**Draft
White Paper**

**Mercury Issues Related
to NPDES and the
CERCLA Watershed
Project at the
Oak Ridge Y-12 Plant**

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Environmental Management Activities
at the

OAK RIDGE Y-12 PLANT
managed by
Lockheed Martin Energy Systems, Inc.

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1. INTRODUCTION

1.1 GENERAL MERCURY BACKGROUND INFORMATION

Between 1953 and 1983, operation of the lithium isotope separation processes at the Oak Ridge Y-12 Plant resulted in the release of 108,000–212,000 kg (239,000–470,000 lb) of mercury into East Fork Poplar Creek (EFPC). Although the primary mercury loss from the Y-12 Plant stopped in 1963, mercury continues to be released into EFPC. The portion of EFPC that occurs within the Y-12 Plant and the Oak Ridge Reservation (ORR) boundary is generally referred to as “Upper EFPC.” EFPC from Bear Creek Road to its confluence with Poplar Creek near the K-25 Plant is generally referred to as “Lower EFPC.”

Point sources of mercury constitute almost all of the dry weather loading of mercury to Upper EFPC and include mercury-contaminated shallow groundwater captured in basement sumps in several buildings and then pumped into the storm drain system; mercury-contaminated natural spring flow into the creek via Outfall 51; and mercury-contaminated piping, both internal and external, to several buildings through which water (mainly cooling water and condensate) passes en route to the creek (Y/ER-251, Energy Systems 1995). During storm events, total mercury levels in surface water increase by up to an order of magnitude. The mercury, however, is largely associated with suspended matter; dissolved mercury levels remain relatively constant over a storm event. Discharge, total mercury, and total suspended solids are highly correlated, as expected.

Mercury is present at elevated levels in surface soils throughout much of the Y-12 Plant and may be the source of the wet weather mercury loading to the creek. Mercury stored in the stream

bed is also mobilized during storm events. Non-point-source mercury represents a significant challenge to control. Although particle-associated total mercury is not generally bioavailable, nor does it have a toxic effect on aquatic life, it is deposited at some point downstream and may become available for conversion to other chemical forms and within the food chain. The current total mercury release averages approximately 12–15 gm/day (0.42–0.525 oz./day), down from 100 gm/day (3.5 oz./day) in 1985. Efforts continue to further reduce mercury losses (Energy Systems 1995). The U.S. Department of Energy (DOE) is systematically working to reduce mercury losses under the Reduction of Mercury in Plant Effluents (RMPE) program, which will be discussed in Sect. 2.

1.2 NPDES DRIVER

The current National Pollutant Discharge Elimination System (NPDES) permit (TN0002968) for Y-12 Plant discharges under the Clean Water Act (CWA) sets a water quality limit for total mercury at Station 17 (the location where EFPC leaves the ORR on the last day of the permit (April 27, 2000) of 0.012 µg/L. This limit is the state water quality criterion for protection of fish and aquatic life and is equivalent to the federal standard. DOE has appealed several of the permit conditions. The appeal is discussed in Sect. 5.2. The permit also specifies a compliance limit of 5 gm/day of total mercury at Station 17 by December 31, 1998. A mercury loading of 5 gm/day is equivalent to an instream concentration of approximately 0.2 µg/L. The 5 gm/day is based on the 90-day average daily value excluding storm flows exceeding 15 million gallons per day (MGD) and also assumes a base flow of 7 MGD, which is maintained by flow

**Major Mercury Compliance
Milestones/Limits**

- 5 gm/day loading by 12-31-98
- 0.012 ppb instream at Station 17 on last day of permit (4-27-00)

augmentation with about 4 MGD of raw water from Melton Hill Lake.

The current average instream total mercury concentration is approximately 0.8 µg/L. The permit contains a compliance schedule for a number of remediation and treatment activities, which are presented below, that are specifically designed to reduce mercury levels in plant effluents to meet the 5 gm/day limit. These activities will not allow compliance with the 0.012 µg/L standard.

Apparently, the Tennessee Department of Environment and Conservation (TDEC) is not planning to include the Y-12 Plant permit among those that will be phased into the watershed management permitting program in 1998. It is likely being excluded because of the difficult issues surrounding the permit appeal and the time it will take to resolve these issues. More details concerning the proposed watershed management permitting program are presented in Sect. 4.2.

1.3 THE UPPER EFPC WATERSHED CERCLA PROJECT

The Upper EFPC Watershed Remedial Investigation (RI)/Feasibility Study (FS) is one of five watershed investigations currently ongoing on the ORR. The objectives of the projects are to evaluate the nature and extent of contamination to provide the data necessary to support human health and ecological risk assessments and to support development and evaluation of remedial alternatives to reduce risk to an acceptable level. This project is addressing all contaminants and sources of contamination, including mercury, and therefore has many areas of overlap with the

NPDES/RMPE program. This Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) action must comply with some of the same state regulations that the NPDES/RMPE program addresses.

The CERCLA project will face a test of compliance with the 0.012 µg/L criterion that will be an applicable or relevant and appropriate requirement (ARAR). CERCLA provides a mechanism for waiving ARARs; however, TDEC has recently (summer 1996) refused to issue an ARARs waiver of the mercury criterion for a Record of Decision (ROD) for the Clinch River/Poplar Creek project proposed by DOE. The strategy that is needed will address and/or solve both program issues/dilemmas.

1.4 WHY THIS EVALUATION AND SOME ACTION MAY BE NECESSARY

This evaluation is necessary because there is currently no clear path toward achieving compliance with permit conditions at the end of the permit period. Given the language in the permit rationale and the fact that the criterion applies on the last day of the permit, it appears that TDEC recognizes that compliance with the 0.012 µg/L criterion is not possible. Current project scopes, baselines, and funding do not include actions required to meet the limit. Some additional activities or actions must be identified to achieve compliance, and they need to be identified and planned now to allow time for such steps as design, procurement, and implementation before the end of the permit. A couple of options for achieving compliance rely on administrative decisions and processes that are currently ongoing. DOE now has an opportunity to engage TDEC in a couple of ways to participate in developing a compliance strategy that works for both the NPDES/RMPE and the CERCLA Upper EFPC programs.

1.5 PURPOSE OF THIS DOCUMENT

The purpose of this document is to present the current understanding of the issues and options surrounding compliance with the current NPDES permit conditions. This is a complicated issue that directly impacts, and will be directly impacted by, ongoing CERCLA activities in Lower EFPC and the Clinch River/Poplar Creek. It may be necessary to "reconstitute the whole" and combine actions and decisions regarding the entire creek (origin to confluence with the Clinch River) to develop a viable long-term strategy that

meets regulatory goals and requirements as well as those of DOE's 10-Year Plan and the new watershed management permitting approach.

This document presents background information on the RMPE and NPDES programs insofar as it is needed to understand the issues and options. A tremendous amount of data has been collected to support the NPDES/RMPE and CERCLA programs. These data are not presented, although they may be referenced and conclusions based on them may be presented, as necessary, to support discussion of the options.

2. RMPE OVERVIEW

2.1 PROGRAM BACKGROUND

Mercury source area characterization has been ongoing intermittently since 1982; more comprehensive surveys were conducted in the mid-1980s, 1990, and 1993–1995. The results of these surveys and characterization projects have led to a series of actions that have been taken and are currently under way at the Y-12 Plant in mercury-use areas. These actions specifically address mercury in the Y-12 Plant environment and in surface water leaving the plant. The RMPE program was established to mitigate current sources of mercury from selected Y-12 Plant buildings that were identified as significant sources of mercury in plant effluents discharged to Upper EFPC. The goal of the program is to comply with the limits for mercury concentration in the NPDES permit (TN0002968), which was issued in July 1995 under the Clean Water Act (CWA).

