

# Chapter 11

## Quality Control for Protective Coating Projects

Thomas A. Jones

### Scope

The purpose of this chapter is to provide an overview for individuals involved in quality control inspection for protective coating projects. Many times inspection is considered the primary quality control activity, when in fact inspection is only one part of the quality control process. Equally important are the activities of document control, calibration verification, and identifying nonconformances and recommending corrective actions. This chapter concentrates on quality control performed by individual inspectors on the project level and not an overall quality program.

### Terminology

- Quality control (QC) is gathering and documenting information that verifies that the work performed meets or exceeds some minimum standard as required by project specifications.<sup>1</sup>
- Quality assurance (QA) is defined as the process to verify that the quality of the work performed is actually what is claimed on the basis of the quality control performed. Quality control is not synonymous with quality assurance. Quality assurance is meant to protect against failures of quality control.<sup>1</sup>
- The quality program or quality system establishes and controls the level of QA and QC that may be required to show conformance to a specification or industry accepted standard.
- The Quality Control Manual is the governing document of written procedures used to implement the quality program.
- The QC manager or supervisor is the qualified person designated by upper management with the full support and authority to oversee the quality program. The overall quality program is maintained and evaluated on an annual basis by the QC manager who is responsible for issuing corrective actions and implementing revisions to the quality program.<sup>2</sup>
- The QA or QC inspector is the qualified person designated by the QC manager to perform individual inspections and verify that work is being performed

according to the predetermined criteria. The QC inspector should have the authority and support of upper management to identify nonconformance, recommend corrective actions, and stop work if required.<sup>2</sup>

### Standards and Guidelines

In addition to this volume, the following SSPC publications provide standards, procedures, and guidelines to better understand the quality control process:

- SSPC-QP 1. *Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)*
- SSPC-QP 3. *Standard Procedure for Evaluating Qualifications of Shop Painting Applicators*
- SSPC-QP 5. *Standard Procedure for Evaluating Qualifications of Coating and Lining Inspection Companies*
- *The Inspection of Coatings and Linings*

### Pre-Job Review

#### Contract and Specification Review

Prior to beginning any job the specification and all supporting documents should be reviewed by the designated individuals responsible for overseeing the job. Written acknowledgement of the specification, revisions, supporting documents, and correspondence should be provided. Ambiguous specifications and uncertainties and differences of opinion should be documented in writing and maintained in the job file. The quality control section of the specification may require verification of conformance of certain requirements prior to starting the job.

#### Quality Control and Inspector Requirements

All persons designated as inspectors may be required to have sufficient documentation or records available for:

- Formalized training or certification of the inspector
- Experience in the type of structure to be inspected

- Inspection equipment required by the job specification available to the inspector
- Records of calibration for all inspection equipment used by the inspector
- Standards and procedures required to show conformance to job specifications are available to the inspector
- Approved copies of material supplier technical data sheets, application instructions, and Material Safety Data Sheets (MSDSs)

### Inspection Plan

A written inspection plan to show conformance to the specification may be required. The inspection plan should list inspection hold or work-stoppage points that conform to the individual specification requirements or industry standards and procedures. The following listed inspection hold points are considered basic for most work.<sup>3</sup> Additional inspection hold points may be added if necessary:

- Prior to the start of work
- Immediately following surface preparation
- Immediately prior to the coating or lining application
- Following the application of each coat
- Following the curing of the coating or lining
- Final inspection and sign off, in accordance with job specifications

### Document Control

The inspector should have sufficient inspection forms and records to show verification to the specification. Specific items required for documentation may vary depending on the job specification. Some specifications require the use of specified forms or approved standard forms. The frequency of recording and reporting all documented information should be determined and understood by the inspector prior to beginning the inspection assignment. Forms should have their own unique numbering system along with a filing system for efficient control. Several examples of different types of reporting forms may be found at the end of this chapter.

### Pre-Job Conference

The inspector, owner representatives, applicator, and supplier should attend a pre-job conference. At this time, the inspector should identify any missing, incomplete, unclear, or ambiguous statements and communicate this information to the owner's represen-

tative. All uncertainties and differences of interpretation should be resolved and documented in writing. Prior to starting the job, the inspector, applicator, and owner's representative should have a clear understanding of the work requirements. In addition the degree of the inspector's authority to stop work or make any other managerial decisions should be established in writing by the owner and communicated to the applicator. An inspector must be careful to never overstep this degree of authority.<sup>4</sup>

### Daily Inspection Activities

Daily inspection activities vary according to specification requirements and the level of inspection performed by the inspector. In order to show conformance to specifications the inspector should prepare detailed documentation of work performed by the applicator. Inspection records provide a means of ensuring that deviations from the specification are corrected prior to final acceptance. In the event that more than one inspector inspects the work, the records provide a history of what has transpired and of the current status of the project.

