THE NATION'S URANIUM PROCESSING FACILITY

UPF PROJECT PROCEDURE

Title:	**UPF Fall Prevention and Protection**
Document Number:	**UPF-CP-212**
Revision:	**005**
Page:	**1 of 15**

Prepared by:

Justin Krey,
BNI UPF Field ES&H Representative

04/12/16
Date

Approved by:

Ed Kelley,
BNI UPF ES&H Manager

04/12/16
Date

Approved by:

Gary Hagan,
UPF ES&H Manager

04/12/16
Date

Concurrence by:

Lynn Nolan,
UPF Manager of Construction

04/13/16
Date

Concurrence by:

James W. Sowers,
UPF Quality Assurance Manager

04/15/16
Date

04/18/16
Effective Date

RC-UPF DMC
04/18/16 07:30

This document has been reviewed by a Y-12 DC/RO and has been determined to retain its current classification.
Name : Terry C. Tindell
Title : Y-12 Classification Specialist
Date : 04/15/16

This document has been reviewed by a Y-12 DC / UCNI-RO and has been determined to be UNCLASSIFIED and contains no UCNI. This review does not constitute clearance for Public Release.
Name: Steven A Buffalo Date: 04/04/16

Revision History

Revision	Reason/Description of Change
5	This revision is a complete re-write, therefore no revision bars are shown. This revision further establishes requirements to safely perform work at elevations above 6 feet.
4	Adopted initial issue from Bechtel Core Process 212 at its current revision 4.

Table of Contents

1.0 PURPOSE

This procedure describes the required means for fall prevention and protection for all workers when working or traveling at elevations 6 feet or more above lower levels.

2.0 GENERAL

2.1 Applicability

The procedure is applicable to the Uranium Production Facility (UPF) construction project workers, including subcontractors where fall protection is required and to all workers who use fall protection in the performance of their job.

2.2 Acronyms

CM	Construction Manager
DS	Discipline Superintendent
FSM	Field Safety Manager
FSR	Field Safety Representative
SME	Subject Matter Expert
SRL	Self-Retracting Lifeline
STARRT	Safety Task Analysis Risk Reduction
STR	Subcontract Technical Representative

Definitions

Alternate Fall Protection Plan	A written planning document prepared when it can be demonstrated that the use of conventional fall protection equipment or systems is infeasible; creates a greater hazard; or when fall protection equipment or systems will be used in a manner inconsistent with ordinary or routine use, thus requiring the approval of a qualified person, subject matter expert and/or Field Safety Representative (FSR).
Anchorage Point	A secure point of attachment for lifelines, lanyards, or deceleration devices.
Body Harness	A system of straps designed by a manufacturer that when secured about the worker, distributes the fall arrest forces over at least the thighs, pelvis, waist, chest, and shoulders, with means for attaching the straps to other components of a personal fall-arrest system.
Competent Person	One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
Connector	A device (e.g. snaphook, carabineer, rope grab) that is used to couple (connect) parts of a personal fall-arrest system and positioning-device system together.
Deceleration Device	Any mechanism (e.g., such as a rip-stitch lanyard, specialty woven lanyard, self-retracting lanyards) that serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limit the energy imposed on a worker during a fall arrest.

Excavation	A man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.
Fall Restraint	A fall protection system that prevents the user from falling any distance. The system is comprised of a body harness, along with an anchorage, connectors and other necessary equipment.
Free-fall	The act of falling before a personal fall-arrest system begins to apply force to arrest the fall.
Free-fall Distance	The vertical displacement of the fall-arrest attachment point on the worker's body harness between onset of the fall and just before the system begins to apply force to arrest the fall.
Guardrail System	A barrier erected to identify an unprotected side/edge and protect workers from falling to lower levels.
Lanyard	Wire rope, or strap that generally has a connector at each end for connecting the body harness to an anchorage point or lifeline.
Leading Edge	The advancing or progressing edge of a floor, roof, deck, platform, formwork, walking and or working surface which changes location as additional floor, roof, deck, planks or formwork sections are placed, formed, installed, constructed or erected. Leading edges are considered to be an "unprotected side/edge."
Lifeline	A component consisting of a flexible line for connection of an anchorage at one end to hang vertically (vertical lifeline), or connection to an anchorage at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage point.
Low Slope Roof	"Low-slope roof" is defined as a roof having a slope less than or equal to 4 inches to 12 inches (vertical to horizontal).
Personal Fall Arrest System	A system used to arrest a worker in a fall from a working level.
Positioning Device System	A body harness system rigged to allow a worker to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.
Qualified Person	One who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to fall protection.
Rope Grab	A connector that travels on a lifeline and automatically, by friction, engages the lifeline and locks in place to arrest the fall of a worker.
Self-retracting Lifeline/Lanyard (SRL)	A fall protection device containing a drum-wound line that can be slowly extracted from, or retracted onto, the drum under slight tension during normal worker movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.
Walking/Working Surface	Means any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, formwork and concrete reinforcing steel but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.
Warning line systems	Means a barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge which designates an area in which roofing work may take place without the use of

