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P R O J E C T
MEMORANDUM

Evaluation Design for the District of Columbia Department of Corrections' Use of Radio Frequency Identification (RFID) Technology with Jail Inmates

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INFRASTRUCTURE, SAFETY, AND ENVIRONMENT

ABSTRACT

Managing correctional populations is challenging and expensive for state and local jurisdictions. One promising approach to assist jurisdictions is using active radio frequency identification (RFID) technology. While RFID appears to be a promising management tool, most of the accessible information about how well it works and how cost-effective it may be has been is produced by the product vendors, a source with a vested interest in promoting the adoption of RFID. Given the significant expense of purchasing and operating the technology, state and local jurisdictions could greatly benefit from an objective assessment of the early lessons learned in a jurisdiction already using RFID. This report represents a research design that could be use to evaluate the implementation of RFID within a major urban jail setting—the District of Columbia Department of Corrections (DC DOC).

In consultation with DC DOC, we developed a research design oriented around the following 5 objectives. To be most useful to DC DOC and the corrections field, an evaluation of RFID should: (1) provide timely feedback to NIJ, DC DOC, and other interested jurisdictions on RFID's implementation; (2) provide feedback on the process of implementing RFID; (3) assess the impact of RFID's implementation on identified outcome measures; (4) compare costs to the facility against the cost of implement RFID technology and examine the direct and indirect costs and benefits associated with RFID; and (5) draw lessons for improving overall RFID implementation, design, and operations.

The research design is broken out into three major study components: (1) process evaluation; (2) outcomes trend analysis; and (3) analyses of categories of costs and benefits.

The process evaluation would seek to understand how RFID may impact and change jail

population management. Taking feasibility issues in to account, the recommended data would be qualitative and descriptive in nature. Ideally, the process evaluation would focus on capturing information about three distinct phases of RFID adoption: initial installation and pilot testing, full deployment, and post-installation. The ultimate goal of the process evaluation would be to identify the factors that facilitated or hindered deployment, and the areas for improvement or of continuing concern. These lessons are expected to provide particularly useful feedback to DC DOC on the RFID implementation, as well as serving as important context for the outcome evaluation. Ideally, the process evaluation findings should be summarized in a manner that would also be informative for other jurisdictions considering the adoption of RFID.

The outcome trends analysis would consist of a pre- post-design and would assess change in relation to a series of variables already tracked by DC DOC (e.g., inmate-on-inmate violence). Because a formal cost-benefit analysis is not likely to be feasible, we would instead recommend a study that seeks to capture areas of expected and unexpected benefits that would set out a sensitizing framework for considering costs and benefits. This would involve a rank-ordering of the identified costs and benefits in terms of their relative magnitude based on the public information sources and interviewees' assessments of how adjustments in certain areas have affected how they perform other functions.

I. Preface

Managing correctional populations is a challenging and expensive task for state and local jurisdictions. One promising approach to help is using active radio frequency identification (RFID) technology. RFID tags are typically wrist bands fitted with a programmable chip that that communicates with a network of RFID sensors to monitor and record the tag's identity and location. The space-time signal data can then be displayed on monitors, used to issue real-time alerts if one of any number of preprogrammed conditions is triggered, or data-mined for intelligence or incident investigations. While RFID appears to be a promising management tool, most of the accessible information about how well it works and how cost-effective it is has been is produced by the product vendors, a source with a vested interest in promoting the adoption of RFID. Given the significant expense of purchasing and operating the technology, state and local jurisdictions could greatly benefit from an objective assessment of the early lessons learned in a jurisdiction already using RFID.

The National Institute of Justice (NIJ) recognizes this need and consequently sponsored the RAND Corporation to develop a feasible research design to assess the implementation and impacts of the RFID use within a large, urban jail setting. Specifically, this document represents a research design that could be used to evaluate the implementation and outcomes of RFID use by the District of Columbia Department of Corrections (DC DOC).

This research was conducted under the auspices of the Safety and Justice Program within RAND Infrastructure, Safety, and Environment (ISE). The mission of RAND Infrastructure, Safety, and Environment is to improve the development, operation, use, and protection of society's essential physical assets and natural resources and to enhance the related social assets of safety and security of individuals in transit and in their workplaces and communities. Safety and

Justice Program research addresses occupational safety, transportation safety, food safety, and public safety—including violence, policing, corrections, substance abuse, and public integrity. Questions or comments about this report should be sent to the project leader, Laura Hickman (Laura_Hickman@rand.org). Information about the Safety and Justice Program is available online (http://www.rand.org/ise/safety). Inquiries about research projects should be sent to the following address:

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II. RFID BACKGROUND

RFID technology has been in use for more than three decades, mostly in the context of inventory tracking. Over the last decade, its use has grown exponentially with both commercial customers -- Wal-Mart requires its top suppliers to place passive RFID tags on all pallets and cases being shipped to its warehouses -- and by the Department of Defense. The latter requires containers shipped outside the U.S. to have RFID tags identifying content and point of origin information. The use RFID technology in supply chains is intended to improve the visibility of the movement of pallet-level inventory; increase the efficiency of shipping, receiving and stocking; and reduce costs for labor, storage and inventory losses. While there have been numerous law enforcement uses proposed, such as controlling property (firearms, laptop computers, and vehicles) and documenting evidence chain-of-custody, the technology does not yet appear to have been adopted by U.S. law enforcement agencies (TechBeat, 2005).

In other applications, the Department of Homeland Security launched an August 2005 pilot test of the use of RFID tags embedded in immigration documents at five border crossings, with the intention of improving the tracking of foreign visitors' entry and exists (Songini, 2007). It is also contemplating the use of RFID tags to speed vehicle traffic movement for certain pre-approved individuals who regularly drive across the nation's border (Stana, 2007).

