

Appendix 3: Analysis of Section 26.207

Overview

Section 26.207 of the final worker fatigue provisions establishes new waiver requirements. Among other provisions, the section restricts the granting of waivers from work hour requirement guidelines to cases where the waiver is needed to mitigate or prevent a condition adverse to safety or to maintain security. The rule also clarifies that work hour limits apply only to workers who perform safety-related functions, which will eliminate the need to grant waivers to other staff. This appendix describes a methodology for estimating the incremental costs and savings associated with eliminating waivers that would no longer be permitted under the final rule.

NRC used this methodology to estimate the net cost per week of the new waiver requirements. The resulting estimate of \$1,087 per week while at-power and \$25,689 per week during plant shutdowns are used as inputs to the cost analysis of §26.207, which is presented in Appendix A2-15. Table 3-1 provides a summary of the waiver data used in this appendix. Table 3-2 provides a breakdown of these data by work-hour provision.

The methodology is based on a review of selected 2003 - 2004 waiver data from six facilities. The analysis categorizes each waiver into one of eight groups and calculates the cost or saving associated with that waiver based on how the situation would be addressed under the final rule. Results for the six facilities are summed and averaged to calculate the net weekly cost of the provision for the average facility (1) while at power, and (2) during an outage.

The remainder of this appendix describes how the analysis estimates the cost or saving of each type of waiver. The discussion is organized into nine sections:

- A3.1 Waivers No Longer Required Under the Final Rule;
- A3.2 Waivers Unaffected by the Final Rule;
- A3.3 Outage Shift Changes that Will Not Meet the New Final Waiver Requirements;
- A3.4 Outage Activities Without Direct Impact on Critical Path;
- A3.5 Outage Activities With Critical Path Impact;
- A3.6 At-Power Costs Associated With Individuals Who Will Not Meet the Final Waiver Requirements;
- A3.7 At-Power Costs Associated With Individuals Involved in Tests or Integrated Evolution Who Will Not Meet the Final Waiver Requirements;
- A3.8 At-Power Costs Associated With Individuals Involved in Return to Full Power Who Will Not Meet the Final Waiver Requirements; and
- A3.9 Generic Costing Assumptions

**Table 3-1
Waiver Data Summary**

Description		Total	Plants					
			A	B	C	D	E	F
Outage Days		295	76	64	30	62	34	29
At-Power Days		452	30	301	31	30	30	30
A3.1	Waivers No Longer Required*	506	114	81	6	48	25	232
A3.2	Waivers Unaffected*	20	15	1	2	1	0	1
A3.3	Outage Shift Change*	158	133	0	5	18	1	1
A3.4	Outage Activities without Direct Impact on Critical Path*	827	150	6	56	330	112	173
A3.5	Outage Activities with Critical Path Impact*	300	40	4	14	186	36	20
A3.6	At-Power Activities*	28	6	1	5	16	0	0
A3.7	At-Power Activities associated with Test and Integrated Activities*	16	7	7	1	1	0	0
A3.8	At-Power Activities Impacting Return to Full Power*	10	0	1	6	3	0	0
TOTAL*		1,865	465	101	95	603	174	427

* The numbers in these rows represent the number of personnel with authorized work-hour rule waivers. Consecutively issued waivers for personnel working 12-hour days without an off-day were counted as one occurrence per person for each 7-day period when allowed by the available data.

**Table 3-2
Work-hour Provision Breakdown**

Provision	Personnel Waived	Percent of Waivers where only a Single Provision is Waived	Percent of Total*
8-hour break	18	6% (1 of 18)	1%
16-hours in 24-hour period	175	28%	9%

		(49 of 175)	
24-hours in a 48-hour period	434	44% (192 of 434)	23%
72-hours in a 7-day period	1536	71% (1333 of 1536)	82%
Total Waived	1865	84% (1575 of 1865)	100%

* Note that since 16% of the waivers address multiple provisions, the sum of provision percentages exceeds 100%.

A3.1 Waivers No Longer Required Under the Final Rule

Numerous work hour waivers that were granted prior to the final rule will no longer be needed (i.e., waivers for engineering staff, waivers that would be eliminated due to the 26-hour in 48-hour rule change and for work not adverse to safety). Licensees will be free to use staff as they did under these waivers, but they will realize incremental savings because they will not have to undertake the administrative exercise of granting the waiver.

