Contract Publication Series 21-127

HISTORIC ARCHITECTURAL RESOURCE SURVEY OF THE DOSIMETRY APPLICATIONS RESEARCH (DOSAR) FACILITY IN THE 7700 AREA OF THE OAK RIDGE NATIONAL LABORATORY

An Addendum to the Oak Ridge National Laboratory
Historic Architectural Resource Survey
Completed January 2018

ORNL/TM-2022/2504

by
Jenny Andrews, MA,
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Prepared for

OAK RIDGE National Laboratory

Prepared by

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Prepared for

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Managed by

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for the
US Department of Energy

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CRA Project No.: T210144

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June 6, 2022

ABSTRACT

In May 2022, Cultural Resource Analysts, Inc., completed a historic architectural resource survey of buildings associated with the Dosimetry Applications Research Facility at the Oak Ridge National Laboratory. The laboratory is one of three Department of Energy facilities located on the Oak Ridge Reservation in Roane and Anderson Counties, Tennessee. The Dosimetry Applications Research Facility is located approximately 2 mi southeast of the main Oak Ridge National Laboratory campus. The survey included Buildings 7709, 7710, and 7712, which date to the 1960s. An additional DOSAR building (Building 7735) dates to the late 1980s and was not surveyed since it is outside the period of significance. The survey was conducted at the request of UT-Battelle, LLC, on behalf of the Department of Energy.

As stipulated by the National Historic Preservation Act of 1966, as amended, the Department of Energy is required to identify any properties under its jurisdiction that are included in or eligible for inclusion in the National Register of Historic Places. In order to identify historic properties at the Oak Ridge National Laboratory, in 2017–2018 Cultural Resource Analysts, Inc., conducted a survey of the main campus as well as outlying facilities, publishing the findings in a 2018 report entitled *Oak Ridge National Laboratory Historic Architectural Resource Survey*. At the time of the 2017–2018 survey, buildings associated with the Dosimetry Applications Research Facility were not accessible for security reasons and the current report serves as an addendum to the 2018 report. In addition, the current survey incorporates information included in a documentation report on Building 7709 completed in 2019.

The properties included in the current survey were also evaluated for their collective potential as a historic district. The identification of archaeological properties that are eligible for inclusion in the National Register of Historic Places is beyond the scope of this report.

Cultural Resource Analysts, Inc., recommends that none of the buildings surveyed for the current report are individually eligible for listing in the National Register of Historic Places. However, the collective of buildings represents a facility that made notable contributions to the Oak Ridge National Laboratory's scientific research endeavors from the 1960s to the 1980s, specifically in the field of Health Physics. The buildings and their associated features have also maintained their integrity of setting, materials, design, location, and association. Therefore, Cultural Resource Analysts, Inc., proposes the Dosimetry Applications Research Facility Historic District, which is recommended eligible for listing under Criterion A. The three buildings addressed in the current survey (Buildings 7709, 7710, and 7712) are recommended eligible as contributing resources of the historic district. The district boundary is scribed to incorporate the environs of these three facilities, as well as additional relevant features.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

In May 2022, Cultural Resource Analysts, Inc. (CRA), personnel completed a historic architectural resource survey of a portion of the 7700 Area of the Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee. The 7700 Area of ORNL is located approximately 2 mi southeast of the laboratory's main campus. The resources in this area are primarily grouped into two facilities, which are the Tower Shielding Facility (TSF) and the Dosimetry Applications Research (DOSAR) Facility, with additional buildings scattered throughout Melton Valley (Figure 1). The current survey addresses resources associated with the DOSAR Facility.

The properties were evaluated both for their potential individual eligibility for listing in the National Register of Historic Places (NRHP) and for their collective potential as a historic district. The survey was completed at the request of UT-Battelle, a nonprofit limited liability company (LLC) composed of the University of Tennessee and the Battelle Memorial Institute, which manages and operates ORNL under a contract with the US Department of Energy (DOE). The purpose of the survey was to assist the DOE in complying with the National Historic Preservation Act (NHPA) of 1966, as amended, by providing updated recommendations regarding the NRHP eligibility of historic architectural resources.

Construction of the DOSAR Facility began in 1962 with Building 7709, which housed the Health Physics Research Reactor (HPRR); Building 7710, which functioned as the DOSAR Control and Laboratory Building associated with the HPRR; and Building 7711, which functioned as the DOSAR Process Waste Basin (Figure 2) (Lundin 1962:36). Additional DOSAR-related facilities were constructed in 1963 (Building 7712, which housed the DOSAR Low-Energy Accelerator [DLEA]) and 1988 (Building 7735, the Radiation Calibration Laboratory [RADCAL]).

Though buildings within the 7700 Area were included in a more comprehensive historic architectural survey of ORNL properties conducted in 2017–2018, published in 2018, the buildings were not then accessible during fieldwork for security reasons (Hearnes et al. 2018). The descriptions and evaluations of the DOSAR Facility buildings were thus derived from previous assessments and based on earlier photography and documentation, which only addressed Buildings 7709 and 7710. Therefore, the 2018 CRA survey did not formally evaluate the buildings associated with the DOSAR Facility in their then-current condition for NRHP eligibility (Ross and Heavrin 2019:1). Pending an updated documentation and evaluation based on future accessibility to the DOSAR site, the 2018 survey recommended that two individual resources of the facility (Buildings 7709 and 7710) should continue to be treated as NRHP-eligible based on recommendations presented in a 2015 draft updated Historic Preservation Plan (HPP) (Hearnes et al. 2018:481–482, 491; Thomason and Associates 2015:51, 53). The current survey of the DOSAR facility's resources is part of the DOE's ongoing efforts to complete an updated survey of ORNL by documenting facilities that were inaccessible for the 2018 survey.

In addition, in 2019, CRA completed an assessment of Building 7709 in anticipation of proposed renovations to accommodate continued use of the building to meet future ORNL mission needs; the associated report was never finalized because plans for the proposed renovations were tabled. The report contained a history of the building and a description of its then-current condition to support an NRHP evaluation and, if eligible, assess the effects of the proposed renovations to assist ORNL in meeting its obligations under Section 106 of the NHPA. One other DOSAR building, Building 7710, was mentioned in the report, though it was not described or assessed. The report recommended that Building 7709 was eligible for individual listing in the NRHP under Criterion A (Ross and Heavrin 2019:10).

The current survey addresses Buildings 7709, 7710, and 7712, which are the three primary buildings associated with the DOSAR Facility during the period of significance, which extends from

1962 when Building 7709 was constructed, to 1987, the year the HPRR was shut down. Building 7735 is not included in the survey since it is not yet 50 years old, having been constructed in 1988, and thus outside the period of significance. Additional structures also not included in the survey are Building 7711, which is an asphalt-lined pit/retention pond, and Building 7758 (High Flux Isotope Reactor [HFIR] Parts Storage), which is a storage building not associated with DOSAR activities.

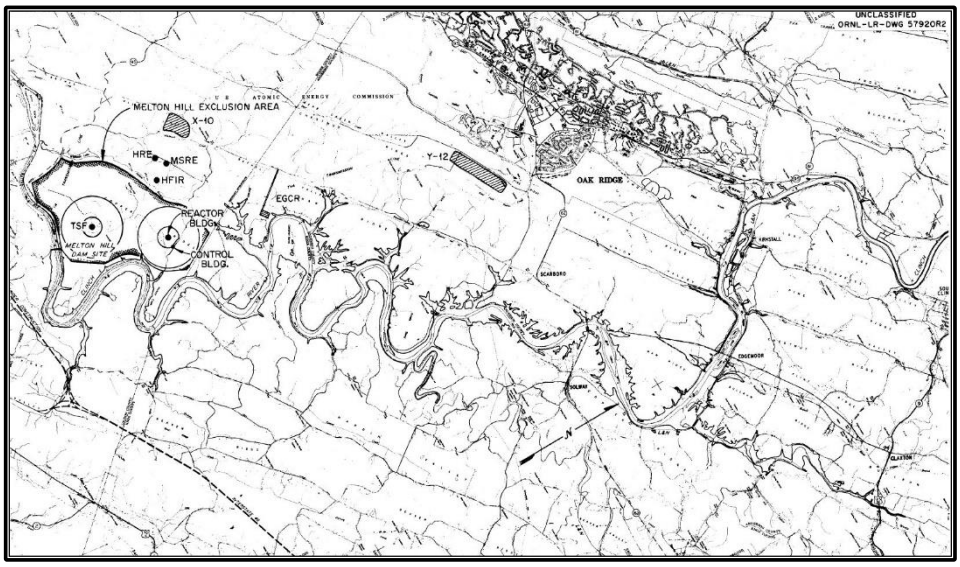

Figure 1. Site plan showing the location of the DOSAR Facility (at left), noting its "Reactor Building" (Building 7709) and "Control Building" (Building 7710, DOSAR Control and Laboratory Building), within the ORR (ORNL-LR_DWG 5792OR2). To the west (left) of the DOSAR Facility is the Tower Shielding Facility (TSF).

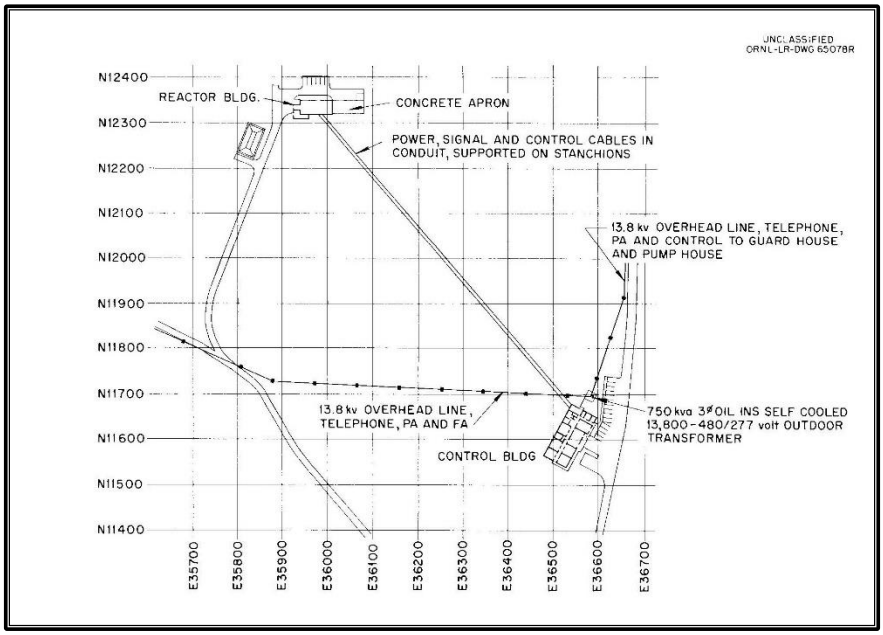

Figure 2. Plot plan of the DOSAR Facility, 1962. At upper left is the Reactor Building (7709). Southwest of the reactor building is the Process Waste Basin (7711). At lower right is the DOSAR Control and Laboratory Building (7710).