The RMPE program was specifically designed to reduce total mercury discharges and non-point sources to meet the 5 gm/day limit. The remedial actions, some of which have been completed, include source removal, source elimination, and source minimization. Source removal refers to removing mercury sources that are obvious and can be removed in a cost-effective manner (e.g., visible mercury in a storm drain or sump). Removal of mercury, when found in sanitary or storm sewers, building piping, or soil excavations, is an ongoing activity. RMPE is supported by other divisions in removing mercury at the Y-12 Plant. The Mercury Recovery Response Team, working under the direction of the Y-12 Emergency Spill Response Team Coordinator, has removed several hundred pounds of visible elemental mercury from drains and process piping at the Y-12 Plant.

Source elimination activities include sampling to identify contaminated building pipes that have clean water flow, as well as remedial actions, which may include relocation, replacement, or cleaning and relining of contaminated pipes. Resampling follows design and construction to verify that the action has been successful.

Source minimization is accomplished by capturing the flow and installing treatment capabilities when the source cannot be eliminated, avoided, or mitigated to acceptable levels.

RMPE Program Highlights

- *Eliminates all major point sources of mercury.*
- *Provides treatment of major known sources of mercury.*
- *Designed to meet 5 gm/day loading requirement.*
- *Does not presently define actions to meet 0.012 µg/L limit.*

2.2 STATUS OF ONGOING AND PLANNED ACTIVITIES

The status of each mercury remediation activity identified in the NPDES permit is presented in Table 1. The compliance completion dates noted in the table refer to the compliance schedule appearing in the current NPDES permit.

Once the actions described in Table 1 have been completed, most known significant point sources of mercury will have been eliminated.

Table 1. Status of mercury remediation activities identified in the NPDES permit

Activity/requirement	Compliance completion date	Status
Source Elimination – 9201-2	12/01/95	Completed 7/30/94
Source Elimination – 9201-5	06/01/96	Original scope completed 1/31/95 Added scope completed 1/31/96
Source Elimination – 9201-4	09/01/96	Completed 10/20/95
Source Elimination – 9204-4	01/01/97	Completed 11/30/95 Added scope completed 01/31/96
East End Treatment System	01/01/98	Completed 5/6/96
Central Mercury Treatment System	01/01/98	Scheduled completion 1/31/97
Hg loading <5 gm/day at Station 17	12/31/98	Under appeal (15 MGD storm exclusion)
Total Hg concentration of 0.012 µg/L at Station 17	4/27/00	Under appeal

Initial calculations suggested that completion of the projects identified in Table 1 would reduce the mercury loading to the 5 gm/day (90-day average) level; however, actual reductions have not occurred at the projected levels. Because of these unexpected results and the fact that under dry weather conditions Lake Reality is currently acting as a net source of mercury, contributing 5 gm/day of mercury under dry weather conditions, additional projects/activities have been identified to offset the shortfall in reductions from the Table 1 projects to reach the 5 gm/day limit in the permit.

The four projects below have been identified and are ongoing in either a planning or an implementation phase.

- Lake Reality Bypass
- Treatment of Outfall 51 discharge
- Treatment of flow from N/S Pipes with stannous chloride
- Collection/treatment of flow to catch basin E-3250

Lake Reality Bypass

Construction of a siphon-system has been completed to bypass Lake Reality (i.e., flow from the diversion channel that normally discharges to Lake Reality will flow directly into the creek channel adjacent to the Lake Reality outlet). The bypass project will be evaluated to determine if it should be continued long-term, in which case Lake Reality would be cleaned out and used for spill control purposes only.

Treatment of Outfall 51 Discharge

Outfall 51 drains a large spring located just south of Building 9201-2; the spring flow is the only flow in the outfall. The flow rate of the outfall ranges from 66 to 130 gal/min, and the range in mercury concentration is 3 to 8 µg/L, resulting in a loading rate of 2–3 gm/day of mercury. Mercury in this outfall exhibits speciation unique from that of other outfalls at the Y-12 in that up to 30% of the mercury is in the elemental form and therefore is potentially air strippable (Energy Systems 1995). Studies were conducted in 1996 to evaluate the use of air stripping to remove elemental mercury from the Outfall 51 discharge. In these studies trace concentrations of stannous chloride were added to convert the dissolved mercury to elemental

mercury, which was subsequently removed by air stripping at an efficiency rate in the range of 95% for the elemental mercury and approximately 75–80% for the total mercury. An engineering analysis is currently under way to evaluate treatment by air stripping versus carbon treatment at Outfall 51; no decision has been made to date.

Treatment at N/S Pipes

A treatability study plan is currently being developed to evaluate the viability of treating dry weather flow at N/S Pipes (~2 MGD) using the stannous chloride/air stripping method. This approach may be viable at this location because a large percentage of the mercury present is in the dissolved form, which can be converted to the elemental/strippable form. The current mercury loading in flow from the N/S Pipe is 7 gm/day, which represents roughly half of the total load. Some of the 7 gm/day loading will be treated and removed by the Central Mercury Treatment System (CMTS) when it becomes operational in March 1997.

Treatment of E-3250 Catch Basin

Recent investigations of the Outfall 169 catch basin and storm drain system have identified a significant source of mercury (1.5–12 gm/day) in upstream catch basin E-3250, which collects water from pipes associated with Building 9201-5. Engineering studies are currently under way to evaluate routing this water to CMTS for treatment.

As new sources of mercury are found in pipes, catch basins, and such, they are addressed

under the RMPE program to the extent that available funding will allow planning and/or action to remediate.

Since 1992 (through fiscal year 1996), DOE has spent more than \$20 million on the RMPE program, and an additional \$14.5 million are planned through 2000 to complete actions required in the permit, in associated studies/support, and as part of operation and maintenance of treatment facilities. This is an enormous investment to reduce the mercury flux from 20 gm/day (1992) to 5 gm/day. The loading required to meet the 0.012 µg/L water quality criterion is 0.3 gm/day—or a further 16-fold reduction in loading. In fact, it may be technologically impracticable to reach this limit using the best available technology.

Highlights

- *DOE has spent and plans to spend \$35 million on RMPE program to meet 5 gm/day limit (1992–2000).*
- *A loading of 0.3 gm/day is needed to meet 0.012 µg/L limit.*
- *Meeting 0.012 µg/L limit may be technologically impracticable.*

Each and all of these actions will contribute to the achievement of the RMPE program goals of compliance with the 5 gm/day requirement for December 31, 1998, and possibly with an even lower number (1–3 gm/day); however, they are not sufficient to reach the water quality standard of 0.012 µg/L.

3. LOWER EFPC

3.1 BACKGROUND

A ROD for Lower EFPC was completed in July 1995. The Lower EFPC project did not address surface water, which was deferred to the Upper EFPC project and will be addressed by the Upper EFPC watershed RI/FS. Conditions in Lower EFPC are a major concern to DOE, TDEC, and the public because the public has access to contaminated areas. Further, conditions in Lower EFPC may create a need for action in Upper EFPC to protect human health and the environment off site. Although there are contaminants other than mercury (polychlorinated biphenyls) that are of concern in Lower EFPC, this document will deal with only mercury issues.

The Lower EFPC RI and ROD determined that there is no ecological or human health risk associated with mercury levels (mean of 35 measurements was 14.9 mg/kg) in sediments in Lower EFPC under the current discharge scenario. Floodplain soils with mercury levels above 400 mg/kg will be removed and replaced with clean fill, or the excavation site will be regraded without fill. (For reference, fine particle sediments in Upper EFPC have mercury levels of about 200 mg/kg.)