The *facility savings per waiver* result from the saved management costs as follows:

$$HOURS_{Manager} \times WAGE_{Management}$$

Parameter	Description
$HOURS_{Manager}$	Manager labor saved for each waiver that no longer needs to be processed (described in assumptions below)
$WAGE_{Management}$	Hourly management labor rate (described in Section A3.9)

Assumption:

- Manager labor saved as a result of reduced planning, coordination and administration for each waiver processed: 1 hour.

A3.2 Waivers Unaffected by the Final Rule

Some of the work hour waivers examined will not be affected by the final rule. These are waivers that satisfy the two required elements of the final rule: (a) the activity is necessary to mitigate or prevent a condition adverse to safety or security and (b) there is reasonable assurance that the individual will be able to safely and competently perform his or her duties during the additional work period. There are no incremental costs or savings associated with this category.

A3.3 Outage Shift Changes that Will Not Meet the Final Waiver Requirements

Another group of work hour waivers includes those granted to accommodate a shift schedule change that will not meet the new waiver requirements. This group includes waivers associated with:

- Shifting between day and night schedules or other outage schedule changes; and
- Shifting personnel due to down-staffing.

All but two of the 158 waivers in this category (99%) authorize a variance from the 72-hour work hour control requirement. Due to the limited information provided on many waiver authorization forms, it is often unclear whether the 72-hour limit is exceeded by only a few hours or an entire shift. In addition to the 72-hour limit, about 23% of these waivers also allow individuals to exceed the 16-hours in 24-hour limit.

Contractor - Local Craft

This category estimates the cost associated with eliminating work hour waivers addressing an outage shift change that will not meet the final waiver requirements. The category applies to local contractors supporting an outage that do not require travel or per diem. Activities addressed by this category are not associated with a test or integrated evolution.

The management cost of this section is the additional management burden for planning and coordination. The additional management burden for waivers that address a single person is assumed to be 1 hour. For waivers that address more than one person, this analysis assumes that the additional management burden will be 2 hours.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Local\ Craft} \times HOURS_{Local\ Craft} \times WAGE_{Local\ Craft} \times CONTINGENCY_{Shift_Schedule_Change}) - (NUM_{Local\ Craft} \times HOURS_{Local\ Craft} \times WAGE_{Local\ Craft})$$

- The management cost of this waiver is the additional management burden for planning and coordination. The management cost is calculated as follows:

If waiver addresses one person, then (1 hour x WAGE_{Manager})
If waiver addresses multiple people, then (2 hours x WAGE_{Manager})

Parameter	Description
NUM _{Local Craft}	The number of local craft workers impacted by shift schedule changes that will no longer be allowed
HOURS _{Local Craft}	Hours worked per local craft worker that exceeded the work hour requirements

	under one waiver
$CONTINGENCY_{Shift_Schedule_Change}$	Contingency factor measuring the significance of expected resource loading associated with shift schedule changes (described in assumptions below)
$WAGE_{Local\ Craft}$	The estimated hourly rate of local craft labor (described in Section A3.9)
$WAGE_{Manager}$	Average manager wage rate (described in Section A3.9)

Assumption:

- A scaling factor is used to adjust baseline costs to reflect higher costs under the final waiver provisions. For this equation, the contingency factor value equals 1. Effective management planning should avoid the need for waivers associated with changes in shift schedules.

Contractor - Specialty Vender

This category estimates the cost associated with eliminating work hour waivers addressing an outage shift change. The category is applicable to contractors supporting an outage that are expected to incur transportation and per diem costs.

The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. Although transportation and per diem costs are likely for this labor category, these costs are excluded from the cost estimate because it is assumed that effective management planning should avoid such a burden.

The management cost of this section is the additional management burden for planning and coordination. The additional management burden for waivers that address a single person is assumed to be 1 hour. For waivers that address more than one person, this analysis assumes that the additional management burden will be 2 hours.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Specialty\ Vender} \times HOURS_{Specialty\ Vender} \times WAGE_{Specialty\ Vender} \times CONTINGENCY_{Shift_Schedule_Change}) - (NUM_{Specialty\ Vender} \times HOURS_{Specialty\ Vender} \times WAGE_{Specialty\ Vender})$$

- The management cost of this waiver is the additional management burden for planning and coordination. The management cost is calculated as follows:

If waiver addresses one person, then (1 hour x WAGE_{Manager})
If waiver addresses multiple people, then (2 hours x WAGE_{Manager})

Parameter	Description
NUM _{Specialty Vender}	The number of specialty vendors impacted by shift schedule changes that will no longer be allowed
HOURS _{Specialty Vender}	Hours worked per specialty vendor that exceeded the work hour requirements under one waiver
CONTINGENCY _{Shift_Schedule_Change}	Contingency factor measuring the significance of expected resource loading associated with shift schedule changes (described in assumptions below)
WAGE _{Specialty Vender}	The estimated hourly rate of specialty vendor labor (described in Section A3.9)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)

Assumption:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. For this equation, the contingency factor value equals 1. Effective management planning should avoid the need for waivers associated with changes in shift schedules.

