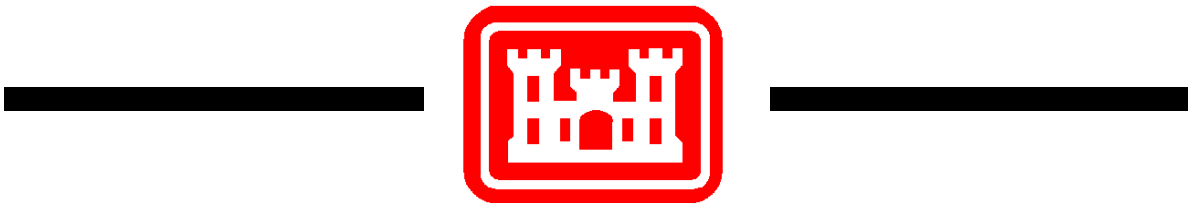


PUBLIC WORKS TECHNICAL BULLETIN 200-1-78  
14 JANUARY 2011

**SPRAY PAINT MATERIALS MANAGEMENT  
AND PILOT DELIVERY SYSTEM  
AT FORT HOOD, TX**



Public Works Technical Bulletins are published by the U.S. Army Corps of Engineers, 441 G Street NW, Washington, DC 20314-1000. They are intended to provide information on specific topics in areas of Facilities Engineering and Public Works. They are not intended to establish new Department of the Army (DA) policy.

DEPARTMENT OF THE ARMY  
U.S. Army Corps of Engineers  
441 G Street NW  
Washington, DC 20314-1000

CECW-CE

Public Works Technical Bulletin

14 January 2011

No. 200-1-78

FACILITIES ENGINEERING  
ENVIRONMENTAL

SPRAY PAINT MATERIALS MANAGEMENT AND  
PILOT DELIVERY SYSTEM AT FORT HOOD, TX

1. Purpose.

a. The purpose of this Public Works Technical Bulletin (PWTB) is to transmit the results of a paint booth emissions management system pilot study conducted at Fort Hood, TX. During that study, a management system was developed to monitor and report paint emissions according to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Follow-on work will be required before this system can be adopted by installations to assist with Clean Air Act compliance requirements, however.

b. All PWTBs are available electronically (in Adobe® Acrobat® portable document format [PDF]) through the World Wide Web (WWW) at the National Institute of Building Sciences' Whole Building Design Guide web page, which is accessible through URL:

[http://www.wbdg.org/ccb/browse\\_cat.php?o=31&c=215](http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215)

2. Applicability.

This PWTB applies to engineering activities at CONUS U.S. Army facilities.

3. References.

a. AR 200-1

b. Clean Air Act<sup>1</sup>, Section 112

c. Draft National Emissions Standard for Hazardous Air Pollutants (NESHAP) for Defense Land Systems and Miscellaneous Equipment (DLSME)

4. Discussion.

a. AR 200-1 requires that Army installations comply with Federal environmental regulations, including pretreatment standards established by authority of the Clean Water Act.

b. The Clean Air Act, Section 112, authorizes the U. S. Environmental Protection Agency (USEPA) to establish NESHAPs.

c. The USEPA is in the process of establishing a NESHAP for DLSME. This new regulation will establish limits on hazardous air emissions from paint booth operations at Army installations.

d. Because of the amount of their hazardous air pollutant emissions, two paint booths at Fort Hood must comply with the NESHAP for aerospace operations. In addition, the remainder of the post's spray booths and all maintenance activities will soon fall under the DLSME Surface Coating NESHAP, which is now being drafted by the USEPA. This new rule will regulate painting of ground-based material, including vehicles and equipment. When the DLSME Surface Coating NESHAP becomes final, Fort Hood will need to comply with the recordkeeping and reporting requirements of that new rule.

To assist compliance with these requirements, a pilot system was developed to automatically sense the delivery of paint via spray guns and monitoring product, along with a system to enter this data into the Air Program Information Management System (APIMS). Hardware and a set of programs were designed for a Spray Paint Materials Management and Delivery System at Fort Hood. The system was designed to quantify air emissions from paint booth operations, through automated measurement and reporting. A pilot system was developed, tested, and ultimately installed at Fort Hood's Corps Support Command (COSCOM) Paint Booth, Building 40009. The system's output was in a format that could easily be integrated into Fort Hood's existing APIMS to calculate volatile organic compound emissions from the installation.

---

<sup>1</sup> The Clean Air Act (42 U.S.C. 7401-7626) consists of Public Law 159 (July 14, 1955; 69 Stat.322) and the amendments made by subsequent enactments'

First, the weight of paint used is automatically measured, and that information is transmitted and stored in a controller. The Spray Paint Materials Management and Delivery System records the amount of paint used every hour and sends these values to its Data Repository Computer daily as two flat files. (Flat files contain raw, unprocessed data.) A Data Repository Computer runs a Microsoft Visual Basic™ program that processes the flat files, and writes them to a Microsoft Access™ database. The database has prewritten queries and reports that allow the operator to view the data by Daily Totals, Daily Records, Monthly Totals, or Yearly Totals. This database has user-friendly input menus designed to assist the operator in writing the files to a Microsoft Excel™ file, for exporting or for display. The Excel file may be inserted into the existing APIMS. A diagram of the system basic flow is given as Figure B-1 in Appendix B.

The system was bench-tested and found to respond properly. The hardware components to fabricate the system were obtained, and the panels and system were built at the MSE Technology Applications Test Facility in Butte, Montana. All problems encountered during the bench testing were resolved. A full-scale test of the system at Fort Hood was planned, but could not be completed due to down time at the test site caused by maintenance on the paint booth building. Therefore, follow-on work is needed before the system can be said to help installations with CAA compliance requirements.

e. See Appendix A "Spray Paint Materials Management and Delivery System at Fort Bragg, TX" and Appendix B, "Design of Monitoring System at Fort Hood" for further information regarding the Fort Hood study. The appendices are the final report submitted by MSE to ERDC/CERL, edited for format and clarity.

f. A glossary of acronyms and abbreviations used is located in Appendix B.