METHODOLOGY

The current survey of buildings associated with the DOSAR Facility was completed in May 2022 by CRA personnel who meet the Secretary of the Interior's Professional Qualifications for History and Architectural History. The survey was conducted in accordance with the *Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines* (National Park Service [NPS] 1983). In addition, guidelines offered in the following documents were followed: *National Register Bulletin #24 Guidelines for Local Surveys: A Basis for Preservation Planning* (NPS 1985), *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation* (NPS 1997), *Tennessee's Historical and Architectural Survey Manual* (Tennessee Historical Commission [THC] 1991), and the THC's *Reporting Standards Checklist* (THC 2015).

Photographic documentation of Building 7709 was completed by CRA personnel on September 5, 2019, and of Buildings 7710 and 7712 on December 6, 2021, including interior photographs of Buildings 7709 and 7710. Photographs were also taken of the exterior of Building 7735 and the exterior and interior of Building 7758. Generally, CRA attempted to capture views of all elevations, exterior building materials, and key architectural details.

CRA utilized field data; information from the 1993 and 2018 ORNL survey reports, 2004 HPP, and 2015 draft updated HPP; other cultural resource management reports; ORNL division reports, histories, and other archival documentation; archival photographs; and drawings to describe each building and evaluate it for listing in the NRHP. In general, in order for a property to be eligible for listing in the NRHP, it must be at least 50 years of age or older and possess both historic significance and integrity. Significance may be found in four aspects of American history recognized by these NRHP Criteria:

A. Association with historic events or activities;

B. Association with important persons;

C. Distinctive design or physical characteristics; and/or

D. Information potential.

A property must meet at least one of the criteria for listing and retain appropriate aspects of integrity: location, design, setting, materials, workmanship, feeling, and association. NRHP eligibility under Criterion D, which is typically used to assess archaeological sites, was not applied to architectural resources for this project. For the purpose of this report, an architectural resource is defined as any aboveground building or structure 50 years of age or older. A historic property is defined as any architectural resource that is listed in, or is eligible for listing in, the NRHP.

While the NRHP typically requires that properties are 50 years of age or older in order to achieve the perspective needed to evaluate the lasting historic importance of a resource, it recognizes that such passage of time is not always necessary to recognize a property's significance and an arbitrary threshold of 50 years is not always appropriate. Therefore, the Department of the Interior (DOI) developed National Register Criteria Consideration G, which allows properties less than 50 year of age to be nominated if they are of "exceptional importance." Properties not yet 50 years old also qualify for NRHP listing if they are integral parts of a district that is eligible for listing.

There are two general cases of "exceptional importance." The first involves properties that have attained significance within the past 50 years and which are clearly recognized as important. A key element in this determination is scholarly evaluation which provides historical perspective and context. This case of significance is bolstered when there is a substantial amount of professional, documented material on the property or the property type. One example would be Cold War Era resources, which have been the subject of research in recent decades. The second case of "exceptional importance" is

when an entire class or category of properties is so fragile or threatened that they are not expected to last 50 years.

Another factor in determining a relevant timeframe for historic built landscapes is change over time, as properties are altered to meet evolving needs. This concept is often used in regards to agricultural resources, but is also applicable to industrial landscapes. A prominent feature of the properties at ORNL is their evolution over several decades.

In addition, ORNL is a highly technical and scientific facility, a type of property not routinely assessed for NRHP eligibility. Recognizing the problems in this area, in 1991 the Advisory Council on Historic Preservation (ACHP) published a document that addresses some of the problems associated with identifying and administering such properties, entitled *Balancing Historic Preservation Needs with the Operation of Highly Technical or Scientific Facilities*. Since many scientific facilities that have been developed since World War II do not meet this criterion, the document discusses exceptions to the 50-year age threshold. The document also emphasizes the need for maintaining adequate perspective in the face of changing perceptions of historicity and the capricious nature of public taste and scholarly interest.

For the current survey, it was determined appropriate to examine a potential period of significance extending beyond the standard 50-year benchmark, from 1962 to 1987. In the years following the construction of the HPRR Building, the Control and Laboratories Building, and the Low-Energy Accelerator Building in the early 1960s, the DOSAR Facility maintained a high level of activity through the 1970s and 1980s, not making its first substantial change until the shutdown of the HPRR in 1987. The year 1987 thus marks the conclusion of research utilizing the HPRR. Shortly thereafter, in 1988, the RADCAL facility was constructed and became ORNL's primary dosimetry research facility.

CRA posits that ORNL presents an unusual set of circumstances, including the technical and scientific nature of the site and the importance of change over time in furthering the laboratory's evolving missions, that warrant evaluation under Criteria Consideration G. Thus, resources included in the current survey were evaluated within the context of a potential period of significance extending from 1962, when construction of Building 7709 began, to 1987, when the HPRR was shut down.

Summary of Results

The findings of this historic architectural survey expand on and update the conclusions of previous surveys, including the 2018 survey by CRA (Hearnes et al. 2018), the 1994 survey by DuVall & Associates, Inc (Carver and Slater 1994), and survey updates completed by Thomason and Associates in 2004 and 2015 in support of the ORNL HPP (Thomason and Associates 2004, 2015). At the time of the 2018 survey, resources in the 7700 Area were not accessible due to security reasons, and descriptions and evaluations were then based on information presented in the 2015 HPP update. In 2019 and 2021 the DOSAR site was accessible and CRA personnel were able to assess the buildings and obtain photographs of the exteriors of buildings, as well as the interiors of two buildings (Buildings 7709 and 7710).

The current survey addresses three buildings (Buildings 7709, 7710, and 7712) associated with the DOSAR Facility. Each resource was evaluated to determine its individual eligibility for listing in the NRHP based on its role and significance within the context of ORNL, and on its current integrity and condition. In addition, the collective of buildings was assessed for its potential eligibility as a historic district.

CRA recommends that none of the three buildings are eligible for individual listing since none is individually associated with notable persons or events, and their importance is dependent on their contributions as a collective. The buildings are also common forms and unremarkable in their

architecture. Thus none of the three buildings is eligible for individual NRHP listing under Criterion A, B, or C.

However, the collective of buildings represents a facility that made notable contributions to ORNL's scientific research endeavors from the 1960s to the 1980s, specifically in the field of Health Physics. The buildings and their associated features have also maintained their integrity of setting, materials, design, location, and association. Therefore, CRA proposes the DOSAR Facility Historic District, which is recommended eligible for NRHP listing under Criterion A. The three buildings addressed in the current survey (Buildings 7709, 7710, and 7712) are recommended eligible as contributing resources of the historic district. The district boundary is scribed to incorporate the environs of the three facilities, as well as additional relevant features, including a conduit that connects the HPRR facility (Building 7709) to the DOSAR Control and Laboratory Building (Building 7710), a radiation shielding hill between Buildings 7709 and 7710, an asphalt-lined process waste retaining pond (Building 7711), the original access road, and perimeter security fencing and gates.

RESULTS

The results of the field survey are presented in the following section. A total of three buildings (Buildings 7709, 7710, and 7712) were surveyed, with three additional buildings (Buildings 7711, 7735, and 7758) addressed within the discussions of the proposed historic district and of the three surveyed buildings. Descriptions of the individual surveyed buildings are presented below, preceded by a description and NRHP evaluation for the potential Dosimetry Applications Research (DOSAR) Facility Historic District.

DOSAR Facility Historic District

District Name

Dosimetry Applications Research (DOSAR) Facility Historic District

Period of Significance

1962–1987

NRHP Eligibility

Eligible

Description

The proposed DOSAR Facility Historic District is located approximately 2 mi southeast of the main ORNL campus. The facility contains three primary buildings constructed in the 1960s for the purpose of conducting research on the effects of radiation and the development of dosimetry standards in the field of Health Physics (Figures 3 and 4). The site also contains ancillary features associated primarily with the HPRR, including a utilities conduit between Buildings 7709 and 7710, a hill behind Building 7710 that functioned as radiation shielding, and Building 7711, which is an asphalt-lined retention pit for collecting radioactive waste in the event of an HPRR incident.

The small, remote, wooded valley within Copper Ridge was chosen as the ideal site for the DOSAR Facility, which would provide natural protection from radiation emitted by the HPRR when it was operated in the open air or that might result from an accident, as well as a high level of security (Lundin 1962:5). Building 7709, designed specifically to house the HPRR, is a tall, steel-framed, aluminum-clad building that accommodated a special traveling crane known as the reactor positioning device,

which transported the reactor in and out of the building along a pair of metal tracks. Sited approximately 800 ft southeast of the reactor building is Building 7710, constructed of reinforced concrete and nestled into a low hill between the two buildings, which held the control room and laboratories associated with the HPRR. As an additional safety measure, the DOSAR Facility was encircled by antipersonnel chain-link fencing at a radius of approximately 1,000 ft, as well as a posted perimeter fence to further restrict access by the general public (Lundin 1962:5). Soon after installation of the HPRR, Building 7712 was constructed on a low rise just northeast of Building 7710, which housed an additional Health Physics research facility known as the DOSAR Low Energy Accelerator (DLEA). Connecting the three buildings was an access road named Greenway Road.

Health Physics is a branch of science devoted to the study of radiation and its potential hazards. As an area of study, Health Physics incorporates aspects from multiple scientific fields of inquiry, from fields as diverse as physics, biology, biophysics, and chemistry. Health physics arose during the Manhattan Project as a specialty focused on protecting people and the environment from potential radiological and nuclear threats (Rosenthal 2010:35). When World War II ended, the Manhattan Project's X-10 site became ORNL, dedicated to pursing a wide variety of research topics in the field of nuclear science. At ORNL, continued research in mammalian radiation tolerance and analyzing the measurements of radiation exposure led to the design and construction of a fast burst reactor called the Health Physics Research Reactor (HPRR) (Rosenthal 2010:35). Constructed in 1961, the HPRR was developed at ORNL to measure radiation exposure and radiation tolerance. Immediately after its construction, the HPRR was delivered to a Nevada test center to aid Operation BREN by evaluating gamma doses received by people in Hiroshima and Nagasaki (Kerr et al. 1992:17).

After the conclusion of Operation BREN in 1963, the HPRR was returned to ORNL for the advancement of biomedical research and installed in Building 7709 at the DOSAR Facility (Figure 5) (Rosenthal 2010:37). The DOSAR Facility then also included Building 7710, which held laboratories and the control room associated with the HPRR, and Building 7711, which functioned as the DOSAR Process Waste Basin (Figure 6). The HPRR was used primarily for the study of radiation dosimetry (the measurement or calculation of radiation dose absorbed by the body), interaction of radiation with matter, reactor accidents, Icheban programs, radiobiology, and medical research (Figure 7) (Lundin 1962; Oak Ridge National Laboratory 2019). The HPRR operated in Oak Ridge from 1963 until it was retired in 1987.

