site. A series of 107 carbon dioxide gas releases were conducted by WRI as part of the Kit Fox project at the Nevada STF between August 22 and September 17, 1995. Initial screening indicated that sufficient data were collected for most of these releases conducted by WRI to provide a characterization of a chemical release cloud. The DOE STF data base supported the WRI design of the Kit Fox field experiments, which are now complete.

This example of the use of the STF data base is also being undertaken through the jointly sponsored research (JSR) program at WRI, with the PERF, project 93-16. The WRI jointly sponsored research project with the PERF project 93-16 includes participants from Allied Signal Corporation; Amoco Corporation; Chevron Research and Technology Co.; CITGO Petroleum Corporation, Clark Oil and Refining Co., Exxon Research and Engineering Co.; Marathon Corporation; Mobil Research and Development Co.; Phillips Petroleum Co.; and Shell Research & Development Co.

From the work done to date, the following observations can be made:

- Significant amounts of data were collected under stable meteorological conditions and under two different surface roughness lengths that have never been achieved in any previous field experiments.
- For the total complement of 150 sensors fielded during the field experiments, the data capture was greater than 98%.
- No significant malfunctions of sensors or data acquisition facilities have been identified that would cause the data to be unusable for analysis, mathematical model validation, or mathematical model modifications.

The simulated gas release data together with meteorology conditions means the difference between data that will be used and data that cannot be used. When funding is available, all of the Kit Fox data sets will be converted to a form that will be usable by the public and industry. The Kit Fox data will also help to provide a basis for any regulations to comply with the development of chemical spill worst-case scenarios required for response to the new risk management plan rule promulgated by the EPA on June 20, 1996. Specifically, experimentally verified data bases will also aid in the improvement of predictive modeling technology.

Vapor dispersion modeling is an important area of related work. All the SARA-directed data management in this project to capture data from all the tests performed at the National STF is aimed at accident prevention and prediction for loss prevention and safety promotion.

ACCOMPLISHMENTS

In this task, WRI has supported efforts for the transfer of the data and technology to the public and industry, focusing on gas dispersion data that will improve the program for the private sector. To simplify technology transfer from government to the private sector, WRI has maintained the STF data base in as complete and up-to-date a form as possible under DOE contract number DE-AC01-91FE62302.

WRI has served as a public safety resource because of this SARA and CAAA activity on behalf of the U.S. Congress. Through access to this data base, users from industry, federal agencies, and state and local safety and health management organizations will have improved capability to implement accident control technology. Emergency response technology will be improved with compatible documentation and transmission of data through acquisition of hardware and software to implement accident prediction and mitigation.

WRI was the lead organization for the collaborative Kit Fox project tests, also supported by the Petroleum Environmental Research Forum, DOE and the EPA. The objective of the STF testing project was to address the key issues to enable dispersion models to more realistically predict downwind hazard zones. The project was designed using data from models and wind tunnel studies. The data from the site and the STF bibliography enabled WRI to fabricate the nine+ acre Kit Fox obstacles or roughness dispersion grid at the STF for the homogeneous roughness array and a WRI-PERF equivalent roughness pattern (ERP). These dense gas dispersion field tests were conducted to demonstrate:

- turbulence from surface roughness and obstacles,
- short, finite-duration release dispersion, and
- dispersion under stable, low wind speed conditions.

Carbon dioxide concentrations were measured using a total of 85 sensors distributed over geometrically placed arrays at 25, 50, 100 and 225 m downwind of the release source. Analysis of these data will include developing different time averaging series from the high, one-second variability observed in the data. Test release clouds will be characterized in terms of cloud height, width and centerline concentrations at each sensor array.

Meteorological data were also collected during the Kit Fox tests from 76 sensors. These included wind speed, wind direction, temperature, solar radiation, barometric pressure, and relative humidity upwind of the roughness array; wind speed, wind direction, and temperature at five heights on two towers within the array; wind speed and direction at four locations in the downwind portion of the array; and wind speed, wind direction, and temperatures at heights of 0.25, 0.5, 1, 2, 4, 8, 16, and 24 m, relative humidity at heights of 1, 4, and 16 m, barometric pressure and soil temperature at the ground, solar and net radiation at 2 m; all at or near a tower near the test array.

Wind speed average mean and standard deviation will be determined. Wind friction velocities will be calculated from wind speed measurements at selected heights. Wind speed and temperature profiles will be developed and used, along with wind direction and the other meteorological data, to relate to the development and behavior of gas clouds from the carbon dioxide releases. The wind profiles will also be examined to determine any discontinuities that may result in decoupling at different atmospheric stabilities. Dispersion parameters will also be calculated and atmospheric stability classifications will be determined using several methods, including calculation of Monin-Obukhov length.

Some discrepancies between the atmospheric stability as determined from vertical heat flux with data from the STF eight-level tower and that of other STF data based on less rigorous weather observations have been found. These less rigorous weather observations were the typical practice at the STF before the dense gas dispersion tests designed by WRI were initiated in 1993. Given confidence in these data, the WRI objective is to compare the eight-level tower data to Kit Fox data to determine values of the surface-roughness length, which is a significant issue in the prediction of dense cloud dispersion location in time and space.

