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Performance Monitoring Program

Developing Comparative Metrics for Fitness-for-Duty Programs

April 2022

Caitlin A Condon
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Prepared for the U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Under Contract DE-AC05-76RL01830
Interagency Agreement: 31310019N0001
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Summary

To comply with U.S. Nuclear Regulatory Commission (NRC) regulations, licensees and entities authorized under Title 10 of the Code of Federal Regulations (CFR) Part 26 Section 26.3 (§ 26.3) are required to have fitness-for-duty (FFD) programs. Under § 26.3, the expectation of these FFD programs is to provide reasonable assurance that individuals who are granted unescorted access to nuclear power reactor protected areas and Category I fuel cycle facility material control areas are trustworthy, will perform their tasks in a reliable manner, are not under the influence of any substance, legal or illegal, that may impair their ability to perform their duties, and are not mentally or physically impaired from any cause that can adversely affect their ability to safely and competently perform their duties.

Pacific Northwest National Laboratory (PNNL) was tasked with developing a performance monitoring program to risk inform NRC inspection and policy regarding quantitative FFD performance data. To meet this need, PNNL developed methodologies that could be implemented within a performance monitoring program. Throughout this report, these methodologies are referred to as comparative metrics. The NRC provided PNNL with 2016–2019 data from annual reporting forms and single positive test forms provided by licensees and other entities. For most of the comparative metrics, the analyses required customized processing, such as creating filtering fields, adding data fields and summaries, and joining datasets. The comparative metrics developed include:

- random testing rate
- random policy violation rate
- pre-access policy violation rate
- subversion attempt rate
- number of policy violations by labor category.

The comparative metrics can be used for parsing and visualizing FFD program data and monitoring FFD performance at the labor category, facility, licensee, and industry levels to risk inform NRC inspection and policy with regard to the FFD data currently collected from licensees and other entities that implement Part 26 requirements. Furthermore, these developed comparative metrics allow a more in-depth look at the FFD programs for the industry to discern trends and patterns that may warrant changes at an industry level and to inform policy decisions. These analyses should be refreshed as new FFD data become available.

Acronyms and Abbreviations

ARF	Annual Reporting Form
CFR	Code of Federal Regulations
C/V	contractor/vendor
FFD	fitness-for-duty
HHS	U.S. Department of Health and Human Services
NRC	U.S. Nuclear Regulatory Commission
PNNL	Pacific Northwest National Laboratory
ROP	Reactor Oversite Process
SPTF	Single Positive Test Form
SSCs	structures, systems, and components
SSNM	Strategic Special Nuclear Material

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1.0 Background

To comply with U.S. Nuclear Regulatory Commission (NRC) regulations, licensees and entities authorized under Title 10 of the Code of Federal Regulations (CFR) Part 26 Section 26.3 (§ 26.3) are required to have fitness-for-duty (FFD) programs. The expectation of these programs is to provide reasonable assurance that individuals who are granted unescorted access to nuclear power reactor protected areas are trustworthy, will perform their tasks in a reliable manner, are not under the influence of any substance, legal or illegal, that may impair their ability to perform their duties, and are not mentally or physically impaired from any cause that can adversely affect their ability to safely and competently perform their duties (§ 26.23).

Licensee programs for regular drug and alcohol testing of personnel must meet requirements described in 10 CFR Part 26. As part of the rule, substance use tests are administered under the following conditions (§ 26.31[c]):

- Pre-access (e.g., prior to employment, initial, updated, or reinstated authorization)
- At random
- For cause (e.g., observing behavior of substance abuse[1])
- Post-event (i.e., following any safety or security events of concern)
- Follow-up (i.e., verifying abstinence).

Licensees and other entities are required to report the results of their FFD programs to NRC (§ 26.717, § 26.417, and § 26.203[e]). Drug and alcohol testing results are reported annually through the Annual Reporting Form (ARF) (NRC 2020a; see Appendix A for more about NRC Form 891) and for all positive tests through the Single Positive Test Form (SPTF) (NRC 2020b; see Appendix B for more about NRC Form 890).[2]

One of the motivations for NRC to pursue a process for performance monitoring with FFD programs is the risk-informed, metrics-based approach for NRC's Reactor Oversight Process (ROP)[3]. While the reporting process illustrated by the ROP is designed to address performance areas for reactor safety, radiation safety, and safeguards, the FFD program is designed to address if individuals with unescorted access are trustworthy and reliable. An example of the performance indicators and threshold values for the NRC's ROP is shown in Table 1.

[1] Per 10 CFR Part 26, "Substance Abuse" means the use, sale, or possession of illegal drugs, or the abuse of prescription and over-the-counter drugs, or the abuse of alcohol.
[2] These forms (NRC Form 890 and 891) may be viewed in Appendices A and B.
[3] Further information on the ROP is available through NRC at: https://www.nrc.gov/reactors/operating/oversight/cornerstone.html#IE01

Table 1. Select ROP performance indicators[a]

Performance Indicator	Lowest Threshold Value[b]
Unplanned reactor scrams	> 3
Unplanned power changes	> 6
Unplanned scrams with complications	> 1.0
Safety System Functional Failures (PWR)	> 5.0
Public Radiation Release Occurrence	> 1.0
Occupational Radiation Exposure Occurrence	> 2

[a] Further information on the ROP is available through NRC at: https://www.nrc.gov/reactors/operating/oversight/cornerstone.html#IE01

[b] The value presented is for the "Increased Regulatory Response Band." These values are based on a designated period of time for the particular performance indicator.

Within NRC's FFD regulations, there are annual reporting requirements as well as those associated with more urgent needs for reporting, as in § 26.719(b), where licensees and other entities are required to report to the NRC, within 24 hours, when a supervisor, licensed operator, or FFD program personnel violates the FFD policy. These reports are important as risk indicators for the NRC to assess, in part, whether any immediate NRC actions are necessary to inspect the occurrence of the policy violation. The assessment includes determining whether (1) any similar incidents had occurred in the recent past, potentially indicating that perhaps corrective actions implemented by the licensee to preclude recurrence were ineffective, and (2) the individual was in a position to cause harm to him/herself, others, or the facility. Depending on the job functions involved, the safety or security significance of the policy violation will vary. For example, the safety significance of radiation protection technicians, quality assurance personnel, or security officers being impaired (or violating the FFD policy) is arguably more significant than an impaired supervisor directing general maintenance activities proceeding within the protected area. For security officers, licensee supervisors, and NRC-licensed operators, very few FFD policy violations in any one year is the norm, so any substantial increase in the number per unit time might be a concern.

Pacific Northwest National Laboratory (PNNL) was tasked with developing comparative metrics to contribute to a performance monitoring program that will risk inform NRC inspection and policy regarding quantitative FFD performance data. To meet this need, PNNL developed methodologies to derive comparative metrics from the ARF and SPTF data that could be implemented within a performance monitoring program. These metrics were designed to characterize FFD program performance and can be used in monitoring FFD programs over time. Comparative metrics focus on substance abuse testing in accordance with the requirements of 10 CFR Part 26 and do not include other program performance factors such as programmatic cost, staffing, leadership, diversity, etc.

PNNL developed these comparative metrics with 2016–2019 data for the ARF (Appendix A) and SPTF (Appendix B) datasets provided by the NRC. The information was based on the ARFs and SPTFs provided by licensees from 2016–2019. The data from which these analyses were performed are based on publicly available source data that is retained by NRC. The goal was to provide a greater understanding of the performance of FFD programs across the nuclear industry. These analyses provide information to allow NRC to compare data for a single facility or licensee to the industry and other comparable licensees or facilities. The figures and values presented for the comparative metrics in this report are limited to the available data (2016–

2019) but can be updated or augmented with more recent datasets. Information is included on how each comparative metric was performed.

The list of licensees and facilities as well as the corporate offices and Category I fuel cycle facilities participating in the FFD program in 2016–2019 are provided in Appendix C. Appendix D contains a detailed overview of the methods for the performance monitoring data processing and preparation. In summary, the analyses required customized data processing steps for most of these data, such as creating filtering fields (e.g., licensee employees vs. contractor/vendors [C/V] employees), adding data fields that count the type of positive tests (e.g., if substance field contains "marijuana," then add a "1" to a new "marijuana field") and summaries of the SPTF totals that needed to be joined to the ARF dataset. Relevant definitions for terms used in these comparative metrics are shown in Table 2 and Section 9.0, Glossary.

Table 2. Key definitions for FFD performance monitoring

Term	Definition
Testing Rate	The proportion of employees who are subject to substance testing over time.
Policy Violation	FFD policy violation requiring submission of an SPTF form. The violations in the SPTF database used in this report include positive drug or alcohol tests, subversion attempts, and refusals for collection (10 CFR 26, Subpart H).
Authorization	Licensee or other entity in § 26.3 has determined that an individual has met the requirements to be granted or to maintain the types of access or perform the duties specified in § 26.4(a) through (e), and, at the licensee's or other entity's discretion, § 26.4(f) or (g).
Positive Test	For drug testing, a positive result is the result reported by a licensee testing facility or U.S. Department of Health and Human Services (HHS)-certified laboratory when a specimen contains a drug or drug metabolite equal to or greater than the cutoff concentration. A result reported by an HHS-certified laboratory that a specimen contains a drug or drug metabolite below the cutoff concentration is also a positive result when the laboratory has conducted the special analysis permitted in § 26.163(a)(2). For alcohol testing, a positive result means the result reported by a collection site when the blood alcohol concentration indicated by testing a specimen is equal to or greater than the cutoff concentrations established in this part.
Subversion Attempt	"[A] willful act to avoid being tested or to bring about an inaccurate drug or alcohol test result for oneself or others at any stage of the testing process" (§ 26.5).
Facility	Reactors (single and multi) owned and operated by licensees. Includes operating reactors as well as those being decommissioned or under construction. See Appendix C for a complete list.
Entities	Those that are enrolled in FFD program related to their oversight (e.g., a corporate office) or training programs associated with authorized access. See Appendix C for a complete list.
Licensee	Corporations (e.g., Dominion) that are licensed to operate nuclear power reactors under 10 CFR Part 50.57 and holders of a combined license under 10 CFR Part 52.
Licensee Employee	Workers employed by licensees and who meet § 26.4 categories of individuals.
C/V	"[A]ny company, or any individual not employed by a licensee or other entity specified in § 26.3(a) through (c), who is providing work or services to a licensee or other entity covered in § 26.3(a) through (c), either by contract, purchase order, oral agreement, or other arrangement" (10 CFR Part 26.5).

The presented comparative metrics can be used as part of a performance monitoring program to evaluate FFD performance for the industry, licensees, facilities, or employee types. This report contains the results for the analyses of random testing rates, FFD policy violation rates from random tests and pre-access tests, rates of subversion attempts, and number of FFD policy violations by labor category. These analyses provide a demonstration of how these data might be used to evaluate performance of an FFD program. Each comparative metric section begins with observations for the data (e.g., discussion of industry trends) followed by recommended figures and/or tables to be generated as part of the FFD evaluation. These observations, figures, and tables can be recreated with future datasets as FFD information becomes available to provide a more up-to-date evaluation of the industry.

2.0 Random Testing Rate

As part of 10 CFR Part 26 (specifically, § 26.31[d][2][vii]), licensees and other entities are required to conduct annual random testing of at least 50% of the "… population that is subject to the FFD program." Thus, the rate of random testing examines the rate at which licensee employees and C/V employees are subject to random testing over time by facility or by licensee. This is one aspect of compliance with NRC regulations and relates to the overall performance of an FFD program. The random testing rate, proposed here as a comparative metric, was designed as a way to compare testing rates in the industry to those from a licensee or even those from an individual facility under a licensee. The data were analyzed to examine how the random testing rates compare between the licensee employee population and the C/V population. The figures presented in this section (and corresponding analyses) can provide useful information on the current state of random testing within the FFD programs for the commercial nuclear industry and provide a metric of comparison for NRC inspectors when preparing for facility inspections.

This first comparative metric focuses on the analyses of the rate of random testing in a given year by facility, by licensee, and by employee type (licensee employees or C/V employees) as defined in Equation (1):

$$Random\ Testing\ Rate = \frac{\#\ Random\ Tests\ Administered}{Average\ \#\ Employees\ in\ Random\ Testing\ Pool} \quad (1)$$

Equation (1) uses the reported average number of employees in the random testing pool in a year to determine the random testing rate. The incidence of random testing rate compared to § 26.31(d)(2)(vii) is best evaluated visually, on a scale of 0 to 100% for random testing of the individuals enrolled in the FFD programs at the licensed facilities. Figure 1 and Figure 2 present random testing rates for all employees by facility and then by licensee, respectively (Appendix C lists the licensee type of facility with the status of operation). Figure 3 and Figure 4 present random testing rates for licensee employees and C/V employees by facility and year. In each figure, the random testing rate of 50% is presented with a red line to show the required testing rate relative to the actual testing rate.

Of note, 10 CFR Part 26 does not specify how licensees are required to implement the random testing rate requirement; thus, although some specific facilities or employee types might show random testing rates below 50%, the licensee might remain at or above a 50% rate when considering all employees at a single facility or across all licensed facilities, according to the manner by which they implement the testing requirement. This is demonstrated in Figure 1 and Figure 2, which show random testing rates for all employees and for all employees at a single licensee, respectively. Figure 4, which shows random testing of C/V employees only, has numerous facilities showing a rate of testing below the required 50% (the rate was often between 30 and 49%). In contrast, Figure 1, Figure 2, and Figure 3 show very few facilities or licensees with rates below 50% when considered for licensee employees, all employees, or licensees overall. Figure 1, Figure 2, Figure 3, and Figure 4 are limited to results between 0 and 100% testing rates. There were few instances when random testing was above 100%, and those instances are not shown in these figures. Facilities that had testing rate instances above 100% included Callaway, Corporate–Southern Nuclear, Kewaunee, and Monticello. These instances occurred when the number of random tests administered in the year exceeded the average number of workers in the random testing pool. These instances where the random

testing is above 100% are not explored further in this report as the primary concern with random testing values are those below the 50% regulatory threshold.

