Coating Condition Monitoring and Assessment of Safety Related Coatings

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I. Definition of Safety related Coatings

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Definition of Safety related Coatings

- **What is Safety-Related Coatings?**
  - **Service Level I Coatings**

Service Level I coatings are used in areas inside the reactor containment where coating failure could adversely affect the operation of postaccident fluid systems and thereby impair safe shutdown.

  - **Service Level III Coatings**

Service Level III coatings are used in areas outside the reactor containment where failure could adversely affect the safety function of a safety-related SSC. (Note that a coating on the external surface of a reactor containment may be designated Service Level III, although no plants licensed under 10 CFR Part 50 have applied this designation.)

Definition of Safety related Coatings

- **What is Safety-Related Coatings?**
  - ▶ **In-scope License Renewal Protective Coatings**

On November 14, 2014, the NRC staff issued the interim staff guidance (ISG), LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" (Ref. 14). The ISG was issued based on the NRC staff's review of industry operating experience related to degradation of coatings. Appendix C of the ISG provides an AMP, GALL Report AMP XI.M42, and "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks." AMP XI.M42 includes recommendations related to managing loss of coating or lining integrity because of blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings, of in-scope piping, piping component, heat exchanger, and tank internal coatings/linings. Internal coatings are not included in the

History of Safety related Coatings

- **Reg. Guide 1.54, Rev.0-1973**

REG GUIDE 1.54, Dated 6/1/73
QUALITY ASSURANCE REQUIREMENTS FOR PROTECTIVE COATINGS APPLIED TO WATER-COOLED NUCLEAR POWER PLANTS

Document: REG GUIDE 1.54
Publication Date: 6/1/73
Pages: 2
Date Entered: 1/3/84
Title: QUALITY ASSURANCE REQUIREMENTS FOR PROTECTIVE COATINGS APPLIED TO WATER-COOLED NUCLEAR POWER PLANTS

June 1973

U.S. ATOMIC ENERGY COMMISSION
REGULATORY GUIDE

DIRECTORATE OF REGULATORY STANDARDS

History of Safety related Coatings

- **Reg. Guide 1.54, Rev.1-2000**
  - **Change of Coating Service Level**
  - **Personnel Qualification**
    - **Coating Applicator(Steel and Concrete)**
    - **Coating Inspector**
    - **Coating Contractor**
  - **Special Process**
  - **Maintenance Requirements(10CFR50.65) for Service Level I**