### Revision Log

The revision log should document the receipt of all revisions and changes to the specifications and inspection procedures. Issuance of all revised specifications should be documented along with verification that all persons involved in the inspection process and the applicator are properly informed of any changes. The removal of obsolete specifications and procedures should be verified.

### Technical Resources Availability

The inspector should have available at the job site all necessary standards, quality control inspection procedures, and technical references required to verify conformance to the job specification. The inspector may be required to have some the following available:

- *SSPC Painting Manual Volume 2: Systems and Specifications*
- SSPC-PA 2. *Measurement of Dry Coat Thickness with Magnetic Gages*
- SSPC Visual Standards applicable to the specified work
- *ASTM Protective Coating Inspection Standards for Field and Shop Applications*
- Updated material supplier technical data sheets and

written recommendations.

- Applicable required copies of SSPC, NACE, ASTM, NAVSEA, AWWA, API, and ISO standards, procedures, and guidelines.

### **Calibration Verification**

Calibration of inspection equipment is usually performed by a qualified individual using industry accepted standards and issuing a certification that the equipment is properly calibrated. The inspector in the field can only verify that the equipment used to perform inspections is calibrated according to industry accepted standards and procedures. The inspector should document the verification of all calibrations according to specifications and procedures. Normally the following information is required to show verification:

- Equipment type and serial number
- Required frequency and calibration method
- Record of calibration data
- Signature and date of person performing calibration verification

### **Daily Work Log**

A description of the inspector's daily duties should be recorded in the daily work log. Supplemental data that cannot be recorded on standard forms should also be recorded in the daily work log. These should be objective observations, not "intuition" or "guesswork." They should be independent, not reflecting bias for or against the applicator or owner.<sup>4</sup>

### **Daily Inspection Report**

The inspection daily report is probably the single most important document. The inspector should record observations and measurements on the coating job conditions as required, and note any hold points. This may include the following:

- Weather and site conditions
- Pre-surface condition and cleanliness
- Surface preparation monitoring
- Post-surface preparation and monitoring of cleanliness and profile
- Pre-application surface cleanliness
- Coating material preparation and application
- Physical film properties or appearance properties
- Dry film thickness measurements according to specifications or industry standard such as SSPC-PA 2, *Measurement of Dry Coat Thickness*

### *with Magnetic Gages*

- Verification of corrective actions prior to final approval
- Drawings, sketches, or photographs indicating where work occurred and to document the cumulative work progress
- Record of instruments used to obtain measurements and calibration verification
- Record of applicator's equipment and workforce

### **Nonconformance and Corrective Actions**

Deviations or nonconformances from specifications and stop-work orders should be documented and corrective actions issued. Corrective actions taken to resolve deviations from specifications and procedures should be approved prior to restarting work. Follow up on the corrective actions should be verified prior to final approval. Any specification issues that were not resolved should be further documented to show nonconformance to the specification.

### **Photographic Record**

Photographs of the coating inspection work taken by the inspector should be documented in such a manner that pictures can be properly identified. When possible the inspector should try to use the time/date stamp available on many cameras. A record showing location, area, and conditions along with corresponding number of the photograph should be noted. Undeveloped film should be properly stored and labeled until the film is developed.

### **Management Review**

In process review should be scheduled and performed by management on an ongoing basis. Inspection documentation and records should be checked for accuracy, identifying problems that may need to be resolved. The review should be recorded and brought to the attention of the person responsible for the problem.

### **Post Job Activities**

#### **Recordkeeping**

After completion of the inspection activities, verify that all required entries and supporting notes have been made and are legible. Signatures and dates required in documentation should be verified. Furnish any photographs (with date taken and other

identification on back of photo) and other supplemental documentation. Deliver or retain all documentation as required by contract or specification.

### **Traceability**

Many times inspection records and documentation are required to be properly stored for a set period of time. Completed inspection records and documentation should be filed and organized in a manner that makes them easily accessible.

### **Summary**

Quality control for protective coating projects begins prior to project start-up and continues after project completion. Many times inspection is considered the primary quality control activity. Specification review, documentation issuance, calibration verification, and corrective action follow-up are equally important. Standards and procedures needed to perform proper inspection need to be available and understood by all inspection personnel. A written inspection plan should be developed and followed by the inspector.