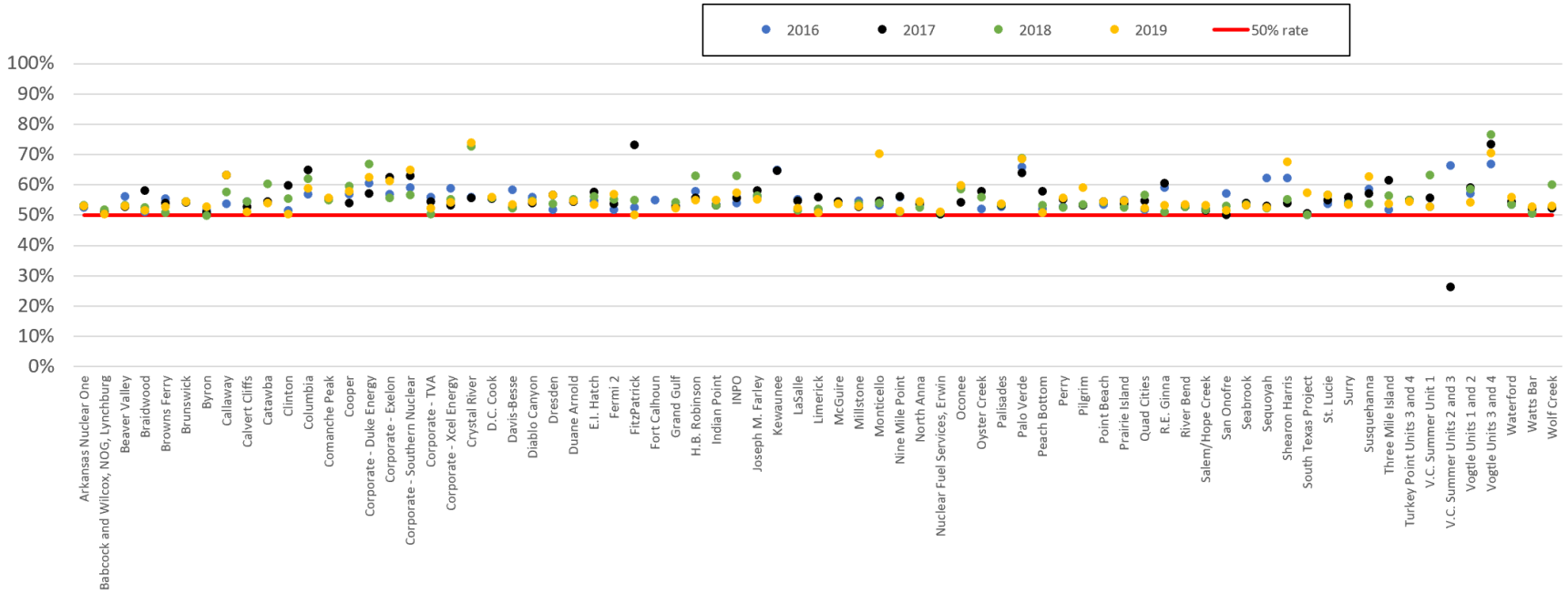


Figure 1. Random testing rates for all employees by facility

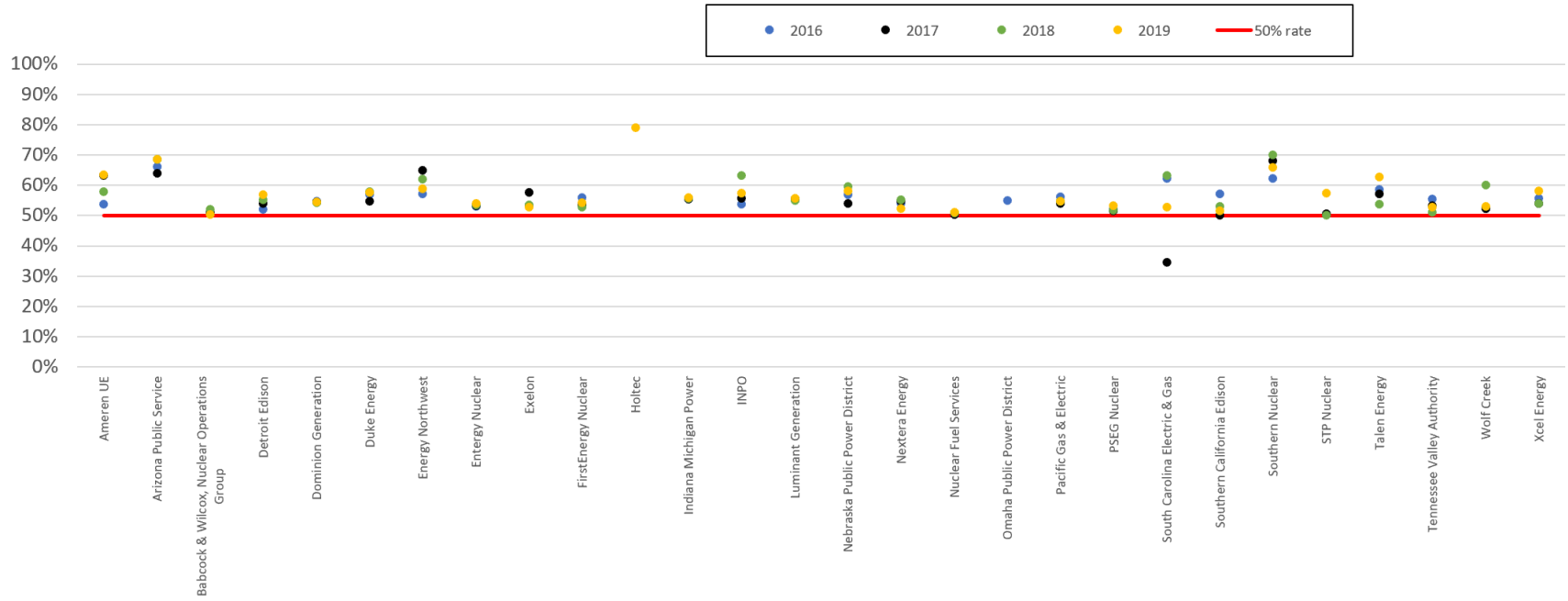


Figure 2. Random testing rates for all employees by licensee

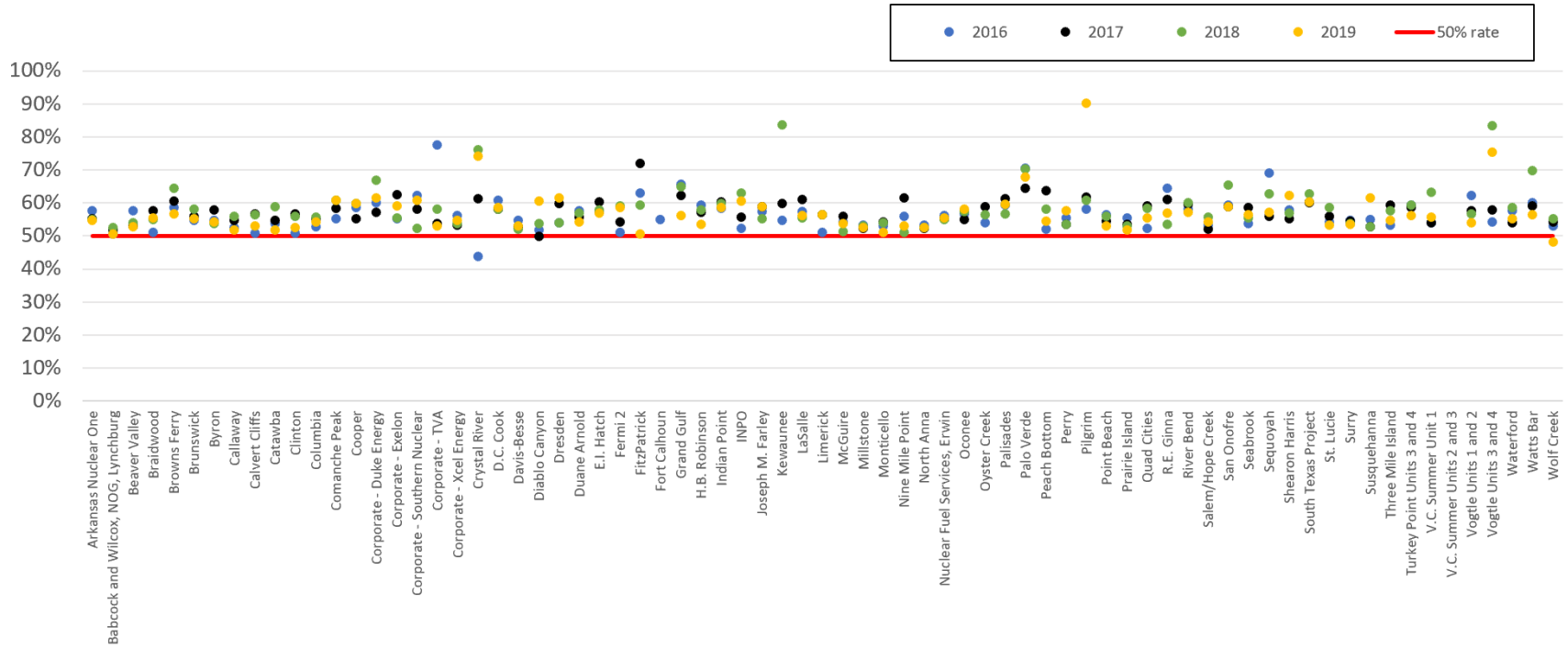


Figure 3. Random testing rates over time and by facility for licensee employees

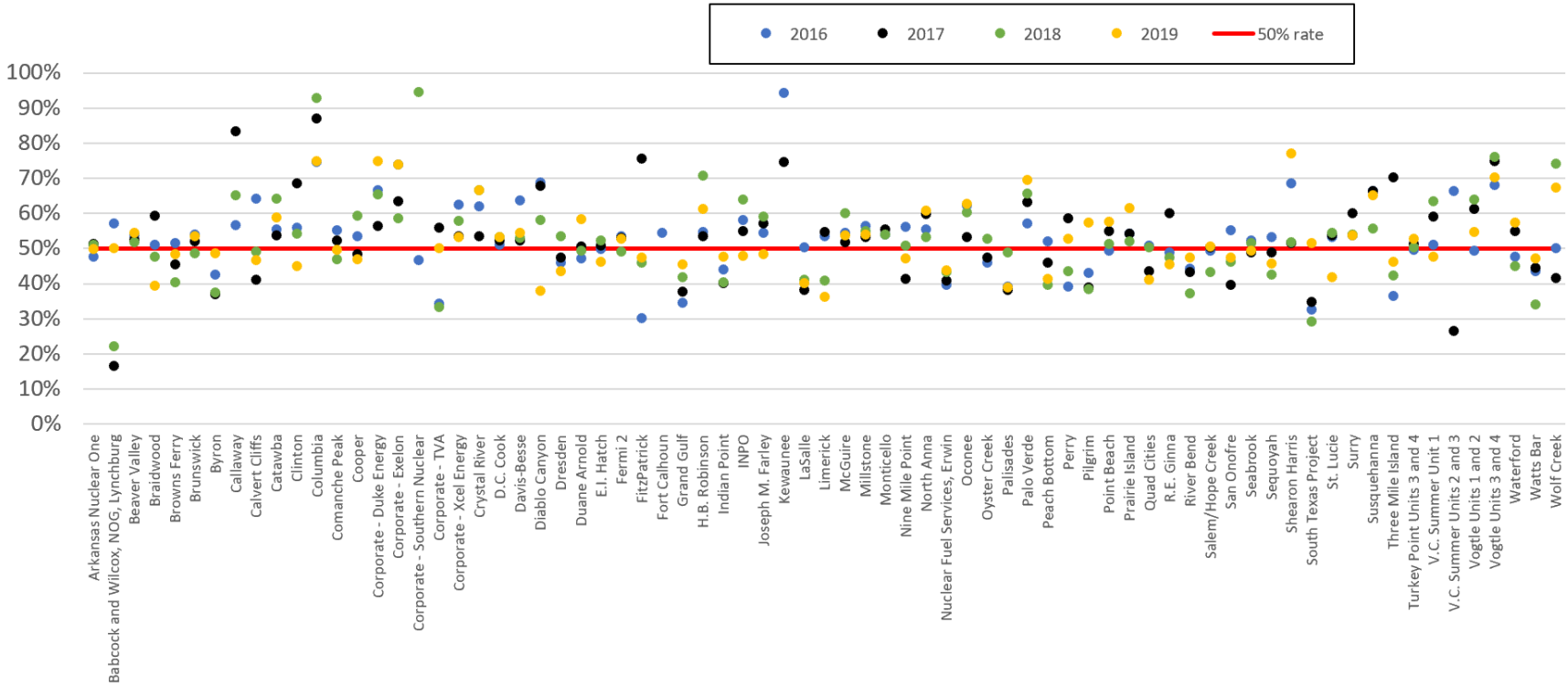


Figure 4. Random testing rates over time and by facility for C/V employees

Random testing rates provide information about the performance of an FFD program and are directly tied to a regulatory requirement (§ 26.31[d][2][vii]). Examining the random testing rate by facility provides information on how individual facilities are performing compared to the industry as a whole. This review generally indicated that facilities and licensees have been randomly testing employees at or above the regulated 50% random testing rate. Unusually low or high rates of random testing indicate a need for additional information and are not necessarily an indicator of strong or poor performance.

From a risk perspective, this comparative metric could be included in an assessment to inform how the random testing rate is being applied to the worker population. That is, the random testing program could be applied such that all work or employment categories individually meet the 50% random testing rate (e.g., all C/V employees), or in a risk-informed manner such that employees involved in safety- or security-sensitive activities are tested at or above the 50% random rate. This performance-based assessment is justified, in part, by:

(1) 10 CFR 26.41(e), Conduct of audits, which states that audits must focus on the effectiveness of the FFD program or program element(s), as appropriate, and must be conducted by individuals who are qualified in the subject(s) being audited

(2) The data in Figures 1–4, which suggest that the facilities and licensees could use the information on random testing rate to further explore if their FFD program is adequately evaluating various employee types, including those employees that have critical safety- or security-sensitive positions (which is further explored in Section 6.0)

3.0 Random Policy Violation Rate

Per § 26.67, after individuals apply for and are granted authorization under 10 CFR Part 26, Subpart C, "Granting and Maintaining Authorization," they are thereafter subject to random testing under § 26.31(d)(2). Random testing is a way to monitor substance abuse in the population of employees who have been granted authorization through an FFD program. A policy violation is a positive drug or alcohol test, subversion attempt, or refusal for collection. The random policy violation rate comparative metric refers to the rate (i.e., percentage) of policy violations from random tests for a facility or a licensee within a given year according to Equation (2):

$$Random\ Policy\ Violation\ Rate = \frac{\#\ of\ Violations\ in\ Random\ Tests}{Total\ \#\ of\ Administered\ Random\ Tests} \quad (2)$$

For example, a policy violation rate of 2% would indicate that, of the random substance use tests conducted within a given year, 2% of the tested individuals were positive for at least one substance tested (per § 26.31[d]), had a subversion attempt, or refused the test. To understand performance of FFD programs across the industry, this random policy violation rate was calculated over time, by licensee, and by facility. This comparative metric could be included in an FFD performance monitoring program as a way to compare random policy violation rates (at the employee type or all employees) in the industry to those rates from a licensee, or from an individual facility or fleet of comparable facilities. The figures presented in this section (and corresponding analyses) can provide useful information on the current state of the random policy violation rate in the commercial nuclear industry, as well provide a metric of comparison for inspectors when preparing to inspect a facility. This comparative metric is important because it is a direct indication of the number of individuals who had violated the FFD policy among those who were given and maintained unescorted access to the facility, materials, and information, thus challenging the basis on which their unescorted access was granted—that these individuals were believed to be fit for duty, trustworthy, and reliable.

Examining the random policy violation rate over time can provide useful information on an individual FFD program's performance and whether there are any concerning trends in the rate of positive random tests over time. Figure 5 and Figure 6 present the random policy violation rate for each facility over time, with the darker gradient on the graphic illustrating higher rates. The grey scale presentation for Figure 5 and Figure 6 was chosen as a way to illustrate differences between rates without picking a subjective threshold limit; these figures were developed to help facilities identify rates that might indicate that they are outside the industry norm. As Figure 5 shows, among licensee employees, the random policy violation test rate is around 1%. Among C/V employees, as shown in Figure 6, the rates were more variable and were generally between 2–4%. This demonstrates that the random policy violation rates are considerably higher among C/V employees as compared to licensee employees. This may be an area of concern, as the random testing rate of C/V employees was often between 30–49%, as discussed in Section 2.0. Examining the random policy violation rate by facility provides information on how a facility is performing as compared to the industry as a whole. In addition, for a single licensee, examining the random policy violation rate by facility provides information on how one facility is performing as compared to other facilities under the same licensee.

Figure 7 shows the random policy violation rates by employee type (licensee or C/V) and by the number of facilities per licensee (one vs more than one facility). This analysis was conducted to determine if there was a noticeable difference in random policy violation rates for licensees with

one facility or multiple facilities. As shown in Figure 7, there was not a noticeable difference in random policy violation rates based on the number of facilities under a licensee or, in this case, a single FFD program.

The random policy violation rate should be evaluated considering the operating status of the facility during the time period of interest. For example, if a facility or licensee is in refueling or maintenance outage or is in the process of construction or decommissioning, this might have an impact on the random policy violation test rate due to the influx of C/V employees required to perform work. The random policy violation rate can provide useful information regarding the rate of substance use at facilities and licensees for understanding FFD program performance. For example, a high random policy violation rate indicates a relatively large number of individuals with unescorted access to the facility, materials, and information, and thus a potential weakness in oversight of the FFD's random testing program. The areas of weakness could be the pre-access screening or testing program, FFD training, FFD program policy, or the safety culture of the facility. If the random policy violation rate were assessed by particular work populations (i.e., maintenance, contractor/vendors, security, etc.), FFD performance insights could be gained and direct corrective actions.