The HPRR was designed to "yield a wide range of [gamma] dose rates without change in spectrum" with a cylindrical core made of uranium-235 and 10 percent molybdenum (Rosenthal 2010:35):

> The core is 8 inches in diameter and 9 inches in height, with a 2-inch center section made of stainless steel. Three holes traverse the exterior of the core and contain the mass adjustment, burst, and regulating rods. An aluminum cage and a stainless steel cylinder underneath the core act as protection for the core.
>
> The reactor was suspended by a supporting framework, which also held drive mechanics, neutron source and shields, radiation detectors, and other apparatus. The framework moved the reactor with hydraulic lifts above and below ground level and inside and outside of Building 7709. The HPRR was capable of operating a steady stream of radiation ranging from a fraction of a watt to 10kW with a restriction of three shots per day (Rosenthal 2010:36).

In 1963, Building 7712 was added to the DOSAR site, in which the Low-Energy Accelerator (DLEA) was installed in 1966 (Figure 8). The original portion of the building, which is metal-paneled and gable-roofed, is extant. Into the 1980s, the control room for the accelerator was housed in a trailer, with protection between the two buildings provided by movable concrete-block walls. In 1967, a concrete-block addition was made on the east side of Building 7712.

In 1988, in the wake of the shutdown of the HPRR and its uncertain future, a fourth building, Building 7735, was constructed at the DOSAR Facility as the Radiation Calibration Laboratory (RADCAL), located on the former site of the control room trailer for the DLEA (Figure 9). The

RADCAL facility became the primary site of dosimetry research and radiation equipment calibration and testing at ORNL, providing a permanent dedicated irradiation facility to house multiple radiation sources to meet a growing demand for calibration research and testing, which had previously been conducted in a less formal manner as other DOSAR laboratory spaces were available (Casson and Sims 1988:206). The facility has been utilized for a wide range of radiological experiments using standards of radiation calibration, primarily for dosimeter intercomparison studies and compliance testing of personal dosimeters, as well as serving as a training facility for radiation dosimetrists and health physicists (Bogard 1998:9). On its interior, the facility contains three rooms for different types of irradiation (gamma, neutron, X-ray, and beta), as well as a control room, restroom, and storage rooms (Casson and Sims 1988:206–207). The RADCAL facility continues to operate.

Noted accomplishments by scientists and staff in ORNL's Health Physics and Radiation Dosimetry Department are not limited to, but include:

- The first definitive study of neutron and gamma radiation fields at large distances from a small fission source, completed at Building 7709 (Kerr et al. 1992:16-17).
- Human-body simulations completed in Building 7709, which were invaluable in setting radiation exposure limits (Rosenthal 2010:38).
- Experiments providing data that guided radiation-instrument development and dosage assessment, which, among other things, helped scientists estimate solar radiation doses the Apollo astronauts would be exposed to (DOE 2003:20; Kerr et al. 1992; Rosenthal 2010).
- Worldwide programs that established the standards of radiation exposure, led by ORNL scientific staff (Rosenthal 2010).
- The dosimetry research group, headed by Walter Snyder and Mary Rose Ford, which established ORNL as an international center for dose calculations (DOE 2003).
- The international standard for the typical exposure of a radiation worker, known as ICRP's "Reference Man," established by Walter Snyder and Mary Jane Cook (DOE 2003).
- A 3D model that calculated radiation doses, developed by Walter Snyder with the Medical Internal Radiation Dose (MIRD) Committee of the Society of Nuclear Medicine, which utilizes the "Reference Man" and is known globally as the "MIRD Phantom" (DOE 2003).
- Age- and gender-specific radiation dose estimates, developed under the guidance of ORNL scientist Keith Eckerman (DOE 2003).
- The introduction of biologically realistic models incorporating physiological changes common during human maturation. These models, led by Rich Leggett's study of biokinetics, yielded improvements in the MIRD Phantom, which evolved into a "Reference Family" (DOE 2003).

National Register Evaluation

CRA recommends that the DOSAR Facility is eligible for listing in the NRHP as a small historic district, proposed as the DOSAR Facility Historic District, under Criterion A for its association with notable research conducted at ORNL in science and health/medicine, specifically as relates to radiation exposure and the establishment of standards of radiation dosimetry. The collective of buildings within the district represents the core group of facilities developed and built by ORNL for DOSAR research in the mid- to late twentieth century. The build dates of the primary facilities, and the years of operation of the HPRR, were used to set the period of significance, which is 1962 (the construction of Buildings 7709 and 7710) and 1987 (when the HPRR was shut down). The physical relationships between the buildings, including the three earliest buildings, Buildings 7709, 7710, and 7712, reflect the earlier arrangement of the facility, and the interstitial landscape has retained important associated features, including the utilities conduit between Buildings 7709 and 7710, the radiation shielding hill between

Buildings 7709 and 7710, Building 7711 (DOSAR Process Waste Basin), the facility's access road, and perimeter fencing and gates.

None of the resources within the district nor the collection of buildings is closely associated with a single scientist or group of scientists of exceptional importance that would qualify for listing under Criterion B; rather, the collective impact of the many researchers who worked at the DOSAR Facility is more appropriately captured under Criterion A. Additionally, although the buildings were designed for their specific functions, they exhibit simple utilitarian designs that characterize ORNL's Cold War Era facilities, lacking notable stylistic elements or other noteworthy design features on the exterior. Thus the district is not recommended eligible under Criterion C.

Although two of the buildings within the district, Buildings 7709 (HPRR Building) and 7710 (DOSAR Control and Laboratory Building), have previously been recommended eligible for individual listing under Criterion A for their contributions to science and health/medicine research, CRA recommends that neither building is individually eligible since they necessarily operated in tandem and their significance is dependent on their contributions as a collective (Thomason and Associates 2015:53). The interdependent nature of the remaining features within the DOSAR Facility means they are also not individually eligible.

However, Buildings 7709, 7710, 7711, and 7712 have retained sufficient integrity of form, mass, materials, location, and association to warrant NRHP listing as contributing resources of the historic district. Two other buildings located within the DOSAR Facility are not considered contributing resources. Building 7735 is not considered contributing due to its age, being less than 50 years old and outside the period of significance. Building 7758 was not associated with DOSAR Facility activities.

The boundary of the proposed district is an irregular shape that incorporates the primary DOSAR Facility buildings (Buildings 7709, 7710, and 7712), as well as important associated features, including the utilities conduit between Buildings 7709 and 7710, the hill adjacent to Building 7710, Building 7711, the original access road, and perimeter fencing and gates (Figure10).

Figure 3. East (façade) elevation of Building 7709, which housed the HPRR, looking west.

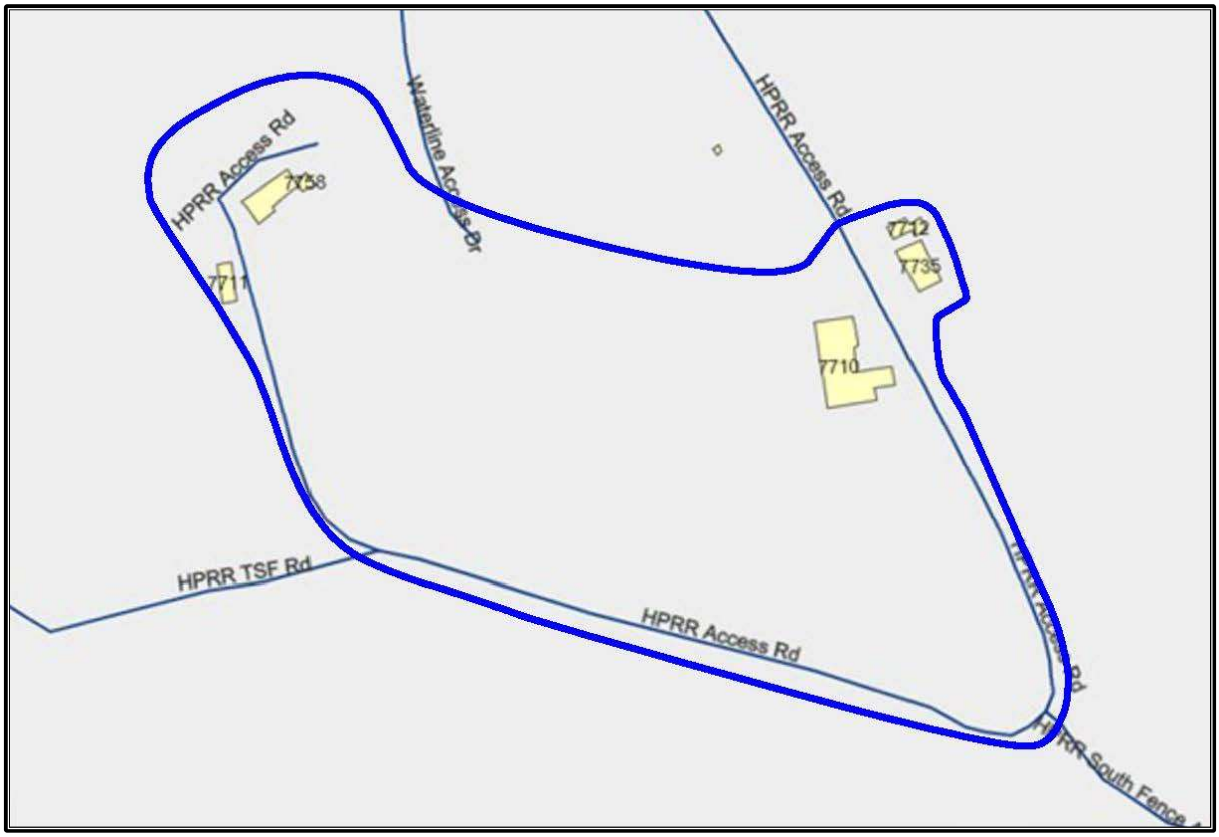

Figure 4. Plan view of the DOSAR Facility showing the associated resources and the boundary of the proposed DOSAR Facility Historic District.

Figure 5. Archival photograph of Building 7709, constructed in 1962 to house the HPRR.