CORRECTIONAL INSTITUTION APPLICATIONS

Using RFID-tagged wrist or ankle bands, RFID technology has also been introduced into correctional environments. The technology is intended to provide real-time, centralized monitoring of inmate locations and movements throughout correctional institutions. Parameters can be set for each individual wrist or ankle band to trigger an alert when its wearer moves into

an unauthorized area or comes near inmates wearing specifically designated wrist or ankle bands. RFID devices may also be worn by correctional officers and staff. These units allow real-time monitoring of staff location and come enabled with a manual alarm function that staff can use to alert a central monitoring station of an immediate need for assistance (Reza, 2004).

Private companies have begun marketing RFID for correctional applications, claiming that many potential benefits will offset the costs of acquiring, installing, maintaining, and operating the technology. To date, however, local, state, and federal jurisdictions have no independent source of information against which to compare the performance claims of product manufacturers. Despite this, an increasing number of jurisdictions are investing in the new technology with the expectation that it will yield some benefits. In this context, independent evaluation of RFID in correctional environments seems particularly important.

One of the most comprehensive descriptions of using RFID in correctional settings to date was included as an appendix in the NIJ Criminal Justice Technology Evaluation solicitation for proposals (NIJ, 2007). This review indicates RFID was first used in 1997 in California State Prison at Corcoran to track staff whereabouts and increase their safety. In 2002, RFID was installed to track youths in a Michigan juvenile facility (Reza, 2004). RFID use appears to have expanded to at least 10 other correctional facilities, ranging from youth detention centers to medium- to high-security adult facilities; overall, its use appears to be more common for tracking inmates than for staff (NIJ, 2007). But it is not possible to make more definitive statements about the use of RFID technology based on readily available public information because vendor- and media-released information may be incorrect or misleading. For example, numerous widely distributed vendor press releases announced that RFID was being installed in Pitchess Detention Center in Castaic, California, in 2004. But in early 2006, Los Angeles County elected to abort

the process of acquiring RFID before installation even began.

RFID ADOPTION BY THE DC DOC

The DC DOC's primary mission is to safely and securely confine persons awaiting trial or serving sentences. The department manages over 3,500 inmates, with a budget of $141 million and 923 positions. Its Central Detention Facility (CDF) is the largest adult detention facility in the municipal jail system, with 18 housing units and over 100,000 inmate movements in and out of the facility annually. To help manage its inmate population, in August 2007 DC DOC solicited bids for an RFID system for its CDF. DC DOC plans to use RFID to track both inmate and staff movements to improve both safety and security and expects that using RFID will eventually result in cost savings. In the next sections, we describe DC DOC's expectations for the capability and function of the technology and its expectations about RFID's long-term impact for improving population management.

Expected Capability of DC DOC's RFID System

In DC DOC's description to vendors of its requirements for an RFID system, it specifies a number of expectations for the operation and performance of the RFID technology. Key among these is that it provides a central monitoring station (made up of multiple workstations) with location information for individual inmates and staff in real-time (no more than a two-second delay). Rather than broad zone location information, the RFID system will utilize a virtual map of the facility to report precise X-Y-Z coordinate positions for each individual, with "Z" indicating a floor location in multi-floor areas.

RFID wristband devices worn by inmates must be tamper-proof and very durable to prevent intentional and unintentional damage to the monitoring function. If tampering or

damage does occur, an alarm will be triggered at the central monitoring station providing the identity and location of the inmate (or staff member) involved. The system will not only monitor movements, but track in real-time whether inmate movements are authorized. For example, location signals from individual RFID wristbands would be automatically and continually matched against the predesignated authorized locations for that particular inmate. If an inmate moves into an unauthorized housing area or other location, an alarm would occur at the central monitoring station providing the identity of the individual inmate and their precise location.

The RFID system would also allow perpetual head-counts of all inmates. It would issue an alert when the number of inmates within the facility does not match an expected number of inmates (taking into account authorized entrances and exits). Moreover, it would issue an alert when an individual inmate is overdue for an authorized facility exit or return.

The devices for staff must also come enabled with a button for staff to manually send an "alarm" to the central monitoring station to call for assistance. The staff RFID units must have a "person down" feature that detects and alerts the central monitoring station if a wearer falls into a horizontal or near-horizontal position. DC DOC further specifies that the RFID system continually archive all it monitors. This allows for time-stamped "playback" of historical events to improve the accuracy and efficiency of investigations occurring within the facility, including such events as assaults or thefts.

Expected Long term Outcomes from the Deployment of RFID

The long term goals of the DC DOC in deploying an RFID system are to improve the efficiency with which it locates, tracks, and manages the inmate population, thus saving staff time. It is also expected to provide increased safety for both inmates and staff. By

accomplishing these goals, the RFID system is also expected to produce cost savings. In this section, we explain these goals in greater detail and discuss the mechanism by which RFID is expected to produce these effects. In preface, we emphasize that *these outcomes are the expected over the long term*. In the next section we will discuss expectations during the lengthy implementation period, including the expected short term outcomes.

Improve Monitoring and Control of Inmates/Reduced Staff Time. RFID technology is expected to reduce staff time spent manually counting, controlling, maintaining separation, and monitoring inmate movements, requiring fewer staff members to achieve the same (or higher) level of inmate surveillance. Moreover, it is expected to improve the egress and ingress control and tracking of inmates outside the facility. This is expected because RFID can provide automated, real-time inmate head counts, identification and location information, and alarms alerting staff to developing problems. Also, since RFID is expected to reduce the level of violence, it would thereby reduce staff time in establishing order, investigating, and responding to acts of violence. Another major source of reduced staff time would be the increased efficiency and effectiveness of investigations. For example, in the case of an assault, homicide, or property theft, investigators could use archived monitoring data to identify all individuals near the incident's location during the window of time in which it occurred. This could serve to substantially shorten and improve the quality of investigations.