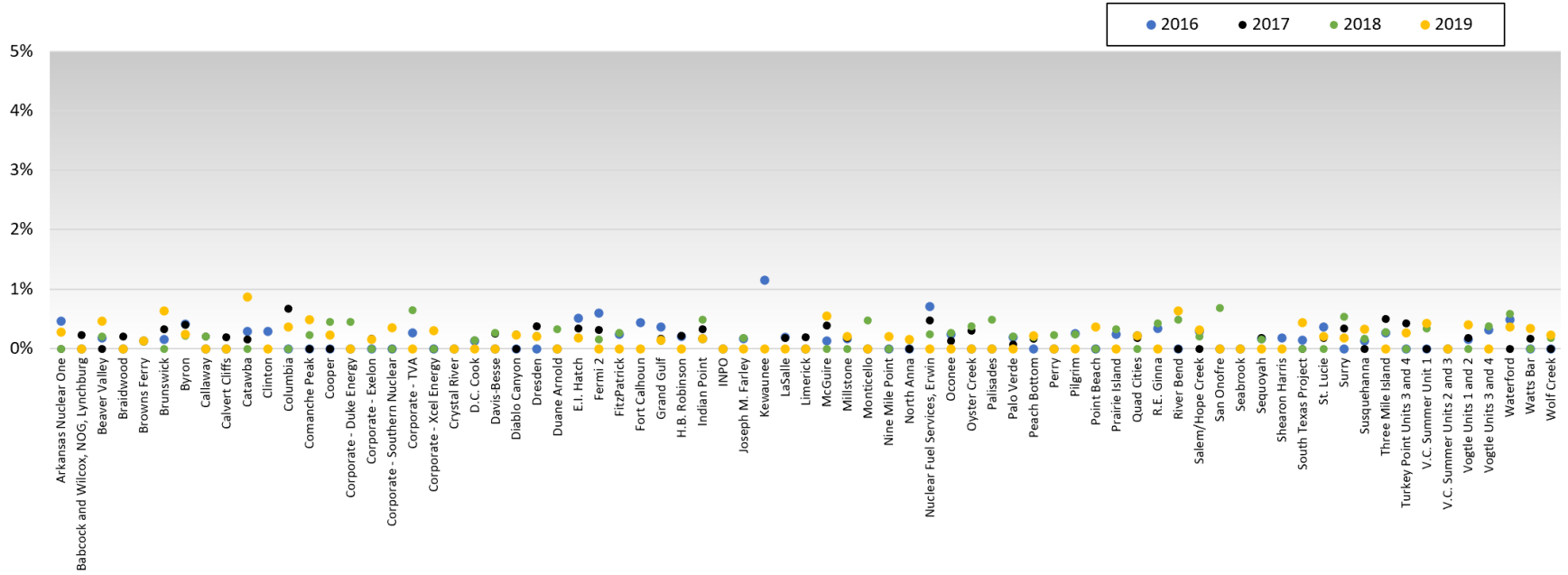


Figure 5. Rate of policy violations in random tests over time and by facility for licensee employees[1]

[1] Overlapping data points in figure may appear as only the most recent data point

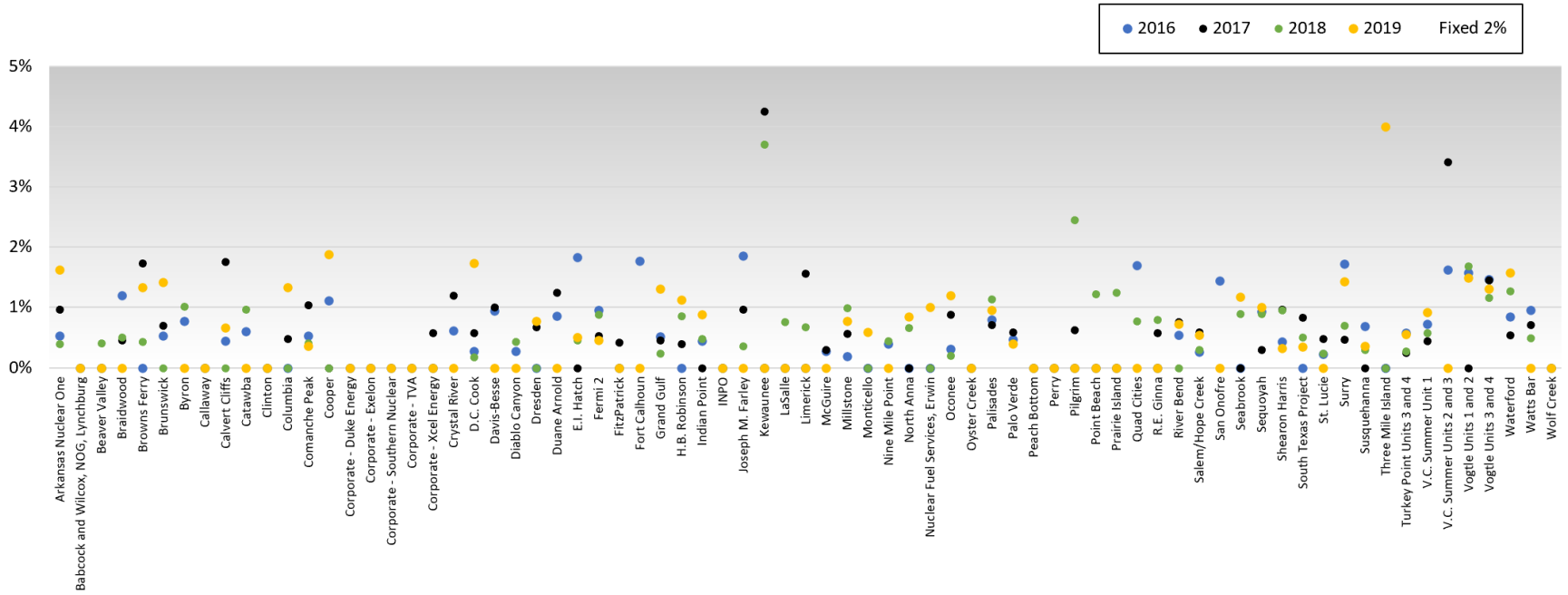


Figure 6. Rate of policy violations in random tests over time and by facility for C/V employees[1]

[1] Overlapping data points in figured may appear as only the most recent data point

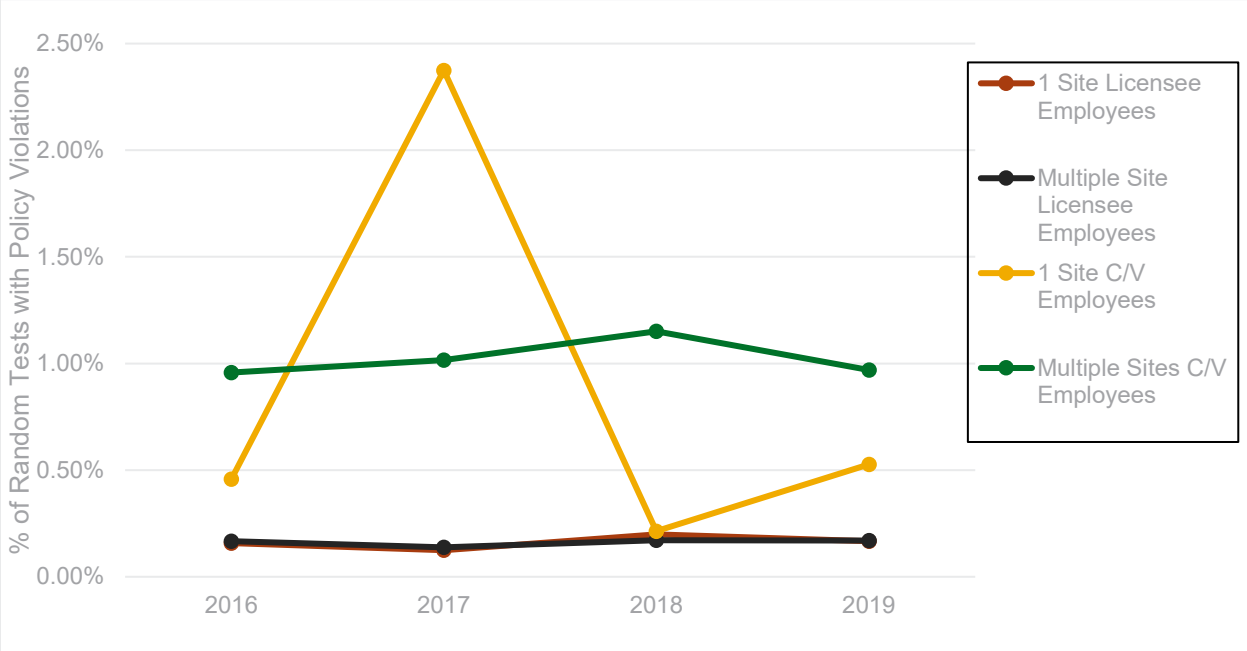


Figure 7. Random policy violation test rates by year and employee type and by number of facilities per licensee[1]

[1] This figure excludes the corporate sites to focus specifically on nuclear reactor facilities (operating, decommissioned, and under construction) and Category I fuel cycle facilities. This figure also excludes Pilgrim because it falls within both categories during the time period of interest (licensee with more than 1 facility and licensee with 1 facility) as it moved from an operating facility under Entergy's license to decommissioning under Holtec's license.

4.0 Pre-Access Policy Violation Rate

Prior to employment with a licensee, applicants seeking access authorization are subject to pre-access drug and alcohol testing per § 26.65. Pre-access testing also includes individuals seeking to update or reinstate access authorization. The pre-access policy violation test rate is defined in Equation (3):

$$Pre - Access\ Policy\ Violation\ Rate = \frac{\#\ of\ Violations\ in\ Pre - Access\ Tests}{Total\ Number\ of\ Pre - Access\ Tests\ Administered} \quad (3)$$

The pre-access policy violation rate is informative of the quality of the applicant pool, whereas the other types of tests (e.g., random) are informative of the FFD program performance within the current workforce. For licensee applicants, the pre-access policy violation test rate was typically 0–1% by facility, but there were numerous instances of 1–2% and periodic instances above 3% or 4% (Figure 8). By contrast, the pre-access policy violation rates for C/V applicants were higher and more variable than for licensee applicants. The pre-access policy violation for C/V applicants were infrequently 0%, were more typically between 0.5 and 2.0%, and periodically were above 3% or 4% (Figure 9). Because pre-access policy violation rates for C/V were frequently above 0%, this demonstrates the validity and benefit of the pre-access screening program.

As discussed above, considering pre-access policy violation rates is not indicative of FFD program performance; however, comparing pre-access policy violation rates to the random policy violation rates can help inform FFD program performance. For this third comparative metric, a lower policy violation rate for random tests than pre-access tests could indicate a successful screening process by the licensee. A Kruskal Wallis non-parametric test demonstrated, at a high degree of statistical certainty ($p < 0.01$), that the median pre-access policy violation rates were higher than the medium random policy violation rates across all facilities in the FFD program. This demonstrates that given the significantly higher prevalence of substance use among the pre-access applicants than the incumbent employees, the pre-access screening test helps reduce the risk of hiring or allowing untrustworthy and unreliable individuals to have unescorted access to the facility, materials, or information, and provides useful input for evaluating FFD program performance.

There are, however, some potential signs of caution when comparing policy violation rates for pre-access tests and random tests. A Spearman's rank-order correlation non-parametric test showed that random policy violation rates were weakly and positively correlated (0.357) with the pre-access policy violation rates (statistically significant, $p = 0.0019$) (Figure 10). This means that facilities with higher pre-access policy violation rates also tend to have higher random policy violation rates (a potential sign of caution). However, this is a correlational, not a causal association, and there were exceptions (as seen in Figure 10, where there are outliers).

For the pre-access comparative metric, comparative analyses could be important to assess the nuclear safety culture associated with individuals being considered for unescorted access to the facility, materials, or information. For example, a high pre-access policy violation rate for a specific vendor performing a specific job during a 30-day period could potentially skew the facility's overall pre-access policy violation rate for the month or quarter, and possibly the year if there are no other activities they are conducting (e.g., refueling or maintenance outages). Similarly, the licensee could compare its pre-access policy violation rate from one refueling/maintenance outage to the next to provide insights into its contracting processes,

background screening, and other authorization activities. In this manner, the licensee or other entity could assess the performance of its pre-access drug and alcohol testing program above that just determined by the sheer number of individuals in violation of the FFD policy to assess whether there is a particular group (e.g., company, trade, or locality) causing the increased policy violation rate.

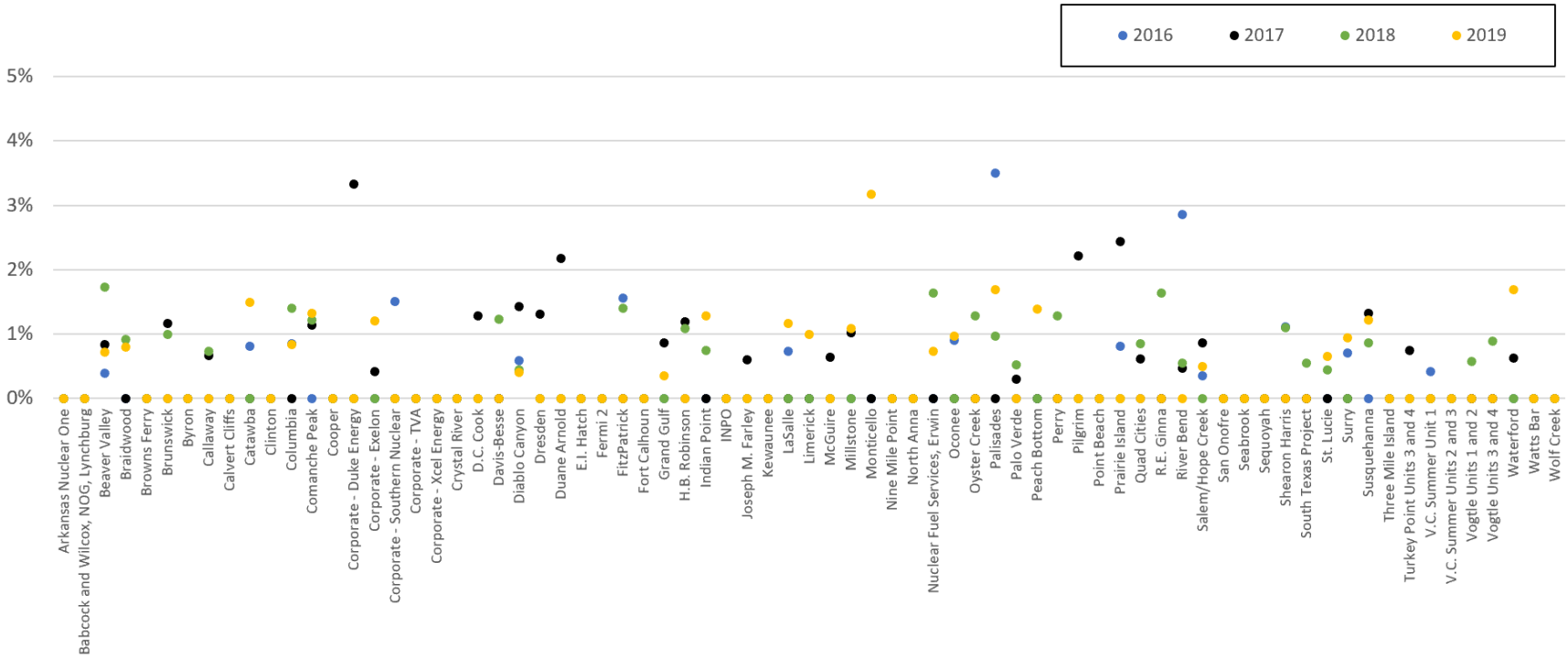


Figure 8. Rate of pre-access policy violations over time and by facility for licensee employees[1][2]

[1] Not shown in figure is Monticello (5.1%) in 2018 as it is outside the axis range
[2] Overlapping data points in figure may appear as only the most recent data point

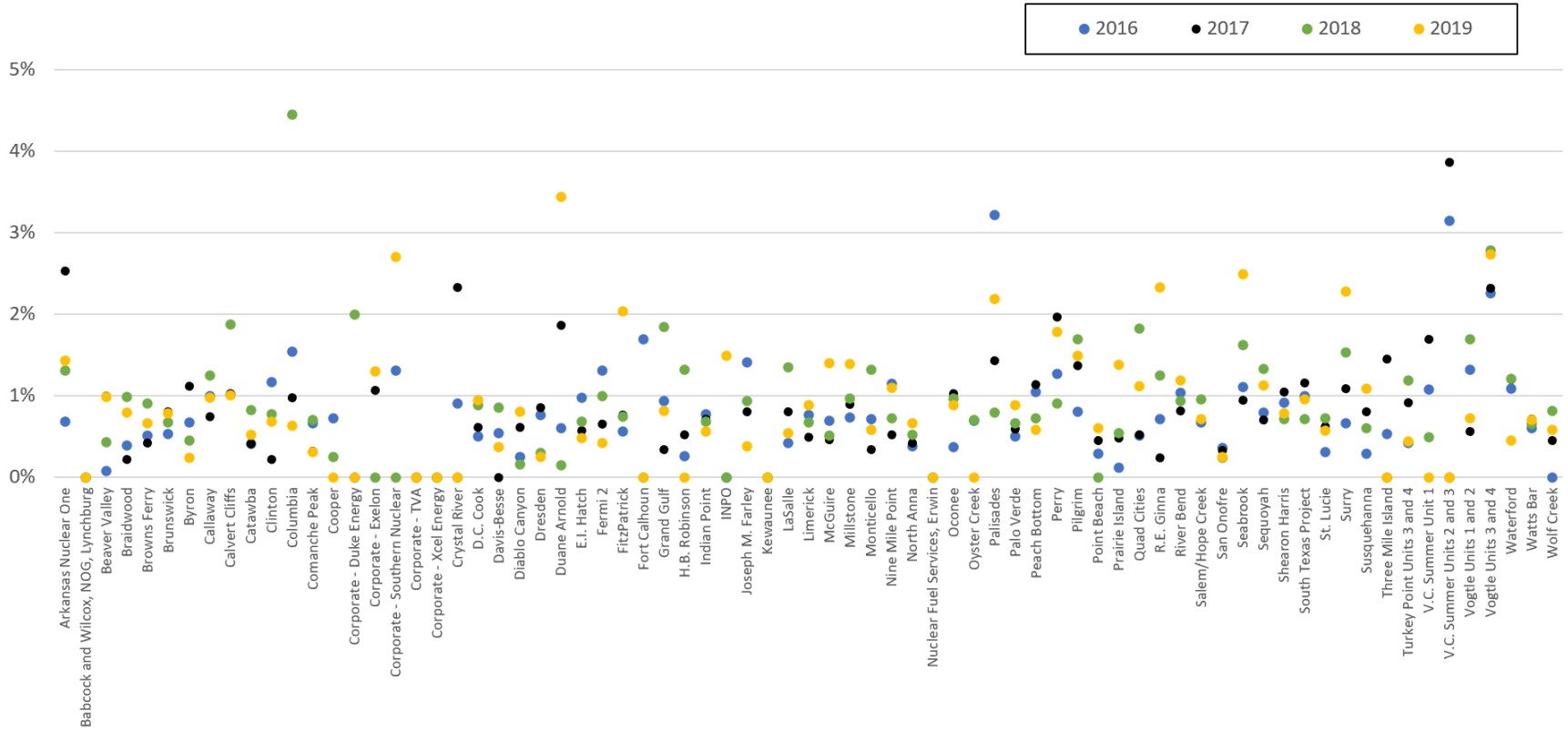


Figure 9. Rate of pre-access policy violations over time and by facility for C/V employees[1][2]