History of Safety related Coatings

- **Reg. Guide 1.54, Rev.1-2000**

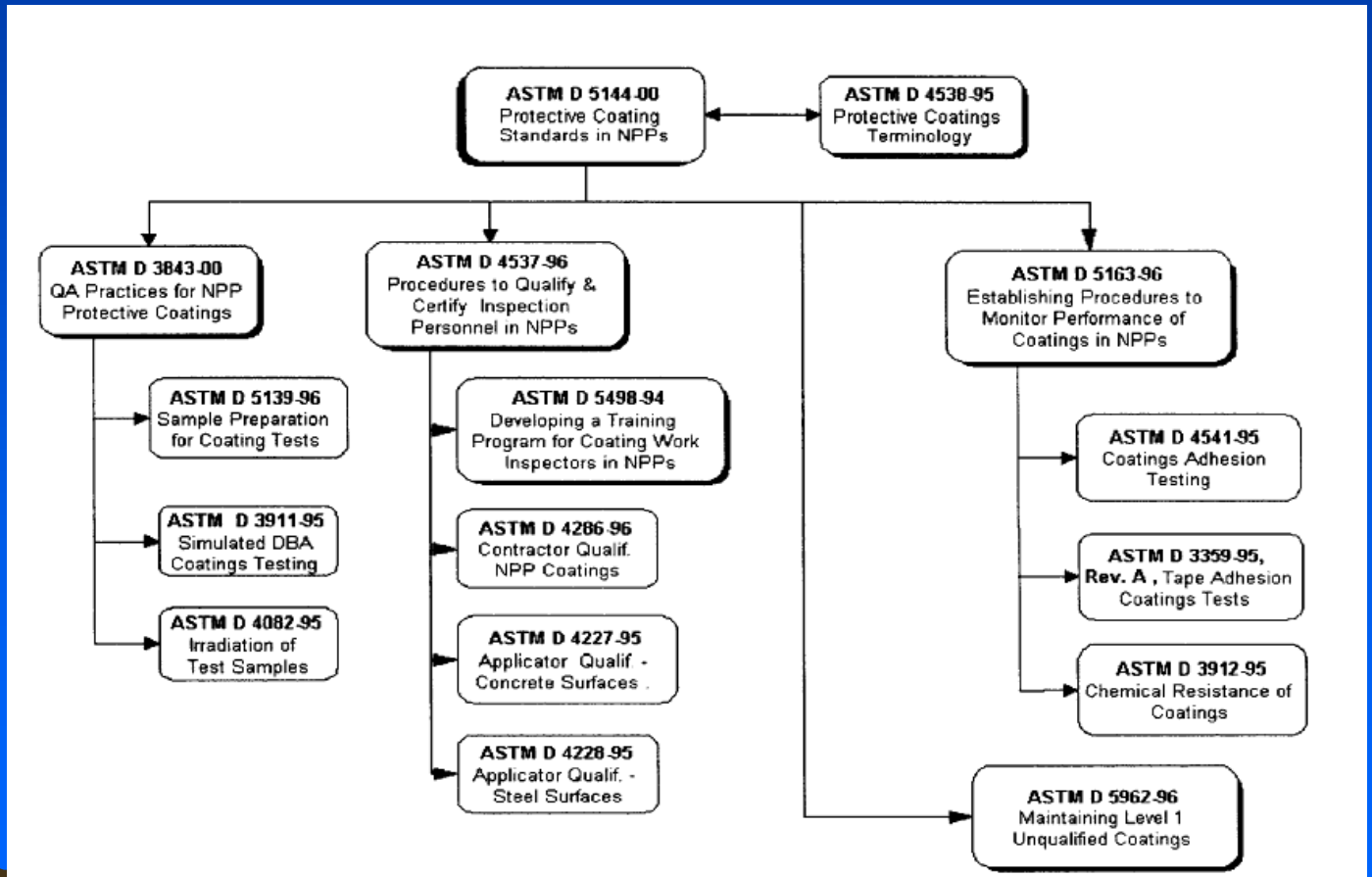


Figure 1, ASTM Standards Relevant to NPP Class I, II and III Protective Coatings

History of Safety related Coatings

- **Reg. Guide 1.54, Rev.2-2010**
  - **Title : "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants": same title with Reg. Guide 1.54, Rev.1**
  - **ASTM D5144-2008 etc. 19 standards**