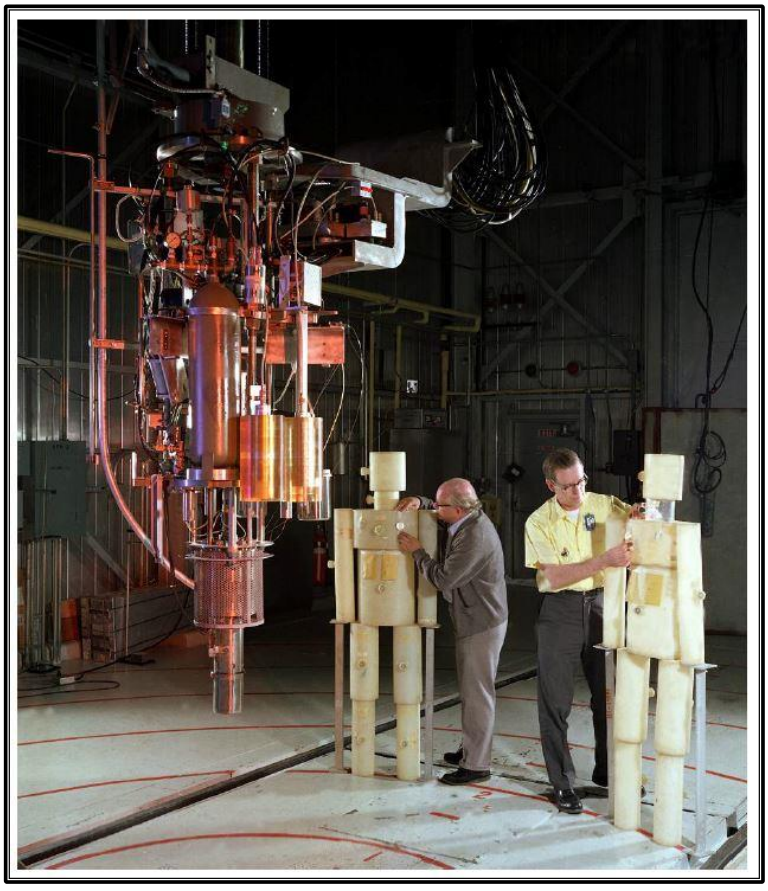

Figure 6. Archival photograph of the HPRR in Building 7709.

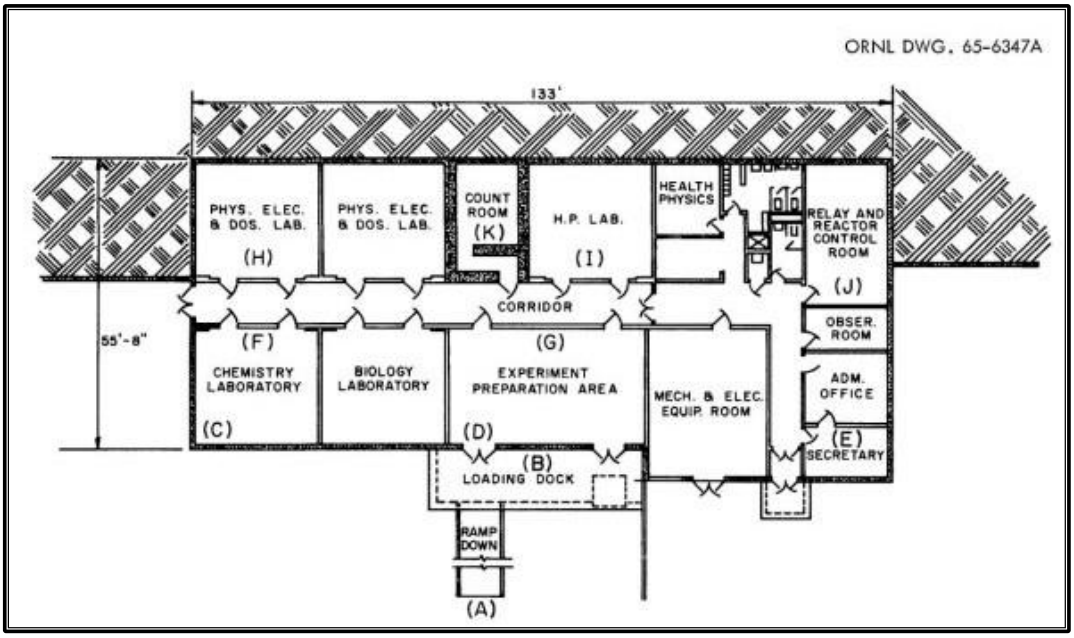

Figure 7. Floor plan of the DOSAR Control and Laboratory Building (Building 7710), 1968.

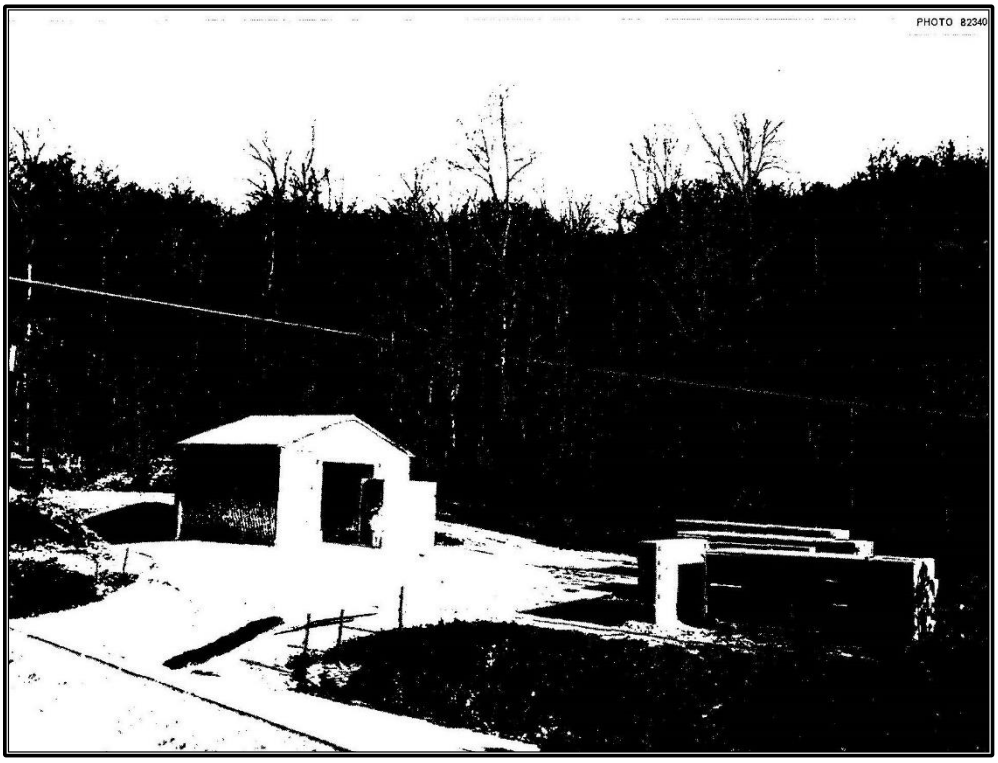

Figure 8. Archival photograph of the original portion of Building 7712 (left), which housed the DLEA. At right is a trailer that served as the remote control facility for the accelerator.

Figure 9. West (façade) and south elevations of Building 7735, the RADCAL facility, looking northeast.

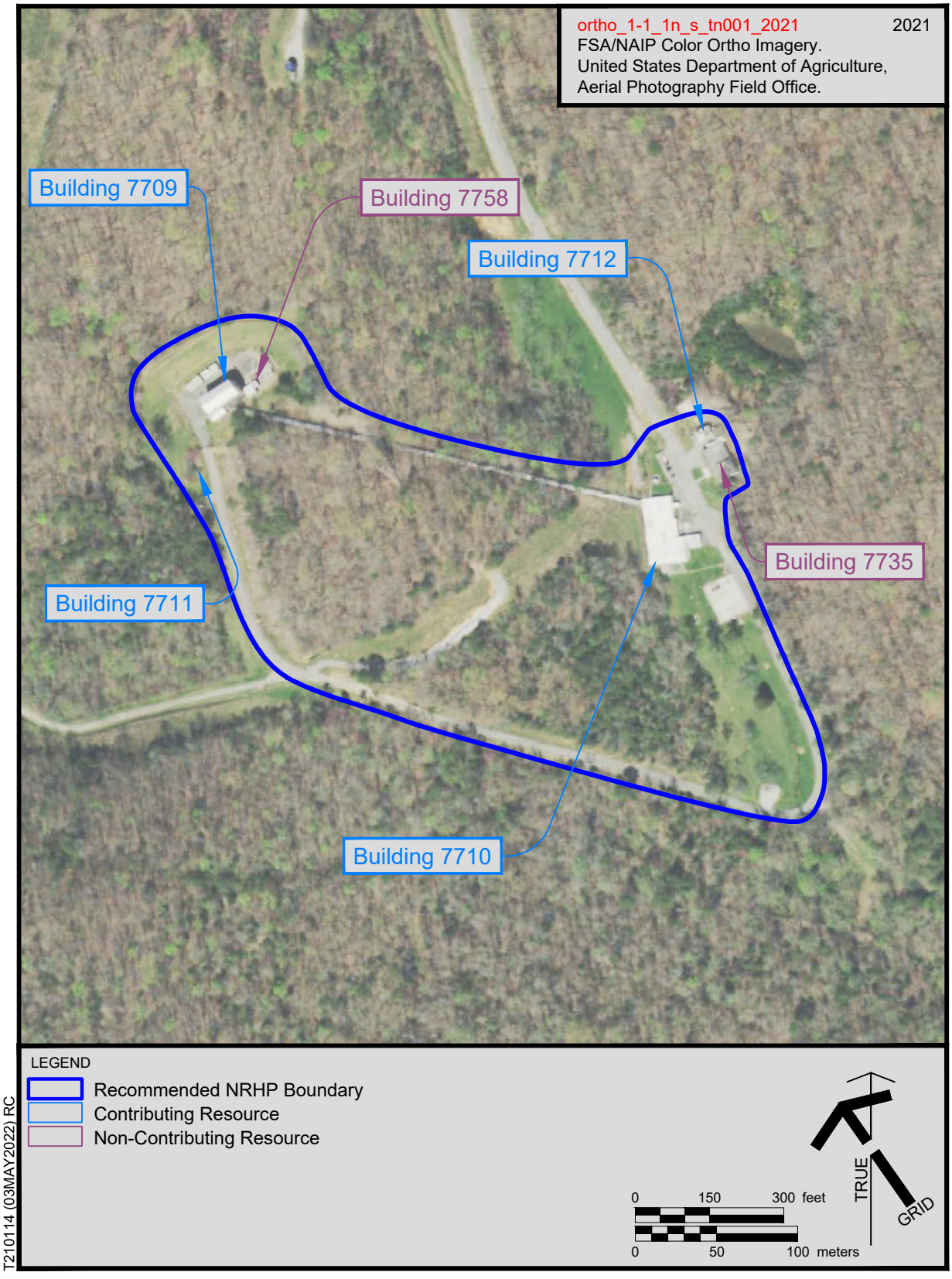

Figure 10. Aerial map showing proposed DOSAR Facility Historic District boundary and the locations of associated resources.

