

## DiabloCanyonNPEm Resource

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**Sent:** Monday, August 30, 2010 2:41 PM  
**To:** Erickson, Alice  
**Cc:** Pick, Greg; Grebel, Terence  
**Subject:** FW: Fuel Oil AMP  
**Attachments:** DCPP-AMP-B2.1.14-Rev4 Markup.doc

Alice,

Attached is the current revision of the Fuel Oil Chemistry 10-Element Evaluation that you requested.

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Philippe,

See attached.  
<<DCPP-AMP-B2.1.14-Rev4 Markup.doc>>

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# Diablo Canyon Aging Management Program Evaluation Report



## Fuel Oil Chemistry - B2.1.14 NUREG 1801 Program XI.M30

**Document No** DCPP-AMP-B2.1.14-Rev3  
**Document Title** Fuel Oil Chemistry  
**Revision** 3  
**Station** Diablo Canyon Power Plant

### Approvals/Revisions:

Rev	Date	Revision	Preparer	Checker	Owner Approval	Owner
0	06/01/2009	Initial Issue	ridavis 09/23/2008	drlipinski 10/07/2008	malbright 06/01/2009	prsoenen 06/01/2009
1	09/04/2009	Removed reference to DCPP Procedure "OP J-6C:IV", as this does not implement any requirements of NUREG 1801. Incorporated clarifications in Elements 4 and 5 per DCPP comments. Updated Appendix B. Aligned sections 2.2 and 2.3 with LRA Rev. A Appendix A and B, respectively.	ridavis 07/30/2009	drlipinski 08/18/2009	malbright 09/04/2009	prsoenen 09/20/2009
2	10/27/2009	Incorporate LRA-PCTF-DC092	kbryant 10/14/2009	rwbrownsberger 10/22/2009	malbright 10/27/2009	prsoenen 10/27/2009
<u>3</u>	<u>03/12/2010</u>	<u>Incorporate subject matter expert comments; update procedure revisions and associated sections referenced</u>	<u>malbright</u> <u>03/12/2010</u>	<u>ewessel</u> <u>03/12/2010</u>	<u>malbright</u> <u>03/12/2010</u>	<u>prsoenen</u> <u>03/23/2010</u>



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### 1.0 PURPOSE AND METHODOLOGY

#### 1.1 Purpose

The purpose of this Program Evaluation Report is to document and evaluate those activities of the Diablo Canyon Fuel Oil Chemistry aging management program that are credited for managing aging, as part of Diablo Canyon License Renewal to meet the requirements of the License Renewal Rule 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

This includes the following:

- The identification of the scope of the program;
- The evaluation of program elements against NUREG-1801;
- The review of Operating Experience;
- The identification of required program enhancements; and
- The identification of Diablo Canyon documents required to implement the program

#### 1.2 Methodology

The nuclear power plant License Renewal Rule 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," describes the License Renewal process and provides requirements for the contents of License Renewal Applications. 10 CFR 54.21(a)(3) states:

"For each structure and component identified in paragraph (a)(1) of this section, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the Current Licensing Basis (CLB) for the period of extended operation."

The NRC and the industry identified 10 program elements that are useful in describing an aging management program and then demonstrating its effectiveness. These program elements are described in Appendix A.1, Section A.1.2.3 of the Standard Review Plan. NUREG-1801 uses these program elements to describe acceptable aging management programs.

The purpose of this Program Evaluation Report is to describe the basis for the Fuel Oil Chemistry aging management program and associated activities credited for managing aging. This Program Evaluation Report also provides a comparison of the credited Diablo Canyon program with the elements of the corresponding NUREG-1801 program Fuel Oil Chemistry aging management



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program. Project Level Instruction PI-2 “Aging Management Reviews” prescribes the methodology for evaluating Aging Management Programs. An evaluation of Diablo Canyon’s aging management program criteria or activities to those of the NUREG-1801 program elements is performed and a conclusion is reached concerning consistency for each individual program element. Required program enhancements are documented. Completion of the program 10 element evaluation consistent with NUREG-1801 demonstrates that the effects of aging on structures and components subject to Aging Management Review will be adequately managed so that their intended functions will be maintained consistent with the current licensing basis in the period of extended operation.

### 2.0 PROGRAM DESCRIPTION

#### 2.1 Program Description

##### 2.1.1 NUREG-1801

The program includes (a) surveillance and maintenance procedures to mitigate corrosion and (b) measures to verify the effectiveness of an aging management program (AMP) and confirm the insignificance of an aging effect. Fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the plant’s technical specifications and the guidelines of the American Society for Testing Materials (ASTM) Standards D 1796, D 2276, D 2709, D6217, and D 4057. Exposure to fuel oil contaminants, such as water and microbiological organisms, is minimized by periodic draining or cleaning of tanks and by verifying the quality of new oil before its introduction into the storage tanks. However, corrosion may occur at locations in which contaminants may accumulate, such as tank bottoms. Accordingly, the effectiveness of the program is verified to ensure that significant degradation is not occurring and the component’s intended function will be maintained during the extended period of operation. Thickness measurement of tank bottom surfaces is an acceptable verification program.

##### 2.1.2 Diablo Canyon Rev. 2

The Fuel Oil Chemistry program manages loss of material on the internal surface of components in the emergency diesel fuel oil storage and transfer system, portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks. The program includes (a) surveillance and monitoring procedures for maintaining fuel oil quality by controlling contaminants in accordance with applicable ASTM Standards, (b) periodic draining of water from fuel oil tanks,



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(c) visual inspection of internal surfaces during periodic draining and cleaning, (d) one-time ultrasonic wall thickness measurements of accessible portions of the fuel oil tank bottoms ~~if there are indications of reduced cross-sectional thickness found during the visual inspection~~, (e) sampling and analysis of new fuel oil before it is introduced into the fuel oil tanks, and (f) supplemental one-time inspections of a representative sample of components in systems that contain fuel oil by the One-Time Inspection program (A1.16).

Fuel oil quality is maintained by monitoring and controlling fuel oil contaminant in accordance with applicable ASTM Standards (ASTM D1796, D2276, and D4057). This is accomplished by periodic sampling and chemical analysis of the fuel oil inventory at the plant and sampling, testing, and analysis of new fuel oil prior to delivery at the plant. Initial samples of new fuel oil are visually inspected for entrained foreign material and water as precautions during the delivery process to avoid introducing contaminants. If a sample of the new fuel oil does not meet acceptance criteria prior to offload into the diesel fuel oil storage tanks, delivery is discontinued or not allowed.

All samples (except for the portable diesel driven fire pump fuel oil tanks and portable caddy fuel oil tanks) are taken in accordance with ASTM D4057 and are shipped to a laboratory approved in accordance with the DCPD QA program for analysis. Sampling frequency for the Fuel Oil Chemistry Program is defined in DCPD Technical Specifications.

### Diesel Fuel Oil Storage Tanks:

The internal surfaces of the diesel fuel oil storage tanks are periodically drained, cleaned, and visually inspected to detect potential aging. The tank draining and cleaning procedure will be enhanced to provide for supplemental ultrasonic thickness measurements if there are indications of reduced cross sectional thickness found during the visual inspection, which could lead to the loss of the tank's intended function, performed as part of the periodic draining and cleaning of these tanks.

### Diesel Generator Day Tanks:

Fuel oil from the diesel fuel oil day tanks is analyzed to maintain chemical content using the limits specified in the DCPD Technical Specifications for total particulate contamination. The Diesel Fuel Oil Storage Tanks Inspection and Cleaning Procedure will be enhanced to include the periodic draining, cleaning and visual inspection of the diesel generator day tanks.