History of Safety related Coatings

- **Reg. Guide 1.54, Rev.2-2010**

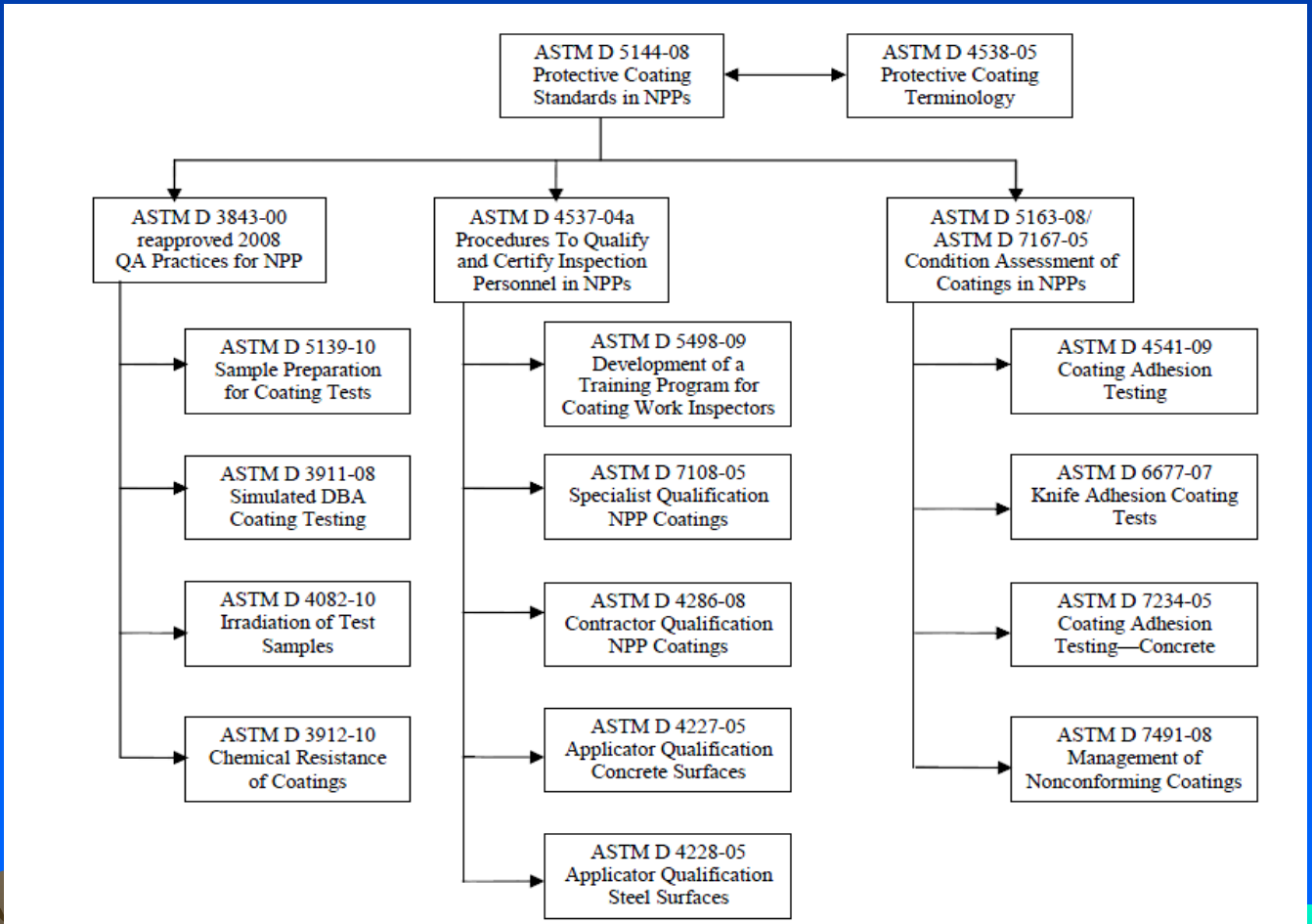


Figure 1 ASTM standards relevant to NPP Service Level I, II, and III protective coatings

History of Safety related Coatings

- **LR-ISG-2012-02**

DRAFT LICENSE RENEWAL INTERIM STAFF GUIDANCE

LR-ISG-2012-02

AGING MANAGEMENT OF INTERNAL SURFACES, SERVICE LEVEL III AND OTHER COATINGS, ATMOSPHERIC STORAGE TANKS, AND CORROSION UNDER INSULATION

INTRODUCTION

This draft license renewal interim staff guidance (LR-ISG) LR-ISG-2012-02, "Aging Management of Internal Surfaces, Service Level III and Other Coatings, Atmospheric Storage Tanks, and Corrosion under Insulation," provides changes to NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," and NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," (SRP-LR), as described below. These changes provide one acceptable approach for managing the associated aging effects for components within the scope of the License Renewal Rule (Title 10 of the *Code of Federal Regulations*, (10 CFR) Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants". A licensee may reference this LR-ISG in its license renewal application (LRA) until the guidance in this LR-ISG is incorporated into the next update to the license renewal guidance documents (i.e., GALL Report, SRP-LR).