## 5. Points of Contact.

HQUSACE is the proponent for this document. The point of contact (POC) at HQUSACE is Mr. Malcolm E. McLeod, CEMP-CEP, 202-761-5696, or e-mail: [Malcolm.E.Mcleod@usace.army.mil](mailto:Malcolm.E.Mcleod@usace.army.mil).

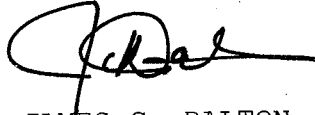
Questions and/or comments regarding this subject should be directed to the technical POC:

U.S. Army Engineer Research and Development Center  
Construction Engineering Research Laboratory

PWTB 200-1-78  
14 January 2011

ATTN: CEERD-CN-E (Gary L. Gerdes)  
2902 Newmark Drive  
Champaign, IL 61822-1072  
Tel. (217) 373-5831 FAX: (217) 373-3430  
e-mail: Gary.L.Gerdes@usace.army.mil

FOR THE COMMANDER:



JAMES C. DALTON, P.E  
Chief, Engineering and Construction  
Directorate of Civil Works

**Appendix A**  
**Spray Paint Material Monitoring System**  
**at Fort Hood**

**Table of Contents**

Table of Contents .....	A-1
List of Tables and Figures .....	A-2
Preface .....	A-3
Introduction .....	A-4
Background .....	A-4
Objective .....	A-4
Approach .....	A-4
Evaluation of Monitoring Technologies .....	A-4
Flowmeter Monitoring Technology .....	A-5
Weight Cell Monitoring Technology .....	A-6
Bench-scale Pilot Test .....	A-6
System Operation .....	A-7
Conclusions and Recommendations .....	A-7
System Design and Layout .....	B-1
Scales .....	B-2
Transmission to Controllers .....	B-2
Data Logging and Storage .....	B-3
Paint Data Entry .....	B-4
Automatic Data Entry .....	B-4
Manual Data Entry .....	B-5
Adding New Paints and Maintenance .....	B-5
Viewing Data on the Data Repository Computer .....	B-6

Daily Totals .....	B-6
Daily Records .....	B-7
Monthly and Yearly Totals .....	B-8
Running the Create Excel Spreadsheet Option .....	B-9
Accuracy .....	B-9
Acronyms and Abbreviations .....	C-1
References Cited .....	D-1
Additional Resources .....	D-1

**List of Tables and Figures**

Figure B-1. Monitoring system layout.....	B-1
Figure B-2. Bench-scale at paint station.....	B-2
Figure B-3. Monitoring paint system's external control panel.	B-3
Figure B-4. Daily Total report screen.....	B-6
Figure B-5. Excel spreadsheet file: Daily Total.....	B-7
Figure B-6. Daily Records screen.....	B-8
Figure B-7. Screen displaying <i>Yearly Totals</i> option.....	B-9



## **Preface**

This project was funded through the Waste Minimization and Pollution Prevention Program (WMPPP) by the U.S. Department of Army Office of the Assistant Chief of Staff for Installation Management (OACSIM). The WMPP was administered by the U.S. Army Engineer Research and Development Center-Construction Engineering Research Laboratory (ERDC-CERL) of Champaign, Illinois. The study was conducted by MSE Technology Applications, Inc. (MSE), of 200 Technology Way, PO Box 4078, Butte, Montana, 59702. The MSE final report was submitted to ERDC-CERL in December 2006.

The major contributors to this project include:

Ms. Marsha Trimble Dunstan, MSE Project Manager

Mr. Bryan Loushin, MSE Project Engineer

Mr. Jack Joyce, MSE Project Engineer

Mr. Steve Antonioli, MSE Program Manager

Mr. Robert Kennedy, Fort Hood, U.S. Army HQ, III Corps, On-site  
Project POC

Mr. Gary Gerdes, ERDC-CERL, WMPP Program Manager, Project  
technical monitor

## **Introduction**

### *Background*

There are 14 spray paint booths on Fort Hood that are used to apply coatings to equipment and vehicles. Two of those spray booths that apply surface coatings on helicopters must comply with the aerospace standard of NESHAP. The other 12 spray booths and all maintenance painting activities will fall under a new standard being developed, tentatively titled the Defense Land Systems and Miscellaneous Equipment (DLSME) Surface Coating NESHAP. The new DLSME Surface Coating NESHAP will replace the requirements of some of previous surface coating NESHAPs, and will regulate the painting of ground-based materiel such as tactical and combat vehicles, ground support equipment (e.g., generators), and field support structures at military installations. When the DLSME Surface Coating NESHAP becomes final, Fort Hood will need to comply with the new recordkeeping and reporting requirements, including monitoring the amount of paint used. A method to automatically measure the delivery of paint to spray guns and record paint usage information was needed to satisfy these reporting requirements.

### *Objective*

The objective of this project was to develop a method to monitor and record paint usage through automated measurement in paint booth operations at Fort Hood.

### *Approach*

Technologies capable of monitoring the delivery of chemical agent resistant coatings (CARC) or other types of paint using high-volume, low-pressure (HVLP) spray equipment were evaluated. This effort included developing a pilot system, bench testing that system, and installing the monitoring system at Fort Hood in the 13<sup>th</sup> COSCOM Paint Booth, Building 40009.

## **Evaluation of Monitoring Technologies**

The investigation of off-the-shelf paint usage data acquisition systems (DAS) revealed that two methods were used. Those two methods – measuring paint flow via inline flowmeters, and using scales to weigh the paint reservoir to measure flow indirectly – were evaluated further.

