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Abstract: This study was prepared to optimize the near-term and long-term 222-S Laboratory Complex configurations to provide project management planning information and engineering bases regarding American Recovery and Reinvestment Act activities and modifications to support the 222-S sample analysis mission.

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Approved For Public Release

A-6002-767 (REV 2)


222-S LABORATORY COMPLEX LAYOUT OPTIMIZATION STUDY

September 2009

prepared by

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prepared for

Washington River Protection Solutions, LLC
EXECUTIVE SUMMARY

Washington River Protection Solutions, LLC, is seeking to determine the optimum engineered solution for the layout of the 222-S Laboratory Complex that will support sample analysis in the near-term, when the Waste Treatment Project becomes operational in 2019, and through the end of the Hanford Site Tank Farm cleanup mission currently scheduled for 2049. To that end, the 222-S Laboratory Complex will require a phased modification and upgrade strategy to address facilities that have outlived their design life as well as to provide expanded capabilities for long-term Laboratory support.

This study was prepared to identify and optimize the 222-S Laboratory Complex near-term and long-term configurations, including recommended modifications and upgrades, to successfully complete the laboratory’s mission. RPP-RPT-41572, “222-S Laboratory Facility Layout Optimization Study,” contains optimization analyses for the Laboratory Facility while this study contains optimization analyses for the 222-S Laboratory Complex. These two studies provide complementary information, with this study referencing RPP-RPT-41572, (as it relates to the long-term Complex Layout) to ensure consistency regarding increased laboratory analyses to support the WTP from 2019 through 2049.

This study identifies a pre-conceptual long-term 222-S Laboratory Complex Layout but specifically focuses on the justification, technical basis, cost estimates, and schedules needed to implement near-term American Recovery and Reinvestment Act (ARRA) facility modifications and infrastructure upgrades.

Based on engineering analyses, a conceptual near-term 222-S Laboratory Complex Modification/Upgrade Plan was developed and determined to be feasible and constructible. Additionally, an alternative evaluation identified a long-term 222-S Laboratory Complex Layout, including associated path-forward recommendations, that logically supplements near-term modifications and provides sufficient analytical laboratory support to Hanford Site Tank Farms and the Waste Treatment Plant through the end of the Hanford Site Tank Farm cleanup mission.
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LIST OF TERMS

Abbreviations and Acronyms

ARES    ARES Corporation
ARRA    American Recovery and Reinvestment Act
ECN     Engineering Change Notice
HLAN    Hanford Local Area Network
PEB     pre-engineered building
REDOX   Reduction Oxidation
ROM     Rough Order of Magnitude
WRPS    Washington River Protection Solutions, LLC
WTP     Waste Treatment Plant

Units

ft      foot
sq ft   square foot
1.0 INTRODUCTION

ORP-11242, “River Protection Project System Plan” identifies the 222-S Laboratory as a key facility providing analytical support to both Hanford Site Tank Farms and the Waste Treatment Plant (WTP) through the end of the tank farm cleanup mission currently scheduled for 2049.

There are numerous facilities associated with maintaining and operating the 222-S Laboratory that will require modification or upgrade. This study provides a pre-conceptual long-term 222-S Laboratory Complex Layout as well as a conceptual near-term 222-S Laboratory Complex Modification/Upgrade Plan that identify actions necessary to support Washington River Protection Solutions LLC, (WRPS) objectives regarding laboratory analytical services through the end of the Hanford Site Tank Farm cleanup mission.

2.0 BACKGROUND

The 222-S Laboratory was constructed during 1950 and 1951 adjacent to the plutonium reduction-oxidation (REDOX) facility on the Central Plateau of the Hanford Site. The laboratory, supporting structures, and office space have been progressively enlarged and upgraded as the mission has warranted. The 222-S Laboratory Complex is over 50 years old and has been maintained; however, it currently needs numerous modifications and upgrades to support the operating/analytical missions, to comply with safety and environmental requirements, and extend its useful life and to improve reliability to support the tank farm cleanup mission.

This study identifies and optimizes the 222-S Laboratory Complex layout, including recommended modifications and upgrades, to successfully complete the laboratory’s mission. RPP-RPT-41572, “222-S Laboratory Facility Layout Optimization Study,” contains optimization analyses for the Laboratory Facility while this study contains optimization analyses for the 222-S Laboratory Complex. These two studies provide complementary information, with this study referencing RPP-RPT-41572, (as it relates to the long-term Complex Layout) to ensure consistency regarding increased laboratory analyses to support the WTP from 2019 through 2049.

3.0 SCOPE

The scope of this study is to identify the optimum 222-S Laboratory Complex layout including replacement of mobile offices, maintenance shop, and storage buildings that support the 222-S Laboratory Facility. Furthermore, the scope includes the selection of 222-S Laboratory rooms, and changes to those rooms, required to relocate the 222-SA Standards Laboratory into 222-S. To accomplish this scope, this study identifies a pre-conceptual long-term 222-S Laboratory Complex Layout and develops a conceptual near-term 222-S Laboratory Complex Modification/Upgrade Plan. The long-term layout will provide sufficient support for analytical analyses required by Hanford Site Tank Farms and the WTP. The near-term 222-S Laboratory Complex Modification/Upgrade Plan will provide the conceptual engineering basis, justification,
technical basis, cost estimates, and schedules needed to implement ARRA funded facility modifications and infrastructure upgrades.

Although, the pre-conceptual long-term 222-S Laboratory Complex Layout is important, the emphasis of this study is placed on developing a conceptual modification and upgrade plan to support ARRA planning and implementation.

4.0 METHODOLOGY

The methodology employed for this optimization study was based on performing two different types of engineering studies. An alternative evaluation was conducted to identify an appropriate pre-conceptual long-term 222-S Laboratory Complex Layout, and an engineering analysis was conducted to determine the feasibility and constructability of an ARRA-funded conceptual near-term 222-S Laboratory Complex Modification/Upgrade Plan.

4.1 PRE-CONCEPTUAL LONG-TERM 222-S LABORATORY COMPLEX LAYOUT ALTERNATIVE EVALUATION METHODOLOGY

The methodology implemented for the alternative evaluation included the following:

- Examining current and future 222-S Laboratory Complex lab space, administrative space, maintenance space, and support space information;
- Conducting initial alternative evaluation sessions with 222-S Laboratory Management and Functional Experts and with ARES Corporation (ARES) Project Management personnel;
- Coalescing data collected from information examinations and initial alternative evaluation sessions;
- Developing/delivering two pre-conceptual alternatives that comply with general requirements and constraints;
- Conducting a final alternative evaluation session that included refinement/modification of the alternatives, refinement of general requirements and constraints, and selection of one pre-conceptual long-term 222-S Laboratory Complex Layout alternative to be the preferred alternative; and
- General planning regarding scheduling, sequencing, and employee relocations to accommodate the preferred alternative.

4.1.1 222-S Laboratory Complex Information

222-S Laboratory management provided configuration and space requirement information to ARES for examination. Additionally, a related study, RPP-RPT-41572, performed by ARES,
provided information relative to 222-S Laboratory future functionality/capability and potential work-loading. This information was assimilated and organized to provide the basis and general outline associated with initial alternative evaluation sessions.

4.1.2 Initial Alternative Evaluation Sessions

Initial alternative evaluation sessions were conducted to brainstorm ideas regarding requirements, constraints, planning objectives, organizational interfaces, footprint preferences, and finally, potential 222-S Laboratory layouts footprints. The initial alternative evaluation sessions were recorded in meeting minutes and meeting notes. A summary of the meeting notes associated with the initial evaluation sessions is included as Appendix A.