Reduce Violence and Injuries. Active monitoring of inmates using RFID is expected to reduce inmate-on-inmate and inmate-on-staff assaults. First, it may reduce violence by deterring this behavior because inmates would be aware that their locations are constantly monitored. Second, violence may be reduced by greater officer awareness of (and thus more rapid response time to) developing incidents, such as when inmates congregate or certain inmates moving into

restricted zones. Given this, RFID would also result in fewer inmate injuries from assaults and in less serious ones. The technology could also increase safety by providing a way to identify violent inmates without relying on victimized inmates or inmate witnesses, who may be at risk of retaliation for identifying assailants. Finally, RFID can reduce violence by helping to ensure that certain individuals or groups of inmates (e.g. rival gang members) do not come in contact with each other.

Reduce Actual and Attempted Escapes. Attempted escapes should be reduced by deterrence and alarms indicating the identity and location of an inmate tampering with an RFID device. Also, alarms indicating an inmate has moved into an unauthorized area allow for quicker detection and more rapid response to the precise location of the attempted or actual escape.

Reduce Number of Investigations and Improve Investigative Capabilities. RFID use is expected to deter rule and law violations, thus yielding fewer incidents in need of investigation. Investigations would also be more efficient, requiring far less time to identify (or rule out) involved individuals and document the evidence supporting (or refuting) allegations of inmate and/or staff misconduct.

Reduce Inmate Grievances, Disciplinary Actions, and Lawsuits. RFID is also expected to reduce inmate lawsuits by preventing incidents that may give rise to grievances and legal action, such as inmate-on-inmate assaults. Relatedly, disciplinary actions should decline through a reduction of incidents that lead to disciplinary actions.

Table 1 summarizes these potential impacts of RFID and how RFID is expected to achieve the impacts. For each one of these outcomes, it also shows how RFID is expected to produce cost savings. The latter primary occurs through reduced requirements for, and more efficient use of, staff time, reduction in need for medical treatment, and fewer expenses related to inmate

lawsuits.

Table 1

Expected Long Term RFID Outcomes, Mechanisms of Impact, and Expected Categories of Cost Savings

Expected RFID Outcomes	Mechanism of RFID Impact	Expected Categories of Cost Savings
Reduce Violence, Improve Safety	Deterrence; reduction/early warning of high-risk inmates congregating; inmates entering restricted areas; quicker staff response time; reduce escalation of inmates property disputes; reduction in need for inmate victims/witness to identify assailants (thereby reducing threat of retaliatory violence)	**Inmate-on-inmate:** fewer and less serious injuries requiring medical treatment; fewer investigations; less staff time record-keeping and administering disciplinary sanctions; fewer inmate lawsuits **Inmate-on-staff:** fewer and less serious injuries requiring medical treatment; less time in recordkeeping; less time in investigation and administering disciplinary sanctions; fewer worker compensation claims, less overtime to replace injured staff; less staff turnover from safety concerns
Reduce Actual and Attempted Escapes	Deterrence; early warning of inmates entering restricted zones	Reduced staff time in search, investigation, and prosecution
Improve Inmate Monitoring and Control/Reduce Staff Time	Surveillance and control of inmate movements from centralized location; reduction of need for in-person head counts, for lockdowns, and for escort	Reduced staff time
Reduce Number of Investigations and Improve Investigative Capabilities	Deterrence of rule/law violations; early warning of and increased response time to certain types of rule/law violations; time coded electronic record of inmate and staff movements to identify suspects/witnesses and to support or refute accusations	Fewer rule/law violations requiring investigation; reduced time in conducting investigations; reduced time in recordkeeping
Reduced Grievances, Law Suits, and Disciplinary Actions	Reduction in the incidents that lead to grievances, law suits, and disciplinary actions	Reduced staff time in investigation and response, recordkeeping, and court appearance; reduced attorney time; fewer settlements; fewer awards

RFID IMPLEMENTATION AND SHORT-TERM GOALS

DC DOC is currently in the final stages of awarding the RFID contract and installation is

expected to begin in July 2008. It will initially install the technology in two to three housing units/common areas of the CDF, monitoring 320 to 480 male inmates and 50 to 100 staff members. The installation experience in these areas will be used to inform the technological customization for RFID installation in the remaining CDF areas. The installation and customization process is expected to be completed by the end of December 2008.

DC DOC intends to incorporate the RFID monitoring function into a planned Correctional Surveillance Center (CSC) within the CDF or ancillary buildings in the correctional complex. DC DOC is soliciting proposals for developing this CSC, requiring bidders to incorporate in state-of-the-art, best practices in surveillance centers. Staff in the CSC will also monitor facial recognition technology, CCTV cameras, the inmate phone system, and a center control system to operate the jail from a route site (e.g., doors, passageways, gates). The CSC will be staffed by trained civilians, rather than correctional officers, partly to protect the monitoring function from staff shortages. For example, if correctional officers staffed the CSC, there would be occasional pressure to assign them to non-monitoring duties in response to unanticipated absences. Civilian staff could not be similarly reassigned.