[1] Not shown in figure are Corporate – Exelon (16.7%) in 2017 and Corporate – Excel Energy (11.1%) in 2017 as they are outside the axis range

[2] Overlapping data points in figure may appear as only the most recent data point

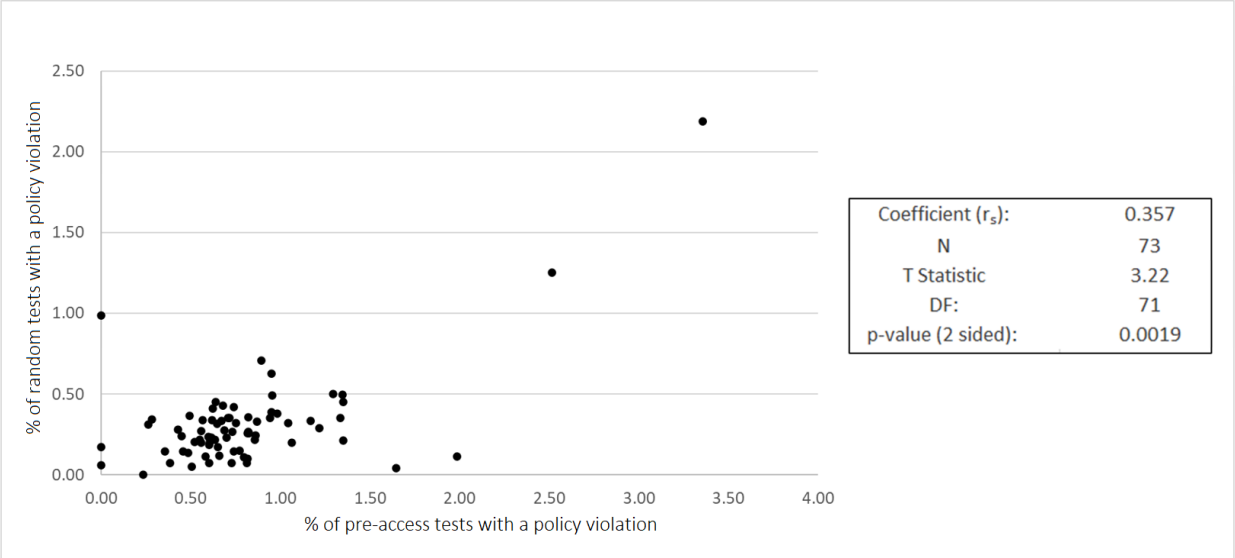


Figure 10. Comparison of policy violation rates for pre-access and random tests and associated Spearman's rank test results

5.0 Rates of Subversion Attempts

Subversion attempts are willful acts to avoid being tested or to bring about an inaccurate drug or alcohol test result (§ 26.5). Subversion attempts are a significant concern for FFD programs because they provide conclusive evidence that the individual is not trustworthy and reliable to be afforded unescorted access to facility, materials, and information. Analyzing these attempts is therefore an integral part of understanding FFD program performance and as such, a comparative metric was developed to assess subversion attempts. The rate of subversion attempts for a given year was calculated in a variety of ways (i.e., over time, by facility, by test type, and by employee type) according to Equation (4):

$$Subversion\ Attempt\ Rate = \frac{\#\ of\ Subversion\ Attempts}{Total\ Number\ of\ Tests\ Administered} \quad (4)$$

The subversion attempt rate for a facility, whether for pre-access or for other testing conditions, can be compared against the industry levels to inform an inspector if the rates at a single facility are comparable to what is seen elsewhere in the industry.

Subversion attempts can occur for any of the five test conditions that are administered in an FFD program and can include adulterating, substituting, or otherwise causing a specimen to provide an inaccurate test result. Subversion attempt rates by test condition are shown for licensee employees and C/V for all years (2016–2019) in Table 3. As the table shows, subversion attempts were highest in tests administered for cause and lowest for random tests. Subversion attempts also generally occurred at a higher rate in C/V employees compared to licensee employees for the same test condition. Other than tests administered for cause, the rate of subversion attempts generally remained at or below 1% of tests.

Table 3. Subversion attempt rates by condition (2016–2019 combined)

Test Conditions	Licensee Employees			C/V Employees		
	# Subversions	# Tests	Rate	# Subversions	# Tests	Rate
Follow-up	6	12,124	<0.1%	29	15,446	0.2%
For Cause	4	506	0.8%	57	2,343	2.4%
Post-Event	0	597	<0.1%	6	2,813	0.2%
Pre-Access	13	33,061	<0.1%	869	283,284	0.3%
Random	11	137,710	<0.1%	220	92,021	0.2%
Total	34	183,998	<0.1%	1181	395,907	0.3%

The data shows that subversion attempts for licensee employees rarely happened within the FFD program (Table 3). Figure 11 shows that the subversion attempts over time and by facility for random tests among licensee employees support the data in Table 3. For instance, the subversion attempt rate by licensee employees during random testing was frequently 0% at most facilities and never exceeded 0.5% (Figure 11). In contrast, the subversion attempt rates for C/V employees during random testing (Figure 12) was higher and more frequent (often 0.5%–1.3%) than for licensee employees, which is a potential area of concern further discussed below. Figure 13 shows a potential area of concern as some licensees consistently have subversion attempts year-after-year whereas others do not.

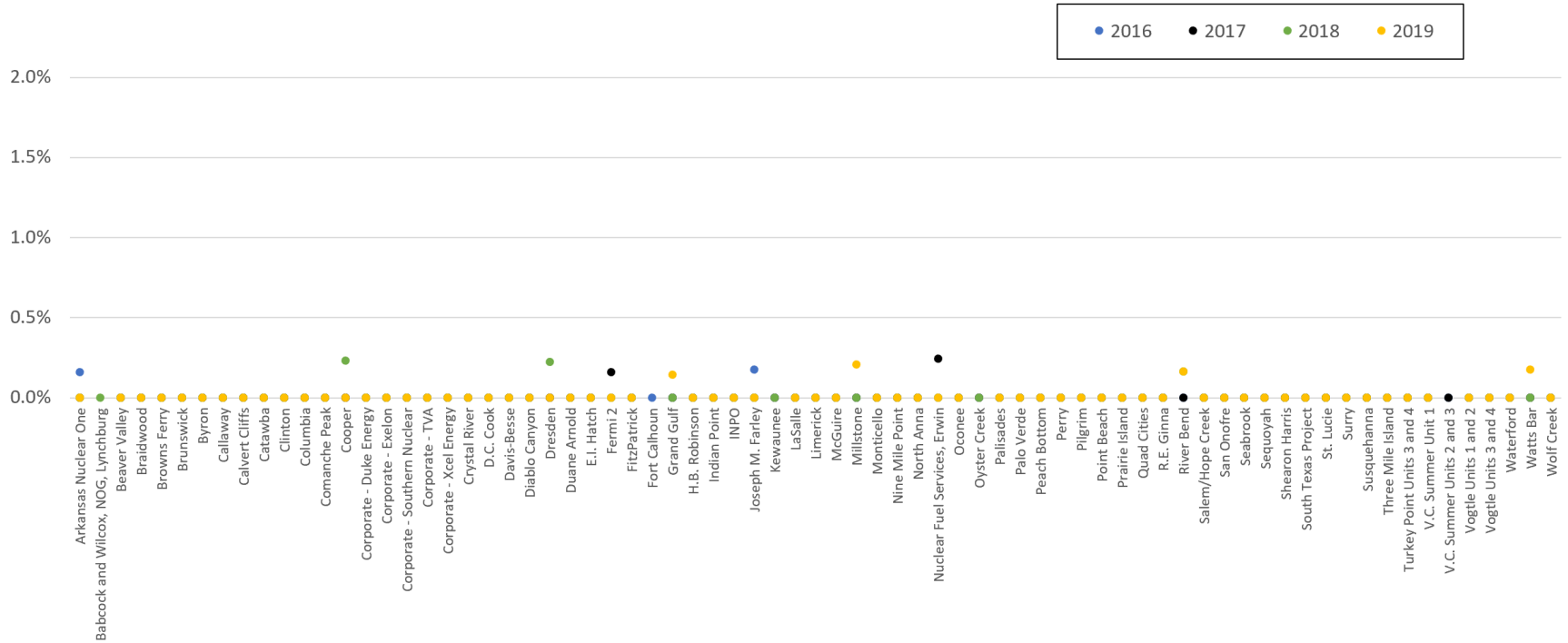


Figure 11. Rate of subversion attempts over time and by facility for random tests among licensee employees[1]

[1] Overlapping data points in figure may appear as only the most recent data point

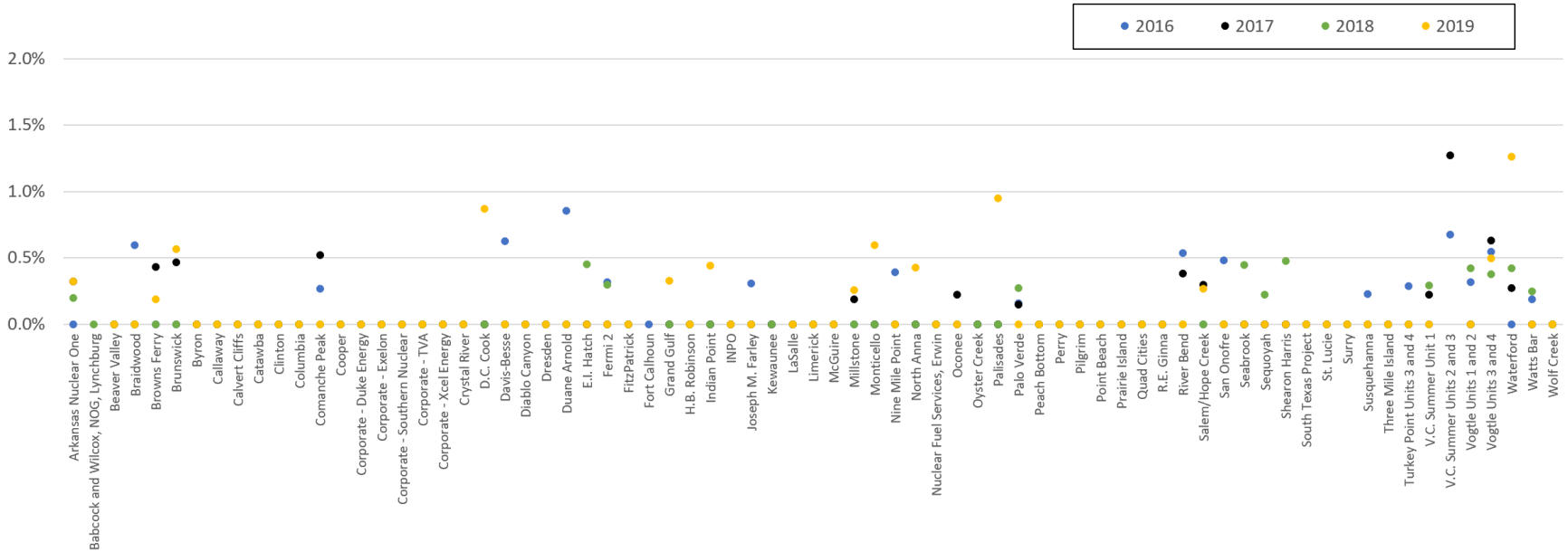


Figure 12. Rate of subversion attempts over time and by facility for random tests among C/V employees[1]

[1] Overlapping data points in figure may appear as only the most recent data point

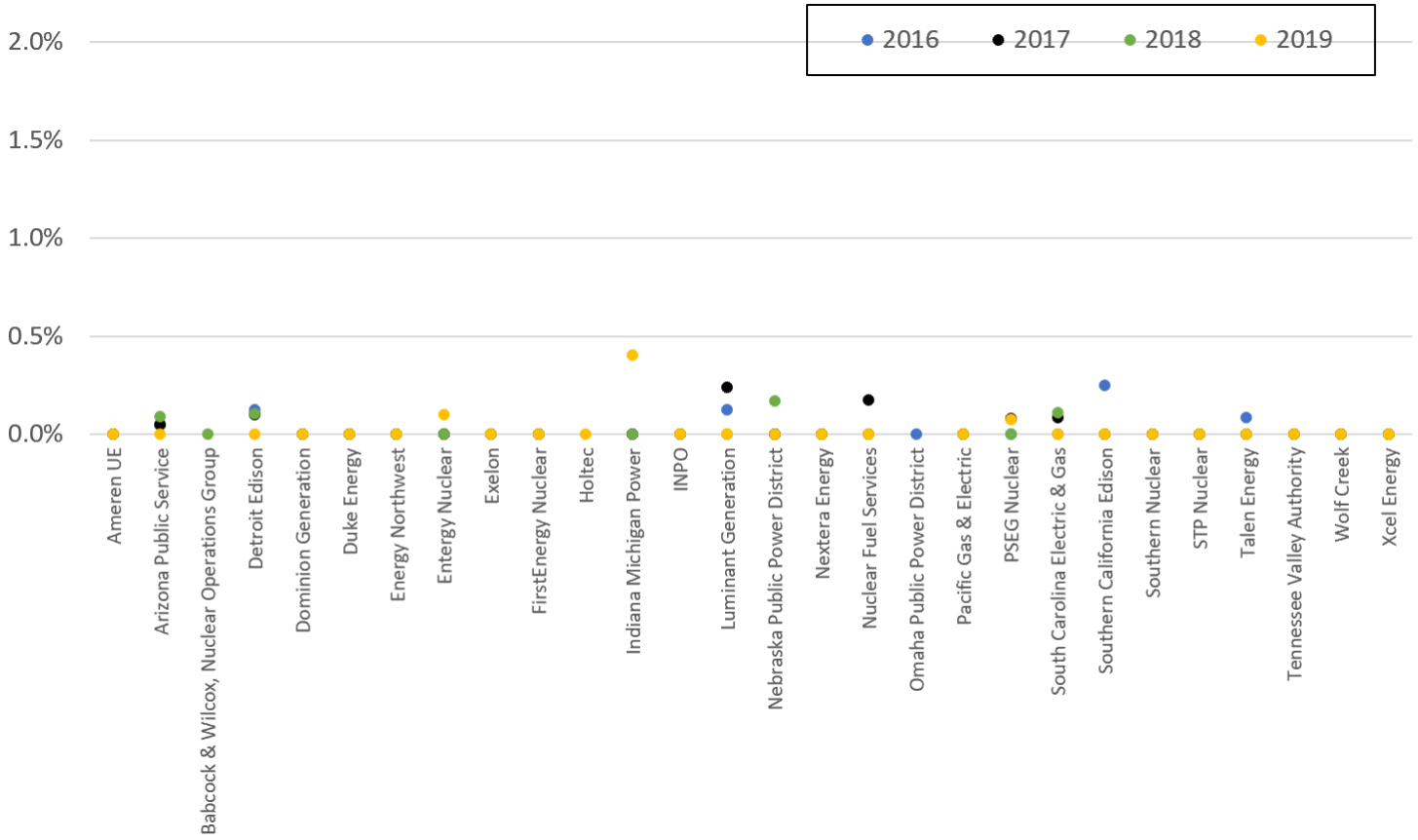


Figure 13. Rate of subversion attempts over time and by licensee for random testing among all employees[1]

[1] Overlapping data points in figure may appear as only the most recent data point

The data show that there are several areas of concern with subversion attempts that are especially prevalent with C/V employees. The first concern is that there are around 300 subversion attempts happening per year for all employee types (Table 4). This concern is significant for one principal reason: not only do individuals with subversion attempts demonstrate that they cannot be trusted and relied upon to follow instructions regarding a federally mandated drug and alcohol test implemented by the licensee through its procedures but purposely hiding their substance use issues potentially adversely impacts their ability to safely and competently perform assigned duties and responsibilities. As stated in the summary for the original Part 26 rule (54 FR 24468; June 7, 1989):

> *Since there is an underlying assumption that workers will abide by the licensee's policies and procedures, any involvement with illegal drugs shows that the worker cannot be relied upon to obey laws of a health and safety nature, indicating that the individual may not scrupulously follow rigorous procedural requirements with the integrity required in the nuclear power industry to assure public health and safety.*

The revised Part 26 rule (73 FR 16966, March 31, 2008) addresses the same concern as the basis for the terminology "trustworthy and reliable" in the performance objectives for the FFD programs (§ 26.23).