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Portable Diesel Driven Fire Pump (PDDFP) Fuel Oil Tank and Portable Caddy Fuel Oil Tank:

New fuel oil for the portable diesel driven fire pumps will be inspected prior to introduction into the integral fuel oil tank and the portable caddy fuel oil tank. New fuel oil will undergo water and sediment analysis. An ultrasonic wall thickness measurement will be performed if there is a reduced cross sectional thickness found during visual inspection. Tanks are refilled quarterly during surveillance test procedures, and drained and cleaned annually per maintenance.

The diesel fuel oil storage tanks, diesel fuel oil day tanks, and PDDFP fuel oil tanks, and portable caddy fuel oil tanks will be drained and inspected before the period of extended operation. A representative sample of components in systems that contain fuel oil will be inspected for evidence of aging effects via the One-Time Inspection Program, XI.M32, and the results documented. These inspections will occur prior to the period of extended operation.

### Procedure

STP M-10B, "Diesel Fuel Oil Testing Program"

#### 2.2 LRA Appendix A Rev. 2

The Fuel Oil Chemistry program manages loss of material on the internal surface of components in the emergency diesel fuel oil storage and transfer system, portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks. The program includes (a) surveillance and monitoring procedures for maintaining fuel oil quality by controlling contaminants in accordance with applicable ASTM Standards, (b) periodic draining of water from fuel oil tanks, (c) visual inspection of internal surfaces during periodic draining and cleaning, (d) [one-time](#) ultrasonic wall thickness measurements of [accessible portions of the fuel oil tank bottoms if there are indications of reduced cross-sectional thickness found during the visual inspection](#), (e) sampling and analysis of new fuel oil before it is introduced into the fuel oil tanks, and (f) supplemental one-time inspections of a representative sample of components in systems that contain fuel oil by the One-Time Inspection program (A1.16).

#### 2.3 LRA Appendix B Rev. 2

Program Description



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The Fuel Oil Chemistry program manages loss of material due to general, pitting, crevice and microbiological influenced corrosion on the internal surface of components in the emergency diesel fuel oil storage and transfer system, portable diesel fire pump fuel oil tanks, and portable caddy fuel oil tanks. The program includes (a) surveillance and monitoring procedures for maintaining fuel oil quality by controlling contaminants in accordance with applicable ASTM Standards (ASTM D1796, D2276, and D4057), (b) periodic draining of water from fuel oil tanks, (c) visual inspection of internal surfaces during periodic draining and cleaning, (d) one-time ultrasonic wall thickness measurements of ~~the accessible portions of fuel oil storage tank bottoms if there are indications of reduced cross sectional thickness found during the visual inspection~~, (e) inspection of new fuel oil before it is introduced into the fuel oil tanks, and (f) supplemental one-time inspections of a representative sample of components in systems that contain fuel oil by the One-Time Inspection program ([B2.1.16](#)).

Fuel oil quality is maintained by monitoring and controlling fuel oil contaminants in accordance with applicable ASTM Standards (ASTM D1796, D2276, and D4057). This is accomplished by periodic sampling and chemical analysis of the fuel oil inventory at the plant and sampling, testing, and analysis of new fuel oil prior to delivery and offload into the fuel oil tanks.

The Fuel Oil Chemistry program specifies the requirements for corrective actions when the fuel oil parameters are out of specification. If a sample of the new fuel oil does not meet acceptance criteria prior to offload into the diesel fuel oil storage tanks, delivery is discontinued or not allowed. All samples are taken in accordance with ASTM D4057, with the exception of the portable diesel driven fire pump fuel oil tanks, fuel oil pump head tanks, and the portable caddy fuel oil tanks.

The Fuel Oil Chemistry program uses fuel additives to minimize fuel breakdown and tank corrosion. During the off-loading of new fuel oil shipments into the fuel oil tanks, DCPD adds a biocide to minimize biological activity and a fuel stabilizer/ corrosion-inhibitor to prevent biological breakdown of the diesel fuel oil and prevent tank corrosion.

Tank coatings are not credited for the prevention of any aging effects for license renewal at DCPD. The One-Time Inspection program ([B2.1.16](#)) is used to verify the effectiveness of the Fuel Oil Chemistry program.

Checking and removal of accumulated water in the diesel fuel oil storage tanks once every 31 days (monthly) eliminates the necessary environment for bacterial survival. Periodic inspection for and removal of accumulated water minimizes fouling, the amount of water, and the length of contact time of the fuel oil system. ASTM Standard D1796 is used for determination of water and



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sediment contamination in new diesel fuel oil prior to offload into the diesel fuel oil storage tanks.

Diesel fuel oil day tanks are checked for accumulated water every 31 days (monthly) in accordance with the DCPD Technical Specifications, and the water is removed. The fuel oil in the diesel fuel oil day tanks is analyzed quarterly for total particulate contamination in accordance with ASTM D2276 using the limits specified in the DCPD Technical Specifications.

Fuel oil from the diesel fuel oil storage tanks is analyzed every 31 days (monthly) to maintain chemical content using the limits specified in the DCPD Technical Specifications for total particulate contamination, in accordance with ASTM D2276. A diesel fuel oil storage tank bottom sample is taken quarterly, as well as a recirculation and a multilevel sample. The diesel fuel oil storage tanks are drained, cleaned, and visually inspected every 10 years to detect potential aging effects.

The Fuel Oil Chemistry program will include periodic draining, cleaning and visual inspection of the diesel fuel oil day tanks, the portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks.

The Fuel Oil Chemistry program will ~~provide for~~ include one-time supplemental ultrasonic thickness measurements ~~if there are indications of reduced cross sectional thickness found during the visual inspection of the diesel accessible portions of~~ fuel oil ~~storage tank bottoms, diesel generator day tanks, portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks.~~

### NUREG-1801 Consistency

The Fuel Oil Chemistry program is an existing program that, following enhancement, will be consistent with exception to NUREG 1801, Section XI.M30, Fuel Oil Chemistry.

### Exceptions to NUREG-1801

### Program Elements Affected

### Scope of Program - Element 1

NUREG 1801 specifies the use of ASTM Standards D1796, D2276, D2709, D6217, and D4057. DCPD only uses D1796, D2276, and D4057, as specified in the DCPD Technical Specifications. The testing conducted using ASTM



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D1796 gives quantitative results that, together with the Technical Specification acceptance criteria, meet the intent of the ASTM D2709 method. The use of ASTM D2276, along with acceptance criteria for total particulate concentration of less than 10 mg/liter, instead of ASTM D6217, is required by DCPP Technical Specifications 5.5.13.c.

### Preventive Actions - Element 2 and Monitoring and Trending - Element 5

NUREG-1801 specifies periodic removal of water in the tanks. Water is not removed from the portable diesel-driven fire pump fuel oil tanks, [portable caddy fuel oil tanks](#), [or the fuel oil pump head tanks](#). These are small tanks that do not have provisions to remove water from the tank bottoms.

Consumption of fuel oil [for the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks](#) is the result of quarterly surveillance tests to run the pump for at least 30 minutes. [The fuel oil pump head tanks are replenished on a daily basis with fuel oil from the day tanks. During this process the excess fuel from the fuel oil pump head tanks returns to the day tanks.](#)

The frequent addition of fuel oil and the annual draining and cleaning of the [portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks](#) obviates the need for periodic water removal. New fuel oil is tested in accordance with the Fuel Oil Chemistry program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks.

[The fuel oil pump head tanks are filled with fuel oil from the fuel oil day tanks. The fuel oil day tanks are checked for accumulated water every 31 days \(monthly\), and the water is removed. The frequent addition of fuel oil and the absence of water from the fuel supply assure that water is not being introduced into or accumulating in the fuel oil pump head tanks. Therefore, periodic removal of water from the fuel oil pump head tanks is not necessary.](#)

### Parameters Monitored or Inspected - Element 3

NUREG-1801 specifies periodic sampling for particulate concentration.