History of Safety related Coatings

- **LR-ISG-2013-01(Draft)**

January 6, 2014

Mr. Jason Remer
Nuclear Energy Institute
1201 F. St, NW
Suite 1100
Washington, DC 20004-1218

SUBJECT: LICENSE RENEWAL INTERIM STAFF GUIDANCE, LR-ISG-2013-01, "AGING MANAGEMENT OF LOSS OF COATING INTEGRITY FOR INTERNAL SERVICE LEVEL III (AUGMENTED) COATINGS"

Dear Mr. Remer:

I am writing to inform the Nuclear Energy Institute of the opportunity to comment on the draft license renewal interim staff guidance (LR-ISG), LR-ISG-2013-01, "Aging Management of Loss of Coating Integrity for Internal Service Level III (augmented) Coatings." Enclosed is a copy of the *Federal Register* notice that announces the U.S. Nuclear Regulatory Commission's (NRC's) request for comments and provides instructions on how to submit comments.

Based on recent operating experience and the staff's review of several license renewal applications, the NRC staff has determined that existing guidance in NUREG-1800, Revision 2, "Standard Review Plan for License Renewal Applications for Nuclear Power Plants," and NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," should be revised to address loss of coating integrity due to blistering, cracking, flaking, peeling, or physical damage of Service Level III (augmented) internal coatings in piping, tanks, and heat exchangers within the scope of 10 CFR Part 54.

History of Safety related Coatings

- **LR-ISG-2013-01(Final)**

LICENSE RENEWAL INTERIM STAFF GUIDANCE

LR-ISG-2013-01

AGING MANAGEMENT OF LOSS OF COATING OR LINING INTEGRITY FOR INTERNAL COATINGS/LININGS ON IN-SCOPE PIPING, PIPING COMPONENTS, HEAT EXCHANGERS AND TANKS

INTRODUCTION

This license renewal interim staff guidance (LR-ISG) LR-ISG-2013-01, "Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks," provides changes to NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," (GALL Report) and NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," (SRP-LR), as described below. These changes provide one acceptable approach for managing the associated aging effects for components within the scope of the License Renewal Rule (Title 10 of the *Code of Federal Regulations* (10 CFR) Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants"). A licensee may cite this LR-ISG in its license renewal application (LRA) until the guidance in this LR-ISG is incorporated into the license renewal guidance documents (i.e., GALL Report, SRP-LR).

History of Safety related Coatings

- **Reg. Guide 1.54, Rev.3-2017**
  - **Title : “Service Level I, II, and III and In-scope License Renewal Protective Coatings Applied to Nuclear Power Plants”: different title with Reg. Guide 1.54, Rev.2**
  - **ASTM D5144-2016 etc. 23 ASTM standards**

History of Safety related Coatings

- **Reg. Guide 1.54, Rev.3-2017**
  - **New definition of Coating Service Level: In-scope coating**
  - **SSPC PA2-2015 version**
  - **Evaluation of Polymeric Lining System: ASTM D 7230-06**
  - **Discontinuity Testing of Coating on Metallic Substrate: ASTM D 5162-15**
  - **Coating Dry Film Thickness Measurement: ASTM D 7091-13**
  - **More detail and specific than Reg. Guide 1.54, Rev.2**