Utility

This category estimates the cost associated with eliminating work hour waivers addressing an outage shift change. The category is applicable to utility workers supporting an outage. Activities addressed by this category are not associated with a test or integrated evolution that requires a formal job brief.

The management cost represented by this section is the additional management burden for planning and coordination. The additional management burden for waivers that address a single person is assumed to be 1 hour. For waivers that address more than one person, this analysis assumes that the additional management burden will be 2 hours.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Utility\ Worker} \times HOURS_{Utility\ Worker} \times WAGE_{Utility\ Worker} \times CONTINGENCY_{Shift_Schedule_Change}) - (NUM_{Utility\ Worker} \times HOURS_{Utility\ Worker} \times WAGE_{Utility\ Worker})$$

- The management cost represented by this section is the additional management burden for planning and coordination. The management cost is calculated as follows:

If waiver addresses one person, then (1 hour x WAGE_{Manager})

If waiver addresses multiple people, then $(2 \text{ hours} \times WAGE_{Manager})$

Parameter	Description
NUM _{Utility Worker}	The number of utility workers impacted by shift schedule changes that will no longer be allowed
HOURS _{Utility Worker}	Hours worked per utility worker that exceeded the work hour requirements
CONTINGENCY _{Shift_Schedule_Change}	Contingency factor measuring the significance of expected resource loading associated with shift schedule changes (described in assumptions below)
WAGE _{Utility Worker}	The estimated hourly rate of utility labor (described in Section A3.9)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)

Assumption:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. For this equation, the contingency factor value equals 1. Effective management planning should avoid the need for waivers associated with changes in shift schedules.

A3.4 Outage Activities Without Direct Impact on Critical Path

Contractor - Local Craft

This category estimates the cost associated with eliminating work hour waivers addressing an outage activity that extends beyond a shift. The category is applicable to local contractors supporting an outage that do not require travel or per diem. Activities addressed by this category are not associated with a test or integrated evolution and do not have a direct critical path impact. This group includes waivers associated with:

- Continuation of on-going work activities (not identified or assessed as critical path);
- Equipment de-contamination and temporary shielding activities; and
- Worker contingency actions (personnel on standby).

The management cost of this section is the additional management burden for planning and coordination. The additional management burden for waivers that address a single person is assumed to be 2 hours. For waivers that address more than one person, this analysis assumes that the additional management burden will be 4 hours.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Local\ Craft} \times HOURS_{Local\ Craft} \times WAGE_{Local\ Craft} \times CONTINGENCY_{Non-Critical\ Path}) - (NUM_{Local\ Craft} \times HOURS_{Local\ Craft} \times WAGE_{Local\ Craft})$$

- The management cost of this waiver is the additional management burden for planning and coordination. The management cost is calculated as follows:

*If waiver addresses one person, then (2 hours x WAGE_{Manager})
 If waiver addresses multiple people, then (4 hours x WAGE_{Manager})*

Parameter	Description
NUM _{Local Craft}	The number of local craft workers impacted by shift schedule changes that will no longer be allowed
HOURS _{Local Craft}	Hours worked per local craft worker that exceeded the work hour requirements under one waiver
CONTINGENCY _{Non-Critical Path}	Contingency factor measuring the significance of expected resource loading associated with non-critical path resources changes (described in assumptions below)
WAGE _{Local Craft}	The estimated hourly rate of local craft labor (described in Section A3.9)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)

Assumption:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. The contingency factor value in this equation is assumed to be equal to 2. The contingency factor value is based on an evaluation of special conditions, including individuals’ level of specialization, potential difficulty in establishing alternative arrangements, the likelihood of cost premiums like travel per diem and the potential impact to outage duration. In this section of the appendix, the contingency value ranges from 1 to 5. For this category, the contingency factor equals 2 due to the low level of specialization, local availability of labor and limited impact on the outage critical path.