*Flowmeter Monitoring Technology*

It was determined that a flowmeter could be attached to the paint line (either as it leaves the paint pot or just before entering the spray nozzle system). The evaluation of flowmeters revealed the following related information (Refs. 1, 2, and 3).

- Any flowmeter inserted in a paint line would be required to be explosion proof.
- The number of commercially available Class I, Division 1, explosion-proof meters with the flow rate necessary for the Fort Hood paint booth is limited.
- There is a type of flowmeter advertised to work with paint sprayers and to be explosion proof – the VHM series<sup>2</sup>.
- It would be difficult to relay an electronic signal to a data logger in an explosion-proof environment.
- Erosion by the CARC paint would affect the accuracy of the flowmeter.
- There would be paint line cleaning problems. To clean the line, the operators must blow air backwards down the line, blowing the excess paint back into the paint pot. This would affect the volumetric count.
- There would be potential clogging of the meter due to build-up of paint deposits over time. A differential pressure meter to monitor this clogging could create additional maintenance problems.
- It would be difficult to keep the flowmeter clean enough to monitor its operation, due to paint overspray in the booth.
- The flowmeter would affect the ease of maintenance of the system by being "in the way" of the operator.
- It would be difficult to find a flowmeter that could accurately measure low-velocity paint flow.

---

<sup>2</sup> manufactured by VSE Volumentechnik GmbH of Germany

- Residuals of solvents in the meter after cleanup could affect the reliability, maintainability, or usability of the meter.

### *Weight Cell Monitoring Technology*

After considering the shortcomings and difficulties above, a decision was made that flowmeters were not a viable option. Instead, it was more feasible to use weight cells to register the amount of paint used from the paint reservoir (as an indirect method of flow measurement). Consequently, development of a robust, continuous, and automated weighting system for the 5-gal pots was required. A weight cell with the proper weight range was found that used an ultra-low power weight indicator designed for hazardous and explosive environments including Class I, Division 1, and Division 2 hazardous locations (Ref. 4). Several programming approaches were evaluated before developing the software program used for the paint measuring and reporting system.

### **Bench-scale Pilot Test**

The hardware components to fabricate the system were obtained, and the panels and system were built at the MSE Test Facility in Butte, Montana. The system was bench-tested and found to respond properly. During the bench testing, several problems were encountered and resolved, as detailed below.

1. The controller chosen for the project did not perform at the capacity anticipated; consequently, a new controller was procured and reprogrammed. This new controller was effective in meeting the specifications of the project needs.
2. The transmitter was moved outside the paint booth to have a more user-friendly, cleaner, and safer system. This resulted in some changes in length of cables and panel layout.
3. Unanticipated signal noise needed to be filtered out by adjusting the sensitivity on the scale.
4. Preset triggers of the controller were unpredictable, even after following explicit directions of the manufacturer. This was partially corrected by adjusting the variables in the programming. Later in the project, the controller manufacturer modified their operating system, which resolved the problem.
5. Blocks of data were dropped randomly, despite repeated programming manipulation. The controller manufacturer resolved the issue by updating the controller's operating system.
6. "Bounce" in the measurements that came from use of the spray guns connected to the pot needed to be resolved. The pull of

the guns by the operator created undesired monitoring effects because the sensor was so sensitive that the slightest movement caused the measurements to bounce. This was resolved by adjusting the scale to be less sensitive and by reducing the sampling time. This change produced a more square-wave signal, allowing a more specific point to be measured and compared, thus eliminating the bounce.

7. Data was lost during a shutdown of the receiving or sending controller. A change in the programming was written in an "Append" to the system, which kept all of the data until a "handshake" told the transmitting controller that the data was received.
8. An operator caution was noted. Care should be taken to only press the *Enter* button once per entry, to eliminate duplication. This caution was noted in the operating instructions.
9. Filling the tank, attaching hoses, or making adjustments, etc., to the tank pot caused the system to read the movement as a change of value and to record the change. A main switch was created to turn the monitoring system off so that the operator could move, set up, adjust, and pour in paint, etc., without interfering with the monitoring count.
10. An automatic tare function was written into the program, thus eliminating the need for the operators to access the indicator (located outside the paint booth) to tare the scale. This change made the system easier to use.
11. The system would incorrectly log paint usage if an operator placed and removed an object on the spray tank when the system was on. Therefore, it was determined that if an item is laid on the tank, the operator should not remove the tool or article until he/she has moved the main switch to "MAINTENANCE (SYSTEM OFF)." The operator may then remove the item without the system logging the weight reduction. This was noted in the operating instructions.

### **System Operation**

A detailed description of how the system operates is described in Appendix B of this report.

### **Conclusions and Recommendations**

The paint monitoring system developed by this project has the potential to lower compliance costs, improve the quality of paint usage data, and help Fort Hood become compliant with the new Defense Land Systems and Miscellaneous Equipment NESHP.

PWTB 200-1-78  
14 January 2011

The system should undergo a full scale demonstration/validation test for a sufficient period (6 months minimum) to fully test the durability of the components and the acceptance by operators. Paint usage should be tracked by means that are independent of the monitoring system in order to check the accuracy of reporting.

If the system proves reliable during the test period, Fort Hood should consider implementing the system at other paint booths, and the Army should consider implementing the system at other installations.

A suggested change to future paint monitoring designs is to spray a rough finish on the top of the scale to keep the paint pot from sliding.

A full integration of the system into APIMS should also be evaluated. Integration with APIMS would expand the benefits of the paint monitoring system, by eliminating another manual recordkeeping step in the compliance chain.