3.2 FISH TISSUE MERCURY LEVELS

Currently Lower EFPC is posted by TDEC to prevent contact with the water and sediments as well as consumption of fish. TDEC posts waterways when mercury is present in fish tissues at a concentration of 0.5 µg/g, which is half the Food and Drug Administration limit of 1.0 µg/g. (Note: the creek may also be posted because of high fecal coliform levels that are not caused by DOE/Y-12 Plant operations.) TDEC is concerned about having to post Lower EFPC to limit public

use and would be reluctant to consider options that include anything less than compliance with water quality standards as long as stream use is impaired or compromised. This issue is of particular concern because the Biological Monitoring and Abatement Program and RMPE data show that although the concentration of mercury in surface water has been declining steadily over the past decade, the concentration of methyl mercury in fish tissue has remained relatively constant near the Y-12 Plant boundary. There is a non-linear relationship between aqueous-phase mercury and the levels in fish tissues, and, therefore, one would not expect to see a direct correlation between these two factors. Nonetheless, knowledgeable scientists expect that fish tissue levels will, over time, decline in response to the reduction in aqueous-phase mercury levels and as mercury is diluted or removed from the ecosystem as a whole.

This issue is important because it may be that mercury levels in biota may have a buffering effect and may introduce "time lags" between actions and effects, but ultimately the biota are not a controlling source. The time needed between actions and effects is an important point to communicate to managers and regulators; patience will be needed to evaluate the effects or benefits of any actions taken. Sediments and floodplain soils in Lower EFPC may have a "controlling" effect over improvement in fish tissue mercury levels, and it is likely that aqueous mercury concentrations must be reduced to technically achievable or lower levels before methyl mercury accumulation in fish declines to an acceptable range. This is an extremely important point because DOE could spend additional millions of dollars to reduce mercury discharges from the Y-12 Plant and see little or no short-term improvement in fish tissue levels downstream, which is the indicator currently

monitored by TDEC to indirectly evaluate DOE's performance (that is, outside NPDES permit compliance). Efforts need to be focused on developing a better understanding of the site-specific relationship between aqueous-phase mercury and fish tissue levels in Lower EFPC as well as on creating a strategy to expedite the decline of fish tissue mercury levels.

The *Integrated Strategy for Mercury Remediation for the Oak Ridge Reservation* (Energy Systems 1994, Y/ER-63&D2) addresses the concern that mercury released from the Y-12 Plant after Lower EFPC has been remediated could recontaminate the sediments and floodplain of Lower EFPC. It also includes data on the mass balance of mercury in historical and current discharges from the Y-12 Plant and in the sediments and floodplain soils of EFPC. The analysis, conducted initially by the Tennessee Valley Authority (TVA) in 1986, suggests that remobilization of contaminated floodplain deposits during storm flow may be much more important in the net export of mercury to downstream TVA reservoirs than are current releases from the Y-12 Plant (TVA 1986). TVA's results suggested that of the approximately 500 lb/yr of mercury exported from EFPC, only 75 lb came from the Y-12 Plant.

What Is the Controlling Source of Mercury?

- 160,000 lb of mercury in EFPC sediments and floodplain soils from historical deposits are a major source of Hg (approximately 500 lbs/yr) to large downstream lakes.
- Current release level is 20 lbs/yr and declining, but remains as an important determinant of base flow concentrations.
- Mercury deposits in the creek may be controlling source of mercury to fish and food chain, especially in Lower EFPC.
- Lag time occurs in recovery (i.e., in fish tissues).
- Non-linear relationship between aqueous-phase mercury and fish tissue levels.

3.3 OVERLAPPING OR GAPPING ISSUES

Clearly the overall remedial strategy for EFPC must combine and coordinate the knowledge and efforts for Upper EFPC [N/S pipes (the location where the water/creek emerges from the underground piping system in the Y-12 Plant, sometimes referred to as the "headwaters" of the creek) to Station 17] and Lower EFPC (Station 17 to Poplar Creek); however, the approach has been to identify separate operable units or projects for planning and funding purposes. Because the ROD for Lower EFPC has been signed and approved, and the remediation is ongoing, there are some associated constraints for the Upper EFPC watershed RI/FS and, from a functional perspective, some impacts on the NPDES program. If these activities are not closely coordinated, it may be necessary to revisit or redo work already completed. (CERCLA projects will automatically be subject to a 5-year review that will allow reevaluation to occur.) For instance, it is unknown to what degree cleanup levels established for Lower EFPC floodplain soils will contribute to an improvement or decline in fish tissue mercury levels, as previously described. This relationship needs to be documented and evaluated before millions more dollars are spent to reduce mercury in Y-12 Plant effluents to comply with the 12 parts per trillion water limit. The CERCLA and NPDES issues must be addressed together, and the entire creek needs to be considered in the development of the ultimate strategy.

Program Integration Needs

- Watershed approach to surface water remediation needed to address Upper EFPC, Lower EFPC, and Poplar Creek.
- State watershed management permitting on horizon.
- Integration of CWA/NPDES and CERCLA needed to address all issues.

Decisions regarding Poplar Creek and the Clinch River also need to be considered because they will have an impact on what is prudent and cost effective in Upper EFPC and Lower EFPC; a watershed approach to off-site surface water should be considered now because the NPDES program is moving rapidly in that direction. There are currently NPDES issues at Oak Ridge National Laboratory that are similar to those at the Y-12 Plant, specifically with regard to mercury. The city of Oak Ridge's wastewater treatment plant discharge has recently experienced difficulty meeting its NPDES permit limits for mercury, and the discharge may impact the conversion of other mercury species into methyl mercury; therefore, it may need to be considered in planning for the overall recovery of the creek and will be an issue for DOE in watershed management permitting.

It is difficult to clearly separate NPDES and CERCLA technical issues, although there is little or no coordination of these programs within TDEC. Ongoing and future activities need to be carefully planned and coordinated to provide the most comprehensive and cost-effective solutions. Current issues surrounding mercury compliance afford the perfect opportunity to conduct a dialogue with the regulators concerning full integration of these two programs regarding specifically legacy wastes and potentially all discharges.

Alternatively it is possible and potentially less controversial to resolve issues related to risk and water quality at Station 17 now and to allow impacts downstream to be addressed under the CERCLA 5-year review.

4. OTHER ISSUES

4.1 DOE'S 10-YEAR PLAN

Over the past year, DOE has endeavored to change the paradigm of those involved in environmental restoration activities at its facilities. The planning horizon has gone from a 70-year basis to a 10- to 15-year basis; few dispute the need for or benefit from this shift, but many have difficulty identifying specific paths for accomplishing the goals. DOE has involved both federal [U.S. Environmental Protection Agency (EPA)] and state (TDEC) stakeholders in the process, as well as the public.

Throughout the discussions, including the Nashville "Work Out" and others, TDEC has maintained a hard line on the need for DOE cleanup actions to fully comply with state standards. TDEC's reluctance to issue an ARARs waiver in the case of noncompliance with the mercury and arsenic standards for the Poplar Creek/Clinch River project is an indication of their intentions/posture. This approach is at direct odds with a major assumption for Al Alm's 10-Year Plan (i.e., maximum regulatory flexibility) and basically sets the program up for a head-on collision with TDEC on a case-by-case basis. To deal with remediation of the EFPC/Poplar Creek/Clinch River system, it may be necessary to combine efforts to negotiate one set of terms and conditions related to compliance with state standards and points of compliance. Recently surface water issues related to the Poplar Creek/Clinch River were deferred to the Upper EFPC watershed ROD as a result of difficulties in negotiating compliance with state water quality standards. The upcoming watershed management permitting program will force this issue.

Another very important consideration is how the public feels about use of these waterways and what they are willing to pay to improve water quality throughout or in particular locations.

Conflicts/Resolutions

- *Regulators want full compliance with state standards.*
- *DOE's 10-Year Plan is predicated on maximum regulatory flexibility.*
- *Resolution of conflicting agendas is needed.*
- *Public involvement to address use issues and determine what taxpayers are willing to pay to remediate is needed.*

Public participation early on would be preferable to waiting until the proposed-plan phase of the CERCLA program because a considerable investment of time and money could be made toward an approach or solution that is unacceptable to the public. The need for a public forum addressing the entire creek and examining all of the issues is significant. There is a sizeable existing body of data on these surface waters to support such a forum, regardless of the official stage in the CERCLA process. Within the context of a 10-to-15-year time frame for complete remediation or stabilization of contaminant sources on the ORR, a watershed approach and end-use planning may be essential to reach some goals in a cost-effective manner. The public will be directly involved in the watershed management permitting process and will review these data and judge these issues at that time, if not before.