4.1.3 Alternative Data Organization

Data collected from information examinations and initial alternative evaluation sessions was reviewed and organized to provide a framework for facilitating alternative generation and further alternative evaluation. That framework, based on logistics and future planning objectives, took the form of general requirements and constraints relating to potential facility modifications and infrastructure upgrades. The resulting requirements and constraints are described in Section 5.1 of this document.

4.1.4 Pre-Conceptual Alternatives Development

Potential 222-S Laboratory footprints (alternatives) were evaluated to determine if the footprints were logical and were consistent with the general requirements and constraints. Two potential initial alternatives are identified and discussed in Section 6.1 of this document.

4.1.5 Final Alternative Evaluation Session

A final alternative evaluation session was conducted to refine and modify the alternatives, refine the general requirements and constraints, obtain concurrence from facility management and functional area experts, and select a pre-conceptual long-term 222-S Laboratory Complex Layout alternative. A summary of the meeting notes associated with the final evaluation session is included as Appendix A. The preferred alternative and long-term space descriptions are described in Section 6.2 of this document.

4.1.6 General Planning

Logistical plans associated with the preferred alternative were determined regarding schedule and sequencing of activities and personnel movement. A summary of the meeting notes associated with these plans is included as Appendix A.
4.2 CONCEPTUAL NEAR-TERM 222-S LABORATORY COMPLEX MODIFICATION AND UPGRADE PLAN METHODOLOGY (ARRA FUNDED)

The engineering analysis methodology implemented to identify near-term modifications and upgrades, and examine the feasibility and constructability of those modifications and upgrades, was similar in some respects to the methodology discussed in Section 4.1 of this document. For example, the meetings described in Section 4.1 included specific and detailed discussions regarding near-term modifications and upgrades as well as long-term layout objectives. It was important to consider both near-term and long-term objectives in conjunction with one another to ensure near-term activities did not preclude long-term implementation and to coordinate near-term activities to eventually support long-term 222-S Laboratory Complex configurations. However, significantly more detail and conceptual level planning were included when near-term modifications and upgrades were discussed.

The following activities were performed as part of this effort:

- Examining current and future 222-S Laboratory Complex lab space, administrative space, maintenance space, and support space information;
- Conducting initial engineering analysis meetings with 222-S Laboratory Management and Functional Experts;
- Performing initial conceptual design activities regarding 222-S Laboratory Complex modifications and upgrades;
- Conducting final engineering analysis meetings with 222-S Laboratory Management and Functional Experts;
- Refining conceptual plans regarding 222-S Laboratory Complex modifications and upgrades, developing conceptual plans regarding scheduling, sequencing, and employee relocations to accommodate near-term modifications and upgrades, and developing rough order of magnitude (ROM) cost estimates associated with the 222-S Laboratory Complex Modification/Upgrade Plan.

4.2.1 222-S Laboratory Building Information

222-S Laboratory management provided configuration and space requirement information to ARES for examination. Additionally, a related ARES study, RPP-RPT-41572, provided information relative to 222-S Laboratory future functionality/capability and potential work-loading. This information was assimilated and organized to provide the basis and general outline associated with initial engineering analysis meeting.
4.2.2 Initial Engineering Analysis Meeting

An initial engineering analysis meeting was conducted to examine near-term 222-S Complex interfaces between the laboratory and support facilities, specific modifications to the laboratory to accommodate changing configurations (i.e., ventilation system capabilities), 222-S Complex space limitations and preferences, near-term requirements and constraints, interim organizational interfaces, and conceptual designs of 222-S Laboratory Complex facilities. A summary of the meeting notes associated with the conceptual near-term 222-S Laboratory Complex Modification/Upgrade Plan is included in Appendix B.

4.2.3 Initial Conceptual Design Activities

Initial conceptual design activities included examining 222-S Laboratory drawings, interfacing with 222-S Engineering, conducting walkthroughs to evaluate interfaces, draft layout and room upgrade drawings, evaluating requirements and future capabilities documented in RPP-RPT-41572, and requesting vendor quotes for estimates.

4.2.4 Final Engineering Analysis Meeting

A final engineering analysis meeting was conducted to refine and modify conceptual requirements and constraints, finalize the decision regarding the 222-S Laboratory Complex Modification/Upgrade Plan, and obtain concurrence from facility management and functional area experts regarding conceptual design inputs. A summary of the meeting notes associated with the final engineering analysis meeting is included as Appendix B. Near-term requirements and constraints are described in Section 5.2 of this document.

4.2.5 Conceptual Planning

Final conceptual planning occurred upon completion of the final engineering analysis meeting. Plans included specific placement of 222-S Laboratory Complex facilities and specific laboratory room upgrades. Additionally, specific logistical plans were determined, regarding schedule and sequencing of activities and personnel movement, and schedules and estimates were completed. The entire conceptual plan is described in Section 7.0 of this document.

5.0 REQUIREMENTS AND CONSTRAINTS

The requirements and constraints considered for this optimization study are organized in two sections. First, the requirements associated with the long-term 222-S Laboratory Complex Layout and second, the requirements associated with the near-term 222-S Laboratory Complex Modification/Upgrade Plan. Both sets of requirements/constraints have been identified and refined, with input from 222-S Laboratory personnel, but remain somewhat high-level given the pre-conceptual and conceptual nature of this study.
5.1 LONG-TERM 222-S LABORATORY COMPLEX LAYOUT ALTERNATIVES REQUIREMENTS/CONSTRAINTS

- Alternatives shall include consideration for locating new buildings in close proximity to the 222-S Laboratory;
- Alternatives shall include at least 33,000-35,000 ft\(^2\) of new administrative facility space;
- Alternatives shall include structures and space to meet future Laboratory maximum work loads of 80,000 analyses per year;
- Alternatives shall be feasibly constructed (those not constructed through ARRA near-term activities) by 2019;
- Alternatives shall be implemented so that the 222-S Laboratory and support functions remain at 100% capacity throughout construction;
- Alternatives shall include characteristics that prohibit the 222-S Laboratory and support facility construction to conflict with each other or another function (e.g., parking, power, construction lay-down or Hanford mission);
- Alternatives shall minimize modification and disturbance to the north side of the 222-S Laboratory to avoid complications due to operational requirements, waste management, and future uncertainties regarding those areas;
- Alternatives shall provide appropriately sized and located space commensurate with organizational job logistics, locations, and responsibilities; and
- Alternatives shall not prohibit compliance with existing or future Hanford Site requirements (e.g., safety, fire protection, emergency management, etc).

5.2 NEAR-TERM 222-S LABORATORY COMPLEX MODIFICATION/UPGRADE PLAN REQUIREMENTS/CONSTRAINTS

- The ARRA-funded short-term support facilities modifications, upgrades and replacements shall not prohibit long-term support facilities uses;
- The Modification/Upgrade Plan shall be implemented so that the 222-S Lab and support functions remain at 100% capacity throughout construction;
- The Modification/Upgrade Plan shall include characteristics that prohibit the 222-S Laboratory and support facility construction to conflict with each other or another function (i.e., parking, power, construction lay-down or Hanford mission);
- The Modification/Upgrade Plan shall minimize modification and disturbance to the north side of the 222-S Laboratory to avoid complications due to operational requirements, waste management, and future uncertainties regarding those areas;
The Modification/Upgrade Plan shall include consideration for locating new buildings in close proximity to the 222-S Laboratory.