## Appendix B Operation of Monitoring System at Fort Hood

### System Design and Layout

The design of the project's paint monitoring system incorporates scales, transmitters, computer-based controllers including input modules, and telemetry in order to measure, transmit, and store data. Data is acquired, manipulated, and stored in the DAS in a format that can be easily incorporated into the user's existing Air Program Information Management System (APIMS)<sup>3</sup>. An APIMS is used at many military facilities, including Fort Hood (Ref. 5). The paint monitoring design brings the data from the field into a format that can easily be inserted into the APIMS and is flexible enough to allow the system to be adapted to field conditions. Figure B-1 shows the system layout.



Figure B-1. Monitoring system layout.

---

<sup>3</sup> APIMS is an air quality management tool that was designed by Northrop Grumman to: track and prepare air emission inventory; manage regulatory compliance; manage permit, Title V, and NESHAP requirements; automate logs; and provide checklists. The APIMS information bank receives data from different sources. It includes data from an application program interface, facility equipment management system, employee demographics, hazardous materials management system, hazardous substance management system, environmental management information system, and graphical information system.

### *Scales*

Scales designed for use in hostile and explosive atmosphere environments were installed in the paint booths. These scales have a weight sensor that is corrosion resistant and permits cleaning. Built-in bubble levels and adjustable feet provide convenience in leveling the scales (Figure B-2). The supporting low-power transmitter is approved for Class I, Division 1 (paint booth) areas.



Figure B-2. Bench-scale at paint station.

The scale is set inside the paint booth. To avoid gas buildups and allow flexibility, the scale's factory-installed, low-voltage communication cable was deliberately not pulled through a conduit from inside the paint booth. Instead, the cable exits the paint booth through an EYS-sealed<sup>4</sup> fitting that prevents gas leakage.

As with any scale, the scales used for measuring paint usage should be calibrated according to the manufacturer's recommendations.

### *Transmission to Controllers*

The scale's communication cable then enters the exterior conduit and goes to the Avery Weigh-Tronix® transmitter. The transmitter

---

<sup>4</sup> EYS refers to Electrical Y Seal.



is located in an exterior control panel (Figure B-3). Data is then sent from that panel to an EtherLogic LC™ Controller from the company, Industrial Control Links (ICL) (Ref. 4).

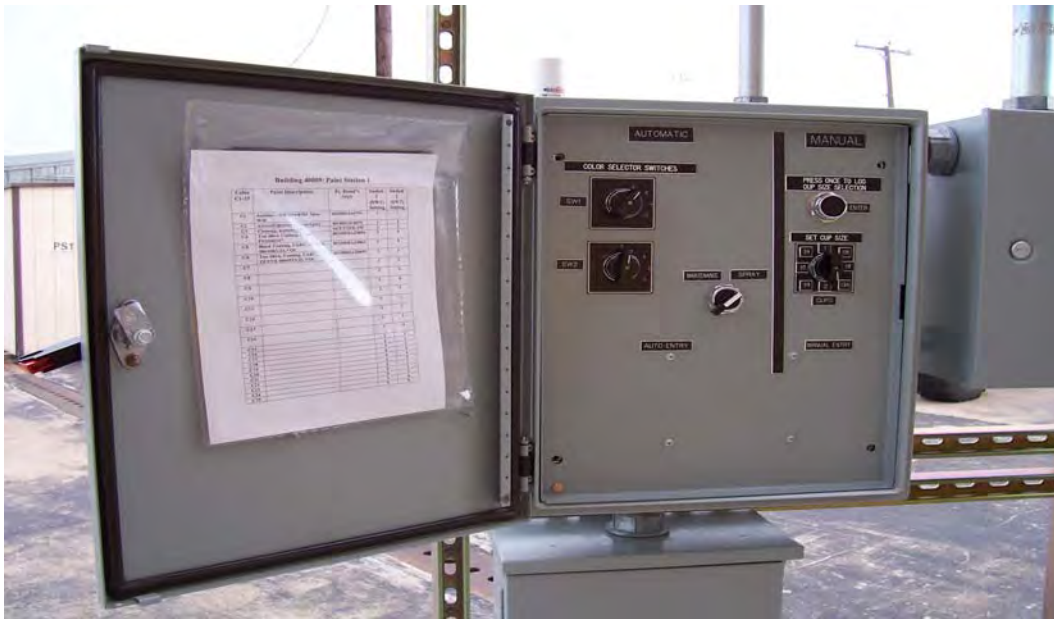


Figure B-3. Monitoring paint system's external control panel.

The EtherLogic LC controller was programmed to manipulate and format the paint data for easy transfer via telemetry to Fort Hood's main receiving station. At the main receiving station, another controller was programmed to receive and store the data until it is transmitted and received into the Data Repository Computer. (For a review of the system's communication path, refer back to Figure B-1).

### **Data Logging and Storage**

Paint data may be viewed in user-selected display formats in the Data Repository Computer. The data can also be saved as an Excel file that easily can be brought into the Fort Hood APIMS by an authorized Fort Hood operator.

The Paint Booth Data Repository System is a set of programs that will receive data and report the amount of paint used. The system manipulates the data so that it may be integrated into Fort Hood's existing APIMS for use in calculating the installation's volatile organic compounds (VOC) air emissions.

A fairly straightforward and fast way to develop the data-logging system is to measure, transmit, and store (in the controller) the amount of paint used every hour, and send these

PWTB 200-1-78  
14 January 2011

values daily to the Data Repository Computer as two flat files (e.g., paint1.csv and paint2.csv).

A Visual Basic™ program was written to process those flat files into a Microsoft Access™ database. The Data Repository Computer runs this program by reading the files and writing them to this Access database. This database has prewritten queries and reports that allow the operator to view the data by daily totals, daily records, monthly totals, or yearly totals. It also features user-friendly input menus, designed to assist the operator in requesting a display and in writing the files to a Microsoft Excel file for exporting. The Excel file may be inserted into the existing APIMS.