Building 7709

Building Name

Dosimetry Applications Research (DOSAR) Facility/Health Physics Research Reactor (HPRR) Building

Date of Construction

1962

DOE Office Responsibility

Office of Science

NRHP Eligibility

Contributing Resource of the DOSAR Facility Historic District

Description

Located south of Haw Ridge in Melton Valley, this multi-story irregular-plan building, which contains 3,004 sq ft, is set on a concrete slab, is clad in insulated aluminum siding over a steel frame, and rests beneath a gable roof sheathed in insulated aluminum (Figure 11). The main portion of the building is rectangular, approximately 70 ft long by 30 ft wide, and approximately 50 ft tall (Dupont and Saylor 2020:11). Attached to the west elevation of the building is a one-story hipped-roof section set on a raised concrete foundation and clad in metal panels, known as the annex room, which housed electrical and mechanical equipment including such utilities as an air conditioning unit and exhaust fans; projecting from the roof of the annex room is a condenser.

The east (façade) elevation of Building 7709 is characterized by a double-leaf service entry, 12 ft wide and 15 ft high, filled by a pair of metal doors (Figure 12) (Lundin 1962:39). Above the entry is a tall narrow opening, approximately 26 ft tall and 6 ft wide, filled by a hinged metal door, which allowed the reactor positioning device to move the HPRR in and out of building (Dupont and Saylor 2020:12). Extending from the east elevation is a rectangular concrete pad, 70 ft by 30 ft, that contains metal tracks on which the reactor positioning device traveled (Figure 13) (Dupont and Saylor 2020:15). To the right (north) of the building's double-leaf entry is a single-leaf pedestrian entry filled by a metal door (see Figure 12). The two entries are protected by heavy wire fencing, gates, and caged areas, which were added to all elevations of the building in the mid-1980s to provide additional security.

The west elevation of Building 7709 is pierced by a double-leaf entry filled by metal doors, which open into a caged area situated on a concrete porch/loading dock lined with a metal handrail, accessed by a set of concrete steps (Figure 14). The one-story annex room on the west side of the building is pierced on its west elevation by two single-leaf entries, which open onto an unsheltered concrete porch lined with a metal handrail, accessed by a set of concrete steps (Figure 15). The south elevation of the annex room is pierced by a single-leaf entry.

The interior of Building 7709 consists primarily of a single large open space. The building is devoid of windows and rooms. The floor of Building 7709 is of poured concrete and features red circles that span the full length and width of the building and the exterior concrete pad (Figure 16). These red circles were used during experiments to measure radiation distances. Tracks are located along the building's centerline and extend the length of the building and the length of the exterior concrete pad (Figure 17). Approximately 5 ft south of the tracks is a control panel used to direct the positioning device and reactor during experiments (Figure 18). Two concrete storage pits are located centrally along the floor to store the reactor when not in use (Figure 19).

The ceiling features exposed aluminum rafters and 12 hanging incandescent lights that are original to the building's construction. Along the east portion of the ceiling is a wood-plank and aluminum platform associated with the 5-ton bridge crane which extends north and south and spans the full 32 ft width of the building (Figure 20).

The east wall of the interior features a double door which allows the reactor positioning device to move between the interior and exterior spaces (Figure 21). To the north of the double door is the main personnel door. Directly above the doorframe of the personnel entry are green and red warning lights, and above the green and red lights is a red, purple, and clear warning light (Figure 22). Located at the southeast corner of the east wall of the interior is a ladder leading to a catwalk along the south elevation (Figure 23).

The south wall of the interior features a full-length catwalk approximately 20 ft above the ground with a ladder at the southeast corner and square aluminum air ducts along the length of the elevation (Figure 24). Along the base of the south elevation are electrical panels and junction boxes used to power telephones, intercoms, and other utilities. Pipes and gauges attached to these boxes lead to various locations around the interior and exterior of the building.

On the west wall of the interior, the reactor positioning device (a gantry type crane) is stationed centrally and was used to carry the reactor along tracks, remove the reactor from one of two storage pits, and position the reactor as required per the experiment (Figures 25 and 26). North of the reactor positioning device is an emergency exit which features a red and green warning light (Figure 27). North of the emergency exit is an original fire pull station. Between the exit and bridge crane is an additional control panel. South of the bridge crane in the southwest corner is a ladder leading up to a platform.

The north wall of the interior features rows of original and contemporary water pipes (Figures 28 and 29). An original fire box pull station, manufactured by the Gamewell Company, is located near the northeast corner. Similar to the south elevation, electrical panels and utility boxes with their associated conduits and gauges are installed along the base of the north elevation. Near the northeast corner is a wood speaker box used to communicate with the control center. Each interior wall features exposed aluminum structural members.

Utilities in Building 7709 included water, electrical, ventilation, and gas. Auxiliary systems used in the day-to-day functioning of the facility included waste disposal, communications systems, and television monitors. A document published in 1962 described the utilities in the following way:

> Water is collected in Melton Valley and travels to DOSAR pumping stations and storage tanks. At these tanks, the water becomes part of the fire-protection supply and the remainder is available as potable supply. Electrical power runs from a substation and distribution center underneath the control center to the reactor.
>
> Air supply in the Reactor building is filtered and recirculated through a duct distribution system and a forced-air cooling system is present for rapid cooling of the reactor immediately after high-power runs. Gas utilities are distributed from a liquid-petroleum gas-receiving and storage station located on the building's loading dock and compressed air is distributed from individual compressor-receiver stations in service equipment rooms (Lundin 1962:44).

Directly adjacent to the east elevation of the main portion of the building is a one-story addition designated as Building 7758, constructed sometime prior to 1985, which functioned as High Flux Isotope Reactor (HFIR) Parts Storage (Figures 30 and 31). Building 7758 is set on a concrete foundation, is clad in insulated aluminum siding, and rests beneath a shed roof sheathed in metal panels. The north (façade) elevation of Building 7758 is pierced by a double-leaf entry filled by a pair of metal doors. Attached to the east elevation is an open shelter supported by square metal posts with partial-height walls clad in metal panels.

Located southwest of Building 7709, on the northwest side of the access road, is Building 7711, which consists of a below-ground-level, rectangular, asphalt-lined retention pond with a 25,000 gal

capacity, known as the DOSAR Process Waste Basin. Built in 1962 concurrent with Building 7709, the purpose of the basin was the retention of radioactive waste that would drain from the reactor building in the event of an emergency decontamination following a reactor incident. The waste would then be transferred via a truck to the ORNL waste-treatment facility (Lundin 1962:57).

National Register Evaluation

Although research conducted in Building 7709 contributed significantly to the field of Health Physics, the building necessarily operated as part of a collective of DOSAR facilities, particularly in association with Building 7710. Therefore, the building is not recommended eligible for individual NRHP listing under Criterion A. In addition, while several prominent scientists conducted research in Building 7709, none of the them individually rise to the level of significance needed for eligibility under Criterion B. Further, the building's design was specific to its function, which was to house the HPRR, but overall it is a simple utilitarian structure that is not distinguished in its architecture or engineering design. Therefore, CRA recommends that Building 7709 is not individually eligible under Criterion C. Thus, CRA recommends that Building 7709 is not eligible for individual listing under Criterion A, B, or C.

However, although the reactor itself has been removed, Building 7709 remains in its original location within the DOSAR Facility and is largely intact. It also retains character-defining features indicative of its historic use, such as the concentric circles on the floor, the storage pits that held the reactor apparatus, signal lights used during experiments, and the tracks and doors that accommodated the reactor positioning device. CRA thus recommends that Building 7709 is eligible for NRHP listing as a contributing feature of the proposed DOSAR Facility Historic District under Criterion A in the areas of Medicine and Science, for its association with important research in the field of Health Physics that informed the establishment of radiation dose limits, which had wide-ranging impacts on the protection of human health.

Building 7711 (DOSAR Waste Process Basin), while also not individually eligible, is original to the site, having been constructed in tandem with and directly connected to Building 7709. Therefore, CRA recommends that Building 7711 is a contributing feature of the proposed historic district.

Building 7758, although adjacent to Building 7709, appears to have performed a function unrelated to DOSAR activities and therefore is not considered a contributing feature of the historic district.

Figure 11. East (façade) elevation of Building 7709, looking southwest.

Figure 12. Double-leaf service entry on the east (façade) elevation of Building 7709, looking west. To the right of the service entry is a single-leaf pedestrian entry.

Figure 13. Concrete pad on the east side of Building 7709, with metal tracks used for moving the HPRR assembly in and out of the building.

Figure 14. North and west elevations of Building 7709, looking southeast.

Figure 15. West and south elevations of Building 7709, looking northeast.

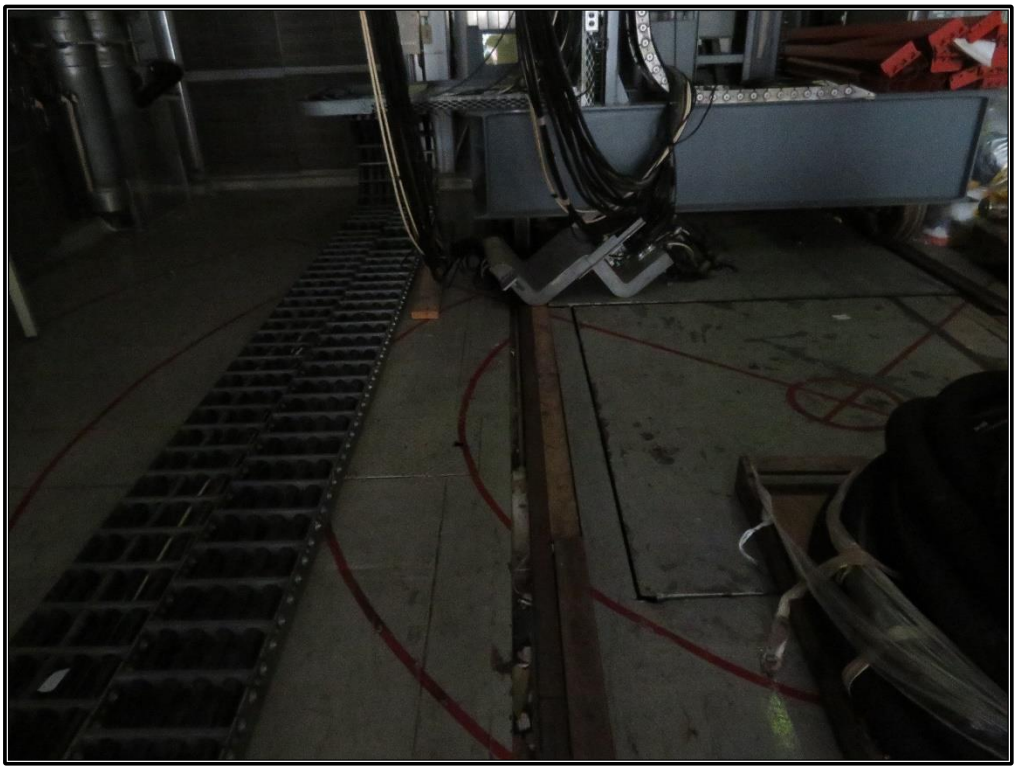

Figure 16. Floor of Building 7709 showing red circles used during radiation experiments.

Figure 17. Tracks on the centerline of Building 7709 on which the reactor positioning device traveled.