Contractor - Specialty Vender

This category estimates the cost associated with eliminating work hour waivers addressing an outage activity that extends beyond a shift. The category is applicable to contractors supporting an outage that are expected to incur transportation and per diem cost. Activities addressed by this category are not associated with a test or integrated evolution and do not have a direct critical path impact. This group includes waivers associated with:

- Continuation of on-going work activities (not identified or assessed as critical path);
- Motor-operated valve and air-operated valve testing; and
- Worker contingency actions (personnel on standby).

The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The contingency cost includes the expected

additional per diem cost. The analysis also assumes that a travel cost of \$1,000 per person per waiver will be incurred.

The management cost of this section is the additional management burden for planning and coordination. The additional management burden for waivers that address a single person is assumed to be 2 hours. For waivers that address more than one person, this analysis assumes that the additional management burden will be 4 hours.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Specialty\ Vender} \times HOURS_{Specialty\ Vender} \times WAGE_{Specialty\ Vender} \times CONTINGENCY_{Non-critical\ Path}) + (NUM_{Specialty\ Vender} \times COST_{Travel}) - (NUM_{Specialty\ Vender} \times HOURS_{Specialty\ Vender} \times WAGE_{Specialty\ Vender})$$

- The management cost of this waiver is the additional management burden for planning and coordination. The management cost is calculated as follows:

If waiver addresses one person, then (2 hour x WAGE_{Manager})
If waiver addresses multiple people, then (4 hours x WAGE_{Manager})

Parameter	Description
NUM _{Specialty Vender}	The number of specialty vendors impacted by shift schedule changes that will no longer be allowed
HOURS _{Specialty Vender}	Hours worked per specialty vendor that exceeded the work hour requirements under one waiver
CONTINGENCY _{Non-Critical Path}	Contingency factor measuring the significance of expected resource loading associated with shift schedule changes (described in assumptions below)
WAGE _{Specialty Vender}	The estimated hourly rate of specialty vendor labor (described in Section A3.9)
COST _{Travel}	The estimated round trip travel fee used for specialty vendors (described in Section A3.9)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)

Assumption:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. The contingency factor value in this equation is assumed to be equal to 4. The contingency factor value is based on an evaluation of special conditions, including individuals’ level of specialization, potential difficulty in establishing alternative arrangements, the likelihood of cost premiums like travel per diem and the potential

impact to outage duration. In this section of the appendix, the contingency value ranges from 1 to 5. For this category, the contingency factor equals 4 due to the high level of specialization, potential difficulty in making alternative arrangements, likely need to pay a premium, and the limited impact on the outage critical path.

Utility

This category estimates the cost associated with eliminating work hour waivers addressing an outage activity that extends beyond a shift. The category is applicable to utility workers supporting an outage. Activities addressed by this category are not associated with a test or integrated evolution and do not have a direct critical path impact. This group includes waivers associated with:

- Continuation of on-going work activities (not identified or assessed as critical path);
- Operations outage support (valve manipulations, clearing danger tags, surveillance support, etc.);
- Health Physics survey and job coverage support; and
- Training and qualification support (welders).

The management cost represented by this section is the additional management burden for planning and coordination. The additional management burden for waivers that address a single person is assumed to be 2 hours. For waivers that address more than one person, this analysis assumes that the additional management burden will be 4 hours.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Utility\ Worker} \times HOURS_{Utility\ Worker} \times WAGE_{Utility\ Worker} \times CONTINGENCY_{Non-critical\ Path}) - (NUM_{Utility\ Worker} \times HOURS_{Utility\ Worker} \times WAGE_{Utility\ Worker})$$

- The management cost represented by this section is the additional management burden for planning and coordination. The management cost is calculated as follows:

$$\begin{aligned} & \text{If waiver addresses one person, then } (2 \text{ hours} \times WAGE_{Manager}) \\ & \text{If waiver addresses multiple people, then } (4 \text{ hours} \times WAGE_{Manager}) \end{aligned}$$

Parameter	Description
$NUM_{Utility\ Worker}$	The number of utility workers impacted by shift schedule changes that will no longer be allowed
$HOURS_{Utility\ Worker}$	Hours worked per utility worker that exceeded the work hour requirements
$CONTINGENCY_{Non-critical\ Path}$	Contingency factor measuring the significance of expected resource loading

Parameter	Description
	associated with shift schedule changes (described in assumptions below)
WAGE _{Utility Worker}	The estimated hourly rate of utility labor (described in Section A3.9)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)

Assumption:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. The contingency factor value in this equation is assumed to be equal to 2. The contingency factor value is based on an evaluation of special conditions, including individuals' level of specialization, potential difficulty in establishing alternative arrangements, the likelihood of cost premiums like travel per diem and the potential impact to outage duration. In this section of the appendix, the contingency value ranges from 1 to 5. For this category, the contingency factor equals 2 due to the assignment flexibility of in-house staff and limited impact on the outage critical path.