The fuel oil in the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks will not be analyzed for particulate concentration since the pumps are tested quarterly. The consumption of fuel oil during the quarterly surveillance test (pump run time of at least 30 minutes) would remove any particulates that accumulated in the tanks. The frequent addition of diesel fuel oil obviates the need for this sampling. Provisions do not exist to sample for particulates. New fuel oil is tested in accordance with the Fuel Oil Chemistry



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program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks.

The fuel oil in the fuel oil pump head tanks will not be analyzed for particulate concentration since the fuel oil in the fuel oil pump head tanks is replenished with fuel oil from the day tanks on a daily cycle. Provisions do not exist to sample for particulates directly from the fuel oil pump head tanks. The fuel oil pump head tanks are filled with fuel oil from the fuel oil day tanks. The fuel oil from the diesel fuel oil day tanks is analyzed quarterly for total particulate contamination in accordance with ASTM D2276 using the limits specified in the DCPP Technical Specifications. The frequent addition of fuel oil and the absence of elevated levels of particulates from the fuel supply assure that high levels of particulates are not being introduced into or accumulating in the fuel oil pump head tanks.

Parameters Monitored or Inspected - Element 3 and Detection of Aging Effects Element 4

NUREG-1801 specifies the use of ASTM Standard D4057 for fuel oil sampling.

ASTM D4057 is not used on the portable diesel-driven fire pump fuel oil tanks, fuel oil pump head tanks, or portable caddy fuel oil tanks. These tanks are too small for multi-level samples to apply. Furthermore, the pumps are tested quarterly. The consumption of fuel oil is the result of the quarterly surveillance test to run the pump for at least 30 minutes. The frequent addition of diesel fuel oil obviates the need for this sampling. New fuel oil is tested in accordance with the Fuel Oil Chemistry program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks.

Provisions do not exist to take samples directly from the fuel oil pump head tanks. The fuel oil pump head tanks are filled with fuel oil from the fuel oil day tanks. The samples taken from the fuel oil day tanks are taken in accordance with ASTM D4057, with the exception of the portable diesel driven fire pump fuel oil tanks, fuel oil pump head tanks, and the portable caddy fuel oil tanks.

Parameters Monitored or Inspected - Element 3 and Acceptance Criteria - Element 6

NUREG-1801 states that ASTM Standards D1796 and D2709 are used for determination of water and sediment contamination. DCPP uses only ASTM D1796 and not D2709. The use of ASTM D1796, along with acceptance criteria for water and sediment contamination of 0.05 volume percent, is required by DCPP Technical Specifications Bases Surveillance



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Requirement 3.8.3.3.c. The testing conducted using ASTM D1796 gives quantitative results that, together with the Technical Specification acceptance criteria, meet the intent of the ASTM D2709 method.

NUREG-1801 specifies the use of a filter with a pore size of 3.0 microns. DCPD uses a filter with a pore size of 0.8 microns per ASTM D2276, Method A as stated in the DCPD Technical Specifications 5.5.13.c.

### Acceptance Criteria - Element 6

NUREG-1801 requires the use of ASTM D6217 for determination of particulates. DCPD uses only ASTM D2276 and not ASTM D6217. The use of ASTM D2276, along with acceptance criteria for total particulate concentration of less than 10 mg/liter, is required by DCPD Technical Specifications 5.5.13.c.

### Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

#### *Preventive Actions - Element 2 and Detection of Aging Effects - Element 4*

Procedures for the diesel generator day tanks and the portable diesel-driven fire pump fuel oil tanks will be enhanced to include the periodic draining, cleaning, and visual inspection of the diesel generator day tanks, the portable diesel-driven fire pump fuel oil tanks, and portable caddy fuel oil tanks.

#### *Parameters Monitored or Inspected - Element 3 and Monitoring and Trending - Element 5*

Procedures for the portable diesel-driven fire pump tanks will be enhanced to include sampling of the new fuel oil prior to introduction into the portable diesel-driven fire pump tanks and portable caddy fuel oil tanks.

#### *Detection of Aging Effects - Element 4*

Procedures will be enhanced to ~~provide for include one-time~~ supplemental ultrasonic thickness measurements ~~if there are indications of reduced cross sectional thickness found during the visual inspection of the diesel accessible portions of~~ fuel oil storage tank ~~bottoms, diesel generator day tanks, portable diesel-driven fire pump fuel oil tanks, and portable caddy fuel oil tanks.~~



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### *Monitoring and Trending - Element 5*

Procedures for the diesel fuel oil storage tanks and the diesel generator day tanks will be enhanced to state that trending of water and particulate levels is controlled in accordance with DCPD Technical Specifications and plant procedures.

Procedures for the portable diesel driven fire pump fuel oil tanks will be enhanced to include monitoring and trending of water and sediment levels of new fuel oil for the portable diesel driven fire pump fuel oil tank and portable caddy fuel oil tanks.

### *Acceptance Criteria - Element 6*

Procedures for the portable diesel driven fire pump fuel oil tanks will be enhanced to state acceptance criteria for new fuel oil being introduced into the portable diesel driven fire pump fuel oil tanks or portable caddy fuel oil tanks.

### **Operating Experience**

The Fuel Oil Chemistry program has been effective in monitoring and controlling diesel fuel oil chemistry to mitigate aging effects. Based on a review of the Corrective Action Program, DCPD has taken timely and effective corrective action to address diesel fuel oil quality concerns and diesel fuel oil system performance issues when requirements were not met. The DCPD operating experience findings for this program identified no unique plant specific operating experience; therefore DCPD operating experience is consistent with NUREG-1801. Maintenance Rule Periodic Assessments and surveillance testing results have proven that the effects of aging are adequately being managed so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation.

In 1988, while performing a surveillance test procedure on the diesel generator, a fuel oil filter became clogged due to biofouling in the day tank. In response, DCPD developed and implemented a biocide, sampling, and inspection program to inhibit the growth of fungus in the diesel generator day tanks. The biofouling event was attributed to lack of sampling and biocide addition to the fuel oil.

During routine quarterly bottom samples of the diesel fuel oil storage tank 0-1 taken in March of 2000, the bulk of the samples taken appeared to be cloudy. There was no water identified in these samples. Samples were sent to an off-site laboratory for evaluation. The results indicated that the cloudiness was precipitation of boron as boric acid, which is a result from the biocide used in



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the fuel oil. The concentration of the biocide added was evaluated, and DCPD revised the procedure for new fuel.

In 2006, there had been several instances where DCPD noticed an increase in particulates in the fuel oil storage and day tanks. In no case did the particulate level ever exceed the Technical Specification limit of 10 mg/liter; however, samples were sent to an off-site laboratory for further evaluation. The results from the laboratory came back satisfactory. Results were entered into the chemistry database, and subsequent samples were closely monitored for any increasing trends. Later samples showed the particulate level to decrease.

Fuel oil quality parameters, including water and sediment ~~volume percentage~~ [contamination](#), are routinely monitored and maintained within acceptance limits and no adverse trends have been identified. In addition, to mitigate against corrosion, the integrity of the diesel fuel oil system is monitored by a leak detection system, which continuously monitors for fuel oil leakage in the fuel oil piping within the trenches, as well as fuel and water leakage in the diesel fuel oil transfer pump vaults and the underground diesel fuel oil tanks. No occurrence of leakage has been detected since the installation of this system in 1994, thus providing further indication that the fuel oil chemistry is maintained to prevent the loss of components' intended function.

The Fuel Oil Chemistry program operating experience information provides objective evidence to support the conclusion that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation.