Records and support documents required to verify conformance with specifications should be filled out in a consistent and timely matter. Inspection equipment should be properly maintained and calibration verified as required. Deviations or nonconformance from specifications must also be properly documented and all corrective actions verified prior to final approval. All records and documents should be reviewed and organized in a consistent filing system. Proper storage of all records and documents allows for easy access should they be required at a latter date for review.

### **References**

1. Glossary. In *The Inspection of Coatings and Linings*; Bernard R. Appleman, ed; SSPC: Pittsburgh, 1997; p 429.
2. Windler, Frank J. Quality Control: A Necessary Factor in SSPC Contractor Certification. *Journal of Protective Coatings and Linings*, April 1988, pp 32-37.
3. Bechtel Power Corp. *Coating and Lining Inspection Manual*; SSPC: Pittsburgh, 1991; Chapter 2.
4. Drisko, Richard W. Reviewing and Preparing Inspection Documents. In *The Inspection of Coatings and Linings*; Bernard R. Appleman, ed; SSPC: Pittsburgh, 1997; pp 13-32.

### **Acknowledgements**

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### **About the Author**

#### **Thomas A. Jones**

Thomas A. Jones is the senior technical auditor at SSPC, performing audits for the painting contractor certification program (PCCP). He has over 25 years experience in the protective coatings industry working in quality control inspection, project management, and technical service. He is the co-founder of the SSPC South Texas Chapter and is certified as a SSPC protective coatings specialist (PCS), NACE coatings inspector, and a NAVSEA paint inspector. Mr. Jones received his BA degree from Texas A&M-Corpus Christi.

**FORM 1**  
**DOCUMENTATION**  
**ACKNOWLEDGEMENT**

PROJECT:	PROJECT:	COPY OFFICE   ESTIMATING QC MGR   HSO Proj Mgr   Inspector _____
LOCATION:		
	START DATE:	
CONTACT:	FINISH DATE:	
<b>THIS IS TO ACKNOWLEDGE RECEIPT OF ONE OR MORE OF THE FOLLOWING DOCUMENTS</b>		
<b>SPECIFICATIONS   REVISIONS   CORRESPONDENCE   REPORTS   TEST RESULTS</b> <b>DRAWINGS   OTHER _____</b>		
<b>RECEIPT OF ALL DOCUMENTATION IS TO BE RECORDED IN THE PROJECT DOCUMENTATION LOG</b>		
<b>DATE</b>	<b>DOCUMENTATION, SPECIFICATIONS, PRINTS &amp; REVISIONS</b>	<b>DESCRIPTION &amp; TITLE</b>
<b>UPDATE ALL SPECIFICATIONS &amp; PROCEDURES AND RECORD IN APPROPRIATE REVISION LOGS</b>		
<b>ISSUED TO:</b> _____ <b>COMPANY:</b> _____		
<b>RECEIPT ACKNOWLEDGED BY:</b> _____ <div style="display: flex; justify-content: space-between; width: 80%; margin: 0 auto;"> <span>SIGNATURE REQUIRED</span> <span>DATE</span> </div>		
<b>RETURN THIS FORM WITH SIGNATURE TO:</b>		

# FORM 2

## INSPECTION EQUIPMENT CALIBRATION RECORD

[illegible]

### FORM 3

<b>INSPECTION EQUIPMENT ISSUANCE SHEET</b>					<b>COPY</b> Office      Employee File QC Mgr    Proj Mgr Inspector    _____	
PROJECT:			PROJECT #:			
LOCATION:						
ISSUED TO:		ISSUED DATE:		START DATE:		
ISSUED BY:		RETURN DATE:		FINISH DATE:		
<b>INSPECTION EQUIPMENT</b>						
ITEM	MODEL #	SERIAL #	DATE OF CALIBRATION	VERIFIED BY	CALIBRATION REQUIREMENTS	
<b>TEMPERATURE/HUMIDITY</b>						
<b>SURFACE PREPARATION</b>						
<b>WET/DRY FILM THICKNESS</b>						
<b>OTHER TOOLS</b>						
<b>SPECIFICATION &amp; STANDARDS</b>						
<b>ACKNOWLEDGEMENT OF RESPONSIBILITY</b>						
<p>The following designated inspector has been issued the above listed inspection equipment, certification and calibration standards required to perform the intended inspection as required by contract. The inspector is required to keep all equipment in a safe place and in good working order. The inspector will document required calibrations and maintain all records per job specifications. Upon completion of the project, the inspector will return all equipment to the QC Mgr. The inspector is responsible for negligence and understands and accepts to replace damaged or stolen equipment.</p>						
<b>ISSUED BY:</b>			<b>ISSUED TO:</b>			
QUALITY CONTROL MANAGER'S SIGNATURE			INSPECTOR'S SIGNATURE			
DATE			DATE			