The Modification/Upgrade Plan shall be consistent with ARRA funding and planning;

The Modification/Upgrade Plan shall not prohibit compliance with existing or future Hanford Site requirements (e.g., safety, fire protection, emergency management, etc.);

The Modification/Upgrade Plan shall include characteristics that allow for near-term location and relocation of 222-S Laboratory personnel, and

The Modification/Upgrade Plan shall include modifications that are feasibly constructible in the fiscal year 2010-2011 timeframe.

6.0 PRE-CONCEPTUAL LONG-TERM 222-S LABORATORY COMPLEX LAYOUT ALTERNATIVE EVALUATION

As described in the methodology, the alternative evaluation included information gathering, evaluation sessions, development of requirements and constraints, and alternatives analyses. Those activities resulted in the alternatives generation and eventual preferred alternative for the pre-conceptual long-term 222-S Laboratory Complex Layout as described in the following sections.

6.1 INITIAL LONG-TERM LAYOUT ALTERNATIVES

Throughout the initial alternative evaluation process, the constants described in Table 6-1 below were identified, and subsequently confirmed, regarding 222-S Laboratory Complex demolition, committed building procurements, laboratory space, maintenance space, and support space.

Based on the information contained in Table 6-1, it was determined that only administrative spaces needed to be evaluated using alternatives. The administrative spaces include office space for Maintenance Management, Operations, Radiological Control, Health Physics, and Waste Management. Figures 6-1 and 6-2 show the two initial alternatives, which include options centered on renovating 2704-S or replacing 2704-S.

6.2 PREFERRED LONG-TERM LAYOUT ALTERNATIVE

The alternatives shown in Figures 6-1 and 6-2 were provided as a starting point in the final alternative evaluation session. Alternative 1 was refined through systematic evaluation and comparison of long-term administrative space needs and long-term complex configuration. Although issues were identified regarding conflicts with certain long-term facility locations, a pre-conceptual layout was determined. Figure 6-3 illustrates a whiteboard solution that was determined in the final alternative evaluation session. The layout may change based on future analyses identified in Section 6.2.2 of this document.
### Table 6-1. Initial Alternative Evaluation Constants

<table>
<thead>
<tr>
<th>Constants</th>
<th>Description</th>
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<tr>
<td>Demolition</td>
<td>Removal of MO-924 and MO-039.</td>
</tr>
<tr>
<td>Committed Building Procurements</td>
<td>227-S Conditioned Storage Building (replacing building 222-SF) and a new modular office building.</td>
</tr>
<tr>
<td>Maintenance Space and Plan</td>
<td>New maintenance shop (utilize or replace 2716-S) and a new proposed ancillary equipment addition, including space for manipulator equipment and possibly archive storage (constructed as part of the 222-S Laboratory; adjoined to the east side of the Laboratory).</td>
</tr>
<tr>
<td></td>
<td>Sufficient work space and maintenance personnel space, not including management, will ultimately be provided in the new proposed maintenance shop and new ancillary equipment addition.</td>
</tr>
<tr>
<td>222-S Laboratory Space Plan</td>
<td>Renovate/upgrade 222-S laboratories to maximize laboratory space for science – Area-Five Offices ultimately turned over for science.</td>
</tr>
<tr>
<td></td>
<td>Laboratory upgrades are based on the projected needs identified in RPP-RPT-41572. Appendix C contains schematics of the 4D, 4P, 5A, and 5B upgraded rooms. Only these rooms, regarding the long-term, are shown in this study because they will also be renovated for the near-term. All other long-term room upgrade schematics are included in RPP-RPT-41572.</td>
</tr>
<tr>
<td>Cold Laboratory Space</td>
<td>A new cold laboratory facility will be located on the foot-print of the existing 222-SA.</td>
</tr>
<tr>
<td>Support Space Plan</td>
<td>A HLAN Hub building and the conditioned storage and gas bottle storage (described above in Committed Building Procurements) will be ARRA-funded and available long-term. The new laundry facility will be located in the current maintenance annex. A Conex box/construction staging area will be located on the far east side of the Complex.</td>
</tr>
</tbody>
</table>

Note: These spaces are described in Table 6-2 (dimensions and square footage) and shown in Appendix D.
Figure 6-1. Long-Term 222-S Laboratory Complex Alternative 1.
Figure 6-2. Long-Term 222-S Laboratory Complex Alternative 2.
Figure 6-3. Final Alternative Evaluation Session Whiteboard Solution.
The whiteboard solution was refined resulting in the preferred alternative shown as Appendix D. The preferred alternative includes:

- Characteristics documented in Table 6-1;
- Characteristics compliant with requirements and constraints identified in Section 5.1 of this document;
- Long-term capabilities consistent with needs identified in RPP-RPT-41572;
- Square footage exceeding 33,000-35,000 ft² of new administrative facility space;
- Pre-engineered buildings instead of mobile offices; and
- Characteristics that do not prohibit ARRA-funded activities described in Section 7.0 of this document.

As shown in Appendix D, the long-term layout provides sufficient administrative space, and is appropriately located near 222-S for Laboratory Maintenance Management personnel, Operations personnel, Radiological Control personnel, Health Physics personnel, Waste Management personnel, and administrative personnel. Table 6-2 identifies dimensions and square footage of facilities relative to the preferred alternative.

**Table 6-2. Preferred Alternative Facility Dimensions and Square Footage.**

<table>
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<tr>
<th>Building</th>
<th>Dimensions (feet)</th>
<th>Total Square Footage</th>
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<tr>
<td>227-S Conditioned Storage</td>
<td>50 x 120</td>
<td>6,000</td>
</tr>
<tr>
<td>2705-S Modular Office</td>
<td>48 x 60</td>
<td>2,880</td>
</tr>
<tr>
<td>PEB Office</td>
<td>67 x 90</td>
<td>6,030</td>
</tr>
<tr>
<td>Conference Trailer</td>
<td>28 x 66</td>
<td>1,848</td>
</tr>
<tr>
<td>HLAN Hub Building</td>
<td>15 x 15</td>
<td>225</td>
</tr>
<tr>
<td>Two-Story Office</td>
<td>100 x 130</td>
<td>26,000</td>
</tr>
<tr>
<td>MO-037 Replacement</td>
<td>64 x 86</td>
<td>6,751</td>
</tr>
<tr>
<td></td>
<td>29 x 43</td>
<td></td>
</tr>
<tr>
<td>Maintenance Shop</td>
<td>50 x 60</td>
<td>3,000</td>
</tr>
<tr>
<td>Ancillary Equip Add/ Archive Storage</td>
<td>64 x 82</td>
<td>6,519</td>
</tr>
<tr>
<td></td>
<td>61 x 11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 x 40</td>
<td></td>
</tr>
<tr>
<td>Cold Laboratory Space</td>
<td>70 x 65</td>
<td>4,550</td>
</tr>
<tr>
<td>Total Space</td>
<td></td>
<td><strong>63,803</strong></td>
</tr>
<tr>
<td>Total Administrative Space</td>
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<td><strong>43,509</strong></td>
</tr>
</tbody>
</table>

PEB = Pre-engineered Buildings
6.2.1 Pre-Conceptual Schedule

The following items reflect a reasonable long-term schedule/sequence:

- Replace MO-037;
- Construct the new maintenance shop;
- Construct a new laundry room in the maintenance annex;
- Remodel 2704-S;
- Design/construct new Cold Laboratory;
- Design/construct new two-story office building; and
- Design/construct ancillary equipment addition/archive storage facility.