4.2 "WATERSHED" NPDES

The Tennessee Division of Water Pollution Control (WPC) recently released its proposed watershed management program (Tennessee Environmental Law Letter 1996). This program will change the focus of NPDES permitting from a point-source focus to a watershed management

approach. The approach is designed to assess the cumulative impact of all permitted activities and unpermitted impacts on a watershed as part of establishing appropriate renewal permit limits. All of the watersheds in the state have been divided into five groups for management. A 5-year management and permitting cycle will be established with the five groups staged so that all NPDES permits in each group will be issued during the same year.

In 1996 the 5-year cycle would be initiated for Group 1 watersheds. A typical cycle would consist of planning and public participation the first year, water quality monitoring the second and third years, modeling the fourth year, drafting the watershed management plan in the fifth year, and issuing the permit in the sixth year of the cycle. The sixth year of the cycle would also be the first year of the next cycle.

The ORR falls into Group 3. According to the proposed schedule, Group 3 permits would be revoked in 1998 and reissued for 5 years while the

watershed management approach was being implemented. A watershed management permit would be in place in 2003 for all Group 3 watersheds.

A recent discussion with TDEC WPC Nashville staff indicated that, as previously noted, they do not intend to revoke and reissue the Y-12 Plant NPDES permit in 1998 along with the other Group 3 permits. The appeal issues and, in particular, the difficulties surrounding the fish and aquatic life criterion ($0.012 \mu\text{g/L}$) will delay inclusion of the Y-12 Plant in the watershed management permitting program. Once the appeal has been resolved, the Y-12 Plant permit can be folded into the watershed management permitting program. DOE needs to pursue being included in development of the Group 3 permits from the beginning to be represented in what is developed all along, regardless of whether a particular DOE facility is included from the beginning.

5. REGULATORY ISSUES/OPTIONS

There are a number of options or strategies for DOE to consider to achieve compliance with the mercury limits in the NPDES permit, as written. (An assumption has been made that noncompliance is not acceptable to DOE and must be avoided by some means.) Each of these options will be presented and discussed in terms of the process, time frame, and advantages or disadvantages, if any. Unfortunately there is some level of uncertainty associated with all of the options, and none can be considered a "sure thing," primarily because all solutions require TDEC's agreement and cooperation. There is no clear regulatory remedy.

To visually represent the options in relation to the requirements and time frame of the current NPDES permit, each of the options has been diagrammed in Figs. 1 through 3. Path A, shown in Fig. 1, represents the requirements in the permit for actions to reduce the discharge of mercury into Upper EFPC to the 5 gm/day loading limit. These activities are being executed under the RMPE program (described in Sect. 2). The final compliance requirement occurs on the last day of the permit, April 27, 2000. On that day the fish and aquatic life criterion continuous concentration (CCC) 0.012 µg/L applies at the instream location, Station 17 (the last monitoring location before the creek flows off site).

In a recent discussion (personal communication, October 4, 1996) with Larry Bunting, TDEC Nashville, to clarify TDEC's intentions regarding inclusion of the Y-12 Plant permit in the watershed management permitting program as proposed, Bunting indicated that TDEC is considering changing the stream use classification of EFPC to resolve the problems associated with complying with the fish and aquatic life standard. If EFPC (all or part) is reclassified to remove the fish and aquatic life use, then the recreation standard for mercury

(0.15 µg/L) would apply and would presumably be substituted for the 0.012 µg/L standard currently in the Y-12 Plant permit, probably through a permit modification.

The change in stream use classification must be accomplished during the triennial review process that will begin in the fall of 1996. TDEC can propose a change in stream use in the new regulations, and the proposal will be reviewed and approved by the public before the state promulgates the new regulations. It is highly likely that if TDEC proceeds with reclassification of EFPC to exclude the fish and aquatic life use, they will also initiate the Natural Resource Damage Assessment (NRDA) process to receive compensation for the loss of use.

5.1 THE TRIENNIAL REVIEW PROCESS

Federal regulations require authorized states to review their water quality standards/regulations every 3 years; this process has been named the triennial review. During the triennial review states may develop and propose revisions to their standards and regulations as long as they are no less stringent than federal requirements. Changes must be reviewed and approved by EPA. In the fall of 1996 TDEC will initiate the next triennial review. According to Greg Denton, WPC Nashville (personal communication November 8, 1996), TDEC will appear before the Water Pollution Control Board (WPCB) on November 19, 1996, to initiate the triennial review. The proposal for revisions will be drafted in the January/February 1997 time frame, and the proposal will be submitted to WPCB for consideration in April/May 1997 timeframe. This review process may provide a mechanism/opportunity for effecting change in the standards/regulations that could be more favorable to DOE and resolution of the mercury problems at

FIGURE 1. OPTIONS TO AVOID NONCOMPLIANCE WITH NPDES LIMIT FOR MERCURY

**FIGURE 2. OPTIONS TO AVOID
NONCOMPLIANCE WITH NPDES
LIMIT FOR MERCURY**

FIGURE 3. OPTIONS TO AVOID NONCOMPLIANCE WITH NPDES LIMIT FOR MERCURY

the Y-12 Plant. It will also provide an opportunity to change the designated use classification of EFPC.

Triennial Review Options

- *Provides mechanism to change the state water quality standards.*
- *Allows work with TDEC WPC staff on fish and aquatic life standard development and stream use classification issues during triennial review.*

As currently written and interpreted, the State of Tennessee Water Quality Standards for Fish and Aquatic Life [1200-4-3-.03(3)] do not allow for development of site-specific criteria for mercury; six metals (cadmium, copper, lead, nickel, silver, and zinc) are subject to development of site-specific criteria. Site-specific criteria are allowed by federal regulations and are subject to EPA review and approval. The Federal Water Quality Standards Regulation at Sect. 131.11(b)(1) provides states with the opportunity to adopt water quality criteria that are "... modified to reflect site-specific conditions" (EPA 1994a). Site-specific criteria are ambient water quality criteria applicable to a site. They are not intended to be direct modifications to NPDES permit limits. Site-specific criteria must fully protect existing uses of water bodies. EPA allows site-specific criteria because it recognizes that its laboratory-derived water quality criteria might not accurately reflect site-specific conditions because of the effects of water chemistry and the ability of species to adapt over time.

In the early 1990s Southworth et al. (1993) performed an analysis of existing site-specific data for Upper EFPC and came to the conclusion that adverse effects to human health and aquatic life are unlikely to occur at concentrations of total mercury less than or equal to 0.2 µg/L in Upper EFPC below Lake Reality. A major conclusion of the analysis was that the biologically available

mercury in the lower portion of Upper EFPC is relatively low and not typical of most systems to which the EPA aquatic life standard was meant to be applied. Less than 1% of the total aqueous-phase mercury in Upper EFPC is methyl mercury, and concentrations of methyl mercury in water are so low that direct uptake is likely to be a very minor source of mercury accumulation relative to food chain accumulation. The purpose of Southworth et al.'s work was to support proposal of a site-specific criterion for mercury associated with, at that time, the impending, new NPDES permit for the Y-12 Plant. TDEC chose not to incorporate the site-specific criterion into the permit. TDEC's official response to the proposal, appearing in the permit rationale (TN0002968), is as follows:

The permittee proposed a site-specific criterion of 0.2 µg/L for mercury for the protection of fish and aquatic life based on the fact that although this value has been exceeded by past discharges, fish tissue have shown reduction of mercury, are generally below the current FDA level, and have reflected the improvements made in mercury reductions instream. If mercury loading is reduced to less than 5 gram per day and the flow of Upper East Fork Poplar Creek is 7 million gallons per day, this value of 0.2 µg/L would be met for water leaving the plant site in the creek. The Division will not accept use of a criterion higher than of 0.012 µg/L at this time. An alternative site criterion will be re-evaluated after further data collection under the biological monitoring plan over the next four years. There is too much uncertainty present over what will happen instream and downstream of the site. The Division's goal under this permit is to continue site progress in eliminating and reducing mercury entering waters of the state and seeing that improvements continue and to monitor the creek and downstream biology to see what is happening in the State waters.