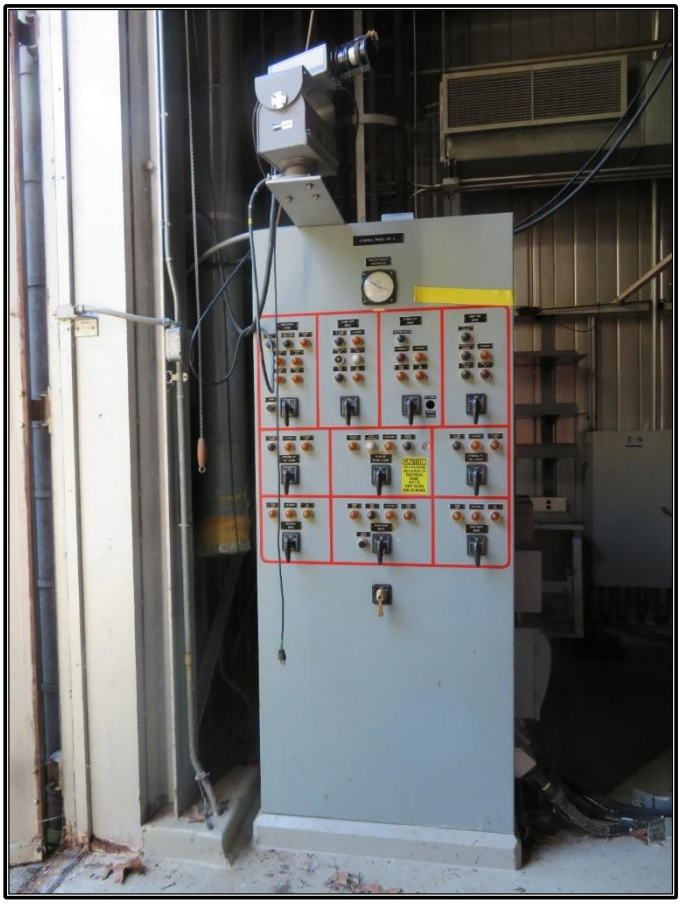

Figure 18. Control panel in Building 7709 that controlled the reactor and reactor positioning device, looking south.

Figure 19. Storage pit in Building 7709 where the reactor was stored when not in use.

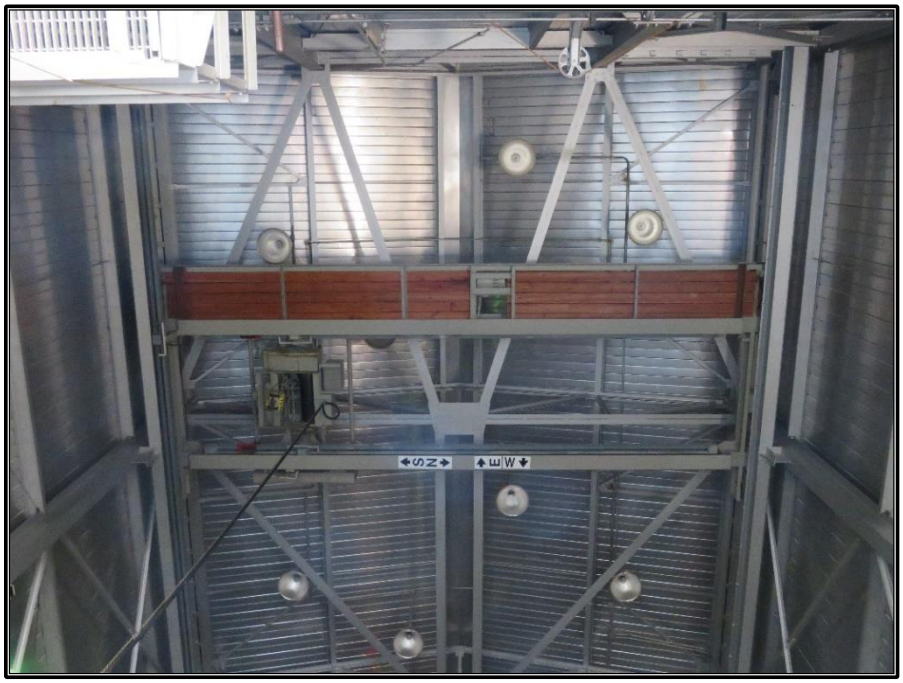

Figure 20. Ceiling of Building 7709 showing the bridge crane and wood-plank and aluminum platform.

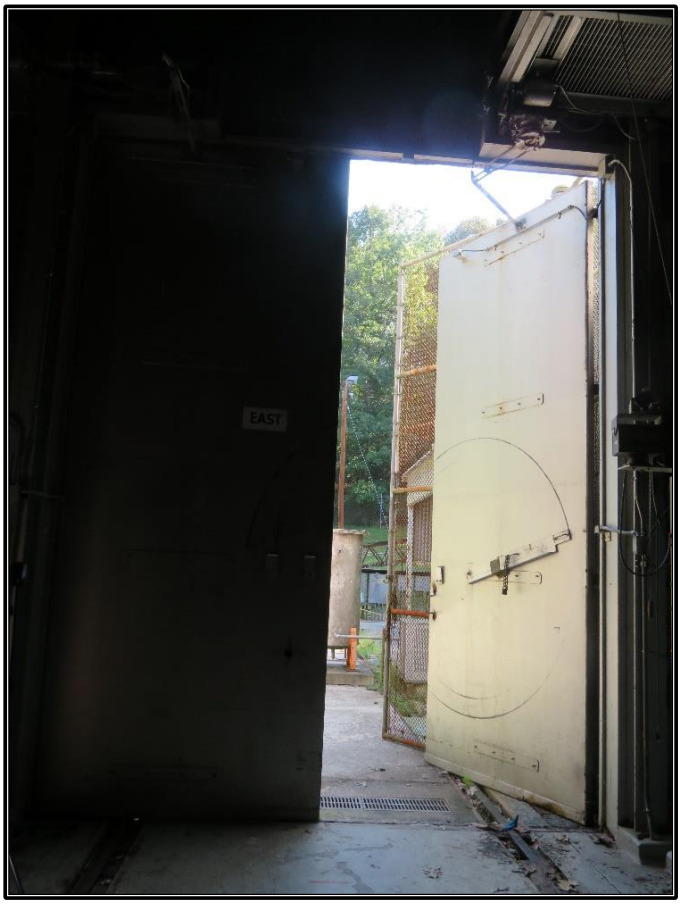

Figure 21. Large double doors located on the east wall of Building 7709, looking east.

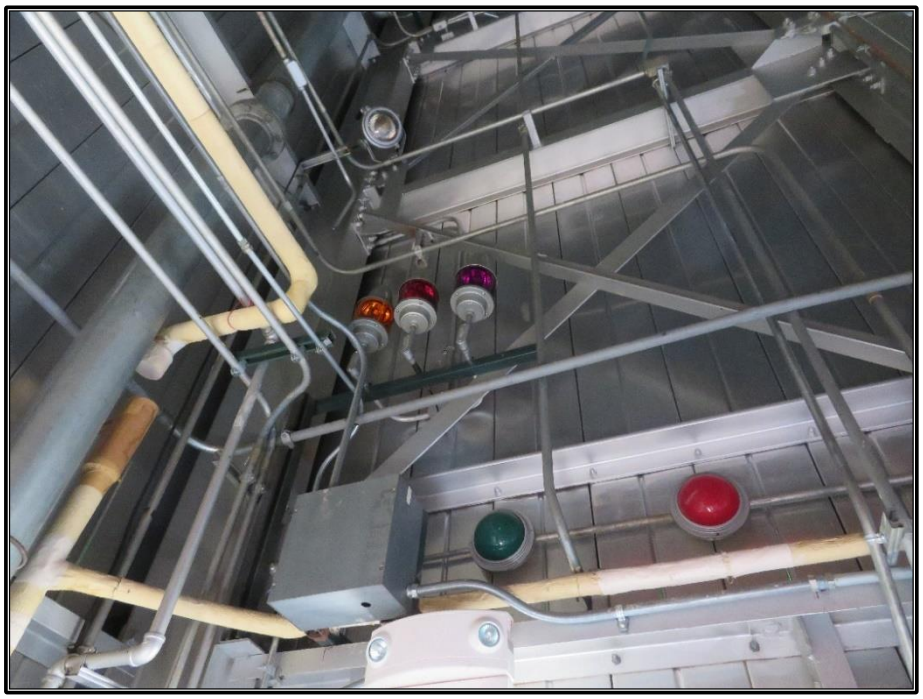

Figure 22. Warning lights above the main personnel door on the east wall of Building 7709, looking east.

Figure 23. Ladder to a catwalk in the southeast corner of Building 7709, looking southeast.

Figure 24. South interior wall of Building 7709, looking southwest.