A3.5 Outage Activities With Critical Path Impact

Contractor - Local Craft

This section estimates the local contractor cost associated with activities that have a critical path impact. The category is applicable to local contractors supporting an outage that do not require travel or per diem. This group includes waivers associated with:

- Support of critical path activities (only 4 waivers were identified as being applicable to the Local Craft portion of this category).

The management cost of this section is the additional management burden for planning and coordination. The additional management burden for waivers that address a single person is assumed to be 2 hours. For waivers that address more than one person, this analysis assumes that the additional management burden will be 4 hours.

The outage portion of this section is used to represent the cost associated with extending the outage as a result of allocating resources without the availability of a waiver. This waiver cost section addresses the potential impact of the job brief on the critical path.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Local\ Craft} \times HOURS_{Local\ Craft} \times WAGE_{Local\ Craft} \times CONTINGENCY_{Critical\ Path}) - (NUM_{Local\ Craft} \times HOURS_{Local\ Craft} \times WAGE_{Local\ Craft})$$

- The management cost represented by this section is the additional management burden for planning and coordination. The management cost is calculated as follows:

*If waiver addresses one person, then (2 hours x WAGE_{Manager})
waiver addresses multiple people, then (4 hours x WAGE_{Manager})*

- The outage portion of this section represents the cost associated with extending the outage as a result of allocating resources without the availability of a waiver. The outage cost is calculated as follows:

$$HOURS_{Turnover} \times HCOST_{Outage}$$

If the waiver is associated with the 72-hour provision, then this analysis assumes that there is no cost for critical path turnover. The analysis makes this assumption because the 72-hour provision is typically exceeded for a seventh 12-hour day in 7 days. As a result, a brief would be required regardless of whether this provision is waived or not.

Parameter	Description
NUM _{Local Craft}	The number of local craft workers impacted by shift schedule changes that will no longer be allowed
HOURS _{Local Craft}	Hours worked per local craft worker that exceeded the work hour requirements
HOURS _{Turnover}	The estimated amount of time (in hours) associated with a turnover job briefing (described in assumptions below)
CONTINGENCY _{Critical Path}	Contingency factor measuring the significance of expected resource loading associated with critical path activities (described in assumptions below)
WAGE _{Local Craft}	The estimated hourly rate of local craft labor (described in Section A3.9)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)
HCOST _{Outage}	The hourly cost of delaying the completion of an outage (described in Section A3.9)

Assumptions:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. The contingency factor value in this equation is assumed to be equal to 3. The contingency factor value is based on an evaluation of special conditions, including individuals' level of specialization, potential difficulty in establishing alternative arrangements, the likelihood of cost premiums like travel per diem and the potential impact to outage duration. In this section of the appendix, the contingency value ranges from 1 to 5. For this category, the contingency factor equals 3 due to the low level of specialization, local availability of labor but a potential impact on the outage critical path.
- The estimated amount of time (in hours) associated with a turnover job briefing: 0.5 hours.

Contractor - Specialty Vender

This section estimates the specialty cost associated with activities that have a critical path impact that will not meet the new waiver requirements. This group includes waivers associated with:

- Refueling path (fuel off-load, on-load, equipment repair, etc.);
- Steam generator eddy current testing;
- Reactor mid-loop operations; and
- Critical path repair/maintenance activities.

The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The cost estimate includes a travel cost of \$1,000 per person per waiver.

The management cost of this section is the additional management burden for planning and coordination. The additional management burden for waivers that address a single person is assumed to be 2 hours. For waivers that address more than one person, this analysis assumes that the additional management burden will be 4 hours.