## FORM 4

<b>DAILY COATING INSPECTION REPORT</b>				DATE: M T W R F S S U		# Pg of					
				PROJECT#:		<b>COPY</b> Office Client Proj Mgr _____					
				INSPECTOR:							
PROJECT/CLIENT:											
LOCATION:											
DESCRIPTION:											
REQUIREMENTS:											
CONTRACTOR:				SPEC#:		REVISION#:					
<b>DESCRIPTION OF AREAS &amp; WORK PERFORMED</b>				<b>HOLD POINT INSPECTIONS PERFORMED</b>							
				1. WEATHER AND SITE CONDITIONS							
				2. PRE SURFACE PREPARATION/CONDITION & CLEANLINESS							
				3. SURFACE PREPARATION MONITORING							
				4. POST SURFACE PREPARATION/CLEANLINESS & PROFILE							
				5. APPLICATION MONITORING/WET FILM THICKNESS (WFT)							
				6. POST APPLICATION/APPLICATION DEFECTS							
				7. POST CURE/DRY FILM THICKNESS (DFT)							
				8. CORRECTIVE ACTIONS FOLLOW UP & FINAL INSPECTION APPROVED BY: _____							
<b>SURFACE CONDITIONS</b>				<b>AMBIENT CONDITIONS</b>							
NEW MAINT PRIMER/PAINT AGE/DRY/CURE _____ STEEL GALVANIZE CONCRETE _____ HAZARD _____ SAMPLE REPORT # _____ DEGREE OF CONTAMINATION: _____ TEST: Cl _____ $\mu\text{g}/\text{cm}^2/\text{ppm}$ Fe _____ ppm pH _____ ppm DEGREE OF CORROSION: _____ SCALE PITTING/HOLES CREVICES SHARP EDGES WELD _____ MOISTURE OILS _____ PAINTED SURFACE CONDITION: _____ DRY TO/TOUCH _____ HANDLE _____ RECOAT _____ DRY/OVERSPRAY RUNS/SAGS PINHOLES HOLIDAYS ABRASION FALL OUT _____				<b>AREAS:</b>							
				TIME							
				DRY BULB TEMP° C/F							
				WET BULB TEMP° C/F							
				% RELATIVE HUMIDITY							
				SURF TEMP° C/F MIN/MAX							
				DEW POINT TEMP° C/F							
				WIND DIRECTION/SPEED							
				WEATHER CONDITIONS:							
				<b>APPLICATION</b>							
<b>SURFACE PREPARATION</b>				START TIME FINISH TIME AREA $\text{ft}^2/\text{m}^2$							
START TIME FINISH TIME AREA $\text{ft}^2/\text{m}^2$				PRIMER INTERMEDIATE TOPCOAT TOUCH UP							
SOLVENT CLEAN HAND TOOL POWER TOOL _____ HP WASH PSI _____ ABRASIVE BLAST ABRASIVE TYPE SAMPLE BLAST HOSE SIZE _____ NOZZLE SIZE/PSI _____ AIR SUPPLY CFM _____ AIR SUPPLY CLEANLINESS WATER/OIL TRAP CHECK EQUIPMENT CONDITION CHECK _____				GENERIC TYPE		QTY MIXED					
				MANUF		MIX RATIO					
				PROD NAME		MIX METHOD					
				PROD #		STRAIN/SCREEN					
				COLOR		MATERIAL TEMP					
				KIT SIZE/COND		INDUCTION TIME					
				SHELF LIFE		POT LIFE					
				BATCH NUMBERS		REDUCER #					
<b>SURFACE CLEANLINESS &amp; PROFILE MEASUREMENT</b>				(A)		QTY ADDED					
				(B)		% BY VOLUME %					
				(C)		Specified WFT mils/ $\mu\text{m}$					
				REDUCER		Acheived WFT mils/ $\mu\text{m}$					
				<b>MEASUREMENTS</b>				AIRLESS/CONV		BRUSH ROLLER PRIMER	
								PUMP/POT		HOSE dia. AIR CHECK	
								RATIO/SIZE		HOSE Lng. TRAP	
								GPM/CFM		SPRAY GUN FILTER	
PSI		TIP SIZE AGITATOR									
<b>D.F.T. GAUGE CALIBRATION</b>											
GAUGE TYPE MODEL	GAUGE SERIAL #	GAUGE CALIB. VERIFIED	SPECIFIED AVERAGE D.F.T.	AVERAGE D.F.T THIS COAT	AVERAGE D.F.T LAST COAT	TOTAL AVERAGE D.F.T					
						INSPECTOR'S SIGNATURE _____ DATE _____					