### Conclusion

The continued implementation of the Fuel Oil Chemistry program, supplemented by the One-Time Inspection program (B2.1.16), provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

#### 2.4 NUREG-1801 Consistency Rev. 0

The DCPD Fuel Oil Chemistry AMP is an existing program, that following enhancement, will be consistent with NUREG-1801 XI.M30 Fuel Oil Chemistry, but takes exception to Elements 1, 2, 3, 4, 5, and 6. The continued implementation of the Fuel Oil Chemistry program provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to



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perform their intended functions consistent with the current licensing basis for the period of extended operation.

### 2.5 Exception to NUREG-1801 Rev. 2

NUREG-1801 specifies the use of ASTM Standards D1796, D2276, D2709, D6217, and D4057. DCPD only uses D1796, D2276, and D4057, as specified in the Technical Specifications. The testing conducted using ASTM D1796 gives quantitative results that, together with the Technical Specification acceptance criteria, meet the intent of the ASTM D2709 method. The use of ASTM D2276, along with acceptance criteria for total particulate concentration of less than 10 mg/liter, instead of ASTM D6217, is required by DCPD Technical Specifications 5.5.13.c. (Element 1)

NUREG-1801 specifies periodic removal of water in the tanks. Water is not removed from the portable diesel driven fire pump fuel oil tanks and portable caddy fuel oil tanks. These are small tanks that do not have provisions to remove water from the tank bottoms. Consumption of fuel oil is the result of quarterly surveillance tests to run the pump for at least 30 minutes. Fuel oil is refilled into the tanks after the each test. The frequent addition of fuel oil and the annual draining and cleaning of the fuel oil tanks obviates the need for periodic water removal. New fuel oil is tested in accordance with the Fuel Oil Chemistry program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks. (Elements 2 and 5)

NUREG-1801 specifies periodic sampling for particulate concentration. The fuel oil in the portable diesel driven fire pump fuel oil tanks and portable caddy fuel oil tanks will not be analyzed for particulate concentration since the pumps are tested quarterly. The consumption of fuel oil during the quarterly surveillance test (pump run time of at least 30 minutes) would remove any particulates that accumulated in the tanks. The frequent addition of diesel fuel oil obviates the need for this sampling. Provisions do not exist to sample for particulates. New fuel oil is tested in accordance with the Fuel Oil Chemistry program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks. (Element 3)

NUREG-1801 specifies the use of ASTM Standard D4057 for fuel oil sampling. ASTM D4057 is not used on the portable diesel driven fire pump fuel oil tanks or portable caddy fuel oil tanks. These tanks are too small for multi-level samples to apply. Furthermore, the pumps are tested quarterly.



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The consumption of fuel oil is the result of the quarterly surveillance test to run the pump for at least 30 minutes. The frequent addition of diesel fuel oil obviates the need for this sampling. New fuel oil is tested in accordance with the Fuel Oil Chemistry program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks. (Elements 3 and 4)

NUREG-1801 states that ASTM Standards D1796 and D2709 are used for the determination of water and sediment contamination. DCPD uses only ASTM D1796 and not D2709. The use of ASTM D1796, along with acceptance criteria for water and sediment contamination of 0.05 volume percent, is required by DCPD Technical Specifications Bases Surveillance Requirement 3.8.3.3.c. The testing conducted using ASTM D1796 gives quantitative results that, together with the Technical Specifications acceptance criteria, meet the intent of the ASTM D2709 method (Element 3 and 6)

NUREG-1801 specifies the use of a filter with a pore size of 3.0 microns. DCPD uses a filter with a pore size of 0.8 microns per ASTM D2276, Method A as stated in the DCPD Technical Specifications 5.5.13.c. (Elements 3 and 6)

NUREG-1801 requires the use of ASTM D6217 for determination of particulates. DCPD uses only ASTM D2276 and not ASTM D6217. The use of ASTM D2276, along with an acceptance criteria for total particulate concentration of less than 10 mg/liter, is required by DCPD Technical Specifications 5.5.13.c. (Element 6)

### 2.6 Enhancements to Plant Program Rev. 1

DCPD Procedure STP M-91A, the Diesel Fuel Oil Storage Tank 10 Year Drain, Clean, and Internal Inspection procedure, will be enhanced to include the periodic draining, cleaning, and visual inspection of the diesel generator day tanks, portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks. (Element 2 and 4)

Procedure STP P-24 will be enhanced to include sampling of the new fuel oil prior to introduction into the portable diesel driven fire pump tanks and portable caddy fuel oil tanks. (Elements 3 and 5)



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DCPP Procedure STP M-91A, the Diesel Fuel Oil Storage Tank 10 Year Drain, Clean, and Internal Inspection procedure, will be enhanced to provide for supplemental ultrasonic thickness measurements if there are indications of reduced cross sectional thickness found during the visual inspection of the diesel fuel oil storage tanks, diesel generator day tanks, portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks. (Element 4).

DCPP Procedure STP M-10B, the Diesel Fuel Oil Testing procedure, will be enhanced for the diesel fuel oil storage tanks and diesel generator day tanks to state that trending of water and particulate levels is controlled in accordance with DCPP Technical Specifications and plant procedures. (Element 5)

Procedure STP P-24 and CAP A-9 will be enhanced to include monitoring and trending of water and sediment levels of new fuel oil for the portable diesel driven fire pump fuel oil tanks and portable caddy fuel oil tanks. (Element 5)

DCPP Procedure STP P-24 will be enhanced to state acceptance criteria for new fuel oil being introduced into the portable diesel driven fire pump fuel oil tanks or portable caddy fuel oil tanks. (Element 6)



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### 3.0 EVALUATION and TECHNICAL BASIS

#### Note

This section is organized by quoting the relevant NUREG-1801 Chapter XI program element followed by the related Diablo Canyon program attributes and a conclusion of the comparison.

Implementing procedure references are included in ( ) for information purposes. This information from the source procedure has been either directly extracted from the procedure or summarized for inclusion into this Program Evaluation Report.

#### 3.1 Scope of Program

##### 3.1.1 NUREG-1801

The program is focused on managing the conditions that cause general, pitting, and microbiologically-influenced corrosion (MIC) of the diesel fuel tank internal surfaces in accordance with the plant's technical specifications ( i.e., NUREG-1430, NUREG-1431, NUREG-1432, NUREG-1433) on fuel oil purity and the guidelines of ASTM Standards D1796, D2276, D2709, D6217, and D4057. The program serves to reduce the potential of exposure of the tank internal surface to fuel oil contaminated with water and microbiological organisms.

##### 3.1.2 Diablo Canyon Rev. 2

The Fuel Oil Chemistry Program manages the loss of material by controlling conditions that would cause general, pitting, crevice, and microbiological influenced corrosion (MIC) on the internal surfaces of the emergency diesel fuel oil storage and diesel fuel oil day tanks, portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks (Reference: STP M-10B, Section 2.1). DCPD uses ASTMs D1796, D2276, and D4057, as specified in the Technical Specification Surveillance Requirement 3.8.3.3.

##### Exceptions to NUREG-1801, Element 1

NUREG-1801 specifies the use of ASTM Standards D1796, D2276, D2709, D6217, and D4057. DCPD only uses D1796, D2276, and D4057. The testing conducted using ASTM D1796 gives quantitative results that, together with the Technical Specification acceptance criteria, meet the intent of the ASTM D2709 method. The use of ASTM D2276, along with acceptance criteria for total particulate concentration of less than 10



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mg/liter, instead of ASTM D6217, is required by DCPD Technical Specifications 5.5.13.c.

### Element 1 Diablo Canyon Program Enhancements

None.

### Element 1 Evaluation Conclusion

This element is consistent with NUREG-1801 Element 1 with exceptions.