Estimating these activities is outside the scope of this study; however, pre-conceptual estimates for the new two-story office building and ancillary equipment addition/archive storage facility are included for information only in Appendix E.

6.2.2 Long-Term 222-S Laboratory Complex Path-Forward Recommendations

The following recommendations support future analyses to confirm and/or refine the activities needed to facilitate the complex layout shown in Appendix D:

- Perform an engineering study to evaluate the logistics, feasibility, interfaces, and costs associated with replacing MO-037 with new office building;
- Perform a ventilation study and design to support 222-S room upgrades described in both Appendix C of this document and more completely in RPP-RPT-41572;
- Perform feasibility study regarding renovation vs. replacement of 2704-S;
- Perform an engineering study to evaluate the logistics, feasibility, interfaces, and costs associated with placing the laundry room in the existing maintenance annex;
- Perform an engineering study to evaluate the logistics, feasibility, interfaces, and costs associated with expanding/reconstructing 2716-S for maintenance shop space; and
- Perform conceptual design on 222-S upgrades as described in RPP-RPT-41572.
7.0 CONCEPTUAL NEAR-TERM 222-S LABORATORY COMPLEX MODIFICATION AND UPGRADE PLAN (ARRA FUNDED)

As described in the methodology, the engineering analysis included identification of near-term modifications and upgrades, and an examination of the feasibility and constructability of those modifications and upgrades, that are needed by the end of fiscal year 2011. The justification, technical basis, cost estimates, and schedules needed to implement near-term ARRA facility modifications and infrastructure upgrades are included in the following sections.

7.1 SPECIFIC SPACE DESCRIPTIONS

Near-term modification and upgrade plans were developed based on design meetings, conceptual design planning, and evaluation of feasibility and constructability. The meetings and design activities placed emphasis on meeting near-term functional space needs and placing current 222-SA activities into 222-S. Therefore, the analyses centered on the functional space descriptions in the following sections. Cost estimates contained in this section are design and construction cost only; they do not include WRPS mark-ups.

7.1.1 Administrative Space

The administrative space additions using ARRA funds are a new 1848 sq. ft. conference trailer, a new 2880 sq. ft. modular building to replace MO-924, and a new 6000 sq. ft. pre-engineered office building.

The conference trailer will be a double-wide trailer placed northwest of 2704-S. This building will allow for meetings to be held in a larger space than is currently available. The trailer will also allow some current conference rooms to be used as office space. This activity is expected to begin and finish in fiscal year 2010. The current cost estimate for this conference trailer totals $418,997.

The new MO-924 replacement (2705-S) will be a 60 ft by 48 ft modular office building placed on top of the current MO-924 footprint and extended north. Portions of the existing abandoned steam line will be removed to allow placement of the trailer. The trailer will accommodate personnel from MO-037 and MO-028. This trailer will have men’s and women’s facilities as well as a kitchenette. New sidewalks will be added along the eastern and southern sides of the trailer as part of this activity. This activity is expected to begin and finish in fiscal year 2010.

The new 6000 square foot pre-engineered office building will accommodate personnel from MO-039, 2704-S, and (some from) MO-291. This new office building will be constructed where MO-039 is currently located and it will extend north parallel to 2704-S. This pre-engineered building will have a lifespan of 50 years and can be remodeled in the future to maintain it as usable office space. In addition to office space, this building will have one large conference room, men’s and women’s restrooms, and a kitchen. This activity is expected to begin in fiscal year 2010 and finish at the end of fiscal year 2010. The current cost estimate for this office building and the cost estimate for demolition of MO-039 totals $2,738,151.
7.1.2 Support Space

The support space additions using ARRA funds are the 227-W Conditioned Storage Building and a new HLAN hub building.

The 227-W Conditioned Storage Building will be 120 ft x 50 ft and will hold equipment and supplies in a climate controlled environment. It will have two doorway entries located on the east and the northwest sides. Located on the east side will also be a loading dock to receive shipments. On the northwest there will be a rollup door to allow forklift access to the building. This activity is expected to begin and finish in fiscal year 2010.

The HLAN hub building will be a 15 ft x 15 ft structure located immediately west of MO-037. The HLAN hub within MO-037 will be moved into this building when it is complete. This building will allow the HLAN equipment to be stored in a climate-controlled environment and allow the replacement of MO-037 without the 222-S Complex losing HLAN access. This activity is expected to begin and finish in fiscal year 2011. The current cost estimate for the HLAN hub building totals $281,321.

7.1.3 222-S Laboratory/222-SA Space

The current 222-SA building is structurally unsound and currently requires a costly maintenance program. The roof leaks, the floor sags and flexes creating an unsafe work environment, and the current HVAC system is strained under the wide variations of weather throughout the year. The premise of a standards laboratory is to maintain a controlled climate where chemicals needed for analysis can be mixed and maintained. Alleviation of these problems is solved by moving the 222-SA functions into the 222-S laboratory; specifically, Rooms 4D, 4P, 5A and 5B. Each room will house a specific function currently performed in 222-SA.

The standards portion of 222-SA will be moved into Room 4D; this will require Room 4D to be remodeled. When the remodel is complete, there will be one new 6-ft long hood located on the west wall to allow for the checking of received chemicals. There will be a 4-ft long hood located in the southwest corner of the lab, and new bench space with storage will occupy the space between the two hoods, as well as the entire length of the east wall. There will be a new center bench that extends across three-quarters of the room and will have twin sinks mounted at the north end. The east wall bench will have at least one HLAN workstation. All new bench space will meet 222-S lab specifications and have the ability to store chemicals and lab supplies beneath the bench top. See Appendix F for a drawing of Room 4D. The current cost estimate for remodeling this room totals $881,875.

The process development portion of 222-SA will be moved into Room 4P; this will require Room 4P to be remodeled. When the remodel is complete, there will be three new 4-ft long hoods located on the west wall, with the remaining wall space occupied by new bench space. The new center bench will extend three-quarters of the way across the lab room and will have one center-mounted sink at the north end. The east wall will have one chemical storage cabinet placed in the northeast corner and the remainder of the east wall will be occupied by bench space. There will be one new HLAN-accessible workstation located on the north wall between the two entry ways. All new bench space will meet 222-S lab specifications and have the ability
to store chemicals and lab supplies beneath the bench top. See Appendix F for a drawing of Room 4P. The current cost estimate for remodeling this room totals $939,501.

The industrial hygiene portion of 222-SA will be relocated to Rooms 5A and 5B; this will require Rooms 5A and 5B to be remodeled. When the remodel is complete, the wall separating these rooms will be removed allowing for better ventilation flow. The ventilation system for the 222-S Laboratory will be modified to create a new service to Room 5AB. It is assumed that the current ventilation system can support this modification; however, it is recommended that a follow-on study be conducted to validate this assumption. This modification will also modify the current ventilation system to create a branch to support future lab space needs in the remaining Area-Five Offices. Two new 4-ft long hoods will be located along the west wall separated by new bench space. The north and south walls will also be occupied by new bench space. All new bench space will meet 222-S Laboratory specifications and have the ability to store chemicals and lab supplies beneath the bench top. See Appendix F for a drawing of Room 5AB. The current cost estimate for remodeling this room totals $603,775.