WRI has continued limited work on the fuel and chemical spill bibliography with literature searches of chemical dispersion and mitigation tests, as it is needed in the SARA and CAAA program, and has accumulated chemical hazard citations for the bibliography with the objective of evaluating existing and future accident prediction models. Also in this dense gas dispersion evaluation project, WRI has collected copies of reports, published and unpublished. WRI is attempting, as a result of an exchange arrangement, to obtain and incorporate publications from the Health and Safety Executive of Great Britain, and other international organizations.

CONCLUSIONS

The data from fuel and chemical spill testing are being used to support public safety through industry studies and individual research. Preliminary analyses of selected portions of the STF data base by WRI have also proven to be useful. The objectives of this subtask were to evaluate results of gas

dispersion testing at the STF and explore possible improvements for predicting dense gas dispersion from chemical spill experiments. The status of this type of testing is clearly incomplete in the national public safety interests.

The Risk Management Program (proposed rule, *Federal Register*, Oct. 20, 1993) is to include (1) an assessment of a worst-case release scenario, (2) a likely significant release scenario, (3) consequence analysis and emergency response, and (4) documentation of all previous releases. This release assessment often requires the use of chemical spill source term and dispersion models. Therefore, the strengths and shortcomings of available models have and will be tested with the national spill test facility results.

Both the DOE Office of Fossil Energy and Office of Nonproliferation and National Security (DOE NN-60) Emergency Management have failed to provide funding to WRI to establish a chemical Spill Control Technology program as required in the Superfund Amendments and Reauthorization Act of 1986, House report 99-962 to accompany H.R. 2005, Section 118 (n) - Spill Control Technologies. Both the SARA and CAAA language continue to be used as government justification for funding these programs.

A WRI evaluation of actual chemical release accidents has lead to the conclusion that releases are more complex than current models can simulate. The required detailed information of the source term and meteorology from field test data needed to compare with models is not available or is not known. Related PL 101-549 Kit Fox tests are expected to improve understanding of dense gas dispersion with three different roughness heights in the dispersion grid under neutral to stable meteorological conditions.

Regulations and technology will be planned with assumptions unless accurate data on air toxic transport between the spill source and public and worker can be developed. The STF data base was requested by EPA CAAA-STF program management, and discussed in meetings with EPA and DOE, held in Las Vegas (March 3, 1993), Reno, Nevada (March 23, 1993), Research Triangle Park, North Carolina (April 21, 1993), and Laramie, Wyoming (May 19, 1993).

Current and future participants need a user-friendly method to reference the STF data base. WRI has determined that a program will be required both to make the national STF facility more accessible and to make the data base user-friendly. Data from an eight-level tower have been collected and are archived in Nevada but have not been made available to the STF data base this year because funding of EPA Contract 68D30018, "Research Program for the Development of Emergency Response Technologies," has been suspended. WRI has also been advised that equipment used for meteorological measurement in the CAAA work will be transferred to NOAA.

The meteorological data collected with this "NOAA" equipment permitted WRI to predict and capture incidents of wind direction and speed that characterize worst-case conditions for chemical spills. These data have also improved the capability to determine atmospheric stability and obtain good estimates for the vertical fluxes of heat and momentum during chemical release tests at the STF.

Future research needs of current related programs are not being met with the Kit Fox data base because of delays in the analysis of the data. Calibration for the total data set was proscribed but is not complete as a result of administration policies to terminate the program in DOE and EPA. These data would lend insight in incremented array(s) installed designated distances from a CO₂ release source and provide answers to turbulence effects.

The overall scope of work under the CAAA portion of the Risk Management Program section 112(r) program is to develop experimental design for test plans, conduct experiments, archive data, conduct annual workshops, and promote industry involvement at the STF. The intent of the CAAA legislation is to bring about experiments at the spill test facility that provide multiple uses for a large variety of observers. In closing, additional activities needed to make the STF data base current are:

- Collect and index publications on gaseous spills in the existing data bases. This will benefit both government and industry because it will prevent unnecessary duplication of research. Tabulate information categories, available sources, and typical content available for program use.
- Coordinate with other information resources (e.g., CHEMTREC clearinghouse), organize and document data from spill tests, and make it available to potential users. Obtain and write documentation to go with the data. Repackage the data if necessary to make it useful in a given model. Make the data available to users that WRI has identified.
- Develop communication with past users and potential participants to identify and validate program targets and initiate greater involvement of industry. Management of the program will include providing a central and institutional function of information accumulation, analysis, and dissemination, together with active technology transfer.
- Work to obtain a full set of data files for each recorded test series still needs to be conducted to review data files for labeling as to their content. At minimum, this activity will require WRI to review the DOE data with Lawrence Livermore National Laboratories (LLNL) and make appropriate changes to specific files based on clarification of questions already posed to LLNL and not yet answered. Other STF users have to be contacted regarding data voids or improvements to data sets to keep the STF data base current.

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