Table 4. Subversion attempt trends (2016–2019)

Subversion metric:	2016	2017	2018	2019
Number of subversion attempts	305	305	298	307
Percentage of policy violations that are subversions	26.1%	25.9%	25.1%	28.3%
Percentage of subversions identified from pre-access testing	72.1%	67.5%	77.5%	73.3%
Percentage of subversions committed by C/V employees	98.0%	97.7%	95.6%	97.4%
Percentage of sites reporting at least one subversion	53.4%	63.9%	70.4%	61.4%

A second concern, shown in Table 5, is that ~26% of the subversion attempts (313 of 1,125) were from employment categories that align with high risk, which includes all employment categories except for facility support and maintenance (general facility). These individuals were attempting to mask their drug or alcohol use, which would include impairment at the workplace. Section 6.4 contains more rationale about why there are heightened concerns with policy violations for safety- and security-sensitive jobs. The other 74% of subversion attempts (70 plus 832 of 1,125) come from general facility maintenance and facility support that have lesser risks yet are still important to prevent.

Table 5. Subversion attempt by employment type (2016–2019)

Employment Type	C/V Employees	Licensee Employees	Total
Engineering	3	3	6
Facility Support	64	6	70
FFD Program Personnel	0	0	0
HP/RP	5	1	6
Licensed Operator	0	0	0
Maintenance (Craft)	1	0	1
Maintenance (general facility)	829	3	832
Maintenance (safety-significant)	40	3	43
Non-Licensed Operator	0	3	3
Other	217	7	224
QA/QC	1	1	2
Security	8	6	14
Supervisor	13	1	14
Total	1181	34	1215

A third concern is that certain facilities and licensees consistently had subversion attempts year-after-year whereas others consistently had few or none (Figures 11–13). If subversion attempts are consistently happening, that could mean that the practice of defrauding drug tests is not effectively contained and eradicated and that not enough corrective actions are being taken. If subversion attempts rarely happen, that could indicate strong program performance, but it could also be a point of caution since staff members may have developed effective methods for going undetected.

The data also demonstrate the FFD programs should be especially vigilant for subversion attempts when for cause testing is conducted; the subversion attempt rates during for cause testing were 8–12 times higher than for other test conditions (Table 3). Subversion attempts may be expected with for cause tests as staff members know they will be tested ahead of time and those who are required to undergo such testing may try to mask it to keep their jobs.

FFD programs should also be aware that the subversion attempts are much more common for C/V employees than licensee employees—especially at construction sites. Table 4 shows that more than 95% of annual subversion attempts were from C/V employees. From 2016 to 2019, there were 1,181 subversion attempts by C/V employees and 34 subversion attempts by licensee employees. Table 5 shows the subversion attempts by employment type of the C/V and licensee employees. Of the 1,181 subversion attempts for C/V employees, the majority were from the two reactor facilities that were under construction (Table 5). The two construction sites accounted for more subversion attempts than the other 71 facilities combined in 2016–2017. Table 6 further discusses the subversion attempts by the C/V employees at the construction sites during 2016–2019. The two construction sites had 200 of the 299 total C/V employee subversion attempts (67%) in 2016. Work at V.C. Summer Units 2-3 was discontinued in 2018; only Vogtle Units 3-4 was a construction facility from 2016–2019. During

that timeframe, Vogtle Units 3-4 alone had more C/V employee subversion attempts than the other 70 remaining facilities combined.

Table 6. Subversion attempts for C/V employees at facilities under construction vs. all other existing

Type	Facility	2016	2017	2018	2019
Facilities Under Construction (*n* = 2)	V.C. Summer Units 2-3	110	68	---	---
	Vogtle Units 3-4	90	102	143	171
	Subtotal for Facilities Under Construction	200	170	143	171
All Other Facilities (*n* = 71 before 2018 and 70 thereafter)	Subtotal for All Other Facilities	99	128	142	128
	Average per Year	1.4	1.8	2.0	1.8
Summary Statistics	Grand Total (Under Construction + All Other)	299	298	285	299
	% of Subversion Attempts from Facilities Under Construction	66.9%	57.0%	50.2%	57.2%
	% of Subversion Attempts from All Other Facilities	33.1%	43.0%	49.8%	42.8%

In summary, the subversion attempt rates presented are a useful comparative metric for identifying groups of individuals, facilities, or licensees that fall outside the typical rates for the industry. If rates of subversion or not within the expected industry range or are increasing further investigation may be warranted.

High rates or increasing rates of subversion for different testing types might indicated different things. For example, since individuals are informed of the pre-access drug and alcohol test and have the opportunity to plan how to subvert the test, subversion attempts from pre-access testing indicate that self-disclosures, background checks, and FFD training are not deterring individuals from attempting to subvert the process. The high incidence of pre-access subversion attempts by C/V employees may indicate that the licensee contracting personnel may not be informing the pool of candidates for employment of the necessity to maintain a nuclear safety culture. Subversion attempts for those who are maintaining unescorted access (all testing except pre-access) may indicate that the deterrent value of permanent denial is not effective in promoting FFD program compliance or that the pre-access screening and testing and FFD training may not be fully effective. Subversion rate analysis has been identified as a crucial comparative metric in an FFD program because abnormal or increasing subversion rates

could warrant further investigation. Furthermore, the identification of subversion attempts by the FFD program staff demonstrates diligence and effective FFD program performance.

6.0 Number of Policy Violations by Labor Category

The final comparative metric presented is the number of policy violations of any kind for individuals within certain labor categories. This number includes positive drug and alcohol tests and subversion attempts from the 2016–2019 data. Notably, this metric refers to *number* rather than *rate*. The rates of policy violations by labor category could not be computed because the SPTF and ARF datasets do not contain information on the total number of workers by labor category who were subject to an FFD program. Rates are preferrable to counts, when the information exists, because rates provide a standardized and more equitable comparison across facilities with variable workforce populations. However, this section discusses performance by labor category even though the incidence of policy violations is very low.

Certain labor categories have different reporting requirements and potentially greater consequences if violations of the FFD program occur per § 26.719(b) (e.g., licensed operators or supervisors). To support monitoring of FFD program performance, the number of individuals in safety- or security-sensitive labor categories with policy violations was calculated by facility and over time to compare across the industry based on the available data. These policy violations provide important information about the performance of the FFD program as it relates to covered individuals in critical roles.

This comparative metric explored the number of policy violations from 2016 to 2019 for selected security- or safety-significant labor categories to evaluate FFD program performance. To do this, the number of policy violations by labor category was evaluated for the existing workforce. Here, existing workforce refers to all employees (C/V or licensee employees), and policy violations include all conditions for testing other than pre-access tests (i.e., for cause, follow-up, post-event, or random). Using a list of labor categories from the SPTF dataset and based on NRC expert input, the number of policy violations was calculated for the following labor categories: licensed operator (and non-licensed operators), security, and supervisor. For context on the policy violations, Figure 14 presents the percentage of violations by substance type or subversion for different job categories included in this metric. In general, the majority of the policy violations were associated with alcohol or marijuana, with the single exception of supervisor C/V employees, where there was an unusually high percentage of subversion attempts. It is important to keep in mind the overall small number of tests when interpreting these percentages, as even small fluctuations in number will have a substantial impact on the trends in the substance type. The following subsections discuss the information in Figure 14 further.

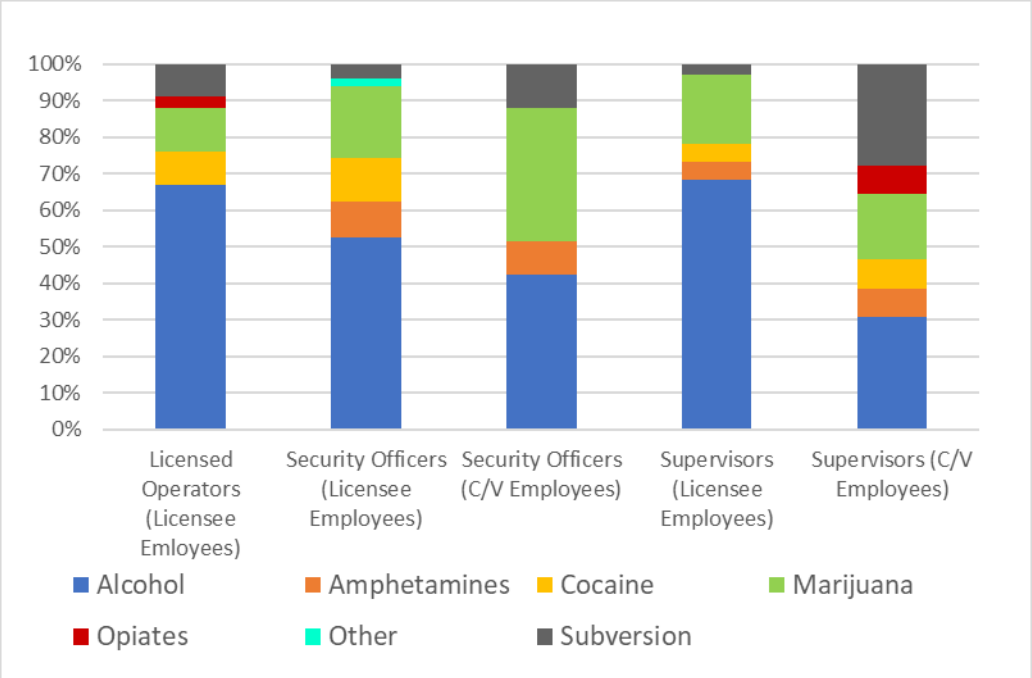


Figure 14. Percentage of substance types for policy violations by labor category, 2016–2019

6.1 Policy Violations by Operators

There were 33 policy violations for operators (licensed or non-licensed) between 2016 and 2019 across the industry and by facility. Overall, policy violations were rare, with few examples of recurrence at any single facility, as shown in Table 7.

Table 7. Policy violations for operators (2016–2019)[a]

Facility	2016	2017	2018	2019	Total
Arkansas Nuclear One	0	0	0	2	2
Browns Ferry	1	0	0	0	1
Byron	0	0	1	0	1
Columbia	0	0	0	1	1
Comanche Peak	0	0	0	1	1
Cooper	0	0	2	0	2
Diablo Canyon	0	0	1	0	1
Fermi 2	0	1	0	0	1
Indian Point	1	1	0	0	2
Limerick	0	1	0	0	1
Millstone	1	1	0	0	2
Nine Mile Point	0	0	0	1	1
North Anna	0	1	0	0	1
Nuclear Fuel Services, Erwin	1	0	2	0	3
Oyster Creek	0	0	2	0	2
Peach Bottom	0	2	0	1	3
Pilgrim	0	1	0	0	1
Seabrook	0	0	0	1	1
South Texas Project	0	0	1	1	2
Susquehanna	0	0	1	1	2
Waterford	0	0	0	1	1
Wolf Creek	0	0	0	1	1
Total	4	8	10	11	33

[a]Note that the vast majority of facilities had no policy violations in any year (51 of 73), and for brevity, those facilities that had no policy violations from 2016 to 2019 are excluded from the table.

6.2 Policy Violations by Security Officers

Between 2016 and 2019, there were 51 policy violations associated with the security officer labor category among licensee employees and 33 policy violations associated with the security officer labor category among C/V employees. Table 8 and Table 9 show the number of policy violations for the security officer labor category for licensee employees and C/V employees, respectively.

Table 8. Number of policy violations for security officer licensee employees, 2016–2019[a]

Facility	2016	2017	2018	2019	Total
Arkansas Nuclear One	0	0	1	0	1
Braidwood	0	1	0	0	1
Browns Ferry	0	2	1	1	4
Brunswick	1	0	0	2	3
Catawba	0	0	0	1	1
Cooper	1	0	1	0	2
Dresden	0	2	1	0	3
Duane Arnold	1	0	0	0	1
E.I. Hatch	1	0	0	1	2
Fermi 2	0	1	0	0	1
FitzPatrick	1	0	0	0	1
Fort Calhoun	1	0	0	0	1
Grand Gulf	1	0	1	0	2
H.B. Robinson	0	1	1	0	2
LaSalle	0	0	0	1	1
McGuire	1	0	0	0	1
Oconee	0	0	1	0	1
Palisades	0	0	1	0	1
Palo Verde	0	1	0	0	1
Peach Bottom	0	0	2	0	2
Perry	0	1	0	0	1
River Bend	0	0	3	2	5
Salem/Hope Creek	0	0	0	1	1
Shearon Harris	1	0	0	0	1
Surry	0	1	1	0	2
Three Mile Island	1	0	0	0	1
V.C. Summer Unit 1	0	0	1	0	1
Vogtle Units 1 and 2	1	0	0	2	3
Waterford	1	0	1	1	3
Watts Bar	0	0	0	1	1
Total	12	10	16	13	51

[a]Note that the majority of facilities had no policy violations in any year (44 of 73), and for brevity, those facilities that had no policy violations from 2016 to 2019 are excluded from the table.

Table 9. Number of policy violations for security officer C/V employees, 2016–2019[a]

Facility	2016	2017	2018	2019	Total
Beaver Valley	0	0	1	0	1
Brunswick	0	0	1	0	1
Comanche Peak	0	2	1	0	3
Corporate–Exelon	0	1	0	0	1
Corporate–Xcel Energy	0	1	0	0	1
Fermi 2	2	1	0	0	3
Millstone	1	0	0	1	2
Nuclear Fuel Services, Erwin	0	0	0	2	2
R.E. Ginna	0	1	1	0	2
Seabrook	0	0	0	1	1
South Texas Project	1	0	1	0	2
St. Lucie	0	0	2	0	2
Susquehanna	0	0	0	1	1
Turkey Point Units 3 and 4	0	0	0	1	1
V.C. Summer Unit 1	2	1	0	1	4
Vogtle Units 3 and 4	1	0	0	2	3
Waterford	0	0	1	2	3
Total	7	7	8	11	33

[a]Note that the vast majority of facilities had no policy violations in any year (56 of 73), and for brevity, those facilities that had no policy violations from 2016 to 2019 are excluded from the table.

6.3 Policy Violations by Supervisors

Between 2016 and 2019, there were 32 policy violations among licensee employees in the supervisor labor category and 39 policy violations among C/V employees within the same category. Table 10 and Table 11 present the number of positive tests by facility and year for employees in the supervisor labor category. As Table 11 shows, there were a large number of policy violations for C/V employees in the supervisor labor category between 2016 and 2019 (26 policy violations), many of which (11) were subversion attempts. As a result, the percentage of subversion attempts was higher for the supervisor labor category, as shown in Figure 14.

Table 10. Number of positive tests for supervisor licensee employees, 2016–2019[a]

Facility	2016	2017	2018	2019	Total
Arkansas Nuclear One	2	0	0	0	2
Babcock and Wilcox, NOG, Lynchburg	0	1	0	0	1
Beaver Valley	0	0	0	1	1
Callaway	0	1	0	0	1
Catawba	1	0	0	0	1
Corporate–TVA	1	0	0	0	1
Davis-Besse	0	0	1	0	1
Diablo Canyon	0	0	1	0	1
Fermi 2	1	0	1	0	2
FitzPatrick	1	0	0	0	1
Grand Gulf	0	0	0	1	1
Indian Point	0	1	0	1	2
Joseph M. Farley	0	0	0	1	1
Oconee	0	1	0	0	1
Oyster Creek	0	1	0	0	1
Palo Verde	1	1	0	0	2
Prairie Island	1	0	0	0	1
Salem/Hope Creek	2	0	0	0	2
San Onofre	0	0	1	0	1
Seabrook	0	0	0	1	1
South Texas Project	1	0	0	0	1
Susquehanna	0	0	0	1	1
Three Mile Island	0	0	1	0	1
Vogtle Units 3 and 4	1	1	1	0	3
Waterford	0	0	1	0	1
Total	12	7	7	6	32

[a]Note that the vast majority of facilities had no policy violations in any year (49 of 73), and for brevity, those facilities that had no policy violations from 2016 to 2019 are excluded from the table.