The 8E corridor north wall will be used to store the refrigerators and freezers currently in 222-SA. The corridor currently has the electrical configuration to support this equipment. Also, door-16 will be used to receive chemicals.

These rooms will be remodeled in sequence beginning with Room 4P in early fiscal year 2010, followed by Room 4D starting two months later, and concluding with the remodel of Rooms 5A and 5B, which begin one month after Room 4D. This will allow all 222-SA functions to move into 222-S in early fiscal year 2011.

7.1.4 Maintenance Space

There currently is no maintenance space identified for construction with ARRA funds.

7.2 CONCEPTUAL NEAR-TERM 222-S LABORATORY COMPLEX LAYOUT

The near-term complex layout resulted from the engineering analysis and configuration required given the above space descriptions. The conceptual plan, and associated layout, includes PEBs because they were determined to be similar in initial cost to mobile offices but provide flexibility regarding future modifications and renovations. Based on a quote for a 12-wide mobile office trailers received April 20, 2009, an estimate for a 10-wide mobile office trailers would be approximately $826,000 (83% of 12-wide estimate). Previous ARES estimates show a PEB cost approximately $132/sq ft. For a 6000 sq ft building, this totals $792,000. Additionally, trailers are not easily renovated; essentially, the whole facility must be replaced. A PEB can be renovated while leaving the overall structure intact.

The near-term 222-S Laboratory Complex Layout is included as Appendix G.

The corresponding dimensions and square footage of facilities relative to the 222-S Laboratory Complex Modification and Upgrade Plan is shown in Table 7-1.
Table 7-1. Modification and Upgrade Plan Facility Dimensions and Square Footage.

<table>
<thead>
<tr>
<th>Building</th>
<th>Dimensions (feet)</th>
<th>Total Square Footage</th>
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<tr>
<td>227-S Conditioned Storage</td>
<td>50 x 120</td>
<td>6,000</td>
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<tr>
<td>2705-S Modular Office</td>
<td>48 x 60</td>
<td>2,880</td>
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<tr>
<td>PEB Office</td>
<td>67 x 90</td>
<td>6,030</td>
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<tr>
<td>Conference Trailer</td>
<td>28 x 66</td>
<td>1,848</td>
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<tr>
<td>HLAN Hub Building</td>
<td>15 x 15</td>
<td>225</td>
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<tr>
<td><strong>Total Space</strong></td>
<td></td>
<td>16,983</td>
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<tr>
<td><strong>Total Administrative Space</strong></td>
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<td>10,758</td>
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</tbody>
</table>

The near-term layout includes:

- A feasible and constructible complex configuration given results of engineering meetings and conceptual planning;
- Characteristics compliant with requirements and constraints identified in Section 5.2 of this document; and
- Characteristics that do not prohibit long-term capabilities consistent with needs identified in RPP-RPT-41572.

7.3 NEAR-TERM RECOMMENDATIONS

The following recommendations are suggested to facilitate near-term 222-S Laboratory Complex Modification and Upgrade conceptual design:

- Perform a ventilation study to confirm existing system can support the near-term modifications and upgrades described in Appendices F and G; and
- Perform conceptual design to support the ARRA-funded 222-S Laboratory Complex Modification and Upgrade Plan.
- Perform an As-Built AutoCAD civil drawing of the 222-S Laboratory Complex to aid in the design and construction of future upgrades.

7.4 NEAR-TERM SEQUENCING AND SCHEDULE

The schedule for these activities is included as Appendix H. The sequence and construction of ARRA-funded buildings is integral to the success of optimizing the 222-S Complex. The first two new facilities to begin construction will be the 2705-S modular office (activity A1000) and the 227-S Conditioned Storage Building (activity A1060). Soon after these two facilities break ground, Room 4P (activity A1020) will undergo remodel to accept the Process Development
portion of the 222-SA Facility, and the new Conference Trailer (activity A1080) will be brought in. Once the 2705-S modular office is in place, personnel from Rooms 5A and 5B will move to MO-037, and the displaced MO-037 personnel will move into 2705-S. Also, once 2705-S is complete, personnel from MO-039 will move in. With MO-039 abandoned, construction can begin on the new office building (activity A1010) and the remodel of Room 4D (activity A1030) can begin, followed by the remodel of Rooms 5A and 5B (activity A1040). At the beginning of fiscal year 2011, the HLAN hub building (activity A1070) will be constructed.

7.5 **COST ESTIMATE**

Cost estimates rough order of magnitude (ROM) were prepared for all ARRA-funded activities (except 2705-S modular office and 227-S Conditioned Storage Building as these projects were in process [design/construct] at the time this study was written). These cost estimates were developed from the input and decisions made at the engineering analysis meetings facilitated sessions, which identified the preferred layout of the 222-S Complex. Conceptual sketches were then prepared, depicting the location and size of the new buildings and 222-S Laboratory room upgrades. The cost estimates are contained in Appendix I. The following sections discuss the methodology of developing the cost estimates.

7.5.1 **Methodology**

Estimates are generally considered “bottoms up” estimates, utilizing quantities from sketches, information obtained from reference drawings, information acquired from narratives, input from the client, field walkdowns, and various technical assumptions. Estimating allowances were also used where the scope was inadequately defined. Material prices, labor unit hours, rental equipment usage costs, and subcontract costs were obtained from vendor budgetary quotes, RS Means 2009 Cost Data (Facilities Construction database), customer provided information, and historical cost data (direct costs escalated to current year as applicable). Estimator’s judgment was also used during the preparation of the cost estimates.

Base costs are derived using a bottoms-up cost estimating approach by developing costs for each estimate detail at the cost element level. These cost elements include labor, equipment usage, materials, subcontracts, and process equipment. Unit pricing is generated for each cost element from sources as described above. Labor pricing is adjusted as required to account for site conditions, safety requirements, etc. Material pricing is adjusted as required to account for quality requirements, shipping, and other relevant factors as applicable.

Craft labor rates are derived from the Davis-Bacon Wage Rate Determinations for Hanford. Non-craft labor rates are based on rates that general construction companies currently utilize.

Consumables – the consumables calculation is a percentage of total base labor and is based on general construction practices. This calculated amount accounts for miscellaneous materials used in the performance of construction activities, such as small tools, weld rod, tape, caulk, plastics, gloves, fasteners, construction personal protective equipment (PPE), etc. These items are not otherwise accounted for in the material take-off.
Cleanup – the cleanup calculation is a percentage of total base labor and is based on general construction practices. This calculated amount accounts for general cleanup of the site during and after the project is complete.

Quality Inspection – the quality inspection calculation is a percentage of total base labor and is based on general construction practices. This calculated amount accounts for quality inspection personnel and quality assurance personnel.

Personnel and Material Movement – the personnel and material movement calculation is a percentage of total base labor and is based on general construction practices. This calculated amount accounts for the cost associated with moving craftsmen and material from the lay down yard to the job site, off-loading trucks, etc.

Other General Conditions – the other general conditions calculation is a percentage of total base labor and is based on general construction practices. This calculated amount accounts for the costs associated with security barriers, signage, temporary lighting, temporary ventilation, congested work areas, minor scaffolding, and other miscellaneous costs.