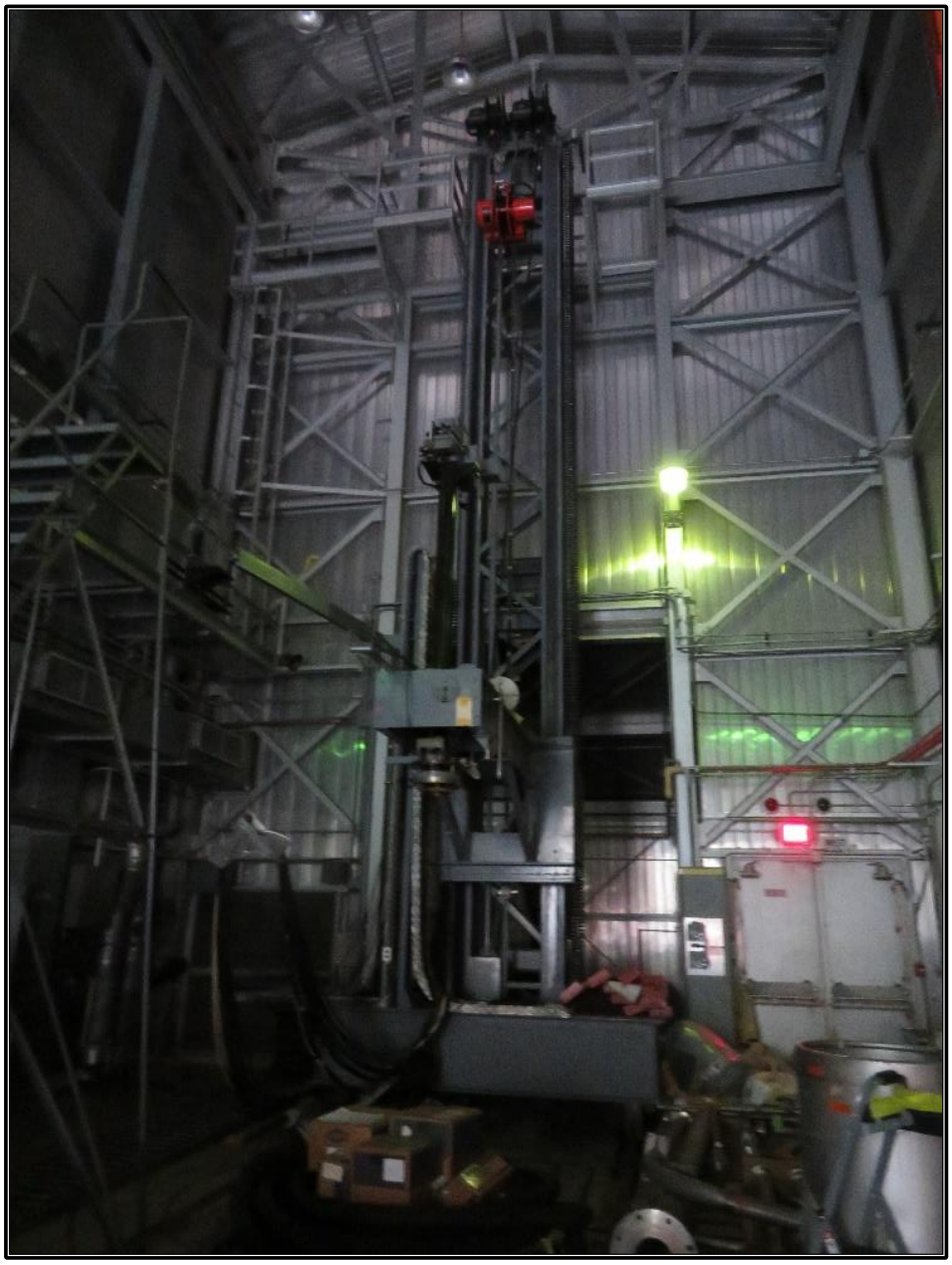

Figure 25. West interior wall of Building 7709 showing reactor positioning device, looking west.

Figure 26. Reactor positioning device in Building 7709, looking northwest.

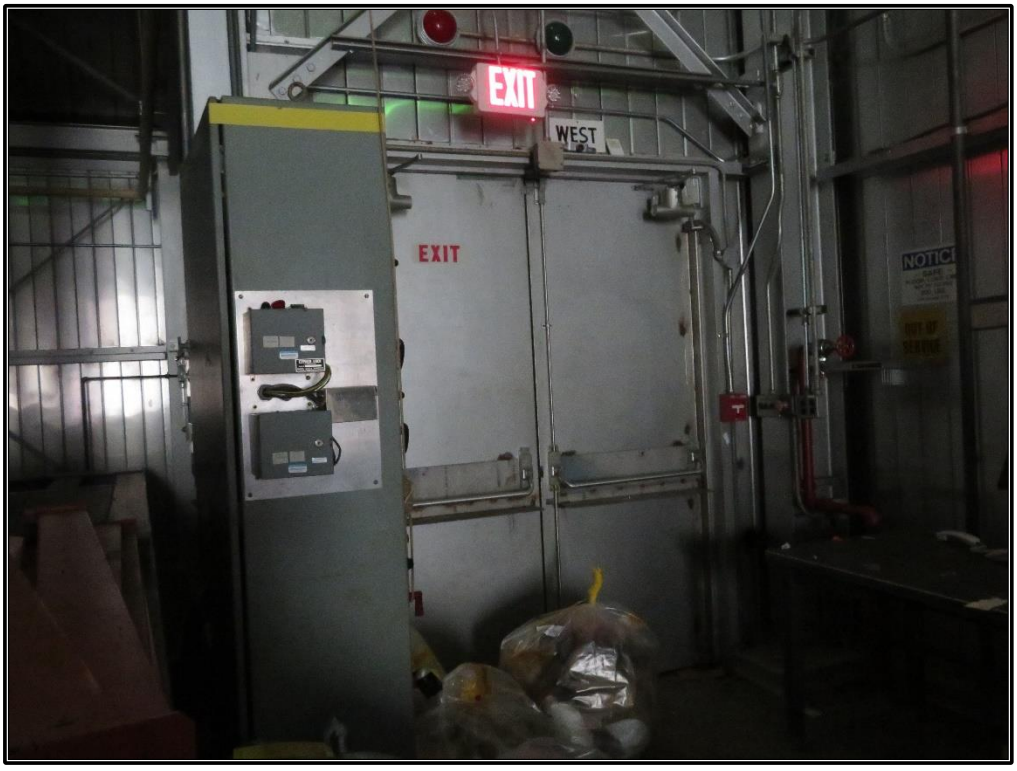

Figure 27. Emergency exit on the west wall of Building 7709, looking northwest.

Figure 28. North interior wall of Building 7709, looking northeast.

Figure 29. Utilities equipment along the north interior wall of Building 7709, looking northwest.

Figure 30. East and north elevations of Building 7758, looking northwest.

Figure 31. Interior of Building 7758, looking south.

Building 7710

Building Name

Dosimetry Applications Research Facility Control and Laboratory Building

Date of Construction

1962

DOE Office Responsibility

Office of Science

NRHP Eligibility

Contributing to DOSAR Historic District

Description

Located southeast of Building 7709, this one-story irregular-plan building contains approximately 2,574 sq ft, has poured-concrete and concrete-block walls to grade, with the poured-concrete walls being 1 ft thick, and rests beneath a flat roof of reinforced concrete that is also 1 ft thick (Figure 32) (Kerr and Johnson 1968:2; Lundin 1962:35). The building is built into the side of a hill so the lower portion of the northwest (rear) elevation is below grade. During the active period of the HPRR, the hill served as a radiation shield between Buildings 7709 and 7710. Projecting from the northeast and southwest elevations of Building 7710 are wing-shaped concrete retaining walls. From the northwest corner of the building, a conduit, approximately 985 ft long, containing power, signal, and control cables, supported on stanchions, leads to Building 7709 (Chou et al. 1985:3; Lundin 1962:36).

The southeast (façade) elevation of Building 7710 is characterized by a main entry at the north end consisting of a double-leaf entry filled by a pair of single-light metal doors, which open into a concrete-block vestibule sheltered beneath a flat roof with a projecting canopy (Figures 33 and 34). To the left (south) of the entry is a loading dock area sheltered by a flat-roof canopy supported by metal posts (Figure 35). At the south end of the dock is a long concrete ramp. Opening onto the loading dock are two service entries filled by metal roll-up doors and one single-leaf entry piercing the concrete-block addition, filled by a single-light metal door. Piercing the southwest elevation of Building 7710 is a double-leaf entry filled by a pair of single-light metal doors (Figure 36). There is no other visible fenestration on the building.

Building 7710 was originally a rectangular building. In 1967, a concrete-block addition was made to the southeast corner, which contained offices and a conference room. Attached to the southeast elevation of the addition is an open shed-roof shelter set on a concrete foundation, supported by metal posts (Figure 37). Beneath the shelter are three small prefabricated structures, designated as Rooms 122 (Gamma Spectroscopy Laboratory), 123, and 124, added to the site sometime after construction of the concrete-block addition in 1967, which functioned as laboratories. Rooms 122 and 124 are modular structures clad in metal with flat roofs, pierced on the north side by single-leaf entries filled by single-light metal doors. Situated in the middle and connected to the other two structures via doorways on the interior, Room 123 is clad in siding and rests beneath a gabled roof, with single window bays piercing the northeast and southeast elevations.

The interior of Building 7710 contains rooms arranged along a single L-shaped corridor (Figure 38). The building is characterized by concrete floors, portions of which are covered in asbestos tiles; walls of concrete block or concrete, some of which are clad in wood paneling; and ceilings of concrete

or dropped acoustic tiles with flush fluorescent light fixtures. Single- and double-leaf entries are filled by single-light or solid metal doors (Figure 39).

The majority of the rooms functioned as laboratories (Figure 40). A handful of rooms served as offices and meeting spaces, including rooms located in an addition at the southeast corner (Figure 41). A room at the northwest corner of the building functioned as the control room for the HPRR, with an adjacent small observation room (Figures 42 and 43). Approximately midway along the north side of the building was a Count Room, which had concrete walls and ceiling 2 ft thick. An Experiment Preparation room was located on the southeast side, adjacent to the loading dock, where experiment materials were prepared prior to being transported to Building 7709 (Figure 44). Northeast of the preparation room was the Mechanical and Electrical Equipment Room.

Building 7710 was completed in 1962 and functioned as the DOSAR Control and Laboratory Building, housing the controls for the HPRR Facility and multiple laboratories, which were used to conduct research on the effects of radiation and the development of dosimetry standards. The facility was also used to measure radiation levels in various locations throughout the building when the HPRR was in use, including a Count Room that had walls 2 ft thick.

National Register Evaluation

Although research conducted in Building 7710 contributed significantly to the field of Health Physics, the building necessarily operated as part of a collective of DOSAR facilities and was intrinsically connected to Building 7709. Therefore, the building is not recommended eligible for individual NRHP listing under Criterion A. In addition, while several prominent scientists conducted research in Building 7710, none of them individually rise to the level of significance needed for eligibility under Criterion B. Further, the building is a simple utilitarian structure that is not distinguished in its architecture or engineering design. Therefore, CRA recommends that Building 7710 is not individually eligible under Criterion C. Thus, CRA recommends that Building 7710 is not eligible for individual listing under Criterion A, B, or C.

However, Building 7710 remains in its original location within the DOSAR Facility and is largely intact. It retains character-defining features indicative of its historic use, such as the control room with its electrical panels and viewing room, multiple laboratories, the Experiment Preparation Room, and the Count Room with its 2-ft-thick walls. CRA thus recommends that Building 7710 is eligible for NRHP listing as a contributing feature of the proposed DOSAR Facility Historic District under Criterion A in the areas of Medicine and Science, for its association with important research in the field of Health Physics that informed the establishment of radiation dose limits, which had wide-ranging impacts on the protection of human health.

Figure 32. Southeast (façade) elevation of Building 7710, looking southwest.

Figure 33. Main entry for Building 7710 on southeast elevation, looking northwest.

Figure 34. Northeast elevation of Building 7710, looking southwest. At right is a hill that served as a radiation shield between Buildings 7709 and 7710.

Figure 35. Loading dock on southeast elevation of Building 7710, looking northwest.

Figure 36. Southwest and southeast elevations of Building 7710, looking northwest.

Figure 37. Concrete-block addition (at right) on the southeast corner of Building 7710, and a shed-roof shelter (at left) attached to the addition. Beneath the shelter are three prefabricated structures designated as (right to left) Rooms 122, 123, and 124.