History of Safety related Coatings

- **Reg. Guide 1.54, Rev.3-2017**

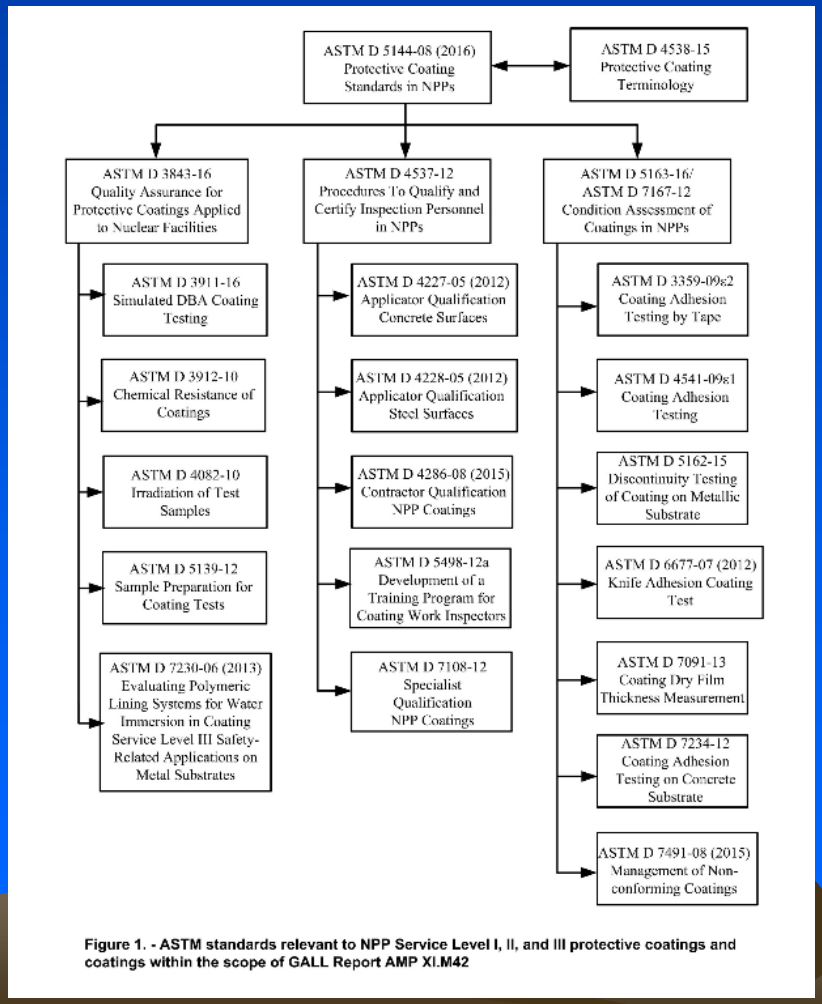


Figure 1. - ASTM standards relevant to NPP Service Level I, II, and III protective coatings and coatings within the scope of GALL Report AMP XI.M42

Condition assessment in ASTM D5139

- **ASTM D5163-08(Service Level I Coating의 유지관리)**
  - 책임사항(4.0항)
    - 사업주는 **Coordinator**를 선임(4.3항)
    - 사업주는 **In-service Coating Performance Monitoring Program**운영(4.4항)
  - 상태조사 빈도(5.0항)
    - **Each refueling outage or major maintenance outages(5.1항)**
  - 기록 및 이력관리(6항)
    - 도장 관련 이력 관리 및 최종 **2**회의 상태조사 관련 기록 검토
  - 사전조사 절차(7.0항)
    - 보안 관련 절차
    - 방사성 관리 및 보건 물리 관련 교육 등

Condition assessment in ASTM D5139

- **ASTM D5163-08(Service Level I Coating의 유지관리)**
  - 도장검사자의 인증 및 교육훈련**(8.0항)**
    - 사업주 **Coordinator**의 자격 요건
    - 평가자는 현재 **ASTM**에서 관련 기술기준 **Develop** 중임
  - **Inspection Plan(9.0항)**
    - 사업주는 **Specific Inspection Plan**을 개발**(9.1항)**
  - 보고서 작성 및 기록관리**(10.0항)**
    - 검사기록서는 최소 **Level II** 이상이 작성**(10.1항)**
    - 보수 우선 순위 결정**(10.1.2항)**
  - 평가**(11.0항)**

Condition assessment in ASTM D5139

- **ASTM D5163-08(Service Level I Coating의 유지관리)**

7. Records and Past History

7.1 Coating performance will depend on the operating conditions experienced by the coating systems. Records of these conditions shall be obtained for each operating unit. These may include, but not be limited to, ambient conditions, temperatures, humidity, immersion, splash and spillage, chemical exposures, radiation exposures, previous decontamination procedures, abrasion and physical abuse, and start-up/shutdown frequency. Any change in service criteria or modifications of the physical design shall be identified and dated.