In the addendum to the Permit Rationale, April 3, 1995, TDEC added the following paragraph to the permit:

The permittee shall demonstrate compliance with the state's chronic water quality criteria for fish and aquatic life by the close of the permit period. Thus, the permittee shall demonstrate compliance with a total mercury concentration corresponding to the chronic criteria of 0.012 µg/L as an instream value measured at Station 17 by the close of the permit period. This value equals 0.32 grams mercury per day for a flow of 7 mgd. For purposes of this permit if the chronic criteria for total mercury is changed before the close of this permit period, that criteria revision may be used to evaluate compliance with this requirement to meet the subchronic water quality criteria.

The addendum goes on to say

It is expected at this time that Tennessee will change its chronic mercury criteria to be consistent with EPA's guidance such that the levels in fish tissue are investigated when total mercury in the water column is greater than the numeric criteria. Thus, although the numeric value may be exceeded, fish tissue at the site and downstream may be used to demonstrate whether water quality is being protected. It is thought that current projects which are being put in place will serve to keep the fish tissue below the FDA level, even though the instream mercury value may be exceeded. Thus, water quality may be protected without actually reaching the criteria numeric value. EPA's criteria document clearly intends that such considerations be made, but Tennessee's currently adopted numeric value makes no such allowance. As Tennessee's criteria is currently stated, the numeric value is not associated with follow-up data from biologic organisms but is strictly a numeric value from the water column. If the criteria is not changed, the permittee will have to meet the numerical criteria value by the end of the permit period

(or a different numeric criteria if the number itself is changed).

Any expected change in the Tennessee regulations would occur during the upcoming triennial review. The language in this paragraph regarding "EPA's guidance" is specifically referring to footnote (i) in a table in EPA's Section 304(a), "Criteria for Priority Toxic Pollutants" that appeared in the *Federal Register*, Vol. 60, No. 86, Thursday, May 4, 1995, Rules and Regulations, page 22236. The footnote reads as follows:

i. If the CCC for total mercury exceeds 0.012 µg/L more than once in a 3-year period in the ambient water, the edible portion of aquatic species of concern must be analyzed to determine whether the concentration of methyl mercury exceeds the FDA action level (1.0 mg/kg). If the FDA action level is exceeded, the State must notify the appropriate EPA Regional Administrator, initiate a revision of its mercury criterion in its water quality standards so as to protect designated uses, and take other appropriate action such as issuance of a fish consumption advisory for the affected area.

The State of Tennessee adopted the federal standards appearing in the table in total; however, they did not pick up footnote (i), apparently as an oversight.

As worded, the rationale suggests that the footnote will be added to the state regulations during the upcoming triennial review.

In 1994 EPA released new guidance on development of site-specific criteria, *Interim Guidance on the Determination and Use of Water Effect Ratio for Metals* (EPA-823-B-94-001). Protection of the intended use of the water body is the ultimate goal of all of the regulations, both state and federal. The Water Effect Ratio (WER) guidance can be used to establish site-specific criteria, as long as they protect the intended use of the water body.

The WER guidance document (EPA 1994a) specifically states, however, that "WERs determined using the methods described herein cannot be used to adjust the residue-based CCC." The guidance document states that because the CCC for mercury is not based on laboratory data concerning toxicity to aquatic life, it cannot be adjusted using a WER. The procedure does allow for establishing a criterion maximum concentration for mercury; however, it is the CCC of 0.012 µg/L that is the water quality standard being applied at the Y-12 Plant.

Difficulties with Mercury Standard

- *Regulatory dilemma with 0.012 µg/L standard; not an appropriate fish and aquatic life standard; intended to indirectly protect human health.*
- *Cannot use WER guidance to establish a site-specific CCC for mercury.*
- *Great Lakes Study establishes precedence for developing site-specific fish and aquatic life standard based on wildlife model.*

Discussion with EPA headquarters water quality standards branch staff confirmed the regulatory dilemma associated with development and application of this standard as an aquatic life criterion. The standard is really a human health standard and not an appropriate aquatic life standard; however, EPA freely admits that they do not currently have the data to support development of a national aquatic life standard for mercury. The fish and aquatic life criterion should be based on a wildlife model with appropriate wildlife species being the endpoint, not humans.

In March 1995 EPA did issue "Final Water Quality Guidance for the Great Lakes System; Final Rule" (40 *Code of Federal Regulations* 9, 122, 123, 131, and 132), and this document does promulgate aquatic life standards that are based on a wildlife model, but they are applicable to only the Great Lakes system. The water quality

criterion for mercury for protection of wildlife in the Great Lakes guidance is 0.013 µg/L. Sample et al. (1996) developed piscivore benchmark values for methyl mercury for mink and kingfishers (ORR-specific species) of 0.0065 µg/L and 0.0045 µg/L, respectively. These values were based on the bioaccumulation factor (BAF) (27,900 L/kg) developed by EPA for the Great Lakes Study (EPA 1995). This BAF may not accurately reflect the condition present in EFPC and, therefore, an EFPC-specific BAF was calculated. The EFPC-specific mink and kingfisher criteria are 0.777 µg/L and 0.286 µg/L, respectively. The uncertainty associated with the EFPC BAF model is very large, however, and piscivore values based on these data may not be adequately protective of piscivore wildlife. The uncertainty is large as a result of the lack of body-burden data in fish from waters with total mercury concentrations less than that in EFPC, coupled with the small degree of change in methyl mercury concentrations in forage fish across the range of total aqueous mercury concentrations. It is likely that a protective criterion falls somewhere between the sets of values presented above. Additional research is needed, however, to derive values with an acceptable level of uncertainty.

The Great Lakes Study guidance document does serve as an example of how to establish an aquatic life criterion for a specific watershed or water body and sets a precedence for others to facilitate development of these standards. It may be prudent to ask TDEC to include language in the water quality regulations that opens the door for this type of initiative. This could be accomplished during the upcoming triennial review.

The bottom line is that, as currently promulgated, neither the federal nor the state water quality regulations allow the development of a site-specific criterion for the aquatic life CCC for mercury. This procedure cannot be used to avoid noncompliance with the standard. The regulations must be modified or an engineering solution must be developed and implemented to

reach the 0.012 µg/L limit to avoid noncompliance. The only other option is to change the stream use classification so as to also change the applicable standard. A change in the stream use classification is an ideal solution in this case; however, it may be difficult to achieve, and it may carry with it penalties by means of an NRDA. A proposal to reclassify a stream must be approved by TDEC WQCB and EPA. If EPA decides the state water in question is also "waters of the U.S.," they will review the reclassification procedure also. EPA has approval rights on all "waters of the U.S." and can turn down TDEC's approved reclassification. For EPA to consider the removal of a use, the Use Attainability Analysis (UAA) must be performed and approved. The UAA must show not only that the stream is not currently supporting the use, but also that it will likely not be able to support the use even if all pollution sources and impacts are fully controlled. Stream damage caused by historical pollution, however, is generally not considered justification for declassification.

EPA will approve removal of a designated use only if the state is able to demonstrate that attaining the designated use is not feasible because of several factors, two of which include: "human-caused conditions of sources of pollution which prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place" and "controls needed to attain the use would result in substantial and widespread economic and social impact" (EPA 1994b).