The outage portion of this section is used to represent the cost associated with extending the outage as a result of allocating resources without the availability of a waiver. This waiver cost section addresses the potential impact of the job brief on the critical path.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$\begin{aligned} & (NUM_{Specialty\ Vender} \times (HOURS_{Specialty\ Vender} + HOURS_{Turnover} \times 2) \times WAGE_{Specialty\ Vender} \\ & \times CONTINGENCY_{Critical\ Path}) + (NUM_{Specialty\ Vender} \times COST_{Travel}) \\ & - (NUM_{Specialty\ Vender} \times HOURS_{Specialty\ Vender} \times WAGE_{Specialty\ Vender}) \end{aligned}$$

- The management cost represented by this section is the additional management burden for planning and coordination. The management cost is calculated as follows:

$$\begin{aligned} & \text{If waiver addresses one person, then } (2 \text{ hours} \times WAGE_{Manager}) \\ & \text{If waiver addresses multiple people, then } (4 \text{ hours} \times WAGE_{Manager}) \end{aligned}$$

- The outage portion of this section represents the cost associated with extending the outage as a result of allocating resources without the availability of a waiver. The outage cost is calculated as follows:

$$HOURS_{Turnovers} \times HCOST_{Outage}$$

If the waiver is associated with the 72-hour provision, then this analysis assumes that there is no cost for critical path turnover. The analysis makes this assumption because the 72-hour provision is typically exceeded for a seventh 12-hour day in 7 days. As a result, a brief would be required regardless of whether this provision is waived or not.

Parameter	Description
NUM _{Specialty Vender}	The number of specialty vender impacted by shift schedule changes that will no longer be allowed
HOURS _{Specialty Vender}	Hours worked per specialty vender that exceeded the work hour requirements
HOURS _{Turnover}	The estimated amount of time (in hours) associated with a turnover job briefing (described in assumptions below)
CONTINGENCY _{Critical Path}	Contingency factor measuring the significance of expected resource loading associated with shift schedule changes (described in assumptions below)
WAGE _{Specialty Vender}	The estimated hourly rate of specialty vender labor (described in Section A3.9)
COST _{Travel}	The estimated round trip travel fee used for contractor workers (described in Section A3.9)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)
HCOST _{Outage}	The hourly cost of delaying the completion of an outage (described in Section A3.9)

Assumptions:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. The contingency factor value in this equation is assumed to be equal to 5. The contingency factor value is based on an evaluation of special conditions, including individuals’ level of specialization, potential difficulty in establishing alternative arrangements, the likelihood of cost premiums like travel per diem and the potential impact to outage duration. In this section of the appendix, the contingency value ranges from 1 to 5. For this category, the contingency factor equals the maximum value of 5 due to the high level of specialization, potential difficulty in making alternative arrangements, likely need to pay a premium, and the potential impact on the outage critical path.
- The estimated amount of time (in hours) associated with a turnover job briefing: 0.5 hours

Utility

This category addresses utility workers and estimates the cost associated with an outage test or integrated evolution that will not meet the new waiver requirements. This group includes waivers associated with:

- Refueling path (fuel off-load, on-load, equipment repair, etc.);
- Steam generator eddy current testing;

- Reactor mid-loop operations;
- Reactor startup activities; and
- Critical path repair/maintenance activities.

The management cost represented by this section is the additional management burden for planning and coordination. The additional management burden for waivers that address a single person is assumed to be 2 hours. For waivers that address more than one person, this analysis assumes that the additional management burden will be 4 hours.

The outage portion of this equation is used to represent the cost associated with extending the outage as a result of allocating resources without the availability of a waiver. This waiver cost section includes the potential impact of the job brief on the critical path. The full weight of this additional activity is included in this cost estimate.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost of this waiver is the difference between the cost of labor for the extended period under the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Utility\ Worker} \times (HOURS_{Utility\ Worker} + HOURS_{Turnover} \times 2) \times WAGE_{Utility\ Worker} \times CONTINGENCY_{Critical\ Path}) - (NUM_{Utility\ Worker} \times HOURS_{Utility\ Worker} \times WAGE_{Utility\ Worker})$$

- The management cost represented by this section is the additional management burden for planning and coordination. The management cost is calculated as follows:

$$\begin{aligned} & \text{If waiver addresses one person, then } (2 \text{ hours} \times WAGE_{Manager}) \\ & \text{If waiver addresses multiple people, then } (4 \text{ hours} \times WAGE_{Manager}) \end{aligned}$$

- The outage portion of this section represents the cost associated with extending the outage as a result of allocating resources without the availability of a waiver. The outage cost is calculated as follows:

$$HOURS_{Turnover} \times H_{COST}_{Outage}$$

If the waiver is associated with the 72-hour provision, then this analysis assumes that there is no cost for critical path turnover. The analysis makes this assumption because the 72-hour provision is typically exceeded for a seventh 12-hour day in 7 days. As a result, a brief would be required regardless of whether this provision is waived or not.