#### *Paint Data Entry*

The ICL controller is configured to log data by two different sources: the automatic entry and the manual entry. Entered data may be viewed following either action.

#### *Automatic Data Entry*

The automatic entry uses a weigh scale that outputs a 4-20 mA signal. This signal is converted to an integer, with the number representing the weight of the paint or thinner used. (Note that the scale should be calibrated regularly, according to manufacturer's instructions.)

When the weight changes by either 0.25 lb or by 10 integer numbers, a count is added to the selected type of paint or thinner. The counts are summed each hour and logged to a file for the appropriate paint or thinner. At the end of the day, files are transmitted to the Master Station.

The measured weight is applied to an operator-selected color<sup>5</sup>. A control panel belonging to the working paint station is accessible to the operator and has a combination of two switches that, when set by the operator, correspond to a paint or thinner type. The selection color chart combination for these two switches can be found on the inside control panel door and is

---

<sup>5</sup> The U.S. Department of Defense (DoD) and APIMS use National Stock Numbers (NSN) to provide a simple and efficient way to identify different paints and cleaners (Ref. 6). To support this protocol, this system was designed to identify the paint by its NSN.

PWTB 200-1-78  
14 January 2011

easily viewed by the operator making the selection. The operator determines the appropriate color by its NSN and description. Northrop Grumman, designer and caretaker of Fort Hood's APIMS, provided a list of the paints used at the selected paint booths for the past 2 years (Ref. 5). These paint types were installed in the monitoring system.

The U.S. Department of Defense (DoD) and APIMS use National Stock Numbers (NSN) to provide a simple and efficient way to identify different paints and cleaners (Ref. 6). To support this protocol, this system was designed to identify the paint by its NSN.

### *Manual Data Entry*

Manual entry is identical to automatic entry as it pertains to choosing the color or type of paint or thinner. A manual entry differs, however, in that it provides the user an opportunity to manually input a volume when an HVLP spray gun is not attached to the large paint pot and scale. This allows for an entry when the HVLP spray gun is attached to the smaller (2-cup) paint holders.

A third switch in the paint station control panel is the paint or thinner volume selector switch. It is used to select the approximate volume (in cups) of paint. The switch has a range of eight increments, from one-quarter to 2 cups. Once the appropriate volume is selected, pressing the "Enter" pushbutton on the front panel will enter the volume into the summed hourly total for the particular paint or thinner type already selected by the color selector switches. The summed values are then treated exactly the same as the automatic entry values. They are logged hourly and sent to the Master Station at the end of each day. Care should be taken to only press the "Enter" button once per entry to avoid duplicate entries.

### *Adding New Paints and Maintenance*

If a new type of paint or thinner is added to the selection list or to change an old type of paint, the controller program code may easily be amended to reflect the change and apply the new paint's weight per gallon to the calculations. A change to an existing paint need only be done if the paint's weight differs by more than 0.25 lb per gal. When starting a new day, the operator may safely assume that the previous day's count of the paint used was already sent. The operator does not need to do anything special to send the data.

### Viewing Data on the Data Repository Computer

The data may be viewed on the Data Repository Computer. After a log-on, an Access™ database will display a startup screen. On the main start-up screen, the user has four options: Daily Totals, Daily Records, Monthly Totals, and Yearly Totals.

Selecting "Daily Totals" will display the aggregate weight of paint used that day, according to the paint's NSN. Selecting "Daily Records" will display a breakdown showing paint used on an hourly basis for that day. Selecting "Monthly Totals" will display the aggregate paint used per different NSN for the selected month. Selecting "Yearly Totals" will display the aggregate paint used for each different NSN for the selected year.

#### Daily Totals

To access the Daily Total report, the user selects the *Daily Totals* option; the report is then displayed on the screen (Figure B-4).