## 3.2 Preventative Actions

### 3.2.1 NUREG-1801

The quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. Periodic cleaning of a tank allows removal of sediments, and periodic draining of water collected at the bottom of a tank minimizes the amount of water and the length of contact time. Accordingly, these measures are effective in mitigating corrosion inside diesel fuel oil tanks. Coatings, if used, prevent or mitigate corrosion by protecting the internal surfaces of the tank from contact with water and microbiological organisms.

### 3.2.2 Diablo Canyon Rev. 2

The DCPD Fuel Oil Chemistry AMP addresses preventive measures identified in NUREG-1801 Element 2 Preventive Actions. These include the addition of fuel additives and periodic tank cleaning to remove sediments and water. Tank coatings are not credited for the prevention of any aging effects for license renewal at DCPD.

The DCPD Fuel Oil Chemistry Program uses fuel additives to minimize fuel breakdown and tank corrosion. During the off-loading of new fuel oil shipments into the storage tanks, DCPD adds U.S. Borax Biobor JF (a biocide) to minimize biological activity and Fuel Quality Services Long Term Stability Additive (LTSA, a fuel stabilizer/corrosion-inhibitor) to prevent biological breakdown of the diesel fuel oil and prevent tank corrosion (References: STP M-10B3, Section [6-2.412.5](#); Maintenance Plans 13667, 13668, 13669).

DCPD performs periodic cleanings of its diesel fuel oil storage tanks (Reference: STP M-91A, Section 1.1). The Diesel Fuel Oil Storage Tanks (DFOSTs) Inspection and Cleaning Procedure will be enhanced to include the periodic draining, cleaning, and visual inspection of the diesel generator



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day tanks, portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks.

Checking for accumulated water in the Diesel Fuel Oil Storage Tanks once every 31 days eliminates the necessary environment for bacterial survival. Periodic inspection for and removal of accumulated water minimizes fouling, the amount of water, and the length of contact time of the fuel oil system (Reference: STP M-10A, Sections 2.1, 4.1, 6.2).

Day tanks are checked for accumulated water every 31 days in accordance with DCPD Technical Specifications, and any water is removed. Results are recorded on the Routine Surveillance Test Data Sheet (Reference: STP M-9A, Attachments 9.1 and 9.2, Section 4.1).

Exceptions to NUREG-1801, Element 2

NUREG-1801 specifies periodic removal of water in the tanks. Water is not removed from the portable diesel driven fire pump fuel oil tanks and portable caddy fuel oil tanks. These are small tanks that do not have provisions to remove water from the tank bottoms. Consumption of fuel oil is the result of quarterly surveillance tests to run the pump for at least 30 minutes. Fuel oil is refilled into the tanks after the each test. The frequent addition of fuel oil and the annual draining and cleaning of the fuel oil tanks obviates the need for periodic water removal. New fuel oil is tested in accordance with the Fuel Oil Chemistry program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks.

Element 2 Diablo Canyon Program Enhancements

DCPD Procedure STP M-91A, the Diesel Fuel Oil Storage Tank 10 Year Drain, Clean, and Internal Inspection procedure, will be enhanced to include the periodic draining, cleaning, and visual inspection of the diesel generator day tanks, portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks.

Element 2 Evaluation Conclusion

This element is consistent with NUREG-1801 Element 2 with exceptions.

3.3 Parameters of Monitored or Inspected

3.3.1 NUREG-1801

The AMP monitors fuel oil quality and the levels of water and microbiological organisms in the fuel oil, which cause the loss of material of



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the tank internal surfaces. The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 and D 2709 are used for determination of water and sediment contamination in diesel fuel. For determination of particulates, modified ASTM D 2276, Method A, is used. The modification consists of using a filter with a pore size of 3.0 um, instead of 0.8 um. These are the principal parameters relevant to tank structural integrity.

### 3.3.2 Diablo Canyon Rev. 2

DCPP Fuel Oil Chemistry Program uses the recommendations and methodology of ASTM D4057 for guidance on diesel fuel oil sampling (References: STP M-10B, Section ~~40-37.35.1~~; Technical Specification Bases, SR 3.8.3.3a). ASTM D4057 is not used on the portable diesel driven fire pump fuel oil tanks or portable caddy fuel oil tanks.

The fuel oil in the storage tanks is analyzed every 31 days for total particulate contamination. A DFOST bottom sample is taken quarterly, as well as a recirculation and a multilevel sample (Reference: STP M-10B1, Sections ~~3-14.2~~, ~~3-24.3~~, ~~8~~, and ~~Appendix 12-1~~). ASTM Standard D1796 is used for determination of water and sediment contamination in new diesel fuel oil (References: CAP C-54, Section 10.1; STP M-10B3, ~~Section 4-1~~, ~~Appendix 13-Table 1~~; Technical Specification Bases, SR 3.8.3.3c). Fuel oil storage tanks are checked for water every 31 days (Reference: STP M-10A, Sections 2.1, 4.1, 6.2).

The fuel oil in the day tanks is analyzed quarterly for total particulate contamination using the limits specified in the DCPP TS (Reference: STP M-10B2, Sections ~~4-12~~, 5.1). Fuel oil day tanks are checked for accumulated water every 31 days in accordance with DCPP Technical Specifications, and any water is removed. Results are recorded on the Routine Surveillance Test Data Sheet (Reference: STP M-9A, Attachments 9.1 and 9.2, Section 4.1).

Multiple analyses are performed on new fuel prior to its addition to the storage tanks to ensure no addition of contaminants (Reference: STP M-10B3, Section ~~4-16~~).

DCPP procedures will be enhanced to include periodic testing of new fuel oil prior to introduction into the portable diesel driven fire pump fuel oil tanks



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and portable caddy fuel oil tanks. This will include testing for water and sediment per ASTM 1796. These tanks will not be analyzed for particulate concentration since the consumption of fuel oil is the result of the quarterly surveillance test to run the pump for at least 30 minutes. The frequent addition of diesel fuel oil obviates the need for this sampling.

NUREG-1801 specifies the use of a filter with a pore size of 3.0 microns. DCPD uses a filter with a pore size of 0.8 microns per ASTM D2276, Method A as stated in the DCPD Technical Specifications 5.5.13.c.

### Exceptions to NUREG-1801, Element 3

NUREG-1801 states that ASTM Standards D1796 and D2709 are used for the determination of water and sediment contamination. DCPD uses only ASTM D1796 and not D2709. The use of ASTM D1796, along with acceptance criteria for water and sediment contamination of 0.05 volume percent, is required by DCPD Technical Specifications Bases Surveillance Requirement 3.8.3.3.c. The testing conducted using ASTM D1796 gives quantitative results that, together with the Technical Specifications acceptance criteria, meet the intent of the ASTM D2709 method.

NUREG-1801 specifies the use of a filter with a pore size of 3.0 microns. DCPD uses a filter with a pore size of 0.8 microns per ASTM D2276, Method A as stated in the DCPD Technical Specifications 5.5.13.c.

NUREG-1801 specifies the use of ASTM Standard D4057 for fuel oil sampling. ASTM D4057 is not used on the portable diesel driven fire pump fuel oil tanks or portable caddy fuel oil tanks. These tanks are too small for multi-level samples to apply. Furthermore, the pumps are tested quarterly. The consumption of fuel oil is the result of the quarterly surveillance test to run the pump for at least 30 minutes. The frequent addition of diesel fuel oil obviates the need for this sampling. New fuel oil is tested in accordance with the Fuel Oil Chemistry program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks.

NUREG-1801 specifies periodic sampling for particulate concentration. The fuel oil in the portable diesel driven fire pump fuel oil tanks and portable caddy fuel oil tanks will not be analyzed for particulate concentration since the pumps are tested quarterly. The consumption of fuel oil during the quarterly surveillance test (pump run time of at least 30



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minutes) would remove any particulates that accumulated in the tanks. The frequent addition of diesel fuel oil obviates the need for this sampling. Provisions do not exist to sample for particulates. New fuel oil is tested in accordance with the Fuel Oil Chemistry program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks.