The triennial review/reclassification process will expose all of the issues and should reveal the public view or opinion on the desired use of EFPC. It will be important to support the public hearing on the use change to provide all the facts the public needs to make an informed decision, such as what it would cost (assuming it is even possible) to reach the 0.012 µg/L standard applicable under the current use classification or similarly low levels needed to protect wildlife.

At this time it is difficult to base the compliance strategy on TDEC's "suggestion" regarding the use classification change. In general it is problematic for a regulated entity to propose a use classification change; however, if TDEC is the source of the proposed change, the change may be a real possibility.

At the mercury workshop in Oak Ridge in May 1996, Greg Denton, WPC Nashville, encouraged DOE to participate in the upcoming triennial review process. As shown in Fig. 1, Path B, the triennial review process will take approximately 2 years from initiation through promulgation of the new regulations. DOE can request access to WPCB to make a presentation at any time during the process, as well as working directly with WPC staff during development of the draft proposal for revisions to the regulations. Once the draft proposal has been finalized, it will go to WPCB and the public for review and comment. Thereafter the WPC staff will respond to comments, modify the proposal as appropriate, and return the proposal to WPCB for approval. Following WPCB approval, the revised regulations will be submitted to EPA Region IV and the Tennessee legislature for review and approval. Once approvals have been obtained, the regulations will be promulgated by the Secretary of State. As shown in Fig. 1, the new regulations should be in place around November 1998, approximately 18 months before expiration of the NPDES permit.

Influencing the state regulators during the triennial review is an important key to success, and DOE should aggressively pursue a dialogue with TDEC to determine if they would support development of a fish and aquatic life standard and an appropriate change in the stream use classification.

Another bargaining chip could be to expedite inclusion of the Y-12 Plant/EFPC in the watershed management permitting program based on the amount of existing monitoring data and the ongoing dialogue with the public. At a minimum

it may be possible to meet the Group 3 target of having a Watershed Management Permit by 2003.

5.2 THE NPDES PERMIT APPEAL PROCESS

The current NPDES permit (TN0002968) was issued to DOE by TDEC in a letter dated April 28, 1995; the effective date of the permit was July 1, 1995. In this letter DOE was advised of its right to appeal any provisions established in the permit, in accordance with the Tennessee Code Annotated (TCA), Section 09-3-110, and the General Regulations of the Tennessee Water Quality Control Board (WQCB) within 30 days of receipt of the permit.

DOE responded on May 25, 1995, with an appeal of the NPDES permit terms regarding mercury limits and toxicity biomonitoring requirements. TDEC responded to this letter on May 30, 1995, and confirmed that all permit provisions that had not been appealed were in effect and enforceable from the effective date of the permit, while those permit provisions that were contested were stayed until the permit appeal was resolved. Further, TDEC indicated that they would like to discuss the appeal in more depth to determine whether a resolution of some of the appealed issues could be reached, which would simplify the case before it was brought before WQCB. For this reason TDEC requested that a hearing date before WQCB be postponed until an effort had been made to resolve the issues. TDEC requested DOE's concurrence with the postponement of the hearing. TDEC staff was to contact DOE to arrange meetings to discuss the appealed provision (with no time frame indicated). DOE responded to TDEC's letter offering concurrence with postponement of the hearing in a letter dated June 15, 1995.

The appeal specifically addresses the mercury limits (i.e., the 5 gm/day mercury loading instream at Station 17 for flow less than 15 MGD by December 31, 1998; and compliance with the

0.012 µg/L chronic criterion instream at Station 17 by April 27, 2000) and the toxicity limits for Outfall 201. As previously mentioned, while these permit conditions are stayed until the appeal is resolved. Appeals of terms and conditions of state-issued NPDES permits are governed by the Tennessee Water Quality Control Act, TCA, §69-3-110. TCA §69-3-110 does not provide a timeline for the appeal process; however, it does refer to the Tennessee Uniform Administrative Procedures Act (UAPA), TCA §4-5-101 et seq., and mentions that hearings will be conducted in accordance with Part 3 of the act. Once the state WQCB has determined that a hearing will be held, then the timeline under UAPA for hearings applies. This timeline is shown in Fig. 2. There is no specific minimum or maximum amount of time because not all activities have set time periods, and undefined extensions are possible. It appears that the process could be completed in less than a year. In May 1995 TDEC indicated that they wanted to discuss the appeal in more depth to resolve some of the appeal issues to simplify the case before it goes to WQCB and requested that a hearing date before WQCB be postponed until an effort was made to resolve the issues. DOE acknowledged postponement, but since that time TDEC has not formally or informally requested meetings to discuss the appeal. Although DOE has shared information with TDEC and initiated several relevant discussions, DOE can, at any time, formally request that TDEC initiate the appeal discussions and move the appeal along. The request should include a framework and schedule for the discussions to facilitate progress, if desired. As shown in Fig. 2, TDEC is required to provide only 30 days notice of a hearing should they determine that discussions or prenegotiations are not necessary.

Appeal Highlights

- *Appeal based on mercury being a "legacy" waste that should be remediated under CERCLA; defer CWA compliance to CERCLA.*
- *No action on appeal to date.*
- *Development of win/win scenario needed to resolve appeal with TDEC.*

It is logical to assume that the discussions with TDEC would result in some compromise position. DOE should be strategizing on a win/win compromise, if possible. One potential area for a win/win solution might be development of a fish and aquatic life standard for EFPC (or a reservation-wide standard) based on a wildlife model, as previously discussed. DOE and TDEC could work together to establish an appropriate and scientifically based fish and aquatic life standard for mercury in lieu of the admittedly flawed federal standard. This approach could contribute to TDEC's resolve to pursue the change in use classification, as well.

There may be another win/win compromise position related to the storm water flow exclusion based on implementing run-on diversion and other engineering controls to reduce the volume of storm water and contaminant loadings. Additional thought should be given to these and other approaches to maximize the outcome of the appeal resolution.

At this time it appears to be advantageous to DOE to have mercury declared a "legacy" contaminant and deferred from CWA compliance to the CERCLA program. TDEC is a party to the Federal Facilities Agreement (FFA), directly oversees the CERCLA activities, and, therefore, would maintain purview and rein over investigation and remediation of the mercury contamination problems at the Y-12 Plant. It may, however, be difficult for TDEC to relinquish mercury compliance to CERCLA with the

impending watershed management permitting program.

The appeal issue related to toxicity limits at Outfall 201 may be easily resolved because flow management has been operational since July 1996, and data should soon be available to demonstrate that it is a non-issue. This argument is not fully compelling, however, because it is a "dilution" remedy. The results of the toxicity identification evaluation/toxicity reduction evaluation and modification to the Groundwater Treatment Facility to eliminate the source are more compelling solutions.

Insofar as any of these issues and approaches can be used to construct win/win compromise positions, they can be used to support the appeal discussions and the hearing before WQCB. If TDEC truly has their own strategy in mind to resolve the appeal issues (i.e., a change in the use classification), these issues may become a moot point.

5.3 THE CERCLA PROCESS

All inactive facilities (not regulated under other environmental programs) on DOE's ORR are subject to the CERCLA process under an FFA between EPA Region IV, TDEC, and DOE. The FFA establishes general procedures and time frames for activities as well as specific milestones for projects. The entire Y-12 Plant is currently being investigated using a watershed approach [named the UEFPC Characterization Area (CA) RI/FS]. This watershed includes all areas and sources of mercury contributing contamination to Upper EFPC. Figure 3, Path A, shows the current schedule for completion of the UEFPC CA RI/FS, which culminates in a ROD by the end of 2000. The ROD will describe remedial actions to be taken to reduce unacceptable risk to human health and the environment in all environmental media (i.e., soils, surface water, and groundwater). Before the ROD, DOE will prepare a proposed plan that will be presented to the public for review

and comment. The proposed plan will describe the intended action and provide a mechanism for public input. Locally, remediation strategies have been modified substantially based on public preference; the public does have a say in the remedy. There is currently an initiative to get public involvement and input to this project in the near term; some consensus is needed on the approach and major project assumptions.