Anticipated and Potential Implementation Issues

Implementation of new technology comes with a host of potential challenges for any organization and RFID technology in a correctional environment is no exception. In discussions with RFID vendors and informal conversations with staff at several correctional facilities currently using RFID technology, we identified several issues that could emerge during implementation. Primary among these issues is that after initially *installing* the RFID system, it could take a minimum of six months before the RFID system becomes "fully operational." During this implementation period, the system is operating but its performance is still being

tested and customized for the facility. For example, it is anticipated that DC DOC will be working with the vendor to identify ways to reduce false alarms by refining hardware installation and software programming, to reinforce or revise staff training on equipment, and to revise the response protocol as needed to address plans for responding to different types of alarms. While facility-specific protocols will be developed in advance of installation, these protocols inevitability require revision and refinement after a period of experience with RFID operation.

Staff must also be trained on the aspects of RFID relevant to their positions. For example, those performing the monitoring function must receive initial, preparatory training and then "on-the-job" training and support as they begin to monitor inmates and staff movements about the facility in real-time. Our informal feedback from staff at another correctional facility using RFID indicated that initially staff may be overwhelmed by the amount of monitoring data being displayed. This can make it difficult to decide whether and/or which action should be taken.

Acceptance of the technology by staff and inmates is another consideration. While only anecdotal, informal conversations with other correctional facilities suggest that staff need time to learn the actual level of reliability of the technology in operation and then to build up adequate confidence to rely on its performance. Likewise, after initial introduction of RFID, inmates will likely attempt to circumvent it by tampering with, attempting to damage, or trying to remove the RFID devices. These attempts are likely to decline over time, as will the need for officers to respond and address them. After RFID is firmly established in the facility, new inmates may be less likely to tamper with or "test" the RFID technology and such incidents would likely occur at a predictable rate.

Expected Short-Term Outcomes of RFID

RFID makes possible closer and continuous monitoring of inmates and, thus, is expected to increase the detection of prohibited behaviors. For example, many authorized movements, even when they result in inmate-on-inmate assaults, may have previously gone undetected or at least undocumented. With RFID, these movements should result in a documented alarm, triggering protocols for officer response and documentation in facility incident data. Thus, the short-term outcome of RFID introduction is an *expected increase*, rather than decrease, in the number of inmate behavior-related incidents tracked in facility data. This "increased detection" effect in official data is consistently observed with interventions that increase monitoring of correctional populations (Petersilia & Turner, 1993; Turner, Petersilia, & Deschenes, 1992).

Thus, the success of RFID at revealing previously undetected behaviors would be observed in facility data showing an increase in indicators capturing inmate behavior-related incidents, specifically inmate-perpetrated assaults, fights, unauthorized movements and escape attempts, and other rule/law violations. These would, in turn, increase the number of investigations and disciplinary actions. Over the longer term, the success of RFID would be observed in the decline of these same indicators over time.

In sum, relative to the period before RFID, indicators of unauthorized inmate activities are expected to "peak" early in the period following full implementation, (i.e., the point at which RFID reaches its maximum ability to detect previously undetected activities). Subsequently, indicators of unauthorized inmate activities would begin to decline (as a result of deterrence). This would be expected as (1) inmates become more certain that such activities will be detected and negative consequences will result and (2) staff response protocols are adjusted for certain types of RFID alarms.

In the next section, we describe the evaluation design which contains a methodology to assess both short- and long-term outcomes.

III. RESEARCH DESIGN

EVALUATION OBJECTIVES

In consultation with DC DOC, we developed a research design oriented around the following 5 objectives. To be most useful to DC DOC and the corrections field, an evaluation of RFID should: (1) provide timely feedback to NIJ, DC DOC, and other interested jurisdictions on RFID's implementation; (2) provide feedback on the process of implementing RFID; (3) assess the impact of RFID's implementation on identified outcome measures; (4) compare costs to the facility against the cost of implement RFID technology and examine the direct and indirect costs and benefits associated with RFID; and (5) draw lessons for improving overall RFID implementation, design, and operations.

EVALUATION COMPONENTS

This evaluation design is broken out into three major study components: (1) process evaluation; (2) short- and long-term outcomes trend analysis; and (3) analyses of categories of costs and benefits. Each component is discussed below.

1) Process Evaluation of DC DOC's Implementation of RFID

The process evaluation would seek to understand how RFID may impact and change jail population management. Taking feasibility issues in to account, the recommended data would be qualitative and descriptive in nature. Specifically, we recommend interviews with key actors and document reviews, such as written alarm response protocols. Ideally, the process evaluation would focus on capturing information about three distinct phases of RFID adoption. These are:

- Phase 1: the period of initial installation and pilot-testing of RFID in several housing units (July – September 2008);
- Phase 2: the period over which RFID is fully deployed across the full facility (October - December 2008); and
- Phase 3: first 12 months after full deployment in the facility (January - December 2009).

The specific dates listed are approximations based upon currently available information but should be adjusted to reflect the realities of installation and implementation. We recommend that data collection occur soon after the end of each of these three phases. Specifically, the early implementation data collection would take place in October 2008. Data collection for the period immediately following full implementation would take place in January 2009 and for the 12-months post full implementation would take place January 2010. Table 2 displays these implementation phases and approximate data collection windows.

Table 2

Process Evaluation Implementation Phases and Data Collection Windows

Phase	Approximate Phase Dates	Timing of Data Collection
Phase1: Initial installation and pilot-testing of RFID in several housing units	July – September 2008	October 2008
Phase 2: Period over which RFID is deployed across the full facility	October - December 2008	January 2009
Phase 3: First 12 months after full deployment in the facility	January - December 2009	January 2010

The specific key personnel to be interviewed should include operations staff, information technology staff, CSC personnel, and correctional officers who have been involved in developing

or implementing RFID within DC DOC facility. Interviewees should include personnel responsible for designing the RFID requirements, and those involved in implementing this technology. In addition, we suggest interviewing personnel responsible for developing the RFID alarm response protocols, for training of staff on RFID use, and for overseeing its initial deployment. DC DOC staff would need to assist the evaluator in identifying appropriate individuals to interview for each area of interest but only the evaluation research team members should be present during interviews. This would bolster the independence of the data collected.