guardrail, full body harness, or safety net systems to protect employees in the area.

3.0 RESPONSIBILITIES

3.1 Construction Manager – has the overall responsibility for ensuring the implementation of this procedure, ensuring that all project personnel actively participate; and provides worker support, facilities, and other resources necessary to effectively carry out this procedure.

3.2 Field Safety Manager – has the overall authority for interpretation of the regulations associated with the procedure and the interpretation of the procedure as to intent and application.

3.3 Field Safety Representative – has the responsibility of compliance oversight with the procedure through periodic field inspections and is responsible for supplying technical advice and interpretation of the environmental, safety, and health codes included in the procedure. A FSR with knowledge and experience in the applications of fall protection can a competent person by definition of this procedure.

3.4 Discipline Superintendent – is responsible for being thoroughly familiar with this procedure and their individual responsibilities regarding compliance with and implementation of this procedure.

3.5 Engineering – is responsible for calculations and approval of job manufactured fall protection system components such as vertical and horizontal lifeline stations, rebar/ wall anchorage points, etc. A designated engineer with knowledge and experience in the dynamics of fall protection can a qualified person by definition of this procedure.

3.6 Supervisor – is responsible for ensuring the applicable safety controls and processes are incorporated into planning and execution of the work and that the workers are implementing and complying with this procedure within their area of responsibility.

3.7 Subcontract Technical Representative – is responsible for being familiar with this procedure and specific individual responsibilities regarding implementation as well as providing this procedure to subcontractors working at the UPF construction site with directions to follow the procedure.

3.8 Workers – are responsible for evaluating their work for fall hazards and using the appropriate fall protection system and/or fall protection equipment assigned to the work they perform. The worker is responsible for inspecting their personal fall protection equipment prior to each use.

4.0 TRAINING

- All workers exposed to a fall hazard of 6 feet or more will be trained and educated in fall hazard recognition, fall protection systems and equipment, and this procedure. Workers will be retrained when the training program or equipment has been changed or the worker exhibits inadequacies in knowledge or the use of fall protection systems and equipment.
- This procedure does not address every situation in which fall hazards could occur. The Job Hazard Analysis (JHA) and Safety Task Analysis Risk Reduction Talk (STARRT) process assist the worker to identify fall hazards at the work location. Only through appropriate planning can fall hazards be determined, proper fall protection systems identified and equipment provided.

5.0 PRIMARY FALL PROTECTION SYSTEMS

- Primary fall protection systems provide walking and working surfaces in elevated areas that are free from floor openings, are equipped with standard guardrail systems on all open sides, including closure apparatus for fixed ladder openings or other points of access when required.
- These systems include scaffolds, aerial lifts (e.g., articulating boom, scissor), and other approved personnel hoisting devices but does not include portable ladders.
- Hole covers are used to close openings and holes in floors, platforms, and walkways, see *Floor and Wall Openings/Holes* (UPF-CP-225).

6.0 SECONDARY FALL PROTECTION SYSTEMS (PERSONAL FALL ARREST SYSTEMS)

- Where there is a fall hazard and an absence of a primary fall protection systems, then secondary fall protection systems or personal fall arrest systems (e.g., safety harness and lanyard) must be used.
- Personal fall protection equipment purchased or used on the UPF project shall meet minimum requirements for the manufacture of fall protection found in American National Standards Institute, ANSI Z359-2007 – Fall Protection Code.
- Workers are prohibited from bringing and using their own fall protection equipment at the UPF Jobsite. Only safety harness/lanyard systems furnished by the employer/contractor/subcontractor are to be used at the UPF Jobsite.
- Fall-arrest systems shall be installed such that a worker cannot free-fall more than 6 feet, nor contact any lower level. When a work activity requires a worker to connect to an anchorage point positioned at or below waist level an alternate fall protection plan will be prepared in accordance with Section 6.4.14, Alternate Fall Protection Plan.