Table 11. Number of policy violations for supervisor C/V employees, 2016–2019[a]

Facility	2016	2017	2018	2019	Total
Arkansas Nuclear One	0	0	0	1	1
Byron	1	0	0	0	1
Calvert Cliffs	1	0	0	0	1
Columbia	0	0	0	1	1
D.C. Cook	0	0	0	1	1
Fermi 2	0	0	1	0	1
Grand Gulf	1	0	0	0	1
Indian Point	0	0	0	1	1
Joseph M. Farley	1	0	0	0	1
Oconee	0	0	0	1	1
Turkey Point Units 3 and 4	1	0	0	1	2
V.C. Summer Units 2 and 3	1	0	0	0	1
Vogtle Units 3 and 4	2	2	14	8	26
Total	8	2	15	14	39

[a]Note that the vast majority of facilities had no policy violations in any year (61 of 73), and for brevity, those facilities that had no policy violations from 2016 to 2019 are excluded from the table.

6.4 Considerations from Evaluation of Policy Violations by Labor Category

Despite the rarity of policy violations among employees in safety- or security-significant labor categories, this is an important comparative metric for monitoring FFD programs due to the potential consequences of policy violations (mainly positive drug or alcohol tests or subversion attempts) by these employees. Having an analysis of the industry as a whole provides a comparative metric by which to assess the relative FFD program performance at a single facility or licensee. Exploring substance type information associated with the positive tests is crucial to provide further context for any policy violations results in the analyzed labor categories.

In summary, the comparative metric for positive tests by labor category used the number of occurrences because there was not enough information to calculate rates. Use of such information should be interpreted with caution because the metrics need to be considered in context of the number of individuals subject to the FFD program, the operations being conducted at the facility (e.g., normal operations, refueling, maintenance, etc.), and the types of employment categories (licensee employees or C/V). Because the numbers of policy violations by labor category are quite small, even small fluctuations can amplify differences in the values. NRC has found that from the inception of the FFD program, the incidence of policy violations by labor category has been small. Tracking this metric over time has the potential to indicate to NRC with reasonable assurance that a licensee is meeting the FFD performance objectives (§ 26.23). Therefore, this comparative metric for policy violations by labor category could be used to monitor FFD program performance and provide risk-informed decisions for improvements.

7.0 Conclusions

Using 2016–2019 data from ARFs and SPTFs provided by NRC, PNNL analyzed the FFD performance data (Sections 2.0–6.0) and developed comparative metrics that can provide useful information on FFD program performance. Comparative metrics considered include:

- random testing rate
- random policy violation rate
- pre-access policy violation rate
- subversion attempt rate
- number of policy violations by labor category.

Several figures and tables are offered for the comparative metrics to visualize and summarize the proposed quantitative data received from the FFD programs across the nuclear industry. These metrics can be used to monitor FFD performance over various scales (labor category, facility, licensee, and industry) to risk inform NRC inspections and FFD policy. Furthermore, these comparative metrics allow a more in-depth look at FFD programs for the industry to discern trends and patterns that may warrant changes at various scales as well as to inform policy decisions by NRC.

The first comparative metric addresses random testing rates in accordance with § 26.31(d)(2)(vii), which states "the sampling process used to select individuals for random testing provides that the number of random tests performed annually is equal to at least 50 percent of the population that is subject to the FFD program." Random testing is a way to monitor substance abuse in the population of employees who have been granted authorization through an FFD program. The random testing rate, proposed here as a comparative metric, was designed as a way to compare testing rates in the industry to those from a licensee or even those from an individual facility under a licensee. Although the random testing rate is typically above the 50% regulatory requirement for all employees (Figure 1), the random testing rate among C/V employees varied and frequently fell below 50% (Figure 4). While the regulatory criteria states that 50% of the employees are subject to random testing, the regulation does not specify that the random testing must be applied to all employee types consistently (i.e., it does not specify how the licensee must implement this requirement). This type of granulated performance assessment does provide useful information to the licensee and NRC about how the random testing rate is being applied to employees at facilities. Low random testing rates for C/V employees may be an area of concern because C/V employees typically have higher FFD policy violation and subversion rates than licensee employees (see Sections 3.0–6.0). There are C/V employees who perform safety- or security-sensitive work activities. Ensuring that these individuals are subject to a 50% random testing rate may contribute to risk-informed deterrence and detection.

The second comparative metric assesses the random policy violation rate by a licensee or entity and can be used to look across the nuclear industry as well as show trends over time. The random policy violation rate comparative metric refers to the rate (i.e., percentage) of policy violations from random tests for a facility or a licensee within a given year. This comparative metric could be included in an FFD performance monitoring program as a way to compare random policy violation rates by employee type, or all employees, across the industry to those rates from a licensee or an individual facility or fleet of comparable facilities. This comparative metric is important because it is a direct indication of the number of individuals who had violated

the FFD policy among those who were given and maintained unescorted access to the facility, materials, and information, thus challenging the basis on which their unescorted access was granted. Examining the random policy violation rate over time can provide useful information about an individual FFD program performance and whether there are any concerning trends in the rate of positive random tests over time. Among licensee employees at all the facilities, the incidence of random policy violation rates was generally less than 1% (Figure 5), compared to C/V employees at the same facilities who had higher and more variable random policy violation rates of 2–4% (Figure 6). The same trend was observed for the licensees of the facilities (Figure 7). The policy violation rate in random testing is a safety- and security-significant metric because it is a clear indication of the potential impairment of individuals on-site who had unescorted access to protected areas, sensitive information, and licensed materials. Furthermore, upward trends in random policy violation rates could indicate weaknesses in the FFD training, policy, and behavioral observation of employees, and warrant a review by the licensee or NRC. Consequently, the historical random policy violation rate (by facility and licensee) provides an empirical frame of reference for NRC to assess whether a facility or the industry can meet the 10 CFR 26.23 performance objectives.

The third comparative metric, pre-access policy violation rate, focuses on the testing of individuals applying for initial (including pre-employment), updated, or reinstated authorization and access to protected areas, sensitive information, and licensed materials. These individuals have a scheduled date for their drug and alcohol testing and can change their behavior to pass the tests, whereas the random testing program checks on their abstinence. For licensee applicants, the pre-access policy violation test rate is typically 0–1% by facility, but there are numerous instances of 1–2% and periodic instances above 3% or 4% (Figure 8). The pre-access policy violation rates for C/V applicants are infrequently 0%, are more typically between 0.5 and 2.0%, and periodically are above 3% or 4% (Figure 9). These results demonstrate the benefit of the pre-access screening program and allow licensees and entities to meet 10 CFR 26.23 performance objectives.

An example of looking at these data from an industry perspective is through comparison of the metrics for both pre-access and random testing data (as seen in Figure 10). The comparison allows the licensee or entity to use their FFD program results to evaluate the pool of applicants in the area/region. If the pre-access policy violation rate is high and if the applicants are mostly from the local areas/regions, the licensee might want to take that into consideration and implement more rigorous screening to reduce the risk of hiring an individual who is not trustworthy or reliable. The data shows a weak but positive and significant relationship between the rates of pre-access individuals and current employees (subject to random testing). That is, these rates move in the same direction. If one rate is lower, the other rate is likely also lower. Thus, this metric provides preventive information to risk inform licensees in their hiring and screening practices.

The fourth metric assesses the rate of subversion attempts. Subversion attempts are a significant concern for FFD programs because they provide conclusive evidence that the individual is not trustworthy and reliable to be afforded unescorted access to facility, materials, and information (§ 26.5). The data shows that subversion attempts for licensee employees rarely happened within the FFD program (Table 3 and Figure 11) as compared to C/V (Figure 12). Figure 13 shows a potential area of concern as some licensees consistently had subversion attempts year-after-year whereas others did not. Further analysis shows that the number of subversion attempts has remained steady from 2016 to 2019 (Table 4), and the highest percentage of subversion attempts was by general facility maintenance and facility support employment types (Table 5). Finally, facilities undergoing construction had the majority

of subversion attempts for C/V employees (Table 6). The trends in subversion attempt rates offer an opportunity for further evaluation of performance at a facility as well as across the industry.

For the subversion and positive drug or alcohol occurrences by labor category, the last comparative metric, there is a paucity of data (Tables 7-11). Despite the low incidence rate of policy violations among employees in safety- or security-significant labor categories, this is a useful comparative metric for providing a more risk-informed and nuanced look at the FFD policy violations (including subversion attempts) and the potential consequences of policy violations on various aspects of nuclear facility operations, ranging from maintenance to safety- and security-significant job categories at these facilities. The inherently higher risk of FFD policy violations committed by an individual in safety- and security-significant labor categories (e.g., supervisors, operators, security) might require more resources and intervention to mitigate and reduce risk. Taking action based on the policy violations by labor category needs to be informed and assessed based on factors or conditions occurring at the site.

In summary, the data analyses presented here as comparative metrics underscore the importance of considering the context of FFD program data when making interpretations. Specifically, licensees and NRC inspectors should consider abnormal operations when examining FFD program performance information, as these operations can have a substantial impact on potential indicators of performance. During data analysis, data that seemed to be aberrations from industry norms were frequently put into context by the status of the facility at the time (e.g., a higher number of subversion attempts occurring at facilities undergoing construction because of a larger workforce).

The comparative metrics provide a way to analyze FFD program data as part of a performance monitoring program. Although the comparative metrics here are useful when incorporated into an FFD performance monitoring program, it is important to fully evaluate changes or deviations based on site-specific considerations, such the types of workers being hired for maintenance and the types of activities being conducted. Therefore, it would be best to consider all information gathered through use of the comparative metrics in the larger context of FFD program compliance, and, when necessary, perform more detailed assessments to understand the nature of the issue and identify potential corrective actions to address it. Furthermore, these comparative metrics allow a more in-depth look at FFD programs for the industry to discern trends and patterns that may warrant changes at an industry level and to inform policy decisions.

The comparative metrics were designed to provide a useful methodology for FFD data analysis. They provide industry, licensee, and facility information to both NRC inspectors and licensees to better understand how they might conduct FFD performance monitoring and continue to improve their FFD programs and meet NRC regulations and requirements. These comparative metrics can be used by NRC inspectors and can also be used by licensees to compare FFD performance to themselves over time as well as other facilities and the industry overall. All analyses in this report were generated using publicly available data from 2016 to 2019 ARF and SPTF datasets. The analyses, plots, and tables from this report should be refreshed as new data become available.

8.0 References

10 CFR 26. *Code of Federal Regulations*, Title 10, *Energy*, Part 26, "Fitness-for-Duty Programs."

54 FR 24468. July 7, 1989. "10 CFR Parts 2 and 26, Fitness-for-Duty Programs." Final rule and statement of policy, *Federal Register*, Nuclear Regulatory Commission.

73 FR 16966. March 31, 2008. "10 CFR Part 26, Fitness-for-Duty Programs." Final rule, *Federal Register*, Nuclear Regulatory Commission.

NRC. 2020a. FFD Program Performance Data Reporting System, NRC Form 891, Annual Reporting Form for Drug and Alcohol Tests. Version 1.9.0. ML18213A283. U.S. Nuclear Regulatory Agency, Bethesda, Maryland.

NRC. 2020b. FFD Program Performance Data Reporting System, NRC Form 890, Single Positive Test Form

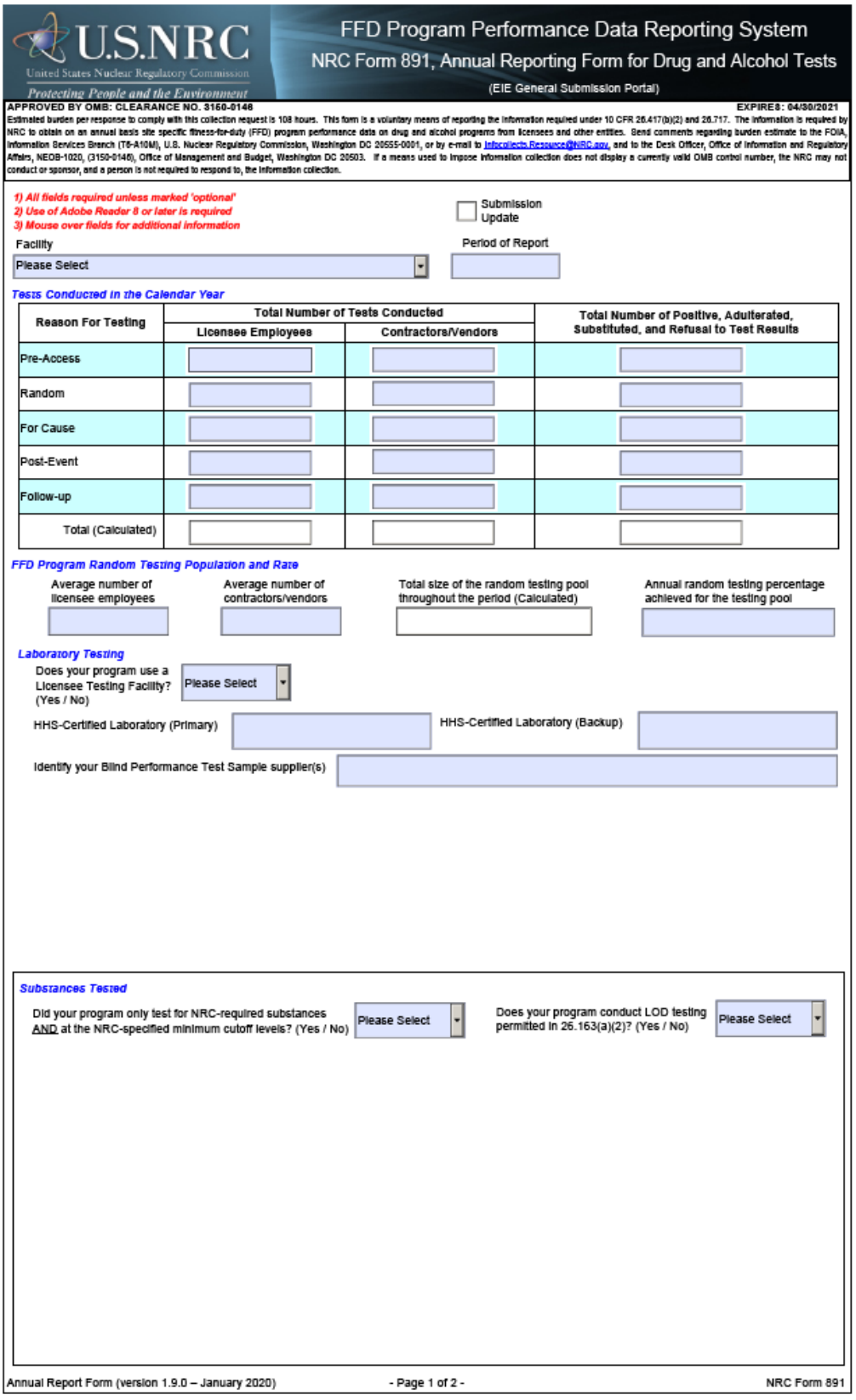
9.0 Glossary

Term	Definition
Authorization	A licensee or other entity has determined that an individual has met the requirements of this part to be granted or maintain the types of access or perform the duties specified in § 26.4(a) through (e), and, at the licensee's or other entity's discretion, § 26.4(f) or (g) (§ 26.5). The types of individuals identified in § 26.4(a) through (e) include: **1.** Operating or on-site directing of the operation of systems and components that a risk-informed evaluation process has shown to be significant to public health and safety **2.** Performing health physics or chemistry duties required as a member of the on-site emergency response organization minimum shift complement **3.** Performing the duties of a fire brigade member who is responsible for understanding the effects of fire and fire suppressants on safe shutdown capability **4.** Performing maintenance or on-site directing of the maintenance of structures, systems, and components (SSCs) that a risk-informed evaluation process has shown to be significant to public health and safety **5.** Performing security duties as an armed security force officer, alarm station operator, response team leader, or watchman, hereinafter referred to as security personnel.
Contractor/Vendor (C/V)	Contractor/vendor refers to “any company, or any individual not employed by a licensee or other entity specified in § 26.3(a) through (c), who is providing work or services to a licensee or other entity covered in § 26.3(a) through (c), either by contract, purchase order, oral agreement, or other arrangement” (§ 26.5).
Comparative Metric	Metrics designed to characterize FFD program performance and that can be used in monitoring FFD programs over time
Facility	For the purposes of this report, a nuclear reactor that is licensed by NRC for operations. The licensee may operate many nuclear facilities.
Follow-up Testing	Drug and alcohol testing as part of a follow-up plan to verify an individual’s continued abstinence from substance abuse (§ 26.31[c][4]).
For Cause Testing	Drug and alcohol testing in response to an individual's observed behavior or physical condition indicating possible substance abuse or after receiving credible information that an individual is engaging in substance abuse (§ 26.31[c][2]).
HHS-certified laboratory	“…Laboratory that is certified to perform urine drug testing under the Department of Health and Human Services Mandatory Guidelines for Federal Workplace Drug Testing Programs (the HHS Guidelines), which were published in the *Federal Register* on April 11, 1988 (53 FR 11970), and as amended, June 9, 1994 (59 FR 29908), November 13, 1998 (63 FR 63483), and April 13, 2004 (69 FR 19643)” (§ 26.5).