7.2 The last two performance monitoring reports pertaining to the coating systems shall be reviewed prior to the monitoring process. Other past coatings history data to be reviewed may include:

7.2.1 Copies of coating specifications, manufacturer's product data sheets, and application procedures for in-place coatings.

7.2.2 Quality control documentation for the existing in-place coating systems and their application.

7.2.3 Copies of previous inspection or monitoring reports.

7.2.4 Documentation pertaining to any maintenance work performed on existing coating systems.

Condition assessment in ASTM D5139

- **ASTM D5163-08(Service Level I Coating의 유지관리)**

8. Monitoring Procedure

8.1 Prior to conducting an inspection of the coating systems, the responsible organization shall ensure that the necessary services and equipment required for inspection are provided. Factors that must be considered while planning the inspection activities include, but are not limited to, lighting, access to coated surfaces, cleaning surfaces of any deposit or build up, ventilation and, where necessary, special underwater inspection requirements.

8.2 Station access procedures for Coating Service Level I coating systems monitoring shall be followed. While access procedures may vary from plant to plant, specific station access procedures may include:

8.2.1 Security clearance for protected, radiation controlled, and vital areas, and escorted or unescorted clearance as required,

8.2.2 Radiological history including prior radiation exposure for all personnel involved,

8.2.3 Health physics classroom training in the use of radiation detection and monitoring devices and procedures for wearing anti-contamination clothing,

8.2.4 A radiation work permit based on health physics' radiological survey of the work location,

Condition assessment in ASTM D5139

- **ASTM D5163-08(Service Level I Coating의 유지관리)**

9. Personnel Requirements, Qualifications, and Training

9.1 Individuals who perform visual assessment and coordinate coating condition assessment shall be the Nuclear Coating Specialist (Guide D 7108) or personnel judged to be acceptable by the Nuclear Coating Specialist. After visual assessment, should the Nuclear Coating Specialist determine that a specific follow-up inspection is needed, individuals performing that inspection shall be trained in the applicable referenced standards of Guide D 5498 and the requirements of licensee's Quality Assurance program.

Condition assessment in ASTM D5139

- **ASTM D5163-08(Service Level I Coating의 유지관리)**

10. Inspection Plan

10.1 The licensee or his designee shall develop a plant specific inspection plan to accomplish the objectives of the monitoring program. A visual inspection shall be conducted on all accessible coated surfaces during a walk-through. After the walk-through, thorough visual inspections shall be carried out on previously designated areas and on areas noted as deficient during the walk-through. The inspection plan shall address the following based on specific licensee or his designee require-ments:

10.1.1 A pre-inspection briefing to familiarize all personnel performing inspection with objectives of the inspections, procedures to be followed, and precautions to be taken,