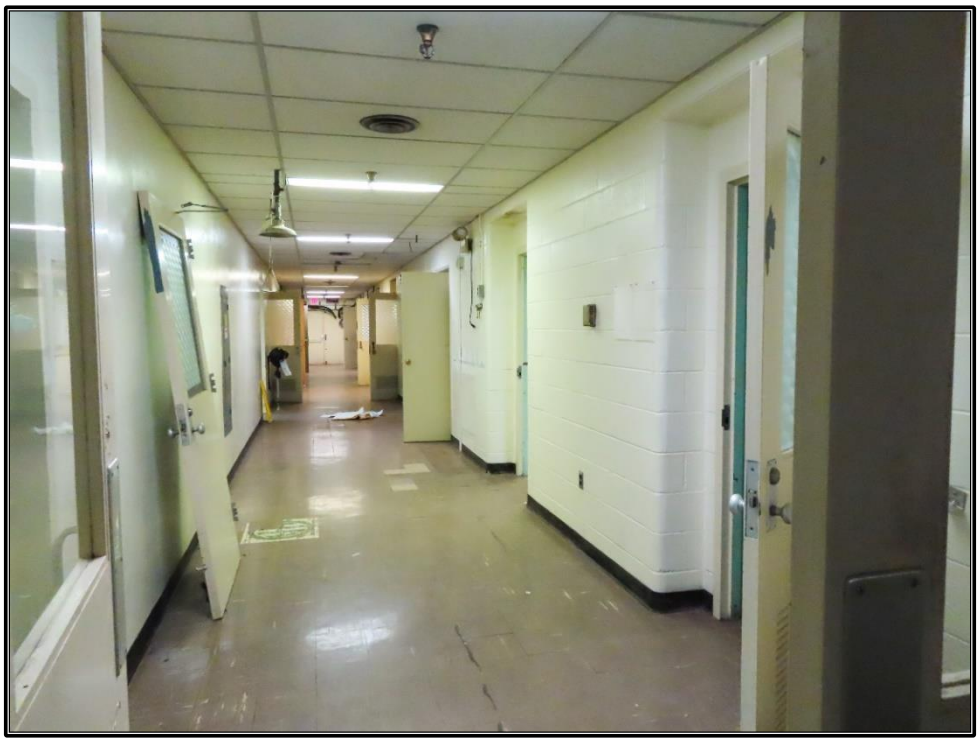

Figure 38. Interior of Building 7710 showing main corridor, looking southwest.

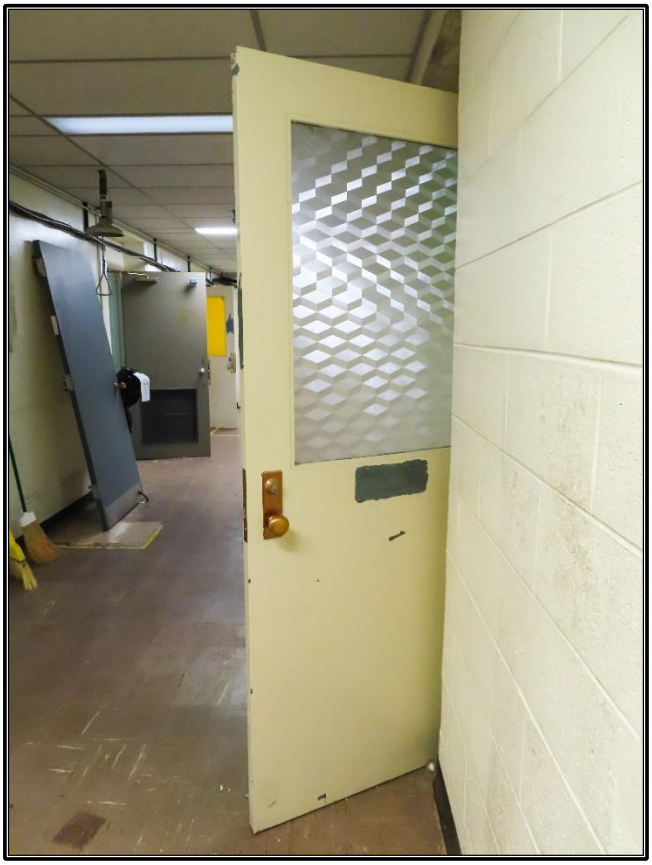

Figure 39. Interior door in Building 7710.

Figure 40. Laboratory (Room 113) in Building 7710, looking north.

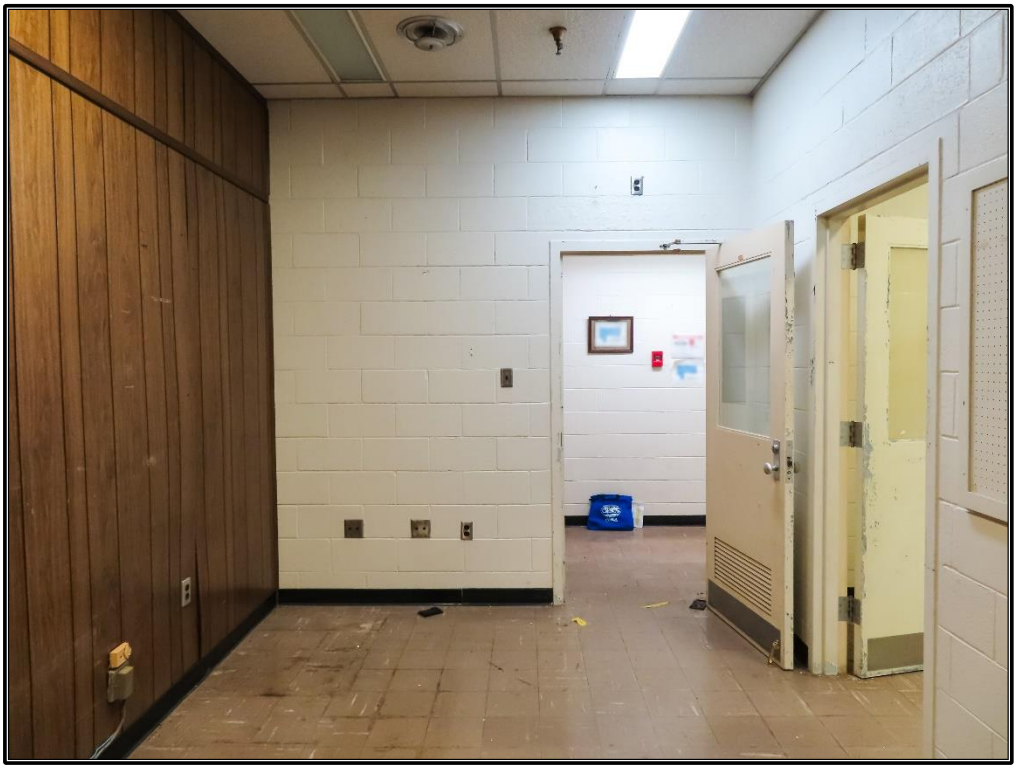

Figure 41. Offices in the northeast corner of Building 7710, looking southeast.

Figure 42. Relay and reactor control room (Room 104) in Building 7710, looking northwest.

Figure 43. Observation room adjacent to the reactor control room in Building 7710, looking southeast.

Figure 44. Experiment Preparation room in Building 7710, looking south.

Building 7712

Building Name

Dosimetry Applications Research Facility, Low-Energy Accelerator Building

Date of Construction

1963–1967

DOE Office Responsibility

Office of Science

NRHP Eligibility

Contributing to the DOSAR Historic District

Description

Located approximately 100 ft northeast of Building 7710 and 900 ft southeast of Building 7709, this one-story irregular-plan building contains 1,122 sq ft and is divided into two distinct rectangular sections, which are connected on the interior by a double-leaf entry (Figure 45). The west portion of the building, which housed the DOSAR Low-Energy Accelerator (DLEA), is 20-x-30 ft, is set on a concrete slab, is clad in metal panels over a steel frame, and rests beneath a gable roof sheathed in metal panels. The east portion consists of concrete-block walls to grade and rests beneath a flat roof with wide metal flashing. The south (façade) elevation of the metal-clad portion is characterized by a single-leaf entry filled by a single-light metal door and a service entry filled by a metal roll-up door (Figure 46). The south (façade) elevation of the concrete-block portion is pierced by a double-leaf entry filled by a pair of metal doors (Figure 47). There are no windows on the building and no other entries (Figure 48). A flat-roofed walkway canopy connects the concrete-block portion to Building 7735 (Radiation Calibration Laboratory [RADCAL] Facility), constructed in 1988.

Originally, Building 7712 consisted of the metal-clad, gable-roof portion of the current building, which was initially considered a temporary structure. In January 1966, a low-energy (200-keV) positive-ion accelerator was acquired by ORNL/Health Physics Division and installed in this "low-scatter" building (Morgan et al. 1966:207–208). The DLEA generated monoenergetic particles (having a narrow range of energies) for important dosimetry and radiobiology experiments (Health Physics Division 1975:57). The accelerator was specifically used as a radiation source for evaluating and calibrating dosimetry and spectrometry systems (Health Physics Division 1966:207). In 1967, the concrete-block portion of Building 7712 was constructed on the east elevation of the metal-clad portion.

The remote control room for the DLEA facility was housed in a trailer located to the south a short distance away, shielded from the accelerator by partial stacked walls of large concrete blocks. Other concrete blocks were positioned around the accelerator building, including a partial wall positioned in front of the service door. The trailer continued to be used as the DLEA control room into the 1980s (Kerr et al 1981:6). In 1988, Building 7735 was constructed on the former trailer site. Currently, Building 7712 is no longer in use.

National Register Evaluation

Although experiments conducted in Building 7712 contributed to the field of Health Physics, research did not uncover notable experiments or prominent scientists directly associated with the building. Therefore, the building is not recommended eligible for individual NRHP listing under Criterion A or B. Further, the building is a prefabricated structure whose architecture exhibits a

common utilitarian form and the concrete-block addition has altered its original footprint. Therefore, CRA recommends that Building 7712 is not individually eligible under Criterion C. Thus, CRA recommends that Building 7712 is not eligible for individual listing under Criterion A, B, or C.

However, CRA recommends that the building is eligible for listing as a contributing feature of the proposed DOSAR Facility Historic District under Criterion A for its association with notable research in the field of Health Physics that took place at ORNL during the 1960s, 1970s, and 1980s.

Figure 45. West and south elevations of Building 7712, looking east.

Figure 46. South (façade) elevation of the west portion of Building 7710, looking northwest.

Figure 47. South and east elevations of the east portion of Building 7712, looking southwest.

Figure 48. East and north elevations of Building 7712, looking west.

RECOMMENDATIONS AND CONCLUSIONS

For the current survey, CRA assessed three buildings (7709, 7710, and 7712) associated with ORNL's DOSAR Facility, and evaluated the potential for an NRHP historic district. CRA recommends that while none of the three buildings are individually eligible for listing, they represent a historic district proposed as the DOSAR Facility Historic District. The boundary of the district is delineated to capture the environs of the three buildings as well as several relevant associated features located within the interstitial landscape. Buildings 7709, 7710, and 7712 are recommended eligible for listing as contributing resources of the historic district. A fourth building within the DOSAR Facility, Building 7735, is less than 50 years old and outside the period of significance, and thus is not considered a contributing feature of the historic district.

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