Parameter	Description
NUM _{Utility Worker}	The number of utility workers impacted by shift schedule changes that will no longer be allowed
HOURS _{Utility Worker}	Hours worked per utility worker that exceeded the work hour requirements

Parameter	Description
HOURS _{Turnover}	The estimated amount of time (in hours) associated with a turnover job briefing (described in assumptions below)
CONTINGENCY _{Critical Path}	Contingency factor measuring the significance of expected resource loading associated with shift schedule changes (described in assumptions below)
WAGE _{Utility Worker}	The estimated hourly rate of utility worker labor (described in Section A3.9)
HCOST _{Outage}	The hourly cost of delaying the completion of an outage (described in Section A3.9)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)

Assumptions:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. The contingency factor value in this equation is assumed to be equal to 3. The contingency factor value is based on an evaluation of special conditions, including individuals' level of specialization, potential difficulty in establishing alternative arrangements, the likelihood of cost premiums like travel per diem and the potential impact to outage duration. In this section of the appendix, the contingency value ranges from 1 to 5. For this category, the contingency factor equals 3 due to the assignment flexibility of in-house staff and the potential impact on the outage critical path.
- The estimated amount of time (in hours) associated with a turnover job briefing: 0.5 hours.

A3.6 At-Power Costs Associated with Individuals Who Will Not Meet the Final Waiver Requirements

This category addresses a general estimate of the at-power cost associated with individuals who will not meet the new waiver requirements. This group includes waivers associated with training, meetings and other miscellaneous activities.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost associated with a shift schedule change that will not meet the new waiver requirements is the difference between the cost of labor for the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Utility Worker} \times HOURS_{Utility Worker} \times WAGE_{Utility Worker} \times CONTINGENCY_{Power}) - (NUM_{Utility Worker} \times HOURS_{Utility Worker} \times WAGE_{Utility Worker})$$

- The management cost associated with a shift schedule change that will not meet the new waiver requirements is the cost of the additional management burden for planning and coordination. The management cost is calculated as follows:

$$(1 \text{ hour} \times WAGE_{Manager})$$

Parameter	Description
NUM _{Utility Worker}	The number of utility workers impacted by shift schedule changes that will no longer be allowed
HOURS _{Utility Worker}	Hours worked per utility worker that exceeded the work hour requirements
CONTINGENCY _{Power}	Contingency factor measuring the significance of expected resource loading associated with at-power activities (described in assumptions below)
WAGE _{Utility Worker}	The estimated hourly rate of utility worker labor (described in Section A3.9)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)

Assumptions:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. The contingency factor value in this equation is assumed to be equal to 2. The contingency factor value is based on an evaluation of special conditions, including individuals' level of specialization, potential difficulty in establishing alternative arrangements, the likelihood of cost premiums like travel per diem and the potential impact on at-power operation. In this section of the appendix, the contingency value ranges from 1 to 5. For this category, the contingency factor equals 2 due to the assignment flexibility of in-house staff and the lack of impact on at-power operation.
- The estimated level of effort to process an at-power waiver is 1 hour.

A3.7 At-Power Costs Associated With Individuals Involved in Tests or Integrated Evolution Who Will Not Meet the Final Waiver Requirements

This category addresses an estimate of the at-power cost associated with individuals involved in test or integrated evolution who will not meet the new waiver requirements. This group includes waivers associated with testing and other operational activities.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost associated with a shift schedule change that will not meet the new waiver requirements is the difference between the cost of labor for the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Utility\ Worker} \times (HOURS_{Utility\ Worker} + HOURS_{Turnover} \times 2) \times WAGE_{Utility\ Worker} \times CONTINGENCY_{Power_Test}) - (NUM_{Utility\ Worker} \times HOURS_{Utility\ Worker} \times WAGE_{Utility\ Worker})$$

- The management cost associated with a shift schedule change that will not meet the new waiver requirements is the cost of the additional management burden for

planning and coordination. The management cost is calculated as follows:

$$(1 \text{ hour} \times WAGE_{\text{Manager}})$$

Parameter	Description
NUM _{Utility Worker}	The number of utility workers impacted by shift schedule changes that will no longer be allowed
HOURS _{Utility Worker}	Hours worked per utility worker that exceeded the work hour requirements
CONTINGENCY _{Power_Test}	Contingency factor measuring the significance of expected resource loading associated with at-power test activities (described in assumptions below)
WAGE _{Utility Worker}	The estimated hourly rate of utility worker labor (described in Section A3.9)
HOURS _{Turnover}	The estimated amount of time (in hours) associated with a turnover job briefing (described in assumptions below)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)