# FORM 5

DFT MEASUREMENT WORKSHEET								DATE: M T W R F S S U		# Pg of													
PROJECT/CLIENT:								PROJECT#:		<b>COPY</b> QC Mgr _____ Proj Mgr _____ Client _____													
								INSPECTOR:															
LOCATION:								SPEC#:															
DESCRIPTION:								REVISION#															
ITEM:								ITEM:															
LOCATION	A R E A	SPOT READINGS						LOCATION	A R E A	SPOT READINGS													
		1	2	3	Total	%Min	Avg			1	2	3	Total	%Min	Avg								
	A								A														
	B								B														
	C								C														
	D								D														
	E								E														
Approx. ft <sup>2</sup> /m <sup>2</sup>								Approx. ft <sup>2</sup> /m <sup>2</sup>															
		Specified DFT mils/μm				Total Avg. mils/μm				Specified DFT mils/μm				Total Avg. mils/μm									
Reference Inspection Report #								for application record				Reference Inspection Report #								for application record			
ITEM:								ITEM:															
LOCATION	A R E A	SPOT READINGS						LOCATION	A R E A	SPOT READINGS													
		1	2	3	Total	%Min	Avg			1	2	3	Total	%Min	Avg								
	A								A														
	B								B														
	C								C														
	D								D														
	E								E														
Approx. ft <sup>2</sup> /m <sup>2</sup>								Approx. ft <sup>2</sup> /m <sup>2</sup>															
		Specified DFT mils/μm				Total Avg. mils/μm				Specified DFT mils/μm				Total Avg. mils/μm									
Reference Inspection Report #								for application record				Reference Inspection Report #								for application record			
ITEM:								ITEM:															
LOCATION	A R E A	SPOT READINGS						LOCATION	A R E A	SPOT READINGS													
		1	2	3	Total	%Min	Avg			1	2	3	Total	%Min	Avg								
	A								A														
	B								B														
	C								C														
	D								D														
	E								E														
Approx. ft <sup>2</sup> /m <sup>2</sup>								Approx. ft <sup>2</sup> /m <sup>2</sup>															
		Specified DFT mils/μm				Total Avg. mils/μm				Specified DFT mils/μm				Total Avg. mils/μm									
Reference Inspection Report #								for application record				Reference Inspection Report #								for application record			
D.F.T. GAUGE CALIBRATION RECORD																							
GAUGE TYPE MODEL	GAUGE SERIAL #	PLATE/ SHIM mils/μm	BMR	ADJUST +/-	SPEC. AVERAGE COAT	D.F.T THIS COAT	D.F.T LAST COAT																
						INSPECTOR'S SIGNATURE																	
						DATE																	

## FORM 6

<b>CORRECTIVE ACTIONS REPORT</b>			DATE: M T W R F S S U		#	Pg	of
			PROJECT#:		<b>COPY</b> QC Mgr      Client Proj Mgr      _____		
			INSPECTOR:				
PROJECT/CLIENT:			<b>ATTACHMENTS</b> STOP WORK ORDER _____				
LOCATION:							
DESCRIPTION:							
REQUIREMENTS:							
CONTRACTOR:			SPEC#:		REVISION#:		
TIME & LOCATION			NAME/COMPANY/TITLE				
DESCRIPTION OF NONCONFORMING ITEM			DESCRIPTION OF NONCONFORMANCE				
REFERENCED: SPECIFICATION/PROCEDURE/STANDARD			ACTION LEVEL				
DISCUSSION & RECOMMENDATIONS							
APPROVAL & CORRECTIVE ACTIONS							
CORRECTIVE ACTIONS FOLLOW UP							
FINAL APPROVAL:							
SIGNATURE	TITLE	DATE	INSPECTOR'S SIGNATURE		DATE		

# FORM 7

<b>PHOTOGRAPH RECORD</b>				DATE: M T W R F S S U		#	Pg	of
				PROJECT#:		<b>COPY</b> QC Mgr      Client Proj Mgr      _____		
				INSPECTOR:				
PROJECT/CLIENT:								CAMERA:
LOCATION:								EXPOSURES:
CAMERA TIME/DATE VERIFIED: YES NO N/A				PERMISSION REQ: YES NO				
FILM DEVELOPER:				#	DATE	ROLL#:		
#	LOCATION	AREA		COMMENT				
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
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15								
16								
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23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
NUMBER ON FORM MUST MATCH WITH PICTURE FILL OUT ONE FORM PER ROLL				_____ INSPECTOR'S SIGNATURE      DATE				