### Element 3 Diablo Canyon Program Enhancements

Procedure STP P-24 will be enhanced to include sampling of the new fuel oil prior to introduction into the portable diesel driven fire pump tanks and portable caddy fuel oil tanks.

### Element 3 Evaluation Conclusion

This element is consistent with NUREG-1801 Element 3 with exceptions.

## 3.4 Detection of Aging Effects

### 3.4.1 NUREG-1801

Degradation of the diesel fuel oil tank cannot occur without exposure of the tank internal surfaces to contaminants in the fuel oil, such as water and microbiological organisms. Compliance with diesel fuel oil standards in item 3, above, and periodic multilevel sampling provide assurance that fuel oil contaminants are below unacceptable levels. Internal surfaces of tanks that are drained for cleaning are visually inspected to detect potential degradation. However, corrosion may occur at locations in which contaminants may accumulate, such as a tank bottom, and an ultrasonic thickness measurement of the tank bottom surface ensures that significant degradation is not occurring.

### 3.4.2 Diablo Canyon Rev. 2

DCPP compliance with diesel fuel oil standards and sampling periodicity is discussed in Element 3.

#### Diesel Fuel Oil Storage Tanks:

Multilevel samples of fuel oil are taken to determine particulate concentration by splitting the tank into thirds (Reference: STP M-10B1, Section [8.4.212.4](#)). The DCPP procedures currently require draining, cleaning, and visual inspection every 10 years to detect potential aging for the diesel fuel oil storage tanks (Reference: STP M-91A, Section 1.1). The fuel oil storage tank drain and clean procedure will be enhanced to provide for supplemental ultrasonic thickness measurements if there are indications



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of reduced cross sectional thickness found during the visual inspection, which could lead to the loss of the tank's intended function.

### Diesel Fuel Oil Day Tanks:

DCPP Procedure STP M-91A will be enhanced to include the ten year periodic draining, cleaning, and visual inspection of the Diesel Fuel Oil Day Tanks. It will also be enhanced to provide for supplemental ultrasonic thickness measurements if there indications of reduced cross sectional thickness found during the visual inspection which could lead to the loss of the tank's intended function.

### Portable Diesel Driven Fire Pumps Fuel Oil Tank and Portable Caddy Fuel Oil Tank:

A DCPP procedure will be enhanced to include periodic visual inspection and cleaning of the fuel oil tanks for the portable diesel driven fire pumps and their portable caddy fuel oil tanks. It will also be enhanced to provide for supplemental ultrasonic thickness measurements if there is indication of reduced cross sectional thickness found during the visual inspection. DCPP does not perform multi-level sampling on these tanks.

### Diesel Fuel Oil Storage and Day Tanks, Portable Diesel Driven Fire Pump Fuel Oil Tank and Portable Caddy Fuel Oil Tank:

The periodic sampling, cleaning, and visual inspection of the fuel oil tanks will ensure that significant aging is not occurring. The effectiveness of the Fuel Oil Chemistry Program will be verified by a one-time inspection of a representative sample of components in systems that contain fuel oil. The one-time inspection will be performed before the period of extended operation.

### Exceptions to NUREG-1801, Element 4

NUREG-1801 specifies the use of ASTM Standard D4057 for fuel oil sampling. ASTM D4057 is not used on the portable diesel driven fire pump fuel oil tanks or portable caddy fuel oil tanks. These tanks are too small for multi-level samples to apply. Furthermore, the pumps are tested quarterly. The consumption of fuel oil is the result of the quarterly surveillance test to run the pump for at least 30 minutes. The frequent addition of diesel fuel oil obviates the need for this sampling. New fuel oil is tested in accordance with the Fuel Oil Chemistry program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks.



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### Element 4 Diablo Canyon Program Enhancements

Enhance STP M-91A inspection procedure to provide for supplemental ultrasonic thickness measurements if there are indications of reduced cross sectional thickness found during the visual inspection of the diesel fuel oil storage tanks, diesel generator day tanks, portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks.

DCPP Procedure STP M-91A, the Diesel Fuel Oil Storage Tank 10 Year Drain, Clean, and Internal Inspection procedure, will be enhanced to include the periodic draining, cleaning, and visual inspection of the diesel generator day tanks, portable diesel driven fire pump fuel oil tanks, and portable caddy fuel oil tanks.

### Element 4 Evaluation Conclusion

This element is consistent with NUREG-1801 Element 4 with exceptions.

#### 3.5 Monitoring and Trending

##### 3.5.1 NUREG-1801

Water and biological activity or particulate contamination concentrations are monitored and trended in accordance with the plant's technical specifications or at least quarterly. Based on industry operating experience, quarterly sampling and analysis of fuel oil provides for timely detection of conditions conducive to corrosion of the internal surface of the diesel fuel oil tank before the potential loss of its intended function.

##### 3.5.2 Diablo Canyon Rev. 2

The DCPP Chemistry Database is used to capture and store fuel oil analysis results. The database is used to as a tool to trend water and particulate concentrations.

##### Diesel Fuel Oil Storage Tanks:

Diesel fuel oil storage tanks are sampled every 31 days for total particulate contamination, and quarterly to monitor the accumulation of sediment (Reference: STP M-10B1, Sections [3-14.3](#) & [3-24.4](#)). DCPP checks for and removes water from the diesel fuel oil storage tanks every 31 days (Reference: STP M-10A, Sections 2.1, 4.1, 6.2).

##### Diesel Generator Day Tanks:

Diesel Generator Day Tanks are monitored for sediment formation and total particulate contamination by analyzing samples that are taken quarterly



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(Reference: STP M-10B<sup>2</sup>, Sections 4.1.1 and 4.4.2). The parameters are measured in accordance with DCPD Technical Specifications (Reference: STP M-10B<sup>2</sup>, Section 45.1). DCPD checks for and removes water from the diesel fuel oil day tanks every 31 days (Reference: STP M-9A, Attachments 9.1 and 9.2, Section 4.1).

Portable Diesel Driven Fire Pump Fuel Oil Tank and Portable Caddy Fuel Oil Tank:

DCPD procedures will be enhanced to monitor and trend the new fuel oil introduced to the portable diesel driven fire pump fuel oil tanks and portable caddy fuel oil tanks. New fuel oil will be sampled and tested for water and sediment prior to the introduction into the tanks.

### Exceptions to NUREG-1801, Element 5

NUREG-1801 specifies periodic removal of water in the tanks. Water is not removed from the portable diesel driven fire pump fuel oil tanks and portable caddy fuel oil tanks. These are small tanks that do not have provisions to remove water from the tank bottoms. Consumption of fuel oil is the result of quarterly surveillance tests to run the pump for at least 30 minutes. Fuel oil is refilled in the tanks after the each test. The frequent addition of fuel oil and the annual draining and cleaning of the fuel oil tanks obviates the need for periodic water removal. New fuel oil is tested in accordance with the Fuel Oil Chemistry program prior to introduction into the portable diesel-driven fire pump fuel oil tanks and portable caddy fuel oil tanks.

### Element 5 Diablo Canyon Program Enhancements

Diesel Fuel Oil Testing Procedure STP M-10B will be enhanced for the diesel fuel oil storage tanks and diesel generator day tanks to state that trending of water and particulate levels is controlled in accordance with DCPD Technical Specifications and plant procedures.

Procedure STP P-24 will be enhanced to include sampling of the new fuel oil prior to introduction into the portable diesel driven fire pump tanks and portable caddy fuel oil tanks.

Procedure STP P-24 and CAP A-9 will be enhanced to include monitoring and trending of water and sediment levels for new fuel oil for the portable diesel driven fire pump fuel oil tank and portable caddy fuel oil tanks.