Term	Definition
Labor Category	As defined in § 26.717(b)(3), the labor categories are: supervisor, licensed operator, non-licensed operator, FFD program personnel, maintenance (safety-significant), maintenance (general facility), facility support, HP/RP (health physicist/radiation protection); QA/QC (quality assurance/quality control), engineering, SSNM (strategic special nuclear material) transporter, or other (and explained further by the licensee).
Licensee	A company, organization, institution, or other entity to which the NRC or an Agreement State has granted a general license or specific license to construct or operate a nuclear facility, or to receive, possess, use, transfer, or dispose of source material, byproduct material, or special nuclear material. (Reference: https://www.nrc.gov/reading-rm/basic-ref/glossary/licensee.html)
Licensee Employee	An individual employed by a licensee.
Pre-Access Testing	Drug and alcohol testing process to grant initial, updated, or reinstated authorization for an individual who does not have authorization (§ 26.31[c][1] and § 26.65).
Pre-Access Policy Violation Rate	The proportion of pre-access tests that return a policy violation (i.e., positive result or indicate a subversion attempt) calculated over time (e.g., annually), by facility, or by licensee.
Positive result	"Positive result means, for drug testing, the result reported by a licensee testing facility or HHS-certified laboratory when a specimen contains a drug or drug metabolite equal to or greater than the cutoff concentration. A result reported by an HHS-certified laboratory that a specimen contains a drug or drug metabolite below the cutoff concentration is also a positive result when the laboratory has conducted the special analysis permitted in § 26.163(a)(2). For alcohol testing, a positive result means the result reported by a collection site when the blood alcohol concentration indicated by testing a specimen is equal to or greater than the cutoff concentrations established in this part" (§ 26.5).
Post-event Testing	Drug and alcohol testing conducted as soon as practical after an event involving a human error that was committed by an individual who is subject to this subpart, where the human error may have caused or contributed to the event. The licensee or other entity shall test the individual(s) who committed the error(s) and need not test individuals who were affected by the event whose actions likely did not cause or contribute to the event. The individual(s) who committed the human error(s) shall be tested if the event resulted in a significant illness or personal injury, a radiation exposure or release of radioactivity in excess of regulatory limits, or actual or potential substantial degradations of the level of safety of the plant (§ 26.31[c][3]).

Term	Definition
Random Testing	Drug and alcohol testing for authorized individuals, both licensee employees and C/V employees, who are tested selected on a statistically random and unannounced basis so that all individuals in the population subject to testing have an equal probability of being selected and tested (§ 26.31[c][5]).
Random Policy Violation Rate	The proportion of random tests that either return a policy violation (i.e., positive result or indicate a subversion attempt) calculated over time (e.g., annually), by facility, or by licensee.
Random Testing Rate	The proportion of employees who are subject to random testing over time, by facility, or by licensees.
Substance Abuse	The use, sale, or possession of illegal drugs, or the abuse of prescription and over-the-counter drugs, or the abuse of alcohol (§ 26.5).
Subversion	Subversion means “a willful act to avoid being tested or to bring about an inaccurate drug or alcohol test result for oneself or others at any stage of the testing process (including selection and notification of individuals for testing, specimen collection, specimen analysis, and test result reporting), and adulterating, substituting, or otherwise causing a specimen to provide an inaccurate test result” (§ 26.5).

Appendix A – Annual Reporting Form (ARF) NRC Form 891



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

FFD Program Performance Data Reporting System
NRC Form 891, Annual Reporting Form for Drug and Alcohol Tests
(EIE General Submission Portal)

APPROVED BY OMB: CLEARANCE NO. 3150-0146 EXPIRES: 04/30/2021

Estimated burden per response to comply with this collection request is 108 hours. This form is a voluntary means of reporting the information required under 10 CFR 26.417(b)(2) and 26.717. The information is required by NRC to obtain on an annual basis site specific fitness-for-duty (FFD) program performance data on drug and alcohol programs from licensees and other entities. Send comments regarding burden estimate to the FOIA, Information Services Branch (T6-A10M), U.S. Nuclear Regulatory Commission, Washington DC 20555-0001, or by e-mail to Infocollects.Resource@NRC.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-1020, (3150-0146), Office of Management and Budget, Washington DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1) All fields required unless marked 'optional'
2) Use of Adobe Reader 8 or later is required
3) Mouse over fields for additional information

☐ Submission Update

Facility: Please Select

Period of Report:

Tests Conducted in the Calendar Year

Reason For Testing	Total Number of Tests Conducted		Total Number of Positive, Adulterated, Substituted, and Refusal to Test Results
	Licensee Employees	Contractors/Vendors	
Pre-Access			
Random			
For Cause			
Post-Event			
Follow-up			
Total (Calculated)			

FFD Program Random Testing Population and Rate

Average number of licensee employees | Average number of contractors/vendors | Total size of the random testing pool throughout the period (Calculated) | Annual random testing percentage achieved for the testing pool

Laboratory Testing

Does your program use a Licensee Testing Facility? (Yes / No): Please Select

HHS-Certified Laboratory (Primary)

HHS-Certified Laboratory (Backup)

Identify your Blind Performance Test Sample supplier(s)

Substances Tested

Did your program only test for NRC-required substances AND at the NRC-specified minimum cutoff levels? (Yes / No): Please Select

Does your program conduct LOD testing permitted in 26.163(a)(2)? (Yes / No): Please Select

Annual Report Form (version 1.9.0 – January 2020) - Page 1 of 2 - NRC Form 891

***Substances Tested** - continued*

***Summary of Management Actions** - 26.717(b)(8)*

Summarize actions implemented to improve FFD program performance. As applicable, reference in the topic description audit reports, 30-day reports, and/or corrective action reports. If reporting information on more than three topics, select "Others" for Topic 3 to report any additional topics.

Topic 1

Please Select

Person(s) Responsible for Information Provided

Person 1 (required):

First Name | Last Name | Position Title | Company Email Address

Person 2 (optional):

First Name | Last Name | Position Title | Company Email Address

***Final Step (Required)** - NRC will consider this form authentic in accordance with 10 CFR 26.11 only when the "Validate & Lock" button has been selected and all errors (i.e., those highlighted in red) have been corrected. The "Validate & Lock" button will change to "Locked" after the data validation process has been successfully completed and the form is ready for submission.*

Validate & Lock | Save to Local PC | Print this Report

Annual Report Form (version 1.9.0 – January 2020) - Page 2 of 2 - NRC Form 891

Form 891 includes drop-down fields with specific information that is used in the summary of data for this report. Further explanations of the fields follow:

Facility

Additional note: Facility docket number(s) included in brackets.

Period of Report

Additional notes: Enter the four-digit numerical value for the year of the Period of Report (e.g., 2018). Note: the Validate & Lock script will not allow you to enter a year in the future.

Tests Conducted in the Calendar Year

Additional notes in table:

- Pre-Access, Licensee Employees: Total number of Pre-Access tests conducted (Licensee Employees). Please enter a whole number value (e.g., 0, 1, 2, etc.).
- Pre-Access, Contractors/Vendors: Total number of Pre-Access tests conducted (Contractors/Vendors). Please enter a whole number value (e.g., 0, 1, 2, etc.).
- Pre-Access, Total Number of Positive, Adulterated, Substituted, and Refusal to Test Results: Enter the total number of:
  1. Positive drug and alcohol test results
  2. Adulterated drug test results
  3. Substituted drug test results
  4. Refusals to test.

  Note: If during a single testing event an individual tests positive for multiple substances (e.g., marijuana and alcohol; marijuana and cocaine), only report this event as one positive in this table. Please enter a whole number value (e.g., 0, 1, 2, etc.).

Remaining Reason For Testing options for Random, For Cause, Post-Event, and Follow-up, have the same instructions as shown above for Pre-Access.

FFD Program Random Testing Population and Rate

Average number of licensee employees

Additional notes: Average number of licensee employees subject to Part 26 throughout the period. Please enter a whole number value (e.g., 0, 1, 2, etc.).

Average number of contractors/vendors

Additional notes: Average number of contractors subject to Part 26 throughout the period. Please enter a whole number value (e.g., 0, 1, 2, etc.).

Total size of the random testing pool throughout the period (Calculated)

Annual random testing percentage achieved for the testing pool

Additional note: Please report the testing percentage to one decimal place (e.g., 50.3)

Laboratory Testing

Does your program use a Licensee Testing Facility?

Yes

No

Additional note: Does your program use a Licensee Testing Facility to conduct initial drug testing and validly screening/initial validity testing specimens?

U.S. Department of Health and Human Services (HHS)-Certified Laboratory (Primary)

Additional notes: If the HHS-certified laboratory has the same name, but multiple locations, add the city and state in the name such as “ABC Laboratories (City, State)”

HHS-Certified Laboratory (Backup)

Additional notes: This is the HHS-certified laboratory where an aliquot of a single specimen or the Bottle B split specimen would be sent for testing. It the HHS-certified laboratory has the same name, but multiple locations, add the city and state in the name, such as “ABC Laboratories (City, State).”

Identify your Blind Performance Test Sample supplier(s)

Additional note: Identify the Blind Performance Sample Test supplier(s) used by your program to meet the requirements in 26.168(g) and (h).

Substances Tested

Did your program only test for NRC-required substances AND at the NRC-specified minimum cutoff levels?

Yes

No

Additional notes: See § 26.31(d) for NRC-required substances. See § 26.133 (as applicable) and § 26.163 for NRC-specified minimum cutoff levels for each substance.

Does your program conduct limit of detection (LOD) testing permitted in § 26.163(a)(2)?

Yes

No

Additional notes: Select “yes” if your program conducts LOD testing on dilute specimens as permitted in § 26.163(a)(2).

Summary of Management Actions – § 26.717(b)(8) Summarize actions implemented to improve FFD program performance. As applicable, reference in the topic description audit reports, 30-day reports, and/or corrective action reports. If reporting information on more than three topics, select "Others" for Topic 3 to report any additional topics.

Topic 1 (Optional):

Program and System Management

Policies and Procedures

Random Testing

Training

Certified Laboratories

LOD Testing Blind Performance Test Samples

Other(s)

Person(s) Responsible for Information Provided

Person 1 (required)

First Name, Last Name, Position Title, Company Email Address

Person 2 (optional)

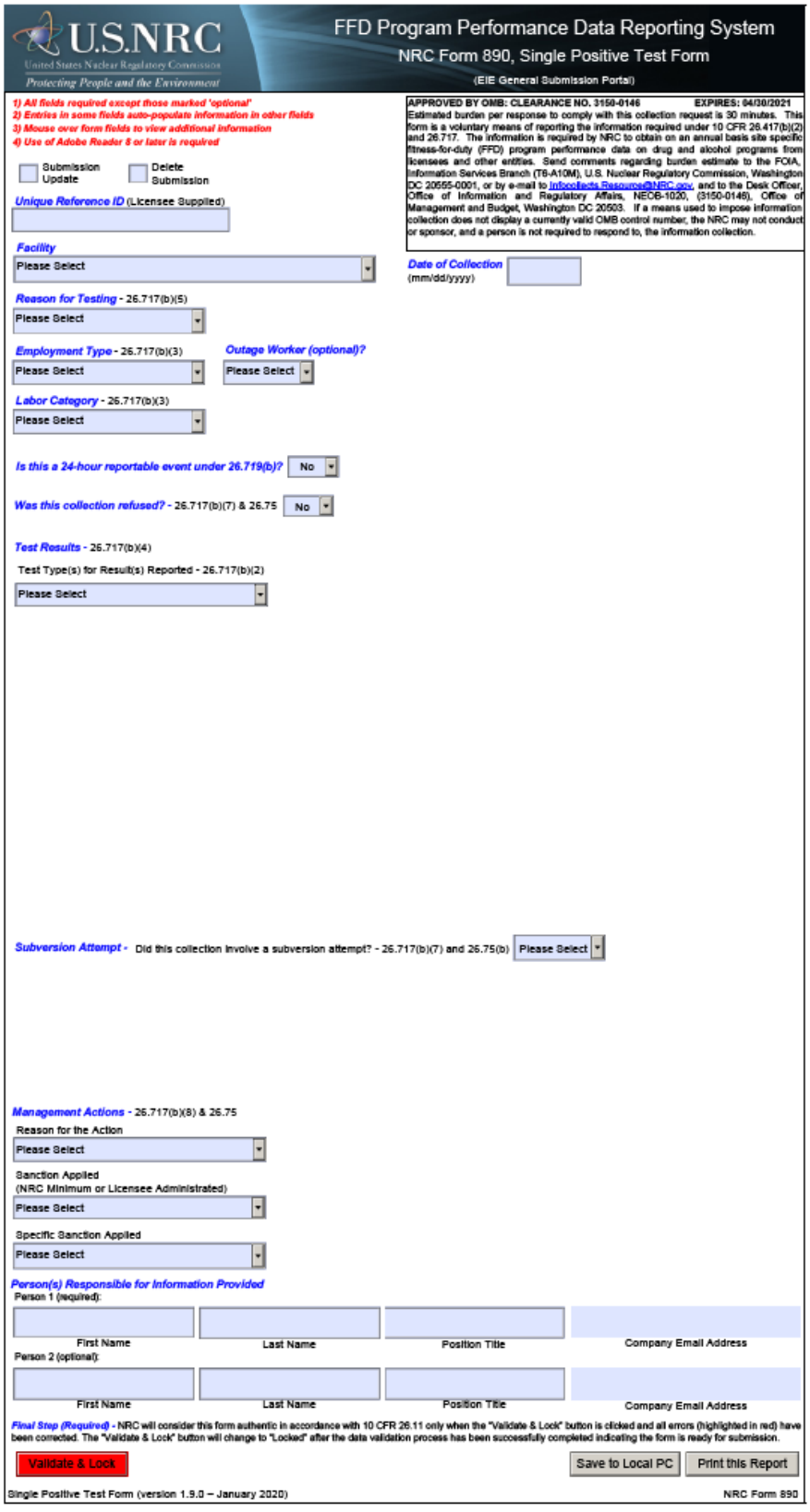
First Name, Last Name, Position Title, Company Email Address

Additional notes: Person(s) Responsible for Information Provided. Information for at least one person must be included for NRC to consider this an official licensee submission.

Final Step (Required) – NRC will consider this form authentic in accordance with 10 CFR 26.11 only when the “Validate & Lock” button has been selected and all errors (i.e., highlighted in red) have been corrected. The “Validate & Lock” button will change to “Locked” after the data validation process has been successfully completed, indicating the form is ready for submission.

Additional notes: Person(s) Responsible for Information Provided. Information for at least one person must be included for NRC to consider this an official licensee submission.

Appendix B – Single Positive Test Form, NRC Form 890



U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

FFD Program Performance Data Reporting System
NRC Form 890, Single Positive Test Form
(EIE General Submission Portal)

1) All fields required except those marked 'optional'
2) Entries in some fields auto-populate information in other fields
3) Mouse over form fields to view additional information
4) Use of Adobe Reader 8 or later is required

APPROVED BY OMB: CLEARANCE NO. 3150-0146 EXPIRES: 04/30/2021
Estimated burden per response to comply with this collection request is 30 minutes. This form is a voluntary means of reporting the information required under 10 CFR 26.417(b)(2) and 26.717. The information is required by NRC to obtain on an annual basis site specific fitness-for-duty (FFD) program performance data on drug and alcohol programs from licensees and other entities. Send comments regarding burden estimate to the FOIA, Information Services Branch (T6-A10M), U.S. Nuclear Regulatory Commission, Washington DC 20555-0001, or by e-mail to Infocollects.Resource@NRC.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0146), Office of Management and Budget, Washington DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

Submission Update
Delete Submission

Unique Reference ID (Licensee Supplied)

Facility
Please Select

Date of Collection
(mm/dd/yyyy)

Reason for Testing - 26.717(b)(5)
Please Select

Employment Type - 26.717(b)(3)
Please Select

Outage Worker (optional)?
Please Select

Labor Category - 26.717(b)(3)
Please Select

Is this a 24-hour reportable event under 26.719(b)?
No

Was this collection refused? - 26.717(b)(7) & 26.75
No

Test Results - 26.717(b)(4)

Test Type(s) for Result(s) Reported - 26.717(b)(2)
Please Select

Subversion Attempt - Did this collection involve a subversion attempt? - 26.717(b)(7) and 26.75(b)
Please Select

Management Actions - 26.717(b)(8) & 26.75

Reason for the Action
Please Select

Sanction Applied
(NRC Minimum or Licensee Administrated)
Please Select

Specific Sanction Applied
Please Select

Person(s) Responsible for Information Provided

Person 1 (required):
First Name | Last Name | Position Title | Company Email Address

Person 2 (optional):
First Name | Last Name | Position Title | Company Email Address

Final Step (Required) - NRC will consider this form authentic in accordance with 10 CFR 26.11 only when the "Validate & Lock" button is clicked and all errors (highlighted in red) have been corrected. The "Validate & Lock" button will change to "Locked" after the data validation process has been successfully completed indicating the form is ready for submission.