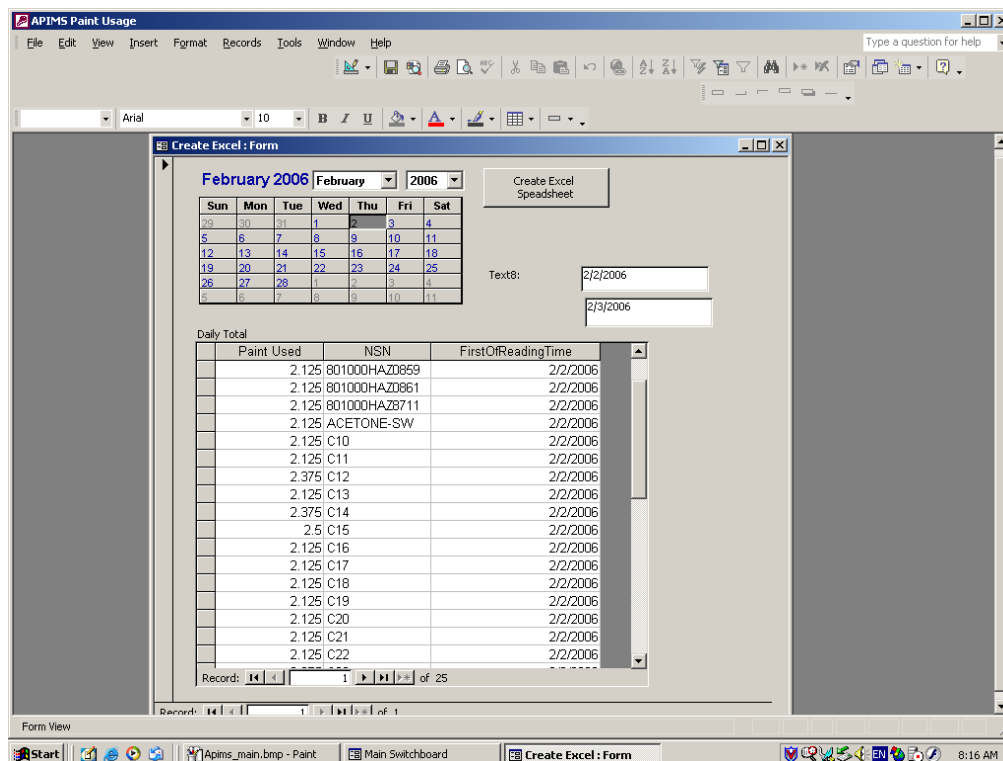


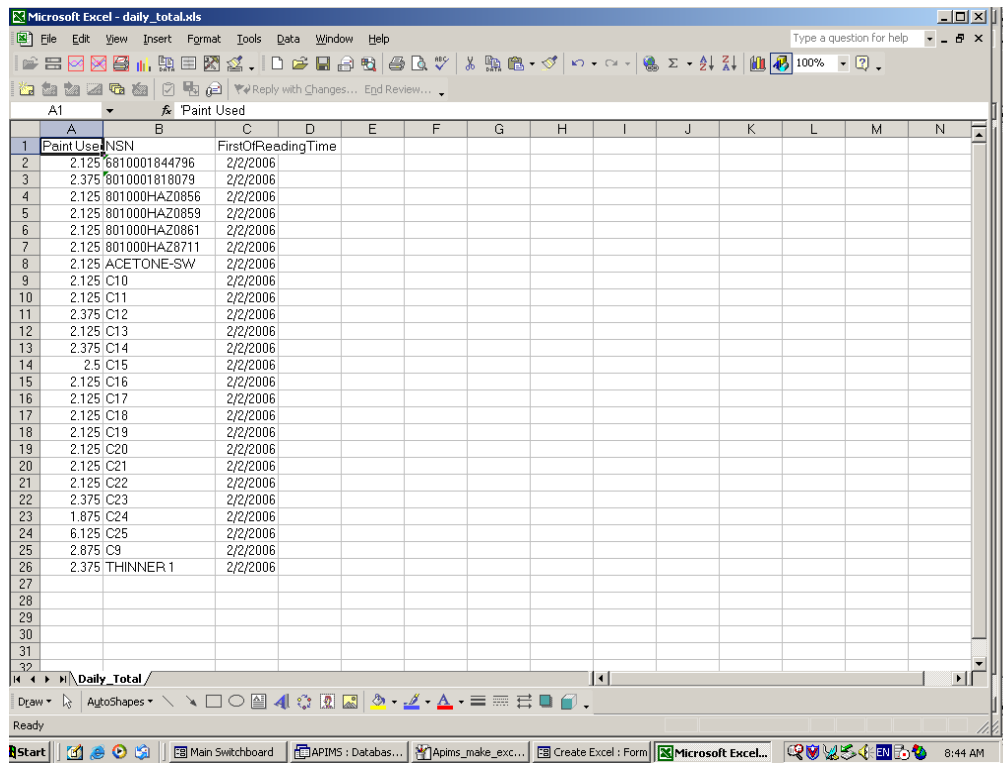
Figure B-4. Daily Total report screen.

In accessing the Daily Total report, the user may select the day he/she wishes to view by using a calendar control. The system

PWTB 200-1-78  
14 January 2011

will run a query on paint usage data for the day selected and display the total weight (in pounds) of paint sprayed by its NSN. The totals shown are the combined totals from all spray stations in the spray booth being reviewed.

Clicking on the *Create Excel Spreadsheet* button sends this information to an Excel spreadsheet file called *daily\_totals.xls*, which is located in the *My Documents* directory. Figure B-5 shows an example of this Excel file. This file may be saved and transferred by authorized personnel to the APIMS for entry.



The screenshot shows a Microsoft Excel spreadsheet with the following data:

1	Paint Used	NSN	FirstOfReadingTime
2	2.125	6810001844796	2/2/2006
3	2.375	8010001818079	2/2/2006
4	2.125	801000HAZ0856	2/2/2006
5	2.125	801000HAZ0859	2/2/2006
6	2.125	801000HAZ0861	2/2/2006
7	2.125	801000HAZ8711	2/2/2006
8	2.125	ACETONE-SW	2/2/2006
9	2.125	C10	2/2/2006
10	2.125	C11	2/2/2006
11	2.375	C12	2/2/2006
12	2.125	C13	2/2/2006
13	2.375	C14	2/2/2006
14	2.5	C15	2/2/2006
15	2.125	C16	2/2/2006
16	2.125	C17	2/2/2006
17	2.125	C18	2/2/2006
18	2.125	C19	2/2/2006
19	2.125	C20	2/2/2006
20	2.125	C21	2/2/2006
21	2.125	C22	2/2/2006
22	2.375	C23	2/2/2006
23	1.875	C24	2/2/2006
24	6.125	C25	2/2/2006
25	2.875	C9	2/2/2006
26	2.375	THINNER 1	2/2/2006
27			
28			
29			
30			
31			
32			

Figure B-5. Excel spreadsheet file: Daily Total.

### Daily Records

The second menu option is *Daily Records*. This option displays all data collected for the selected day, broken down on an hourly basis. The controller logs the paint used from the weigh scale systems on an hourly basis, recording one record for each of the 25 NSN paints (Figure B-6). If the value has not changed, a zero is recorded.

This *Daily Records* option is a snapshot of all of the daily records in the system. It may be used to record the weight (in pounds), time, and location that a particular paint was sprayed.

The *Create Excel Spreadsheet* button at the top right of this screen will write this information to an Excel spread file called *daily\_records.xls* that is located in the *My Documents* directory of the logged-on program.