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### Element 5 Evaluation Conclusion

This element is consistent with NUREG-1801 Element 5 with exceptions.

#### 3.6 Acceptance Criteria

##### 3.6.1 NUREG-1801

The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 and D 2709 are used for guidance on the determination of water and sediment contamination in diesel fuel. ASTM D 6217 and Modified D 2276, Method A are used for guidance for determination of particulates. The modification to D 2276 consists of using a filter with a pore size of 3.0 um, instead of 0.8 um.

##### 3.6.2 Diablo Canyon Rev. 0

DCPP uses ASTM Standard D4057 for guidance on oil sampling (Reference: STP M-10B, Section 1.[24](#)).

NUREG-1801 states that ASTM Standards D1796 and D2709 are used for the determination of water and sediment contamination. DCPP uses only ASTM D1796 and not D2709. The use of ASTM D1796, along with acceptance criteria for water and sediment contamination of 0.05 volume percent, is required by DCPP Technical Specifications Bases Surveillance Requirement 3.8.3.3.c. The testing conducted using ASTM D1796 gives quantitative results that, together with the Technical Specifications acceptance criteria, meet the intent of the ASTM D2709 method.

NUREG-1801 specifies the use of a filter with a pore size of 3.0 microns. DCPP uses a filter with a pore size of 0.8 microns per ASTM D2276, Method A as stated in the DCPP Technical Specifications 5.5.13.c.

NUREG-1801 requires the use of ASTM D6217 for determination of particulates. DCPP uses only ASTM D2276 and not ASTM D6217. The use of ASTM D2276, along with an acceptance criteria for total particulate concentration of less than 10 mg/liter, is required by DCPP Technical Specifications 5.5.13.c.

The acceptance criteria for the diesel fuel oil introduced to the diesel generator fuel oil storage tanks and day tanks are as follows (Reference: STP M-10B3, [Appendix 13-Table 1](#)):

Parameter; Units; Value

Particulate Concentration; mg/L; ≤10



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API Gravity; API; 27 - 42  
Flash Point; °F; ≥125  
Kinematic Viscosity; cSt @40°C; 1.9 - 4.1  
Water and Sediment (new fuel oil only); % Vol.; ≤0.05  
Cloud Point; °C; ≤5  
ASTM Color; ≤5  
Carbon Residue; % mass; ≤0.35  
Ash Weight; % mass; ≤0.01  
Distillation Temp; C 90% vol. recovered; 282 - 338  
Sulfur; % mass; ≤0.5  
Copper Strip Corrosion; ≤No. 3  
Cetane Number; ≥40

The acceptance criterion for the fuel oil introduced to the portable diesel driven fire pump fuel oil tanks or portable caddy fuel oil tanks is less than or equal to 0.05 volume percent for water and sediment (Reference: STP M-10B3, [Appendix 13-Table 1](#)). A DCPD Procedure will be enhanced to state the acceptance criteria for new fuel oil being introduced into these tanks.

### Exceptions to NUREG-1801, Element 6

NUREG-1801 states that ASTM Standards D1796 and D2709 are used for the determination of water and sediment contamination. DCPD uses only ASTM D1796 and not D2709. The use of ASTM D1796, along with acceptance criteria for water and sediment contamination of 0.05 volume percent, is required by DCPD Technical Specifications Bases Surveillance Requirement 3.8.3.3.c. The testing conducted using ASTM D1796 gives quantitative results that, together with the Technical Specifications acceptance criteria, meet the intent of the ASTM D2709 method.

NUREG-1801 requires the use of ASTM D6217 for determination of particulates. DCPD uses only ASTM D2276 and not ASTM D6217. The use of ASTM D2276, along with ~~an~~ acceptance criteria for total particulate concentration of less than 10 mg/liter, is required by DCPD Technical Specifications 5.5.13.c.

NUREG-1801 specifies the use of a filter with a pore size of 3.0 microns. DCPD uses a filter with a pore size of 0.8 microns per ASTM D2276, Method A as stated in the DCPD Technical Specifications 5.5.13.c.

### Element 6 Diablo Canyon Program Enhancements



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DCPP Procedure STP P-24 will be enhanced to state acceptance criteria for new fuel oil being introduced into the portable diesel driven fire pump fuel oil tanks or portable caddy fuel oil tanks.

### Element 6 Evaluation Conclusion

This element is consistent with NUREG-1801 Element 6 with exceptions.

### 3.7 Corrective Actions

#### 3.7.1 NUREG-1801

Specific corrective actions are implemented in accordance with the plant quality assurance (QA) program. For example, corrective actions are taken to prevent recurrence when the specified limits for fuel oil standards are exceeded or when water is drained during periodic surveillance. Also, when the presence of biological activity is confirmed, a biocide is added to fuel oil. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the corrective actions.

#### 3.7.2 Diablo Canyon Rev. 0

The Diesel Fuel Oil Chemistry Program specifies the requirements for corrective actions when the fuel oil parameters are out of specification (References: STP M-10B1, Section 5-16; STP M-10B2, Section 6.1; STP M-10B3, Section 6.1).

DCPP site QA procedures, review and approval process, and administrative controls are implemented in accordance with the requirements of 10 CFR 50 Appendix B and are acceptable in addressing corrective actions. The QA program includes elements of corrective action, confirmation process and administrative controls and is applicable to the safety-related and non-safety related systems, structures and components (SSCs) that are subject to aging management review. (Reference: DCPP FSAR Chapter 17.2 "Quality Assurance Program and implementing Program Directives OM5 "Quality Assurance Program and OM7 Corrective Action Program).

### Exceptions to NUREG-1801, Element 7

None

### Element 7 Diablo Canyon Program Enhancements

None.

### Element 7 Evaluation Conclusion



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This element is consistent with NUREG-1801 Element 7.

3.8 Confirmation Process

3.8.1 NUREG-1801

Site QA procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process and administrative controls.

3.8.2 Diablo Canyon Rev. 0

DCPP QA procedures and review and approval processes are implemented in accordance with the requirements of 10 CFR 50 Appendix B and include: administrative controls as described in DCPP FSAR Section 17.2 and provisions that specify when follow-up actions are required to be taken to verify that corrective actions are effective and those implemented to address significant conditions adverse to quality are effective in preventing recurrence of the condition. (Reference: DCPP Program Directives OM5 Quality Assurance Program, OM7 Corrective Action Program and AD1 "Administrative Controls Program.")

Exceptions to NUREG-1801, Element 8

None

Element 8 Diablo Canyon Program Enhancements

None.

Element 8 Evaluation Conclusion

This element is consistent with NUREG-1801 Element 8.

3.9 Administrative Controls

3.9.1 NUREG-1801

See Item 8

3.9.2 Diablo Canyon Rev. 0

See Item 8

Exceptions to NUREG-1801, Element 9

None

Element 9 Diablo Canyon Program Enhancements

None.

Element 9 Evaluation Conclusion

This element is consistent with NUREG-1801 Element 9.



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### 3.10 Operating Experience

#### 3.10.1 NUREG-1801

The operating experience at some plants has included identification of water in the fuel, particulate contamination, and biological fouling. However, no instances of fuel oil system component failures attributed to contamination have been identified.

#### 3.10.2 Diablo Canyon Rev. 2

Fuel oil chemistry experience at DCPD is evaluated and monitored to effectively maintain fuel oil quality in the Diesel Fuel Oil System. This is accomplished by promptly identifying and documenting (using the Corrective Action Program) any conditions or events that could compromise operability of Diesel Fuel Oil System components. In addition, industry operating experience provides input to ensure that the program is maintained.