Subcontractor Markup – this markup accounts for a 15% markup of all subcontract costs. This accounts for all indirect costs the General Contractor incurs when managing subcontractors, which equates to 5%. The other 10% is for subcontractor field administration and overhead and profit. This markup is historically a typical percentage found in construction contracts and is applied only to subcontract base (direct) costs.

General Contractor Markup – this markup is used to calculate indirect costs consisting of home office overhead (payroll, contract administration, clerical, bonds/insurance, etc.), field office overhead (project management, superintendent, field engineer, material coordinator, warehousing, administration, etc.), and profit. The percentage used for these estimates is 43%.

Sales Tax – Washington’s state sales tax of 8.3% is based on the current established tax rate. The sales tax is applied to equipment usage, materials, process equipment, and consumables.

Engineering (Preliminary, Detailed, Engineering During Construction) – the engineering calculation is a percentage of total construction costs (direct costs plus general requirements plus contractor markups plus sales tax).

WRPS Markups – the WRPS markups have been addressed to ensure total project costs are captured. WRPS costs are shown at the bottom of each estimate (and are not included in the subtotal per client direction). The percentages were provided by WRPS from reviewing WRPS-prepared cost estimates and using that historical cost date to calculate the percentage of a given WRPS function (i.e., Construction Support) against the total construction cost. This process was performed for several WRPS-prepared construction estimates to establish average percentages.

Escalation – escalation was not applied to the base estimate.
Contingency – contingency was applied to the base estimate. A 30% rate has been uniformly applied to each of the ROM estimates.

Assumptions – assumptions are contained on each individual estimate.

8.0 CONCLUSION

Based on engineering analyses, a conceptual near-term 222-S Laboratory Complex Modification/Upgrade Plan was developed and determined to be feasible and constructible. The plan described in Section 7.0 includes a feasible and constructible complex configuration given results of engineering meetings and conceptual planning, characteristics compliant with requirements and constraints identified in Section 5.2, and characteristics that do not prohibit long-term capabilities consistent with needs identified in RPP-RPT-41572. Recommendations described in Section 7.3 are integral in successful conceptual design implementation.

Additionally, an alternative evaluation identified a long-term 222-S Laboratory Complex Layout that logically supplements near-term modifications and provides sufficient analytical laboratory support to Hanford Site Tank Farms and the WTP through the end of the Hanford Site Tank Farm cleanup mission. The layout described in Section 6.2 includes characteristics compliant with requirements and constraints identified in Section 5.1, long-term capabilities consistent with needs identified in RPP-RPT-41572, and characteristics that do not prohibit ARRA-funded activities described in Section 7.0. Recommendations described in Section 6.2.2 are integral to support future analyses to confirm and/or refine the activities needed to facilitate the long-term complex layout.

9.0 REFERENCES


APPENDIX A

SUMMARIZED MEETING MINUTES

PRE-CONCEPTUAL LONG-TERM 222-S LABORATORY COMPLEX LAYOUT
ALTERNATIVE EVALUATION
PRE-CONCEPTUAL LONG-TERM 222-S LABORATORY COMPLEX LAYOUT ALTERNATIVE EVALUATION

Summarized Meeting Minutes

The following summarization is from the meeting minutes taken on August 24, 2009 and September 11, 2009. The meetings were held to reach consensus on the preferred alternative long-term layout of the 222-S Laboratory Complex. The meeting participants are listed in Attachment A.

1. Office Space Requirements
   a. Current office space is ~23,000 sq. ft. The future amount of office space needed was determined to be ~33,000–35,000 sq. ft.
   b. This number was derived from the amount of work for the lab rising to 80,000 analyses per year and that will drive the lab to double its personnel from 200 to 400 during the peak years.
   c. The long-term solution was to construct a new 26,000 sq. ft. two-story PEB office building and a ~6,750 sq. ft. replacement for MO-037 to house operations, maintenance, radiation control, and hazardous material control personnel in building with access directly to 222-S.
   d. Building 2704-S will require a study to determine if it should be renovated or demolished. A factor this study must consider is the building's historical value as one of the oldest buildings on site. This may preclude it from being demolished.

2. Maintenance Space Requirements
   a. Using Jay Heinemann's requirements (see Attachment B) it was determined that a new maintenance shop be constructed where 2716-S is currently located.
   b. The planned location for the Ancillary Equipment Addition and the Archive Storage Facility was determined to be feasible but a study will be needed to support this determination.

3. Support Space
   a. The laundry facility will be moved into the current maintenance annex once the maintenance functions move into their new buildings.
   b. This will allow an easier access point for laundry pick-up and keep it within the lab.

4. Laboratory Space
   a. The existing 222-SA building will be removed once its functions are moved into 222-S. This footprint will be utilized in the future as Cold Laboratory Space or as an option for the Ancillary Equipment Addition or Archive Storage Facility.
   b. Future use of the Area Five offices has yet to be determined.
Attendees from meeting held on 8-24-09

<table>
<thead>
<tr>
<th>Name</th>
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<th>Company/Department</th>
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<tbody>
<tr>
<td>Jay L. Heineman</td>
<td>Mgr.</td>
<td>WRPS/222-S Lab.</td>
</tr>
<tr>
<td>Ann B. Handy</td>
<td>Facility Mgr.</td>
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<td>K. J. Glennough</td>
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<td>L. B. McDowell</td>
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<tr>
<td>G. D. Guth</td>
<td>ARES - Mgr.</td>
<td>ARES</td>
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<td>J. D. (Dave) Fafard</td>
<td>Radiol. Tech.</td>
<td>WRPS - 2225 RayCnl</td>
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<tr>
<td>Luis J. Bernaldez</td>
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<tr>
<td>Dennis Hambrecht</td>
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<td>Andrew M. Frech</td>
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<tr>
<td>C. DePrimo</td>
<td>EMCC</td>
<td>WRPS</td>
</tr>
<tr>
<td>T. Kimmel</td>
<td>Radiation SOR</td>
<td>WRPS</td>
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</table>
Maintenance's Needs

Ideally centrally located:

One: Shared secretary – computer work station, desk, 2 file cabinets
Four: Field work supervisors – work station, desk, file cabinet.
Three: Rooms for pre-job briefs – one should be able to hold up to 16 people. Other two rooms up to 9 people.
Six: Instrument Specialist – Bench tops of 3’ x 10’ for each. One work station.
Four: Pipefitter. One work station…Open shop area, include large bench area.
Four: Millwrights. One work station…Open shop area, include large bench area.
Five: Electricians: 3’ x 10’ bench for each. Work station…Open shop area.
One: Carpenter. Work station – open shop area.
One: Tool room attendant. Work station – secure storage area for tools and consumables.
Two: Material coordinator – 2 work stations and desk/table area – need 20 by 30 equipment staging area.
APPENDIX B

SUMMARIZED MEETING MINUTES

CONCEPTUAL NEAR-TERM 222-S LABORATORY COMPLEX MODIFICATION AND UPGRADE PLAN (ARRA FUNDED)
CONCEPTUAL NEAR-TERM 222-S LABORATORY COMPLEX MODIFICATION AND UPGRADE PLAN (ARRA FUNDED)

Summarized Meeting Minutes

The following summarization is from the meeting minutes taken on August 24, 2009 and September 11, 2009. The meetings were held to reach consensus on the ARRA funded modifications and upgrades to the 222-S Laboratory Complex. The meeting participants are listed in Attachment A.