  See Appendix A – *Fall Clearance* for minimum anchorage height and determination of fall clearance requirements.

Note: Fall protection devices and systems shall not be used for any other purpose other than employee safeguarding.

6.1 Quarterly Inspections

- Secondary fall protection systems and associated equipment shall be inspected quarterly by a person familiar and knowledgeable with these systems. The applicable quarter's color will be clearly marked on the piece of equipment.

Quarter	Months	Color
1	January, February, March	Yellow
2	April, May, June	Green
3	July, August, September	Red
4	October, November, December	Blue

- The inspections are to be documented using form Safety Condition Inspection (UCN-23239) and identified as being inspected using the UPF Jobsite quarterly inspection tagging system.

- For equipment found to be damaged or unacceptable for future use, tag and process the equipment in accordance with procedure *General Safe Work Practices* (UPF-CP-200), Section 4.4.

6.2 Anchorage Points/Anchors

Whenever full body safety harnesses are used they must be attached to a secure anchorage point. Anchorages and anchorage connectors must be independent from all other uses and capable of supporting 5,000lb per employee attached, or designed, installed, and used under the supervision of a qualified person as part of a complete personal fall arrest system. Common anchorage points include installed structural steel I-beams, columns, rebar, and other structural components.

6.2.1 Anchorage Connectors

Anchorage connectors are designed as the intermediary for securing a connecting device (e.g. lanyard) to an anchor or anchorage point, also referred to as a tie-off point. Anchorage connectors are used to join the connecting device to the anchor point when a direct connection does not exist. Common anchorage connectors include web beam straps, beam/column clamps, and structural steel connector toggles.

6.2.2 Fall Restraint Anchor Points

Fall restraint systems have the capacity to withstand at least 3,000lb of force or twice the maximum expected force that is needed to restrain the person from exposure to the fall hazard. In determining this force, consideration should be given to site-specific factors such as the force generated by a person walking, leaning, or sliding down the work surface.

6.2.3 Non-Traditional Anchor Points (e.g. Crane Hook)

- When the anchorage point is not designed for this use (such as the crane's hook), a qualified person evaluates the anchorage point and documents in an Alternate Fall Protection Plan (Section 6.4.14).
- A personal fall arrest system is permitted to be anchored to the crane/derrick's hook (or other part of the load line) where all of the following requirements are met:
  (a) A qualified person has determined that the set-up and rated capacity of the crane/derrick (including the hook, load line and rigging) meets or exceeds the requirements of supporting 5,000lb per employee attached.
  (b) The equipment operator is at the work site and informed that the equipment is being used for this purpose.
  (c) No load is suspended from the load line when the personal fall arrest system is anchored to the crane/derrick's hook (or other part of the load line).

6.3 Lifelines

6.3.1 Horizontal Lifelines

- Pre-engineered lifelines shall be secured above the point of operation to an anchorage or structural member meeting the requirements of the system manufacturer. Lifelines are installed to provide mobility to personnel working

in elevated areas. Installation of lifelines will be given priority as structures are erected.

- Application, installation, and maintenance of horizontal lifeline systems must be in accordance with the manufacturer's requirements or the direction of a qualified person by workers familiar with these systems.
- Tags or signs indicating the maximum number of persons allowed to be attached to a lifeline shall be affixed to each end of the lifeline.
- Lifelines will not be used for any purpose other than fall protection (e.g. handrail).

6.3.2 Static Rope Lifelines (Vertical)

- A vertical lifeline is used for personnel fall protection when vertical mobility is required. Vertical lifelines consist of static lifelines made of synthetic fiber rope or cable equipped with an approved rope grab.
- Sliding rope grabs approved for the size of the synthetic fiber rope or cable is the only approved method for securing a safety lanyard to a vertical lifeline. Lanyards will not be attached to a vertical lifeline by means of knots or loops.
- Rope grabs will be positioned on the vertical lifeline, as a minimum, above the worker's shoulders.
- Only one worker shall be attached to a vertical lifeline at a time.

6.3.3 Self-Retracting Lifelines (SRL)

- Except as otherwise required, directed and/or approved by a qualified person, subject matter expert (SME) and/or FSR, SRLs are to be secured in accordance with the manufacturer's recommendations.
- Only one worker shall be attached to a SRL at any time.
- An 18 inch D-ring extension may be used between the SRL attaching hook and the user's harness back D-ring.
- Do not attach a standard lanyard to a SRL.