For phase one of RFID implementation, we recommend the process evaluation focus be on identification and description of procedures developed and decisions made in customizing the RFID system for the DC DOC, both during the initial installation and pilot testing. It should also identify and describe the development and refinement of officer response protocols and any adjustments required in during is early period of full implementation. How closely RFID was implemented to the original intent and design is important to understand because of its potential impact on the outcomes of interest (e.g., an anticipated use of RFID might turn out to be infeasible).

The focus of the process evaluation during phase two (the period ending in full RFID implementation) should be on issues that may have arisen during scaling-up for the full facility, ongoing staff training needs identified, how RFID has impacted response procedures, what mid-course adjustments were necessary, and the behavioral response of inmates and officers.

Phase Three of the process evaluation (first full year of experience with RFID) would assess later challenges encountered and how addressed, identifying any issues that remain unresolved, perceptions about the costs and benefits of RFID, and perceptions about the effect of RFID in reducing response times, increasing the frequency of response and of interventions,

reducing the severity of incidents, improving the effectiveness of investigations, reducing time required to adjudicate cases, and improving institutional intelligence for different activities of interest. The goal should also be to identify the factors that facilitated or hindered deployment, and the areas for improvement or of continuing concern. These lessons are expected to provide particularly useful feedback to DC DOC on the RFID implementation, as well as serving as important context for the outcome evaluation.

Interview Protocols

We recommend that the key informant interviews utilize a semi-structured interview protocol to guide the data collection. In this section, we offer an example protocol, containing key topics and issues to be covered in informant interviews. The interview protocol should be customized as appropriate for each of the three phases of data collection, particularly to include issues that were identified in the previous data collection period. Moreover, the interview protocol must remain flexible enough to allow researchers to follow the lead of informants and to gather additional information about topics raised by them.

Generally, the in-depth interviews should provide information about the decisionmaking processes and organizational changes necessary to implement this new technology and capture the learning curve the facility went through in implementing RFID initially, in ramping up to full implementation, and after one full year of operation. The general interview protocol should be tailored to include questions only relevant to each individual respondent's position in the facility.

In general, the interview protocols will addresses the following broad questions:

1. How does RFID fit into the continuum of existing technology and policies, such as those intended to prevent escapes, inmate-on-inmate violence, or inmate-on-staff violence?

2. How has RFID changed, if at all, the way the officers are deployed? What effect, if any, has this had on other aspects of facility operations?
3. What is the role of civilian staff in the deployment and/or operation of RFID?
4. Has the use of RFID led to changes in tactics and procedures within the facility?
5. What type of initial and on-going training of officers and staff was required to implement RFID? Was the type and level of training as expected? If not, what was unexpected? How has RFID training impacted the overall training schedule or priorities? Were there differences among the staff (e.g., new versus more seasoned) in the ability to adapt to using RFID in place of previous procedures?
6. What impact, if any, did training for RFID usage have on overtime and associated costs?
7. What education of inmates was required to implement RFID? How did inmates respond to RFID initially and over time? What inmate concerns were expressed and how were these addressed?
8. How do officers perceive the role of RFID in ensuring their safety and helping to better monitor inmates? What concerns, if any, do they have in using this technology? How were they addressed?
9. Were there any concerns expressed by the correctional officers union (Federal Order of Police) about deploying or use of RFID? If so, how have these concerns been addressed?
10. What types of adjustments were made during the implementation phase? How, if at all, did these changes affect the use of RFID within the jail setting?
11. What technology issues (e.g., false alarms, sizing of RFID bracelets, cleaning and maintenance of bracelets) arose during implementation and how were they addressed?
12. Did RFID meet the overall expectations of DC DOC management and senior staff?

Where there any unintended negative consequences? Where there any unanticipated benefits?

Questions about potential economic costs and benefits of RFID should also be included in a general interview protocol. This issue will be discussed in more detail in a later section. In each phase, we recommend that researchers seek to obtain any written documents pertaining to such issues as RFID vendor specifications, timetables, DC DOC officer and staff alarm response protocols, internal progress reports, and other documented information relevant to the installation and operation of RFID. This written documentation should be used to augment and clarify the information gained from the interviews to obtain a more complete picture of implementation.

Descriptive Analysis of Process Evaluation Data. Drawing on the information from the semi-structured interviews and review of documents, we recommend that the process evaluation data be summarized to address: (1) how the implementation process has evolved, what organizational adjustments in RFID's deployment were made as a result, and implications for the outcomes of interest; (2) what technology issues arose during implementation phase and how they were addressed; (3) how RFID fits into the continuum of security and safety procedures and technology systems already in place; (4) what procedures and response protocols were put into place; (5) what impact RFID has had on population management and what factors may have facilitated or hindered its usage as envisioned; (6) the initial and on-going training process; and (7) perceptions of the economic costs and benefits; and (8) whether adjustments to the original plans for RFID's implementation reduced or increased the number of outcome areas technology is expected to impact.