Validate & Lock
Save to Local PC
Print this Report

Single Positive Test Form (version 1.9.0 – January 2020)
NRC Form 890

Form 890 includes drop-down fields with specific information that is used in the summary of data for this report. The following explains the fields further:

Unique Reference ID: A Unique Reference ID must be provided by the licensee for each form submitted. Do not include any personally identifiable information in the number used, such as a person's name, initials, or employee badge number. If a form needs to be revised after it has been submitted to the NRC, the revised form must use the same Unique Reference ID as the original submission, and the Submission Update box on the form must be checked.

Facility: Facility docket number(s) included in brackets.

Date of Collection (mm/dd/yyyy)

Reason for Testing – § 26.717(b)(5):

Reason for Testing – 26.717(b)(5)	Testing Reason (Optional) Includes:
Pre-Access	Initial Authorization Reinstatement (Between 6 and 30 days) Reinstatement (Between 31 and 365 days) Update Authorization
Random	Remark field available for elaboration
For Cause	Observed Behavior Physical Condition/Smell of Alcohol Credible Report Other
Post-Event	Illness or Injury Radiation Exposure Plant Safety Event Security Event
Follow-up	Prior 10 CFR 26 positive result Prior positive result not related to 10 CFR Part 26 testing Potentially disqualifying FFD information Other

Additional notes: Select Pre-Access for the Reason for Test when a Random test is conducted per § 26.55(a)(4), § 26.57(a)(4), § 26.59(a)(4), or § 26.59(c)(3) on an individual that has received a Pre-Access test but has yet to be granted authorization.

Employment Type 26.717(b)(3) includes:

Licensee Employee

Contractor/Vendor

Outage Worker (optional)?

Yes

No

Labor Category – 26.717(b)(3):

Supervisor

Licensed Operator

Non-Licensed Operator

FFD Program Personnel

Maintenance (safety-significant)

Maintenance (general facility)

Facility Support

HP/RP (Health Physicist/Radiation Protection)

QA/QC

Engineering

SSNM (Strategic Special Nuclear Material) Transporter

Other

Additional notes: For all persons except licensed operators, if the subject person is a supervisor or manager, always select "Supervisor" and then provide a short comment regarding the particular area the person was assigned (e.g., maintenance, security, etc.). Select "Maintenance safety-significant SSCs, including crane, gantry or lift operations". Select "Maintenance (general facility)" for maintenance that is not performed on safety- or security-significant SSCs (e.g., cleaners, painters, roofers, scaffolders, etc.). Select "Facility Support" for delivery, equipment room.

Is this a 24-hour reportable event under § 26.719(b)?

Yes

No

Additional notes: Select "Yes" if this is a 24-hour reportable event. Note: submission of this form does not satisfy the 24-hour report to the NRC Operations Center.

Was this collection refused? – § 26.717(b)(7) and § 26.75

Yes

No

Additional notes: Select "Yes" if this collect was refused. Refusing to provide a specimen for testing is a subversion attempt per 26.75(b); the form field "Did this collection involve a subversion attempt (Yes/No)?" will auto-populate with "Yes," and information on the event must be provided.

Test Results – § 26.717(b)(4)

Test Type(s) for Result(s) Reported – § 26.717(b)(2)

Drug and Alcohol

Drug Only

Alcohol Only

Additional notes: Choose the Test Types(s) associated with the reportable occurrence. Do NOT report the Test Type for a negative result (e.g., do not choose Alcohol if the Alcohol testing result is negative).

Subversion Attempt – Did this collection involve a subversion attempt? – § 26.717(b)(7) and § 26.75(b) includes:

Yes

No

Management Actions – § 26.717(b)(8) and § 26.75

Reason for the Action

First drug or alcohol positive

Second drug or alcohol positive

Third drug or alcohol positive

Resign/withdraw application – 26.75(d)

Subversion attempt

Other

Sanction Applied (NRC Minimum or Licensee Administrated)

NRC Minimum

Licensee Administrated

Additional notes: Select “NRC minimum” if the 26.75 sanction was applied. The form will auto-populate the “Specific Sanction Applied” form field according to the “Reason for the Action” selected. Select “Licensee Administrated” if more stringent sanction than required by NRC regulation was applied.

Specific Sanction Applied

14-Day Denial

1-Year Denial

3-Year Denial

5-Year Denial

Permanent Denial

Other

Additional notes: If “Licensee Administrated” sanction is selected in form field “Sanction Applied,” the sanction applied must be more stringent than the sanction required by NRC regulation (§ 26.75). Note: The PADS entry shall be the NRC sanction per § 26.75.

Person(s) Responsible for Information Provided

Person 1 (required)

First Name, Last Name, Position Title, Company Email Address

Person 2 (optional)

First Name, Last Name, Position Title, Company Email Address

Additional notes: Person(s) Responsible for Information Provided. Information for at least one person must be included for NRC to consider this an official licensee submission.

Final Step (Required) – NRC will consider this form authentic in accordance with 10 CFR 26.11 only when the “Validate & Lock” button is clicked and all errors (highlighted in red) have been corrected. The “Validate & Lock” button will change to “Locked” after the data validation process has been successfully completed, indicating the form is ready for submission.

Additional notes: Person(s) Responsible for Information Provided. Information for at least one person must be included for NRC to consider this an official licensee submission.

Appendix C – Licensee and Facility Information for 2016–2019 Dataset

Table C.1. Licensees and facilities considered in the Fitness-for-Duty program 2016–2019, by reactor operation type

Licensee	Facility	# Operating Reactors (2016–2019)	# Decommissioned Reactors (2016–2019)	# Reactors under Construction (2016–2019)
Ameren UE	Callaway	1		
Arizona Public Service	Palo Verde	3		
Detroit Edison	Fermi 2	1		
Dominion Generation	Kewaunee		1	
	Millstone	2		
	North Anna	2		
	Surry	2		
Duke Energy	Brunswick	2		
	Catawba	2		
	Crystal River		1	
	H.B. Robinson	1		
	McGuire	2		
	Oconee	3		
	Shearon Harris		1	
Energy Northwest	Columbia	1		
Entergy Nuclear	Arkansas Nuclear One	2		
	FitzPatrick	1		
	Grand Gulf	1		
	Indian Point		1	
	Palisades	1		
	Pilgrim*		1	
	River Bend	1		
	Waterford	1		
Exelon	Braidwood	2		
	Byron	2		
	Calvert Cliffs	2		
	Clinton	1		
	Dresden	2		
	LaSalle	2		
	Limerick	2		
	Nine Mile Point	2		
	Oyster Creek		1	
	Peach Bottom	2		
Exelon (continued)	Quad Cities	2		

Licensee	Facility	# Operating Reactors (2016–2019)	# Decommissioned Reactors (2016–2019)	# Reactors under Construction (2016–2019)
	R.E. Ginna	1		
	Three Mile Island		1	
FirstEnergy Nuclear	Beaver Valley	2		
	Davis-Besse	1		
	Perry	1		
Indiana Michigan Power	D.C. Cook	2		
Luminant Generation	Comanche Peak	2		
Nebraska Public Power District	Cooper	1		
Nextera Energy	Duane Arnold		1	
	Point Beach	2		
	Seabrook	1		
	St. Lucie	2		
	Turkey Point Units 3 and 4	2		
Omaha Public Power District	Fort Calhoun		1	
Pacific Gas & Electric	Diablo Canyon	2		
PSEG Nuclear	Salem/Hope Creek	2		
South Carolina Electric & Gas	V.C. Summer Unit 1	1		
	V.C. Summer Units 2 and 3			2
Southern California Edison	San Onofre		3	
Southern Nuclear	E.I. Hatch	2		
	Joseph M. Farley	2		
	Vogtle Units 1 and 2	2		
	Vogtle Units 3 and 4			2
STP Nuclear	South Texas Project	2		
Talen Energy	Susquehanna	2		
Tennessee Valley Authority	Browns Ferry	3		
	Sequoyah	2		
	Watts Bar	2		
Wolf Creek Nuclear Operating Corporation	Wolf Creek	1		
Xcel Energy	Monticello	1		
	Prairie Island	2		
Totals		**91**	**12**	**4**

Table C.2. Corporate facilities participating in the Fitness-for-Duty program 2016–2019

Licensee	Location of Corporate Facility
Duke Energy	Charlotte, North Carolina
Exelon	Chicago, Illinois
Institute of Nuclear Power Operations (INPO)	Atlanta, Georgia
Southern Nuclear	Birmingham, Alabama
Tennessee Valley Authority	Knoxville, Tennessee
Xcel Energy	Minneapolis, Minnesota

Table C.3. Category I Fuel Cycle facilities participating in the Fitness-for-Duty program 2016–2019

Licensee	Location of Fuel Fabrication Facility
Babcock & Wilcox, Nuclear Operations Group (NOG)	Lynchburg, Virginia
Nuclear Fuel Services	Erwin, Tennessee

Appendix D – Data Manipulation Notes

The Pacific Northwest National Laboratory (PNNL) fitness-for-duty team was provided data from the U.S. Nuclear Regulatory Commission (NRC) in the form of a spreadsheet with the information sourced from Annual Reporting Forms (ARFs) and Single Positive Test Forms (SPTFs) for all facilities between 2016 and 2019. The spreadsheet included a tab with all data compiled from the ARFs as well as a tab with all the information compiled from the SPTFs. The information in the tabs was limited to the information that was collected on these two forms; see Appendix A and Appendix B for the information that is gathered through the ARF and SPTF forms. The data analysis detailed in this report included analysis that could be accomplished using the data in its native format as provided by NRC as well as analysis that could not be accomplished without data manipulation. A summary of the analyses as well as the data manipulation required is shown in Table D.1.

Table D.1. Summary of data analysis and associated data manipulations required

Test	Type
Random Testing Rates	All Employees
	By C/V Employees vs Licensee Employees
Policy Violation Rates Subversion Rates	All Employees
	By C/V Employees vs Licensee Employees
	By Labor Category (e.g., safety)
	By Licensee (e.g., Exelon)
	By Number of Units
# Positive drug or alcohol tests # of tests with policy violations	All Employees
	By Labor Category (e.g., operators, safety)
	By C/V Employees vs Licensee Employees
	By Substance (e.g., alcohol, marijuana, opiates, etc.)
# Subversion attempts	All Employees
	By C/V Employees vs Licensee Employees

Key:
Green – Analysis possible with only NRC provided ARF or SPTF data
Orange – Complex PNNL data manipulation required
Red – Insufficient information for analysis regardless of manipulation

Data manipulation varied by the data request but generally consisted of:

- Word extraction from text fields
- Custom filtering of fields
- Joining tables to connect the ARF summaries with developed SPTF summaries
- Creating new fields from existing data
- Developing custom data summaries
- Building in accuracy checkers to assure data manipulation accuracy.

The first step in this data analysis was to work through the data to create master data sheets that we refer to here as SPTF-enhanced and ARF-enhanced.

D.1 SPTF-Enhanced

The SPTF-enhanced spreadsheet was manipulated in a variety of ways to make the data easier to process. One of the first manipulations was to create new data fields from the fields that were originally text fields within the spreadsheet. These included the creation of 33 new data fields for each entry. Many of the new data fields were generated using logic tests within Microsoft Excel to create a data field with a binary response value that was necessary for the future data processing. An example of this newly created data field included an Excel logic test to determine if the data in an SPTF entry was for a C/V for a pre-access test. A nested logic test was set up in Excel to look through the entries for the SPTF for a given row and return a 1 in the new data field if the row had text fields that indicated a “Contractor/Vendor” employee type as well as a “Pre-Access” testing type per the equation:

[=IF((AND(E5="Contractor/Vendor",F5="Pre-Access")),1,0)].

Of the 36 newly created fields in the SPTF-enhanced data sheets, 30 were custom created logic tests to develop numerical fields from previous text entries by looking for specific combinations of text information from a single entry. The remaining six newly created fields included summary rows and check rows; these rows allowed for data accuracy verification to confirm that the data being generated in the new fields accurately reflected the information within the field itself. For example, there was a field created to verify that the logic tests that were developing numerical data fields for the drug types to make sure the number of drugs for which a person tested positive indicated by the new numerical drug fields matched the number of drugs that were indicated on the SPTF. All the new data fields created in the SPTF-enhanced spreadsheet are listed below:

- C/V Pre-Access (binary)
- C/V Random (binary)
- C/V For Cause (binary)
- C/V Post-Event (binary)
- C/V Follow-Up (binary)
- C/V Other (binary)
- C/V (binary)
- Licensee Pre-Access (binary)
- Licensee Random (binary)
- Licensee For Cause (binary)
- Licensee Post-Event (binary)
- Licensee Follow-Up (binary)
- Licensee Other (binary)
- Licensee (binary)
- Amphetamines (binary)
- Marijuana (binary)

- Alcohol (binary)
- Cocaine (binary)
- Opiates (binary)
- PCP (binary)
- Refusal to Test (binary)
- Drug Data – Accuracy Check row (binary indicator)
- Secondary Accuracy Test Row (binary)
- Subversion attempts (binary)
- Positive for Drug or Refusal to Test (binary)
- Accuracy testing for Subversion attempts, positive for drug results, and refusal to test
- Licensee Non-Pre-Access (binary)
- C/V Non-Pre-Access (binary)
- Licensee Pre-Access (binary)
- C/V Pre-Access (binary)
- Accuracy check for Pre-Access and Non-Pre-Access (binary indicator)
- Subversion C/V Random (binary)
- Subversion Licensee Random (binary)
- Policy violation – any type (binary)
- Subversion C/V Pre-access (binary)
- A positive drug or alcohol type – any substance type (binary)

D.2 ARF-Enhanced

The ARF-enhanced spreadsheet was manipulated in a variety of ways to analyze metrics from the data. The most complicated enhancements to the spreadsheet were from merging data from the SPTFs to the data in the ARF spreadsheet. In the original (non-enhanced) ARF spreadsheet, the number of tests given was broken up by the employee type (i.e., licensee or C/V), but the total number of positive tests was not broken up by employee type, so the metrics from the original ARF spreadsheet were limited to the total positive rate based on testing type (i.e., random, pre-access, for cause, etc.). The enhancements to the spreadsheet included creating 26 new fields in the spreadsheet created by joining summary data from the SPTF data with the ARF spreadsheet. These new fields allowed for the analysis of the data in greater detail than was previously possible. The new data fields added to the ARF spreadsheet are listed below:

- # Pre-Access Positive Tests Licensee (any type of policy violations)
- # Pre-Access Subversion Licensee
- # Pre-Access Total Positives Licensee (any type of policy violations)
- Pre-Access Positive Rate Licensee (rate of any type of policy violations)

- # Pre-Access Positives Tests C/V (any type of policy violations)
- # Pre-Access Subversion C/V (any type of policy violations)
- # Pre-Access Total Positives C/V (any type of policy violations)
- Pre-Access Positive Rate C/V (rate of any type of policy violations)
- Total # for Licensee and C/V (total policy violations)
- Is mismatch ARF vs. SPTF? (logic test for accuracy)
- # Random Positives Tests Licensee (any type of policy violations)
- # Random Subversion Licensee
- # Total Random Positives Licensee (any type of policy violations)
- Random Positive Rate Licensee (rate of any type of policy violations)
- # Random Positives Tests C/V (any type of policy violations)
- # Random Subversion C/V
- # Total Random Positives C/V (any type of policy violations)
- # Total Positives Licensee and C/V (any type of policy violations)
- Random Positive Rate C/V (rate of any type of policy violations)
- Is mismatch ARF vs. SPTF? (logic test for accuracy)
- # Subversion attempts Licensee in Random Tests
- # Subversion attempts C/V in Random Tests
- Subversion Rate Licensee Random Tests
- Subversion Rate C/V Random Tests
- # Subversion attempts all employees random tests
- Subversion rate all employees in random tests

D.3 Data Analysis Sheets

After creating the enhanced summary spreadsheets for both the ARF data and the SPTF data, the metrics analysis began with the following data analyses being conducted:

- Positives by Job Type by Licensee (# of policy violations)
- Pre-Access Positive Rates (# of policy violations)
- Random Test Rates
- Random Positivity by Licensee (# of policy violations)
- Random Positivity by Licensee (# of policy violations based on all their facilities)
- Random Positive Rates (of policy violations)
- Random Positivity augmented with Subversion data
- Pre-Access & Random Positivity (of policy violations)

- Positives by employment type (by drug and alcohol type or if a subversion)
- Subversion Rates
- Subversion Attempt #s_Augmented

This list does not include all the data analysis conducted during this task; rather, it only includes the analysis tabs that were used to create the figures and analyses included in this report. Other analyses that were conducted but were not included in this final report included detailed analysis of positivity based on drug types.

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