Assumptions:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. The contingency factor value in this equation is assumed to be equal to 3. The contingency factor value is based on an evaluation of special conditions, including individuals’ level of specialization, potential difficulty in establishing alternative arrangements, the likelihood of cost premiums like travel per diem and the potential impact on at-power operation. In this section of the appendix, the contingency value ranges from 1 to 5. For this category, the contingency factor equals 3 due to the assignment flexibility of in-house staff and the increased importance of on-going operational activities.
- The estimated level of effort to process an at-power waiver is 1 hour.
- The estimated amount of time (in hours) associated with a turnover job briefing: 0.5 hours.

A3.8 At-Power Costs Associated With Individuals Involved in Return to Full Power Who Will Not Meet the Final Waiver Requirements

This category addresses an estimate of the at-power cost associated with individuals involved in activities that are associated with the return to full power who will not meet the new waiver requirements. This group includes waivers for individuals involved in repair activities that are not associated with technical specification equipment and that likely result in a power reduction. This analysis assumes that a facility will operate at 75% of its capacity.

The *facility cost per waiver* results from the sum of the following factors:

- The labor cost associated with a shift schedule change that will not meet the new waiver requirements is the difference between the cost of labor for the final rule and the cost of labor pre-rule. The labor cost is calculated as follows:

$$(NUM_{Utility\ Worker} \times (HOURS_{Utility\ Worker} + HOURS_{Turnover} \times 2) \times WAGE_{Utility\ Worker} \times CONTINGENCY_{Return\ to\ Full\ Power}) - (NUM_{Utility\ Worker} \times HOURS_{Utility\ Worker} \times WAGE_{Utility\ Worker})$$

- The management cost associated with a shift schedule change that will not meet the new waiver requirements is the cost of the additional management burden for planning and coordination. The management cost is calculated as follows:

$$(1\ hour \times WAGE_{Manager})$$

- The return to power cost associated with operating at a reduced power level is the cost of allocating resources without the availability of a waiver. The return to power cost is calculated as follows:

$$HOURS_{Turnovers} \times REDUCED_POWER \times HCOST_{Outage}$$

Parameter	Description
NUM _{Utility Worker}	The number of utility workers impacted by shift schedule changes that will no longer be allowed
HOURS _{Utility Worker}	Hours worked per utility worker that exceeded the work hour requirements
CONTINGENCY _{Return to Full Power}	Contingency factor measuring the significance of expected resource loading associated with return to full power activities (described in assumptions below)
WAGE _{Utility Worker}	The estimated hourly rate of utility worker labor (described in Section A3.9)
HOURS _{Turnover}	The estimated amount of time (in hours) associated with a turnover job briefing (described in assumptions below)
REDUCED_POWER	Percent of total power lost per hour from operating at a reduced power level (described in assumptions below)
HCOST _{Outage}	The hourly cost of delaying the completion of an outage (described in Section A3.9)
WAGE _{Manager}	Average manager wage rate (described in Section A3.9)

Assumptions:

- A scaling factor is used to increase baseline costs to reflect higher costs under the final provision. The contingency factor value in this equation is assumed to be equal to 5. The contingency factor value is based on an evaluation of special conditions, including individuals' level of specialization, potential difficulty in establishing alternative arrangements, the likelihood of cost premiums like travel per diem and the potential impact on at-power operation. In this section of the appendix, the contingency value

ranges from 1 to 5. For this category, the contingency factor equals 5 due to the direct impact waivers have on production output.

- The estimated amount of time (in hours) associated with a turnover job briefing: 0.5 hours.
- The estimated level of effort to process an at-power waiver is 1 hour.
- Percent of total power lost per hour from operating at a reduced power level: 25%.

A3.9 Generic Costing Assumptions

- Management labor rate: \$100/hour.
- The estimated hourly rate of utility craft labor: \$40/hour.
- The estimated hourly rate of specialty contractors: \$80/hour.
- The estimated hourly rate of local labor: \$25/hour.
- The effectiveness of additional resources relative to those that are being augmented: 100%.
- The hourly cost of delaying the completion of an outage: \$10,000.
- The estimated round trip travel fee used for contractor workers: \$1,000.
- The estimated level of effort to process a waiver is 1 hour.