The extensive semi-structured interviews and document reviews would allow evaluators to qualitatively examine how DC DOC has approached incorporating RFID into its operations

and whether there have been unintended consequences or benefits for doing so. For example, it may be that interviews cite benefits that include improvements in incident response, in officer and inmate safety, or in accuracy of investigations. Some of the "costs" cited may include deferring routine training, a longer time horizon than initially anticipated to incorporate RFID into the continuum of safety and security procedures available to staff, or increased overtime costs. Ideally, the process evaluation findings should be summarized in a manner that would also be informative and beneficial for other jurisdictions considering the adoption of RFID.

Task 2. Outcomes Trend Analysis

We recommend that the trends in RFID outcomes be tracked over time to assess whether they move in the expected direction. Since the DC DOC must phase-in RFID across the full jail facility over roughly 6 months comparing housing units with and without RFID will not be possible. Even if RFID could be fully implemented instantly in the initial housing units, the possible follow-up period would still be too brief to afford an adequate comparison of outcomes in housing units with and without RFID. Thus, the suggested outcome evaluation design will be a pre/post comparison across the entire CDF.

Evaluation Time Period. For purposes of the outcomes analysis, the key points of comparison would be (1) the 18 months before RFID introduction or "pre-RFID period," (2) a six-month "implementation period," and (3) the 12 months after RFID is fully operational or "post-RFID period" (see Table 3). The length of the implementation period is a best estimate; the process evaluation data collection should play a key roll in determining whether this period needs to be extended. (If so, the process evaluation data collection would also identify the reasons for delay in full implementation.)

Table 3

Estimated Outcome Evaluation Timeline

Pre-RFID Period (18 months)	Implementation Period (6 months)	Post-RFID Period (12 months)
Jan'07–June '08	July '08–Dec '08	Jan '09–Dec '09

We identify a 12-month post-RFID period because we understand there is a need to produce timely findings for DC DOC and the correctional field more broadly and, critically, longer study periods can require increased resources. But the pre-RFID window is set at 18 months because these data are available and the longer period allows clearer observation of trends in outcome data. Because of diminishing returns for each additional month, 18 months is the maximum period we would recommend.

Outcome Measures. Because the evaluation would rely on historical trends as the one source of comparison for the post-RFID period, feasible outcome measures are only those that already tracked by DC DOC. Fortunately, DC DOC appears to have a fairly robust tracking system, including many outcome variables that we feel would be appropriate for assessing the impact of RFID technology. Most of these variables are tied to American Correctional Association (ACA) accreditation standards or part of the Bureau of Justice Statistics (BJS) corrections institution Survey on Sexual Violence.

Specifically, the available outcome measures we recommend utilizing are: the number and severity of inmate-on-inmate violence (assaults and fights), inmate disturbances, inmate-on-inmate non-consensual sexual acts, number and severity of inmate-on-staff incidents, attempted and successful inmate escapes, unauthorized inmate movements, staff use of force, inmate lawsuits, inmate disciplinary reports, and investigations of rule and law violations. As discussed

previously, RFID is expected to lead to an increase in the number of recorded unauthorized inmate behaviors of all sorts in the short term (through the end of the full implementation period), but that these measures would decrease in frequency over the long term (beginning in post-RFID implementation period). Table 4 presents each outcome measure and the expected direction of effects (increase or decrease) in both the short term and over the long term.

Table 4

Outcome Measures and Expected Short Term and Long Term Results

Outcome Measures	Indicators	Expected Short Term Results	Expected Long Term Results
Inmate-on-Inmate Violence	# of actual assaults	Expect increase due to improved incident detection	Expect decrease due to deterrence effect of RFID
	# of actual fights	Expect increase due to improved incident detection	Expect decrease due to deterrence effect of RFID
Inmate Injuries from Fights or Assaults (as an indicator of incident severity)	# of assaults of fights with injury	Expect reduction as RFID enables staff faster response time to location of assault	Expect decrease as RFID enables staff faster response time to location of assault
Inmate Disturbances	# of disturbances	Expect increase due to improved incident detection	Expect decrease due to deterrence effect of RFID
Inmates-on-Inmates Non-Consensual Sexual Acts	# of completed non-consensual sexual acts	Expect increase due to improved incident detection	Expect decrease due to deterrence effect of RFID
	# of attempted non-consensual sexual acts	Expect an increase as RFID enables staff faster response time to detected location	Expect decrease as RFID enables staff faster response time to location
Inmate-on-Staff Incidents	# of actual assaults	Expect reduction due to deterrence effect of RFID	Expect decrease due to deterrence effect of RFID
Staff Injuries Caused by Inmates (as an indictor of incident severity)	# of incidents of staff injury due to assaults or fights	Expect decrease as RFID enables other staff to more rapidly respond to location of assault or fight	Expect decrease as RFID enables other staff to more rapidly respond to location of assault or fight
Inmate Escapes	# of successful escapes	Expect increase due to improved incident detection	Expect decrease due to deterrence effect of RFID & as greater reliance on RFID alerts increases over time

Outcome Measures	Indicators	Expected Short Term Results	Expected Long Term Results
Inmate Escapes	# of Attempted escapes	Expect increase due to improved incident detection	Expect decrease due to deterrence effect of RFID & as greater reliance on RFID alerts increases over time
Unauthorized Inmate Movements	# of unauthorized inmate absences	Expect increase due to improved incident detection	Expect decrease due to deterrence effect of RFID
Inmate Law Suits	# of Law Suits Filed by Inmates	Unclear: deterrence effect of RFID could result in a decrease, but an increase could also occur could as archived RFID data becomes available to aid in investigations, and RFID itself could motivate suits	Unclear: deterrence effect of RFID could result in a decrease, but an increase could also occur could as archived RFID data becomes available to aid in investigations, and RFID itself could motivate suits
Staff Use of Force	# of Incidents of Force Used By Staff	Expect decrease as RFID gives early warning of developing incidents, increase response time, and number of responding staff	Expect decrease as RFID gives early warning of developing incidents, increase response time, and number of responding staff
Inmate Disciplinary Reports	# of Disciplinary Reports for Inmate Infractions	Expect an increase due to improved incident detection	Expect decrease as a result of deterrence, and reduction in staff response time to developing incidents, allow time to defuse incidents rapidly
Investigations of Inmate Rule/Law Violations	# of Investigations	Expect an increase due to improved incident detection	Expect a decrease due to the deterrent effect of RFID