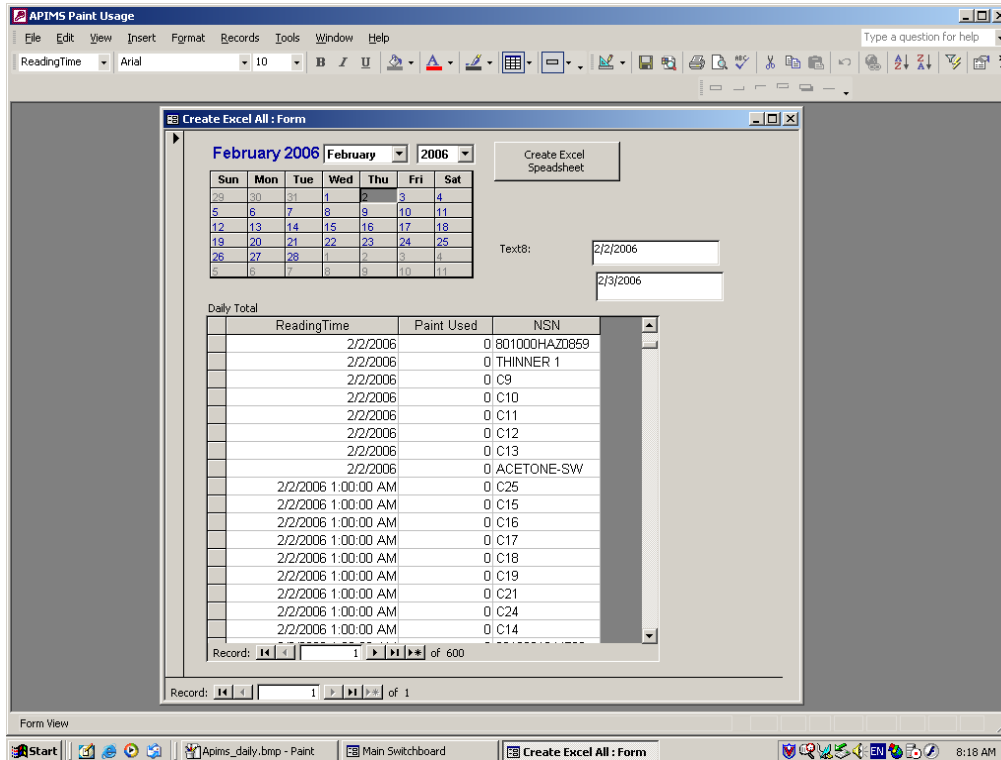


Figure B-6. Daily Records screen.

### Monthly and Yearly Totals

The third and fourth options, *Monthly Totals* and *Yearly Totals* sum the paint used on a monthly or yearly basis by its NSN. If the current year is selected, a year-to-date total is calculated and displayed. If a previous year is selected, the totals for that year are displayed. The system is designed to hold 10 years of data. This data is displayed by total weight (in pounds), by its NSN, and by the date the last reading was added. Figure B-7 shows an example of the display for the Yearly Total option.

The user may select the desired year from the drop-down menu in the upper left corner. The *Create Excel Spreadsheet* button on this screen will create an Excel spreadsheet named *monthly\_totals.xls* or *yearly\_totals.xls* in the current user's *My Documents* directory.

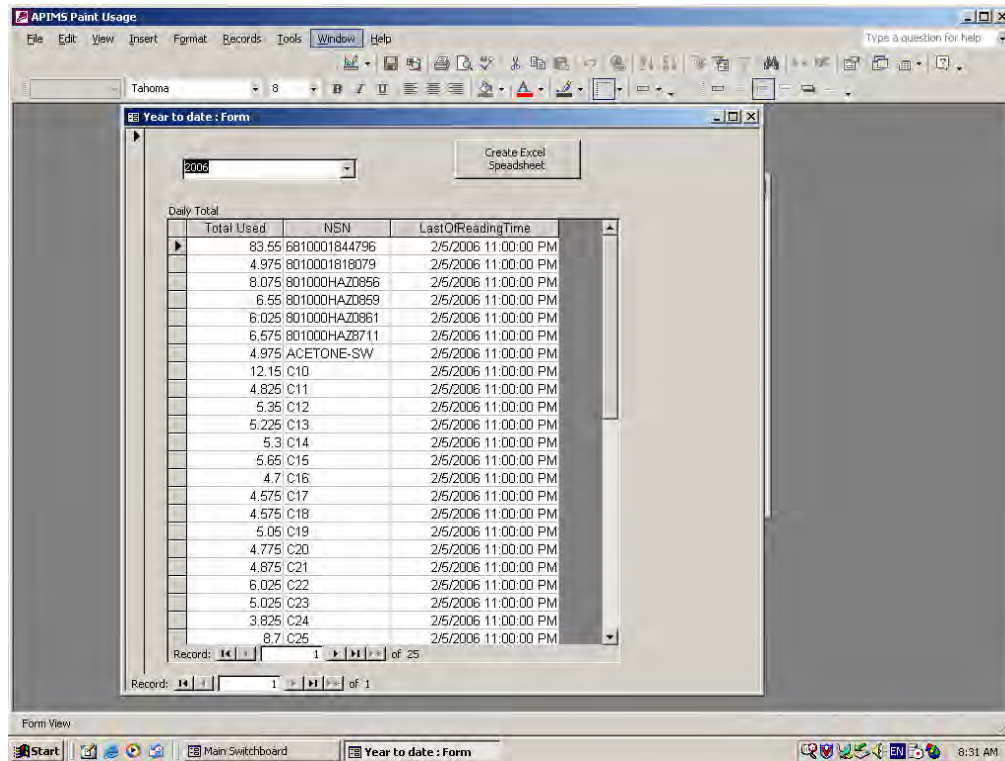


Figure B-7. Screen displaying *Yearly Totals* option.