CERCLA Highlights

- *CERCLA ROD for Upper EFPC Watershed RI/FS due in late 2000.*
- *CERCLA establishes risk-based remedial goals for human health and the environment and evaluates feasibility of actions to achieve goals.*
- *CERCLA provides for 5-year review and monitors progress toward achieving goals.*

The CERCLA process is specifically designed to evaluate the feasibility of remedial actions to meet goals or targets for protection of human health and the environment. A key aspect of any CERCLA action is that remediation goals are "risk-based" numbers that protect human health and the environment. Remedial actions are taken to reduce contaminant levels to meet the remediation goals, and progress toward meeting the goals is evaluated once the action is completed and on a 5-year review cycle thereafter. In this case, it is especially appropriate to provide some evaluation time following actions because there is a lag time for seeing improvement or change in the biological system.

Although the ROD is not projected to be completed until after the current NPDES permit expires (April 27, 2000), the risks to human health and the environment from mercury will be defined by this time, as will the actions needed to reduce unacceptable risks. Furthermore, public review of the proposed plan will be complete. The remediation projects will be well defined; therefore, information will be available to provide

the technical basis for deferring further mercury remediation to CERCLA from the NPDES permit. It should also be noted that the schedule is currently being updated, and the process may be closer to a decision document (ROD) by April 27, 2000.

If a signed decision document (i.e., ROD) is required for TDEC to officially "render the meeting of the 0.012 µg/L total mercury value instream a moot point" as suggested in the permit rationale as currently written, DOE could elect to pursue an Interim Record of Decision (IROD) or a separate mercury ROD that addresses only mercury and could be completed on an accelerated schedule well in advance of the expiration of the current permit. The need for an official, signed decision document is a technicality but could be required to avoid third-party intervention. DOE has recently had conversations with TDEC to clarify that they may, if they so choose, defer CWA compliance issues to CERCLA; however, it was made clear that this is a voluntary act and that TDEC cannot legally be compelled to do so.

Figure 3, Path B, shows a hypothetical approach and schedule for a mercury IROD/ROD. The time to complete the IROD/ROD would largely depend on the scope of activities to be included in the FS. In any case, the IROD/ROD could be completed before expiration of the permit.

The major advantage of dealing with mercury under CERCLA is that actions are based directly on risk reduction and not solely on meeting water quality standards. The risk scenarios and calculations can realistically reflect site-specific conditions (i.e., bioavailability of mercury). The water quality standards are ARARs that are met to the fullest extent possible; however, CERCLA provides a mechanism for potentially waiving ARARs if they cannot be met but it is still possible to protect human health and the environment. At the May 1996 mercury workshop, the possibility of pursuing a mercury

IROD was discussed, but TDEC made it very clear that they would not consider pursuing a mercury IROD simply as a mechanism to avoid noncompliance with the permit requirements. It is likely that their position can be modified by offering substantial actions to reduce the flux of mercury from the site—actions above and beyond those being conducted under the RMPE.

A mercury IROD/ROD is a possibility if a final decision document is key to a successful compliance strategy. Unfortunately the dynamics of the deferral from CWA to CERCLA are in the realm of discretionary actions and are not specifically detailed in either of the laws or their implementing regulations.

6. SUMMARY AND CONCLUSIONS

6.1 SUMMARY

A summary of the various compliance options is presented in Table 2. The format of the table was developed to summarize and present important details associated with each option that would allow strategy development and decision making.

Table 2 includes two options (1 and 2) that were not presented and discussed in Sect. 5 (i.e., complying with the permit conditions and "declaring victory"). Complying with permit conditions is problematic; however, it may be technologically feasible in the future to remove mercury from dry weather flow to very low (regulatory) levels using ion-specific resins (e.g., SAMMS™ or SolmeteX™). The cost of treatment may be quite high, and the ability to capture or intercept the mercury sources for treatment may be limited. Currently, however, it is considered technologically impracticable to treat effluent to comply with the 0.012 µg/L limit.

The "declare victory" scenario is based on the success of the RMPE program and the elimination of point-source mercury discharges to Upper EFPC. In this case DOE would pursue recognition of the \$35 million already invested and planned in past and in baselined activities and would take a position that it has accomplished all that can economically be accomplished to reduce mercury leaving the Y-12 Plant. This option may be viable only if combined with deferral of the legacy mercury to the CERCLA program, which would address non-point sources of mercury and evaluate residual risk to public health and the environment.

The option to petition for a change in stream use classification has not been included because in the past TDEC has been implacable regarding

suggestions to downgrade the intended use of Upper EFPC or EFPC. It may now be a viable option, but only if TDEC develops and supports the position. If TDEC successfully changes the stream use classification, doing so would likely favorably resolve the permit appeal issues and provide relief from permit noncompliance. "What reach is subject to the change?", however, is a key issue/question. Surface water in Poplar Creek to the Clinch River fails to meet the 0.012 µg/L standard. The use classification would need to be changed from Upper EFPC to the Clinch River to resolve the problem completely, and this extensive a change could be politically difficult to support and could result in a large NRDA. Development of a fish and aquatic life standard for mercury could support the change and provide information needed by everyone to properly evaluate the options and to develop an appropriate regulatory strategy.

Options 3 through 6 are interrelated in many respects and cannot be executed as totally separate options. Most of the disadvantages are related to funding and administrative issues. Probably the biggest disadvantage overall is that, although the sources of mercury, pathways, exposure points, and receptors are the same, there are two different groups of regulators to resolve the permit issues and the CERCLA process. All of the options require action, and the one action that is common to all is dialogue with the regulators and the public. An important issue that is common to a successful outcome from both regulatory programs is identifying the controlling source of mercury in the watershed. The CERCLA program is more suited to the type and depth of evaluation needed to establish the risk-based human health and aquatic life remediation goals as well as to guide remediation. It also has a built-in monitoring and periodic review of remedial actions to evaluate compliance with remediation

Table 2. Summary of options to avoid noncompliance with NPDES mercury limits

Option	Major premise/assumptions	Achieves compliance	Requires further action	Actions required	Advantages	Disadvantages
1. Comply with permit limits/conditions	<ul style="list-style-type: none"> Wet/dry mercury sources collected and treated Technologically feasible Funding available Public supports 	Yes	Yes	<ul style="list-style-type: none"> Studies/FS design/build/operate Add to baseline 	<ul style="list-style-type: none"> Final remedy Cheaper/more efficient to perform work under CWA than CERCLA Gets to having done everything possible 	<ul style="list-style-type: none"> Long-term operation and maintenance Costly May not improve downstream problems and sources of mercury; mercury in fish tissue problem Precedes decisions and actions for source control Unknown probability of success
2. Declare victory	<ul style="list-style-type: none"> DOE has done and planned \$35M to control major point sources of mercury and that is enough (as planned under RMPE) 	No	No	None	<ul style="list-style-type: none"> No further cost over current baseline 	<ul style="list-style-type: none"> Potential fines and third party suits Noncompliance inevitable
3. Resolve permit appeal favorably	<ul style="list-style-type: none"> Eliminate all mercury limits from permit; mercury deferred to CERCLA/ROD Demonstrate toxicity testing at Outfall 201 is not needed 	Yes	Yes	<ul style="list-style-type: none"> Prepare case materials for appeal Meetings/negotiations with TDEC/EPA Hearings Permit modification 	<ul style="list-style-type: none"> Reasonable cost of actions Remedy planned as part of whole Can be handled by current CERCLA project/schedule Remedy based on risk, not solely compliance with CWA standards 	<ul style="list-style-type: none"> CERCLA actions more costly than CWA and take longer Shifts work from Defense Programs to Environmental Management (EM); must compete for shrinking EM \$ Unfavorable outcome could reduce options; timing may be a critical issue If TDEC determines mercury is not legacy waste, may preempt using the IROD/ROD option to resolve noncompliance issue