In 1988 while performing a surveillance test procedure on the diesel generator, a primary fuel oil filter became clogged due to biofouling in the day tank. In response, DCPD developed and implemented a biocide, sampling, and inspection program to inhibit the growth of fungus in the diesel generator day tanks. The biofouling event was attributed to lack of sampling and biocide addition to the fuel oil (Reference: PG&E Letter DCL-88-195).

On June 3, 1997, the Unit 1 diesel fuel oil storage tank received a shipment of fuel. When sampling per the procedure for new fuel, the accelerated stability was shown to be above normal limits. This parameter is not governed by DCPD Technical Specifications, so the fuel was accepted. However, the next shipments for new fuel were closely monitored to determine if a negative trend was occurring. Subsequent shipments of new fuel revealed acceptable values for accelerated stability (Reference AR A0434425).

During routine quarterly bottom samples of the diesel fuel oil storage tank 0-1 taken in March of 2000, the bulk of the samples taken appeared to be cloudy. There was no water identified in these samples. Samples were sent to an off-site laboratory to evaluate the samples. The results indicated that the cloudiness was precipitation of boron as boric acid, which is a result from the biocide used in the fuel oil. The concentration of the biocide



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added was evaluated, and DCPD revised the procedure for new fuel (Reference: AR A0504266).

In 2006, there had been several instances where DCPD noticed an increase in particulates in the fuel oil storage and day tanks. In no case did the particulate level ever exceed the Technical Specification limit of 10 mg/liter; however, samples were sent to an off-site laboratory for further evaluation. The results from the laboratory came back satisfactory. Results were entered into the chemistry database, and subsequent samples were closely monitored for any increasing trends. Later samples showed the particulate level to decrease (References: ARs A0681634, A0681636, and A0669239).

The Diesel Fuel Oil system is monitored by a leak detection system, which continuously monitors for fuel oil leakage in the fuel oil piping within the trenches, as well as fuel and water leakage in the Diesel Fuel Oil transfer pump vaults and the underground Diesel Fuel Oil tanks. No occurrence of leakage has been reported since the installation of this system in 1994.

There have been no fuel oil related issues identified with the Portable Diesel Driven Fire Pumps. A review of 10 years of DCPD operating experience shows that issues relating to biofouling, loss of material, or water in the Diesel Fuel Oil System have been identified and corrected. The DCPD operating experience findings for this program identified no unique plant specific operating experience, therefore DCPD operating experience is consistent with NUREG-1801. The Fuel Oil Chemistry Program operating experience information provides objective evidence to support the conclusion that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation.

### Exceptions to NUREG-1801, Element 10

None

### Element 10 Evaluation Conclusion

This element is consistent with NUREG-1801 Element 10.

## 4.0 REFERENCES Rev. 2

- 4.1 STP M-10B, "Diesel Fuel Oil Testing Program," Rev. ~~48~~19



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- 4.2 STP M-10B1, "Emergency Diesel Fuel Oil Tank Analysis," Rev. 810
- 4.3 STP M-10B2, "Diesel Generator Day Tanks Fuel Oil Analysis," Rev. 45
- 4.4 STP M-10B3, "New Fuel Oil Shipment Analysis," Rev. 79
- 4.5 STP M-9A, "Diesel Engine Generator Routine Surveillance Test," Rev. 7983
- 4.6 STP M-91A, "Diesel Fuel Oil Storage Tanks Inspection and Cleaning," Rev. 7
- 4.7 STP M-10A, "Diesel Fuel Oil Tank Inventory," Rev. 18
- 4.8 DCPD Technical Specification 3.8, "Electrical Power Systems," Rev. 78
- 4.9 DCPD Technical Specification Bases Section 3.8, "Electrical Power Systems," Rev. 5b
- 4.10 FSAR Sections 9.5.4.2 and 9.5.4, Rev. 18
- 4.11 STP P-24, "Testing of the Portable Long Term Cooling Water Pumps," Rev. 2021
- 4.12 CAP C-54, "Water and Sediment," Rev. 2
- 4.13 CAP C-71, "Total Particulate Contamination of Fuel Oil," Rev. 6A7
- 4.14 DCPD Technical Specifications 5.5.13, "Diesel Fuel Oil Test Program," Rev. 2227
- 4.15 OM5, "Quality Assurance Program", Rev. 5A
- 4.16 OM7, "Corrective Action Program", Rev. 4
- 4.17 FSAR 17.2 "Quality Assurance Program", Rev. 18
- 4.18 Maintenance Plan 13667, FPDDP 1: Oil Sample-Change/Clean/Insp PM 52000"
- 4.19 Maintenance Plan 13668, FPDDP 2: Oil Sample-Change/Clean/Insp PM 52001"
- 4.20 Maintenance Plan 13669, FPDDP 3: Oil Sample-Change/Clean/Insp PM 52002"

**5.0 COMMENTS/OPEN ITEMS Rev. 2**

5.1 Comments/Additional Information

1. Element 2 initially discusses LTSA in detail and was going to enhance a procedure to state specifically what the chemical does. This enhancement was removed from the AMP, but below is the additional detail regarding LTSA for future reference if needed.

LTSA is a fuel oxidation inhibitor with DuPont FOA-15 as its active ingredient. This additive has the effect of eliminating oxidation concerns in the system, and therefore the corrosion mechanism is not considered active.

2. Maintenance Plans 13667, 13668, & 13669 are in place to annually inspect the cart and wheels of the portable equipment associated with the Portable Diesel Driven Fire Pumps. These Maintenance Plans also specify to contact



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the Chemistry foreman to add Biobor and LTSA to both tanks associated with the PDDFPs.

3. Currently, there are no provisions to remove/drain water from the PDDFP tanks or fuel oil caddy tanks. So an exception is being taken not to drain based on the quarterly surveillance test (STP P-24) and annual Maintenance Plans and run the pump and drain the tanks, respectively. A future modification by the site may install drain valves or other provisions to perform the drain in the future, but the AMP is not taking credit for this.

4. The acceptance criterion for water and sediment in PDDFP tanks is less than or equal to 0.05 volume percent, as noted in the PER. The reference is the New Fuel Oil procedure for the Emergency Diesel Fuel Oil (STP M-10B3). This value however, is not in the STP P-24 procedure, which is where this test will be procedurally performed once STP P-24 is enhanced. Therefore, an enhancement is being written to enhance STP P-24 to refer to ~~the Appendix 43-Table~~ 1 of STP M-10B3 for the acceptance criterion.

Also, the exception related to acceptance criteria for the PDDFP tanks has been removed.

5. Further support information regarding the exception to not use ASTM D6217 for particulate determination:

ASTM D6217 states that it is the first ASTM standard test method for assessing the mass quantity of particulates in middle distillate fuels. Test Method D2276 was developed for aviation fuels and used 1 gallon or 5 liters of fuel sample. Using greater ~~that~~ than or equal to one 1 gallon of middle distillate fuel often requires significant time to complete the filtration. The D6217 test method uses about a quarter of the volume as the D2276 aviation fuel method. There is no indication that ASTM D6217 is either technically superior to D2276 as far as managing the effects of aging (it merely allows for faster filtration), or that the combination of the two standards adds any value beyond using just D2276 itself.

5a. Beaver Valley took exception to using ASTM D6217 and used only ASTM D2276 to determine particulate concentration. The NRC's SER,



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Exception 2, acknowledges this fact. Beaver Valley's justification was, "BVPS does not use ASTM standard D 6217. BVPS uses ASTM D 2276 versus ASTM D 6217 for guidance on the determination of particulate contamination. The use of ASTM D 2276, with an acceptance criterion of a total particulate contamination of less than 10 mg/liter, is required by BVPS Technical Specification Surveillance Requirements." The NRC found this to be acceptable after review of the referenced Technical Specifications. Therefore, the additional detail noted above is not used as part of Diablo Canyon's justification to this exception.

### 5.2 Open Items

None.