#### *Running the Create Excel Spreadsheet Option*

When the user selects the *Create Excel Spreadsheet* option on any of the report forms, the system creates the new table. After the system has created the table, it will export it to an Excel spreadsheet. This spreadsheet may be saved to a disk and be used to transfer data to the APIMS at the convenience of the user.

#### *Accuracy*

Since the incremental change of the paint used is only logged at a change of 0.25 lb (volume for most CARC paint of approximately one-half cup), the accuracy of the weight of paint used is limited by this increment.

## Appendix C Acronyms and Abbreviations

### Acronyms and Abbreviations

<b>Term</b>	<b>Spellout</b>
AFB	Air Force Base
APIMS	Air Program Information Management System
AR	Army Regulation
CAA	Clean Air Act
CARC	chemical agent resistant coating
CERL	Construction Engineering Research Laboratory
CFR	Code of the Federal Regulations
COSCOM	Corps Support Command
DA	Department of the Army
DAS	data acquisition system
DLSME	Defense Land Systems and Miscellaneous Equipment
DoD	Department of Defense
DOE	Department of Energy
DOIM	Directorate of Information Management
DPW	Directorate of Public Works
EPA	Environmental Protection Agency; also USEPA
ERDC	Engineer Research and Development Center
HAP	hazardous air pollutants
HQUSACE	Headquarters, U.S. Army Corps of Engineers
HVLP	high volume, low pressure
ICL	industrial control links
MSE	MSE Technology Application, Inc
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NSN	national stock numbers
OACSIM	Office of the Assistant Chief of Staff for Installation Management
PDF	Portable Document Format
POC	point of contact
PWTB	Public Works Technical Bulletin
RTU	remote telemetry unit
URL	Universal Resource Locator
VOC	volatile organic compound
WMPP	Waste Minimization and Pollution Prevention
WWW	World Wide Web



**Appendix D**  
**REFERENCES**

**References Cited**

1. VSE Flow, Flow-Measurement Technology, info@vse-flow.com, <http://www.vse-flow.com>.
2. JV-KL Series Positive Displacement Flow Meter, <http://www.awcompany.com>.
3. Flow Technology, ftimarket@ftimeters.com; <http://www.ftimeters.com>.
4. Avery Weigh-Tronix, 1000 Armstrong Dr. Fairmont, MN, <http://www.wtxweb.com>.
5. Northrop Grumman Mission Systems, 875 South 2000 East, Clearfield, UT.
6. DefenseData, The National Stock Number Resource, <http://www.defensedata.com>.

**Additional Resources**

Avery Weigh-Tronix, 1000 Armstrong Dr. Fairmont, MN,  
<http://www.wtxweb.com>.

Beckner, Jeffery. HVLP, high-volume, low-pressure sprayers have generated a high volume of misconceptions. HVLP systems aren't the penicillin of the painting industry, and they were never intended to be,  
<http://mysearch.myway.com/jsp/Gggres.jsp?id=o9uqoPx9ndAJ&su>.

Flow Technology, ftimarket@ftimeters.com;  
<http://www.ftimeters.com>.

Fort Hood History, [www.hood.army.mil/fthood/info/htm](http://www.hood.army.mil/fthood/info/htm).

Industrial Control Links, 12840 Earhart Ave, Auburn, CA.

JV-KL Series Positive Displacement Flow Meter, AW Flow Meters.  
Franksville, WI:AW-Lake Company  
[http://www.awflowmeters.com/products/product\\_type/positive\\_displacement\\_flow\\_meters/](http://www.awflowmeters.com/products/product_type/positive_displacement_flow_meters/)

PWTB 200-1-78  
14 January 2011

MSE Technology Applications, Inc., Preparation Booth Building  
#269 Evaluation and Feasibility Study.

National Defense Center for Environmental Excellence. 2003.  
NDCEE Newsletter, Winter 2003. Available at  
<http://www.ndcee.ctc.com/newsletters/winter2003.html>

*NEC 1999, National Electrical Code*, International Electrical  
Code Series, National Fire Protection Association, Inc., One  
Batterymarch Park, Quincy, MA.

*Paint Spray Guns, Keeping an HVLP Gun in compliance with  
Regulations*, Ron Joseph & Associates, Inc.,  
<http://www.ronjoseph.com/articles.htm>.

*PS Assessment at Truck Assembly Plant*, Abstract, Science  
Applications International Corporation, McLean VA,  
[www.es.epa.gov/techinfo/specific/truck.html](http://www.es.epa.gov/techinfo/specific/truck.html).

Sherwin-Williams Company, Warrensville Heights, OH, paint  
manufacturer. [www.sherwin-williams.com](http://www.sherwin-williams.com) and [www.sherwin-automotive.com](http://www.sherwin-automotive.com).

Strategic Environmental Research and Development Program (SERDP)  
*Statement of Need for FY 05, Pollution Prevention New Start*,  
Nov 6, 2003, [www.serdp.org/funding](http://www.serdp.org/funding).

Texas Natural Resource Conservation Commission, Special  
Conditions, Permit No. 24538.

Texas Natural Resource Conservation Commission, Title 30 Texas  
Administrative Code Section 116.116(b) (30 TAC 116.116).

U.S. Army Environmental Center, *Environmental Update, EPA to  
Develop Defense-Specific Surface Coating Rule*.  
[www.aec.army.mil/usaec/publicaffairs/update/win04/win0412.html](http://www.aec.army.mil/usaec/publicaffairs/update/win04/win0412.html)

VSE Flow, *Flow-Measurement Technology*, <http://www.vse-flow.com>

This publication may be reproduced