As Table 4 shows, it is unclear whether to expect RFID to increase or decrease inmate lawsuits. Vendors of RFID technology often assert that it will reduce such lawsuits but there

may be reason to suspect the effect to be in the opposite direction. In this context, insights gain through the process evaluation data collection would be particularly informative in terms of interpretation of trends during the study period.

Data Sources. The DC DOC Electronic Offender Management System captures the data on the identified outcome measures. Incidents are submitted as hard-copy text incident reports. A DOC analyst collects and scans these reports into Adobe Acrobat files. The analyst manually collects other data elements of relevance, particularly to officer-related incidents, and logs them into an Excel workbook. The data are reviewed once a quarter by the analytic staff. Other data are supplemented with information from the Offender Management System (Jail and Community Corrections System, or JACCS) and the Electronic Medical Record (GE Centricity or Logician). These electronic data are collected using MS Access and then electronically matched and augmented to the original workbook. The DC DOC plans to maintain this existing data collection, adding records as they occur over time to the file tracking outcomes. This data file (in de-identified form) would serve as the source of outcome measure data for the evaluation.

In addition, DC DOC staff are currently in the process of developing additional, new measures of the severity of inmate-perpetrated violence. Recall that one expected RFID outcome is an initial increase in the number of detected inmate acts of violence but a reduction in the severity of such incidents. This is expected because RFID will provide greater staff awareness of developing incidents, providing an opportunity to more rapidly suppress violent incidents as they are developing. As shown in Table 4, the only indicator of incident severity available for the full study period is an indicator of whether an injury occurred. DC DOC is currently developing measures of incident severity using correctional expert severity rankings of descriptions of actual violent incidents. Ultimately, the process is expected to yield a more complex set of incident

severity measures. DC DOC expects to have completed this measurement develop process complete before RFID is fully installed. When complete, DC DOC will incorporate data collection on these measures into its existing procedures.

Because these measures are not expected to be in place before RFID installation begins, it would not be possible to include these severity measures in the full outcome analysis. These data, however, could be used to compare the severity of incidents detected via RFID alone versus those detected with traditional/existing correctional officer surveillance.

Outcomes Data Analysis. The performance of RFID in achieving its expected outcomes will be suggested in the comparison of the trends for some of the variables listed in Table 4 across the three relevant time windows: (1) pre-RFID, (2) RFID implementation period, and (3) post-RFID implementation. This would lend itself to directly interpreting the practical significance of observed changes in key outcomes over time. Insights from the process evaluation would also be very informative in the interpretation of these trends. Because the base rate for a number of measures is quite low, it would not be possible to use statistical approaches to compare all outcome measures across each time period.

Specifically, we recommend comparing trends in outcome measures before and after the implementation of the RFID system. Before employing statistical analyses, however, we recommend that evaluators conduct a power analysis to be certain that the design would afford adequate statistical power to detect an effect for each outcome measure of interest. For example, DC DOC data indicate that inmate-on-inmate assaults presently occur at a rate of about three per month. Additional statistical power could be gained by examining incident types that are more frequent, such as inmate fights, or by aggregating several unauthorized inmate activity types together. This said, it is not clear how best to define “adequate” statistical power since no

evaluation has yet been conducted of RFID's impact generally, and specifically on a jail population. While the product vendors have argued that RFID would have a large impact on each outcome measures, there is no evidence that can be cited to support this claim. Thus, we would recommend a more conservative standard in this first ever assessment of RFID, assuming only a small to moderate effect size in power calculations. Moreover, where possible we would recommend measuring time in weekly units, rather than monthly, in order to maximize statistical power.

Where adequate statistical power exists to conduct such analyses, researchers could employ an interrupted time series model draw conclusions upon these results. Regarding measures for which adequate statistical power does not exist, researchers would be able to interpret trends across the three relevant time periods with more heavy reliance on the findings from the process evaluation.

Task 3. Analyze Categories of Costs and Benefits

One claim commonly made by product manufacturers is that RFID technology reduces correctional-facility operating costs. Costs are expected to be reduced through reductions in staff time needed to manage correctional populations. A formal cost-benefit analysis does not appear to be feasible for a moderately resourced study, tracking a one-year post-RFID period. Such an analysis would require sizeable resources and a significantly longer study period (i.e. possibly five or more years post full implementation) to allow for the technology and costs and benefits to fully mature in the environment. However, the early stages of RFID implementation and operation offer an ideal time to explore and document areas of expected and unexpected costs and benefits. Moreover, it allows for the identification and collection of key cost and benefits

data that could lay the foundation for a future cost-benefit analysis. First, we discuss how evaluators could identify and assess the issue of RFID cost, followed by a discussion of an approach to identifying and capturing initial RFID benefits.