10.1.2 Monitoring team(s) assignments to specific areas for inspection(s), and

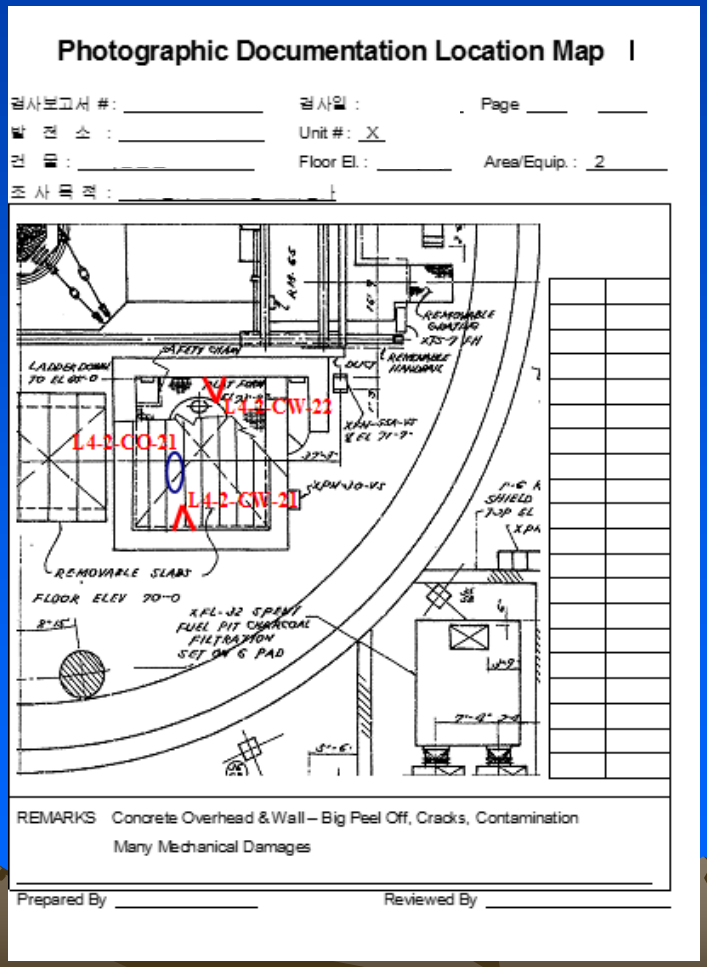
10.1.3 Location maps dividing the plant into identifiable areas for inspection activities to be issued to inspection teams. The maps shall also identify items/areas requiring special testing, if any. The locations of all defects and of all tests performed shall be recorded on the maps so that additional testing, recoating, and further monitoring may be performed.

Condition assessment in ASTM D5139

- 도장상태조사의 업무 프로세스
  - 도장이력조사
  - 설계요건 분석
  - 검사기록서 개발
  - 발전소별 Location Map 작성
  - 검사계획 수립
  - 도장검사자 인증
  - 도장상태조사

Condition assessment in ASTM D5139

- **Photographic Documentaion Location Map (참고)**



Photographic Documentation Location Map

검사보고서 #: _____ 검사일 : _____ Page ____ ____

발 전 소 : _____ Unit #: X

건 물 : _____ Floor El. : _____ Area/Equip. : 2

조 사 목 적 : _____

L4-2-CW-22

L4-2-CO-21

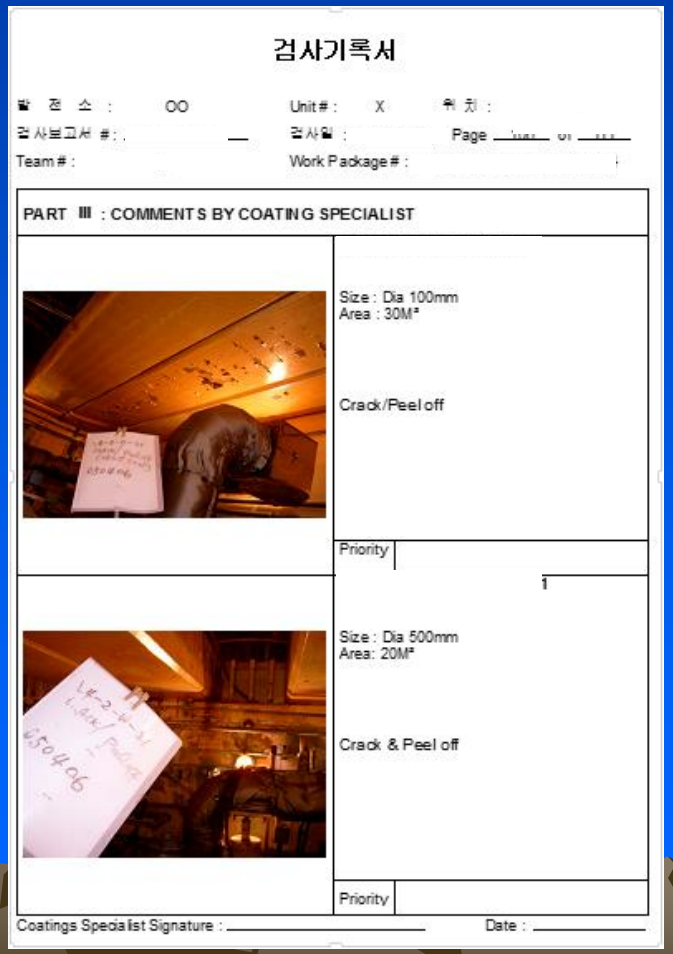
L4-2-CW-21

REMARKS Concrete Overhead & Wall – Big Peel Off, Cracks, Contamination
Many Mechanical Damages