Note: When SRLs are anchored at an elevation that cannot be reached from the working level a rope tag line will be used to allow the lifeline to extend to the work level and attach to the user's harness, the rope tag line will also be used to allow the lifeline to retract when not in use.

6.4 Activities/Equipment Requiring Fall Protection

6.4.1 Suspension Scaffold Devices (Spyders and Ski-Climbers)

- Workers riding in or working from suspension scaffold devices will wear approved safety harnesses and lanyard systems. Each worker will be provided an independent vertical lifeline and rope grab or self-retracting lifeline. Workers using a suspension scaffold device will be secured to the independent lifeline at all times.
- Anchorage points used for attachment of personal fall protection equipment shall be independent of any anchorage being used to support or suspend platforms.

6.4.2 Suspended Personnel Platforms (Manbasket)

Workers riding in or working from a suspended personnel platform must wear approved safety harnesses/lanyard systems and secure their safety lanyard to the

lift basket anchorage point or to a collar chain/sling that is attached to the crane hook at all times. See *Suspended Personnel Platforms* (UPF-CP-219) for additional requirements.

6.4.3 Aerial/Scissor Lifts

- Workers riding in or working from aerial lifts and scissor lifts must wear an approved safety harness/lanyard system with the lanyard secured to the platform anchorage point at all times such that a worker cannot free-fall more than 6 feet nor contact any lower level.
- Aerial/scissor lifts may be used to access elevated areas or structures by exiting or entering the lift platform under the following requirements:

  (a) The job must be evaluated to ensure that the use of an aerial lift is the safest means to access the elevated area or structure.

  (b) The DS responsible for the work and the area FSR must approve exiting or entering the aerial lift platform at elevation and document the approval on the task STARRT Card.

  (c) Workers must use the lift manufacture's access point (e.g., gate, slide bar) when entering or exiting the lift. Climbing on and/or over any part of the railing system is prohibited.

  (d) Workers must be provided appropriate fall protection equipment during elevated work: in the aerial lift, during movement to and from the lift and to and from the elevated area or structure, and while on the elevated area or structure.

6.4.4 Ladders

See *Portable Ladders - Control and Use* (UPF-CP-222) for requirements.

6.4.5 Temporary Work Platforms, Walkways, and /or Scaffolds

- Every effort will be made to ensure that all temporary work platforms, walkways, and scaffolds are equipped with solid decks free of openings.
- Workers working from or traveling on temporary work platforms, walkways, or scaffolds must be provided with appropriate fall protection equipment.
- Personnel who work or position their body through or over a protective railing must secure their lanyard to an approved anchorage point.

6.4.6 Skeletal Steel, Open Structures, and Steel Erection

- This section deals with fall protection when workers are required to gain access to travel and work in skeletal steel and open structures. This includes traveling on or working from any elevated surface that is not designed as a walking or work surface (e.g., pipe and/or cable tray).
- Workers working or traveling in elevated skeletal steel and open structures 6 feet or more or adjacent to a completed surface with a leading edge will wear an approved safety harness and lanyard system and be tied off.
- The use of aerial lifts will be maximized as the safest method of vertical travel in structural steel elevations. Where infeasible, the use of properly placed and secured access ladders will facilitate vertical travel.

- Horizontal and vertical lifeline systems will be provided in skeletal steel and open structures to allow appropriate fall protection for workers working or traveling in these structures.
- In lieu of lifelines, workers may secure safety lanyards to substantial, stationary, structural-steel members, welded pipe, and pipe supports capable of supporting 5000lb per Engineering review and approval. Workers will not secure lanyards to cable tray, conduit, or small-bore screw pipe.

6.4.7 Reinforcement Steel and Concrete Form Work

- Fall protection during steel and concrete formwork activities can be achieved using retractable lifelines, static lifelines, rope grabs, or double lanyards.
- Workers working on rebar or formed walls and elevated piers generally require a work-positioning assembly that is *NOT* to be used in lieu of fall protection.
- Installation of rebar anchorage points:
  (a) Rebar used as an anchorage point for the connection of personal fall arrest systems is only installed by persons who possess knowledge; training and experience in the proper installation, attachment, and connection of rebar and rebar systems.
  (b) Install rebar anchorages in accordance with designs, specifications, drawings and/or instructions approved and verified by a qualified person.
- On concrete form walls, workers will use patented construction form (e.g. Symons) tie-off attachments to secure safety lanyards or SRLs. These attachment points are to be used when placing concrete forms at elevations 6 feet or greater where a fall exposure exists or where there is a potential exposure to an impalement hazard.
- These workers will receive specific instruction regarding equipment to be used and the fall protection practices to be implemented.