1. Office Space
   a. It was agreed that the first additional office space added will be the modular office to replace MO-924 as planned.
   b. The new conference trailer will be placed north of 2704-S and west of the new modular office.
   c. Also during FY 2010 a new 6,000 sq. ft. PEB office building will be constructed where MO-039 is currently located and it will extend north parallel to 2704-S.

2. Maintenance Space
   a. It was agreed that there is no maintenance space associated with ARRA funds.

3. Support Space
   a. A new HLAN Hub Building will be constructed and located immediately west of MO-037.
   b. 227-S Conditioned Storage Space will be built as planned.

4. Laboratory Space
   a. It was agreed that Room 4D will be remodeled and used as the standards lab, Room 4P will be remodeled and used as the process development lab, and Rooms 5A and 5B will be remodeled and used the industrial hygiene lab.
   b. All of lab room remodels will begin in FY2010.
5. Attachment A

Attendees from meeting held on 9-11-09

<table>
<thead>
<tr>
<th>Name</th>
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<th>Company/Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mike Casman</td>
<td>Project Eng.</td>
<td>WRPS</td>
</tr>
<tr>
<td>Don Casman</td>
<td>Sr. Project Eng.</td>
<td>AEC5</td>
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<tr>
<td>Bruce Gutknecht</td>
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<td>Bennie Davis</td>
<td>Proj. Eng.</td>
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<tr>
<td>Dan Lucera</td>
<td>RA Project Mgr.</td>
<td>WRPS</td>
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<tr>
<td>Kathleen Han</td>
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<tr>
<td>Dennis Rappe</td>
<td>Proj. Mgr.</td>
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<tr>
<td>Bruce Rappe</td>
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<td>Jay Heinemann</td>
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<td>Mgr Ops</td>
<td>WRPS</td>
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<td>LeBermam</td>
<td>2025 Environmental</td>
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<td>Ben B. Hardy</td>
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Attendees from meeting held on 8-24-09

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<td>Guy H. Newman</td>
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<td>WRP5/222-5 Lab</td>
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<td>Jim Hardy</td>
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<td>J.B. McDonald</td>
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<td>B. D. Grath</td>
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<td>L.B. Grimes</td>
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<td>H. Holland</td>
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<td>Steve Perry</td>
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<tr>
<td>T. Krammel</td>
<td>Radiation Lab.</td>
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APPENDIX C

Long-Term 4D, 4P, 5AB Laboratory Room
Layout
New Hoods:
3 - Four Foot Hoods
2 - Five Foot Hoods
3 - Six Foot Hoods

PRE-CONCEPTUAL LAYOUT

RPP-RPT-42486, Rev. 0
New Hoods:
6- Four Foot Hoods
New Hoods:
4 - Four Foot Hoods

- Bench
- New 4ft Hood
- Bench
- Rollaway CPU Desk
- Bench
- New 4ft Hood
- Rollaway CPU Desk
- Bench
- New 4ft Hood
- Bench

PRE-CONCEPTUAL LAYOUT

222-S Rooms 5A-5B
Long-term Layout

RPP-RPT-42486, Rev. 0
APPENDIX D

PRE-CONCEPTUAL 222-S LABORATORY COMPLEX
LAYOUT PREFERRED ALTERNATIVE
APPENDIX E

LONG-TERM COST ESTIMATES
## 222-S 2 STORY OFFICE

### TABLE OF CONSTRUCTION COSTS

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<th>DESCRIPTION</th>
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<th>IMPULSE 10000</th>
<th>IMPULSE 100000</th>
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<td></td>
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</table>

### BREAKDOWN OF COSTS

#### BASE COST RECURS
- Labor: 1,000
- Material: 1,000
- Equipment: 1,000
- Transportation: 1,000

#### GENERAL RESOURCES (SPECIAL)
- 1,000

#### SUBTRACTION MARKUP
- 1,000

#### AVERAGE COST PER ACRE
- 1,000

#### SUMMARY OF PROJECT COSTS SUBTOTAL
- 4,498

#### SUMMARY OF OTHER PROJECT COSTS SUBTOTAL
- 4,796

#### SUMMARY TOTAL
- 7,404

---

**Note:**
- The costs are based on the estimated pricing for the project.
- All figures are in USD.

---

**Gross Definitive:**
- Provisions for 222-S Lab with 2 (2) Story Office addition.

**Gross Basis:**
- Estimated based on MHC.CER/BID-012.7/01-018.7 "Compass Buildings, 222-S Ancillary Equipment Additions." Woodbridge.
## 222-S Ancillary Equipment Addition

### WBS 5.1.3.1.6.26-27 & 5.1.3.1.4.1-4

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<th>TOTAL</th>
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<th>INDIRECT</th>
<th>MULTIPLIED</th>
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<td>-</td>
<td>-</td>
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<tr>
<td>Year 2023 Ancillary Equipment Additions</td>
<td>2,681,584</td>
<td>170,459</td>
<td>7,048</td>
<td>1.50</td>
<td>3,108,000</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>2,969,584</td>
<td>170,459</td>
<td>7,048</td>
<td>1.50</td>
<td>3,376,000</td>
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### Base Cost breakout:

- **CONSTRUCTION:** 0.8
- **PROJECT MANAGEMENT:** 0.2
- **DEAI ACTIVITY:** 0.5
- **DEAI ACTIVITY OPERATIONS:** 0.5
- **OWNER'S REPRESENTATIVE:** 0.1
- **GENERAL CONTRACTOR'S MANAGEMENT:** 0.05
- **PROJECT ENGINEER:** 0.1
- **PROJECT ADMINISTRATION:** 0.05
- **TOTAL:** 1.0

### Ancillary Equipment Cost:

- **Construction Activity:** 268,000
- **Project Management:** 2,681,584
- **Total:** 2,969,584

### Non-Construction Costs:

- **Rental:** 0.00
- **Other Non-Construction Costs:** 0.00
- **Total:** 0.00

### Ancillary Equipment Cost Budget:

- **Total:** 3,376,000

### Ancillary Equipment Cost vs. Budget:

- **Total:** 100%

### Ancillary Equipment Cost Breakdown:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Direct Cost</th>
<th>Indirect Cost</th>
<th>Total Cost</th>
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<tbody>
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<td>2,681,584</td>
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<td>Total</td>
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<td>2,969,584</td>
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### Ancillary Equipment Cost:

- **Construction Activity:** 268,000
- **Project Management:** 2,681,584
- **Total:** 2,969,584

### Non-Construction Costs:

- **Rental:** 0.00
- **Other Non-Construction Costs:** 0.00
- **Total:** 0.00

### Ancillary Equipment Cost Budget:

- **Total:** 3,376,000

### Ancillary Equipment Cost Breakdown:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Direct Cost</th>
<th>Indirect Cost</th>
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<td>Total</td>
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### Ancillary Equipment Cost:

- **Construction Activity:** 268,000
- **Project Management:** 2,681,584
- **Total:** 2,969,584

### Non-Construction Costs:

- **Rental:** 0.00
- **Other Non-Construction Costs:** 0.00
- **Total:** 0.00

### Ancillary Equipment Cost Budget:

- **Total:** 3,376,000

### Ancillary Equipment Cost Breakdown:

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<thead>
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<td>Total</td>
<td>2,969,584</td>
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### WBS 5.1.3.1.6.16 & 5.1.3.1.6.25 & 5.1.3.1.13.1-4 222-S ARCHIVE STORAGE FACILITY

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**TOTAL DIRECT COST:** 4,783,000