Prepared By _____ Reviewed By _____

Condition assessment in ASTM D5139

- **Inspection Record (참고)**



검사기록서

현 장 소 : OO Unit # : X 위 치 :

검사보고서 # : ___ 검사일 : Page ___ of ___

Team # : Work Package # :

PART III : COMMENTS BY COATING SPECIALIST

Size : Dia 100mm
Area : 30M²

Crack/Peel off

Priority 1

Size : Dia 500mm
Area: 20M²

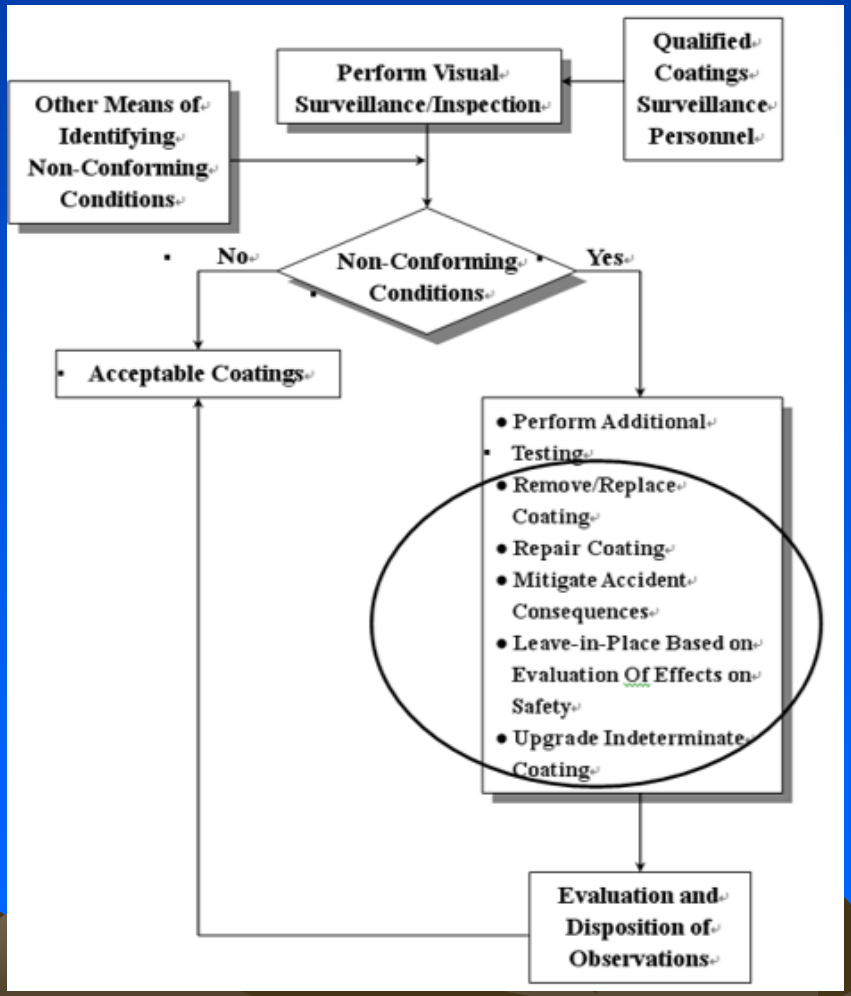
Crack & Peel off

Priority

Coatings Specialist Signature : _____ Date : _____

Condition assessment in ASTM D5139

- **General Process of Coating Condition Assessment**



Discussion

질의 및 토론