Analysis of RFID System Costs. The expected costs associated with implementing RFID include the cost of the RFID contract, the CSC contract (including the cost for an integration contractor to develop the software), correctional staff time to work with the contractor to develop the response protocols, and civilian staff time to retrieve RFID data and generate reports for internal use, as well as internal operating costs associated with transitioning to the RFID system, including overtime and costs for the training of correctional officers on the new response tactics and procedures within the RFID environment, and maintenance and operations costs. We also recommend that the evaluation include interaction with the technology vendor to identify any likely RFID technology upgrades in the future (and associated costs) to factor into alternative cost scenarios. Finally, we recommend obtaining information from the technology vendor about the likely maximum technological life of the RFID systems, which is a key input required for assessing the lifecycle costs of RFID technology.

To quantify costs, we recommend use information collected as part of the process evaluation interviews (described in Task 1) and analysis of secondary data sources from the DC DOC. The interviews should provide information on where the resources and personnel came from to accommodate this new technology and if any shifts were required from other activities. The interviews would also inform about the infusion of funds (and their sources) to cover these activities. Evaluators should seek to understand where resources came from and what they would have been used for if they had not been shifted to help implement RFID in the facility.

Analysis of Benefits. The move to RFID technology promises several direct and indirect

benefits. Direct quantifiable benefits include reduction in staff size and/or overtime expenses for a given inmate population size. While quantifying costs associated with implementing RFID technology, particular attention should be paid to staff resources permanently moved from various departments to the operation of the RFID technology systems because such permanent staff movements or reductions represent a net benefit as well.

RFID is expected to increase the ability of DC DOC staff to detect incidents, respond, report, and undertake disciplinary actions. Thus, RFID as a result may generate a higher level of staff activity. Thus, it is possible that cost savings in staff time produced from improved efficiency of inmate head counts, for example, may be offset by increases in staff time generated by the detection of more incidents in an RFID environment. However, over time, as the staff fine-tunes their response protocols to RFID alerts and efficiency of operations, RFID may ultimately lead to cost savings through a reduction in overall staff time and overtime costs.

Indirect benefits, however, may not be entirely quantifiable. For example, these include improvements in the safety of officers and inmates, in incident management and response, in the accuracy of information for investigations, in the accuracy of head counts, or in the enabling of staff to be more proactive in preventing incidents. Although it may be possible to quantify changes in the frequency of many of these outcome measures, it will be much harder to translate these changes into dollar values, especially with rare events such as inmate-on-staff assaults. Indirect benefits could, however, be set out conceptually, to judge their relative magnitude. For example, interviewees could be asked what types of incidents have been averted through the use of RFID. This would allow evaluators to rank-order the identified costs and benefits in terms of their relative magnitude based on the available information sources and interviewees' assessments. This would allow an evaluator to delineate in a matrix the categories we think

represent the biggest costs and benefits on a multi-year, lifecycle basis. This type of analysis is feasible for an evaluation examining a period of one year post-RFID, and affords an informative method of early comparison of RFID costs and benefits.

Limitations of the Evaluation Design

The pre/post RFID design described here allows the researchers to identify trends but not a causal relationship. That is, the design does not rule out other factors that may be responsible for any changes observed. For example, RFID technology will be part of a continuum of security and surveillance tools used by DC DOC. Thus, it may not be possible to identify whether changes in some outcomes of interest are the result "purely" of RFID implementation or a blend of strategies. For some measures, insufficient statistical power prevents us from using statistical tools to draw conclusions about the effectiveness of RFID. Thus, conclusions must be tentative and based on the apparent practical significance of trends. Nonetheless, this should not be seen as a flaw of the evaluation design or a feature of the jurisdiction because few, if any, other large urban jail systems could expect to have adequate base rates to statistically test trends in many of these outcome measures unless they track them over a long period of time. Moreover, no correctional facility (even state prison facilities) likely would have adequate counts of key factors such as escapes to measure statistically. Yet the practical significance of preventing or averting an even small number of escapes is enormously important in correctional population management.

This evaluation is not intended to address several areas. We have not recommended that an evaluation attempt to examine inmate perceptions of RFID. It has been suggested that inmate focus groups may serve as a source of this information (NIJ, 2007). We have not recommended

this approach because our experience indicates that representative groups of inmates would not speak freely in each other's presence—a necessary condition for meaningful focus group data. Alternative approaches, such as individual inmate interviews or surveys, would be very expensive and challenging to implement appropriately. Given that the direct target of RFID is inmate behavior, rather than perceptions, the evaluation design described here captures more directly the outcomes of interest though inmate behaviors such as violence, escapes, and violations.

Finally, it is beyond the scope of this evaluation design to address the strict technical performance of the RFID system itself. This would involve systematic and repeated assessment of the technological functioning of each component of the RFID system. Those assessments will be conducted by DC DOC during the implementation period and this evaluation design would tap the results of those assessments though the process evaluation key informant interviews.

IV. CONCLUSION

If executed, the results of the evaluation described here could have immediate and direct utility both to the DC DOC, as well as other jurisdictions interested in exploring the use of RFID technology. In particular, the results would immediately provide feedback to DC DOC about whether the technology is performing as expected and provide the opportunity to make any adjustments necessary to improve performance. More broadly, it would begin to a fill a major gap in knowledge about RFID's deployment in correctional settings, about implementation challenges that may arise and strategies for addressing them, and about the direct and indirect costs and benefits of utilizing RFID to enhance facility operations.

Although much has been written about the use and potential benefits of RFID technology in correctional settings, most information comes from the product vendors and private sector. In contrast, this proposal provides a rigorous evaluation approach to systematically assessing the implementation of RFID in a correctional setting. Given the significant expense of purchasing and operating the technology, state and local jurisdictions will benefit greatly from an objective outcome evaluation to assess how much RFID use actually does produce the expected benefits promoted by vendors.

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