Table 2 (continued)

Option	Major premise/assumptions	Achieves compliance	Requires further action	Actions required	Advantages	Disadvantages
4. Influence Triennial Review	<ul style="list-style-type: none"> Mechanism for agreement to allow development of a new fish and aquatic life standard for ORR watershed or a change in stream use classification 	Unknown	Yes	<ul style="list-style-type: none"> Prepare wildlife model; develop standard and support regulatory process State/EPA approval and promulgation of standard Add new work to baseline Continue with current scope in baseline 	<ul style="list-style-type: none"> Establishes a meaningful standard for ORR, not just the Y-12 Plant Contributes to solution for Lower EFPC and Poplar Creek/Clinch River projects Fits into state/EPA watershed permitting strategy for 2000 Provides opportunity to pilot watershed permit program Changes favorably impact CERCLA 	<ul style="list-style-type: none"> Time it takes to get a new standard promulgated by state/EPA New work not in baseline Requires complete buy-in by TDEC-Nashville and approval by EPA Could backfire Could result in an NRDA
5. CERCLA ROD-late 2000	<ul style="list-style-type: none"> TDEC could defer permit compliance to the CERCLA process before having a "signed" final decision document (ROD) 	Yes	Yes	<ul style="list-style-type: none"> Modification of permit CERCLA process complete to point at which decision is apparent 	<ul style="list-style-type: none"> Current/planned actions under RMPE completed; no new studies or actions; additional studies deferred to CERCLA Eliminates two program approaches; simplifies analysis 5-year review provides mechanism to see improvement from actions taken, then take more actions or declare victory Public directly involved in deciding what gets done and how much gets spent Likelihood of NRDA less 	<ul style="list-style-type: none"> ROD will not be signed before permit expiration Greater cost and time required to work under FFA; planning and document review requirements CERCLA may require investigation, treatability studies, and actions forever
6. Mercury IROD	<ul style="list-style-type: none"> TDEC cannot or will not defer mercury compliance from CWA to CERCLA without a signed decision document Can be completed before expiration of permit TDEC/EPA will accept/support a contaminant-specific decision for surface water under CERCLA 	Yes	Yes	<ul style="list-style-type: none"> FS/proposed plan IROD work Add new work to baseline Modification of the permit 	<ul style="list-style-type: none"> Gets credit for RMPE work and money already invested Risk-based remedy 5-year review process Eliminates further work under RMPE not in baseline; to be included in FS/remedy development; saves money Public directly involved in deciding what gets done and how much gets spent Likelihood of NRDA less 	<ul style="list-style-type: none"> New work not in current baseline Greater cost and time required to perform work under the FFA; planning/document review requirements CERCLA may require investigation, treatability studies, and actions forever

goals. If remediation goals are not being met, additional action can be taken to further reduce contaminant levels, if technologically feasible and if funding permits.

6.2 CONCLUSIONS

All of the options described in this analysis require negotiations/cooperation with the regulators to be achievable except the option to comply with the permit limits. DOE could unilaterally initiate and complete this option without approval or involvement of the regulators; however, the cost of compliance is likely to be prohibitive, and, as previously discussed, it is questionable whether meeting the limits would result in the desired reduction of mercury in fish tissues in EFPC and Poplar Creek downstream.

Resolution of the permit appeal to defer mercury as a legacy waste to the CERCLA program may be a viable approach and can be accomplished within the term of the permit. Viability of appeal resolution could be enhanced by also influencing the triennial review process and establishing a new fish and aquatic life standard, which could provide a technical basis for TDEC to justify "loosening the reins."

The CERCLA program appears to be the logical mechanism for evaluating risk and alternatives for further remediation of mercury-contaminated media at the Y-12 Plant, and it may

Bottom Line

- *CERCLA is the logical program to evaluate, plan, and execute remediation of historical release of mercury from the Y-12 Plant on a watershed basis.*

be the "best" option for setting appropriate remediation goals for protection of human health and the environment and for monitoring the progress toward meeting the goals. The lag time for seeing measurable improvement in biota following remedial action to reduce aqueous-phase mercury makes it especially difficult to regulate mercury remediation under an NPDES permit that specifies unchangeable limits and deadlines. A combination of Options 3, 4, and 5 might produce the win/win scenario for all parties. Communication and coordination/cooperation with the regulators (Division of WPC and the DOE Oversight Office) will be critical to developing a win/win scenario. Planning needs to begin immediately to capitalize on the timing of the triennial review.

7. DECISION ANALYSIS AND ACTION PLAN

The purpose of this section is to identify specific actions or activities that are ongoing or about to be initiated to prepare for and facilitate a meeting with TDEC to resolve outstanding issues and problems associated with NPDES permit compliance and compliance with ARARs under CERCLA.

There are a number of key decisions to be made internally, by DOE and the project team and externally, by various TDEC entities, and by the public. These decisions occur in both the CWA and CERCLA programs, and the impacts of the decisions are crosscutting. The diagrams presented in Fig. 4 represents an attempt to show the major decisions or decision-points associated with the two programs and the impacts of decisions on either or both programs. The triennial review is just beginning, and this timing affords DOE an excellent opportunity to work with TDEC in resolving the difficult issues surrounding mercury remediation. At this time perhaps the most critical activities are those associated with developing the strategy for influencing the outcome of the triennial review. Since TDEC will be preparing their proposal for revision during the January/February 1997 time frame, it is critical for DOE to finalize and present its strategy during or before that time.

A number of issues can be readily identified, while others are notional. To capitalize on the timing of the triennial review and acquire a full understanding of TDEC's current thinking/position/issues, short-term efforts should be focused on developing a thorough, focused strategy to address all of the key determinants of

the outcome. Figure 5 presents short-term activities/actions that may define the strategy for influencing triennial review and resolution of the appeal and that may provide a mechanism of effectively communicating the "bigger picture" to achieve integration of CWA and CERCLA decisions/analyses within TDEC.

Figure 5 shows a meeting with TDEC WPC and Tennessee Oversight Agreement personnel in mid-January 1997 to present the win-win strategy. Desired outcomes of this meeting are shown in Fig. 5; these items are fairly critical to efficiently and effectively moving forward and should provide the basis for an ultimate strategy to ensure compliance with NPDES requirements and clarify CERCLA issues as well.

Figure 5 also shows several internal stakeholder meetings to review the issues in preparation for strategy development. In addition, a list of questions regarding TDEC's current thinking and position on the key areas of concern (triennial review, permit compliance/appeal, and watershed management permitting) has been compiled and will be mailed to Larry Bunting for review before the December 11, 1996, meeting on the Annual Mercury Abatement Report. The plan is to discuss TDEC's response to these questions informally at this meeting; thereafter the internal stakeholders will convene to draft the strategy, with a better understanding of TDEC's intentions. The strategy would then be finalized internally in early January 1997 and presented to TDEC on or about January 17, 1997, while TDEC is actively working on the proposal for triennial review changes.

¹This input comes from diagram on short-term project actions/activities figure.

²If TDEC is considering changing standards, we want to have early input and confirm that site-specific criteria may be developed for the recreation standard.

FIGURE 4. OVERALL INTEGRATION ACTIVITIES AND MAJOR DECISIONS RELATED TO MERCURY SURFACE WATER ISSUES AT THE Y-12 PLANT

**TECHNICAL ACTIVITIES TO
SUPPORT MERCURY COMPLIANCE
STRATEGY DEVELOPMENT
(MAJOR TOPICS)**

FIGURE 5. ACTIONS/ACTIVITIES FOR PROJECT PLANNING AND STRATEGY DEVELOPMENT IN THE SHORT TERM (NEXT 3 TO 6 MONTHS)

8. REFERENCES

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