**TOTAL PROJECTED COSTS:**

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**UNENCUMBERED LABOR HOURS / UNIT**

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**CONSTRUCTION & SITE DEVELOPMENT COSTS**

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**PLANNING & DESIGN COSTS**

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**CONSTRUCTION COSTS**

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**SITE DEVELOPMENT COSTS**

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**CHART & SPACING**

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<td>Design</td>
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**TOTAL PROJECTED COSTS:** 4,783,000

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**DETAILED DESIGN ENGINEERING**

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**PROJECTED PERCENTAGES**

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<tr>
<td>Notes</td>
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</table>
APPENDIX F

NEAR-TERM 4D, 4P, 5AB LABORATORY ROOM LAYOUT
New Hoods:
1- Four Foot Hood
1- Six Foot Hood

CONCEPTUAL LAYOUT
New Hoods:
3 - Four Foot Hood

CONCEPTUAL LAYOUT

NORTH

Bench Space New 4ft New 4ft New 4ft New 4ft
Bench w/ Storage Hood Hood Hood Hood

4-P

HLAN WS
New Hoods:

2 - Four Foot Hoods

PRE-CONCEPTUAL LAYOUT
APPENDIX G

CONCEPTUAL 222-S LABORATORY COMPLEX LAYOUT (ARRA FUNDED)
APPENDIX H

ARRA-FUNDED NEAR-TERM SCHEDULE
### 222-G Facility Layout Optimization Schedule

<table>
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**Legend:**
- Actual Work
- Critical Remaining Work
- % Complete
- Remaining Work
- Milestone

© Precision Systems, Inc.

H-2
APPENDIX I

ARRA ESTIMATES
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</tbody>
</table>

Note: The above table outlines the labor-man hours and precedence factors for various tasks and objectives in the project. Each task is categorized under different headings such as Nonstandard Training Objective, Identification, Definition, Demonstration, Evaluation, Reporting, General Information, and Miscellaneous. The table also includes columns for total labor-man hours, precedence factors, and unfinished labor hours. The project includes various tasks such as preparation, installation, evaluation, and reporting, each with specific labor man-hour requirements.
# 222-S ROOM 4P UPGRADES

## 222-S ROOM 4P UPGRADES

### DESCRIPTION

<table>
<thead>
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<th>Item</th>
<th>Total</th>
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<th>NRV Labour &amp; Materials</th>
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<th>Total Material</th>
<th>NRV Labor &amp; Material</th>
<th>Total Labor &amp; Material</th>
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### NOTES

- Description of work
- Impact of work
- Total labor & material
- Productivity factor
- Change in labor & material

---

**Example of Calculations**

- NRV
- Total
- Impact
- Change

---

**Base Case**

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<th>Item</th>
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<tr>
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**Productivity Factor**

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**Impact**

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**Notes**

- Description of work
- Impact of work
- Total labor & material
- Productivity factor
- Change in labor & material

---

**Base Case**

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<th>Item</th>
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**Productivity Factor**

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**Impact**

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**Total**

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## 222-S ROOM SAB UPGRADES

### DESCRIPTION SUMMARY

| DESCRIPTION | TOTAL SQUARE | MADE SQUARE | ASHARE | PERCENT | GTGL | GTG | GTGP | GTMP | GTPM | GTMP'S | PAC | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC'S | PAC_S_HINTER]]=1

### ACCESS REQUIREMENTS

- 1. Emergency work will be performed in accordance with the work performed in secure areas.
- 2. Access work will be performed by construction personnel.
- 3. Completion prior to the installation.
- 4. Equipment installation will be made by others prior to construction.
- 5. Completion work will be performed at the time of the installation.
- 6. A total of 10 hours is required for the installation.
- 7. A total of 4 hours is required for the installation at a total cost of 4 hours.
- 8. A total of 3 hours is required for the installation at a total cost of 3 hours.
- 9. A total of 1 hour is required for the installation at a total cost of 1 hour.
### HLAN Hub Bldg

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**Note:**

The HLAN Hub building will be located in the immediate need of MD-67. The HLAN Hub will be MD-67 will be served with this building. This will allow the HLAN Hub equipment to be stored in a climate-controlled environment.

**Materials:**

- Lumber, labor, and other equipment costs, and sub-contract costs were obtained from vendor-bid quotations, RFI's, and other means.
- Materials used in the determination of the construction contracts were used to determine the applicable materials.
- Labor costs were determined from previous contracts of similar nature.
- Labor costs were determined from prior contracts for new buildings.

**Specifications:**

- The specifications and sub-contracts were prepared in accordance with the construction contract requirements.
- The specifications were prepared in accordance with the construction contract requirements.
- The specifications were prepared in accordance with the construction contract requirements.

**Assumptions:**

1. Total cost is per P-10 00.
2. The cost is total cost of the construction.
3. The cost is total cost of the construction.
4. The cost is total cost of the construction.

**Cost Breakdown:**

- Total cost is for the entire project.
- Total cost is for the entire project.
- Total cost is for the entire project.

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**Column Labels:**

- Description
- Cost
- Labor
- Material
- Other Costs
- Total Cost
- Percent of Total Cost

**Cost Breakdown:**

- Total Labor: $10,000
- Total Material: $5,000
- Total Other Costs: $2,000
- Total Cost: $17,000

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**Construction Duration:**

- 4 months
- 10 months
- 15 months

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**Construction Contract Breakdown:**

- Total Contract: $10,000
- Total Contract: $5,000
- Total Contract: $2,000

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**Construction Contract Breakdown:**

- Total Contract: $17,000
- Total Contract: $12,000
- Total Contract: $11,000
## 223-5 DOUBLE WIDE CONFERENCE CENTER

### DESCRIPTION

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### SUBCONTRACTS

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### TOTAL LABOR AND MATERIALS

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### IMPACTED LABOR AND COSTS

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### NOTES

- The Conference Center will be a doublewide trade place devoted to 223-5. This building will allow for meeting and training in a larger space than is currently available.
- Conference Center work will be performed only in areas of the building which are not obstructed by trade activity. Space will be allocated in a manner that will allow for the work to be performed in a safe and efficient manner.
- All work will be performed in accordance with the schedules established by the Prime Contractor.
- All work will be performed in accordance with the specifications and drawings provided by the Prime Contractor.
- All work must be performed in a manner that will not interfere with the work of other trades.
- All work will be performed in accordance with the safety rules and regulations established by the Prime Contractor.
- All work will be performed in accordance with the environmental regulations established by the Prime Contractor.

### CONTACTS

- Prime Contact: [Name]
- Phone: [Phone]
- Email: [Email]

### APPENDIX

- Appendix A: Schedule
- Appendix B: Specifications
- Appendix C: Drawings

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1. Conference Center work will be performed only in areas of the building which are not obstructed by trade activity. Space will be allocated in a manner that will allow for the work to be performed in a safe and efficient manner.
2. All work will be performed in accordance with the schedules established by the Prime Contractor.
3. All work will be performed in accordance with the specifications and drawings provided by the Prime Contractor.
4. All work must be performed in a manner that will not interfere with the work of other trades.
5. All work will be performed in accordance with the safety rules and regulations established by the Prime Contractor.
6. All work will be performed in accordance with the environmental regulations established by the Prime Contractor.

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**Cost Breakdown:**

- Total Cost: $[Total Cost]
- Labor Cost: $[Labor Cost]
- Material Cost: $[Material Cost]
- Subcontractor Cost: $[Subcontractor Cost]