6.4.8 Permanent Structures, Low Slope Roofs, Stairs, and Ladders

- Workers working or traveling on permanent decks, floors, and walkways that are free of fall exposures are not required to wear a safety harnesses and lanyard system, provided they can access the elevations by completed permanent stairs, scaffold stair towers, approved ladder, or elevators.
- Warning line systems can be utilized to protect works from fall hazards on a low-slope roof provided they are erected and maintained per the requirements of procedure *Barricades and Signs* (UPF-CP-214), Section 4.4.
- When none of the above can be applied, establish an Alternate Fall Protection Plan as found in this procedure.
- Priority will be given to the installation and securing of permanent floors, walking surfaces, stairs, and all guardrails and other permanent fall protection devices.
- Only authorized workers (e.g. *structural* ironworkers) involved in work activities associated with the installation of fall prevention systems shall work on floors or walkways that are incomplete. These workers must be provided with secondary fall protection systems.

6.4.9 Grating, Floor Plate, and Handrail Removal/Modification

All modifications or changes made to completed/permanent elevated surfaces that will create a fall hazard must follow the requirements of *Floor and Wall Openings/Holes* (UPF-CP-215).

6.4.10 Crane Assembly, Disassembly, Maintenance and Operations

- Originally-equipped steps, handholds, ladders and guardrails/railings/grab rails are to be maintained in good condition.
- Fall protection is not required when using crane catwalks to access the crane cab, access maintenance hatches or conduct daily pre-operational inspections and checks; provided that, workers remain firmly on the catwalk and utilize the crane grab rail system.
- Working on any part of the equipment over 6 feet above the ground or lower level without fall protection is prohibited.
- Fall protection will be provided during rigging and crane assembly/dismantling operations using appropriate fall protection systems. Attachable anchor devices (e.g. beam strap) must be anchored to an apparently substantial part of the equipment (e.g. chords and lacings) capable of supporting at least 5,000llb per employee attached.
- Aerial lifts and ladders will be the preferred method of access work areas during assembly/dismantling operations.

6.4.11 Off-Loading Trailers

When off-loading trailers during which a fall exposure of 6 feet or greater exists, workers must be provided appropriate fall protection.

6.4.12 Excavations/Trenching

When an excavation with vertical banks and depths of 6 feet or more is created (in conjunction with a trench box or other shoring/shielding system), workers shall be protected from falls into excavation by means of standard guardrail systems, or other approved barricade systems). This protection will guard the entire perimeter of the fall hazard and is separate from ‘soft’ barricades identifying the excavation itself.

6.4.13 Safety Nets

Safety nets can be used in some situations as secondary fall protection. Use and installation of nets, when required, will be discussed with the FSM for approval. Nets will be installed by qualified workers, in accordance with specifications provided by the net manufacturer.

6.4.14 Alternate Fall Protection Plan

- When it can be demonstrated that the use of conventional fall protection equipment or systems (e.g., fall restraint, fall arrest systems) are infeasible; creates a greater hazard; or when conventional fall protection equipment or systems will be used in a manner inconsistent with ordinary or routine use requiring the approval of a qualified person, SME and/or FSR, an alternate fall protection plan is to be prepared and implemented using form Alternate Fall Protection Plan (UCN-26359).
- The alternate fall protection plan is to be prepared by a qualified person in conjunction with supervision, FSR and workers engaged in the work. The alternate fall protection plan must conform to the following:

(a) The alternate fall protection plan shall be prepared by a qualified person and developed specifically for the work activity (e.g. scaffold erection) or site where the work is being performed.
(b) Any changes to the alternate fall protection plan shall be approved by the qualified person. Open plans must be reviewed and reapproved every six (6) months.
(c) A copy of the alternate fall protection plan shall be maintained with the work package. Record plans will be filed with Document Management Control.
(d) The implementation of the alternate fall protection plan shall be under the supervision of a competent person.
(e) The alternate fall protection plan shall include a written discussion of other control measures that will be taken to reduce or eliminate the fall hazard for workers who cannot be provided with protection from conventional fall protection equipment or systems.
(f) Workers engaged in work under an alternative fall protection plan are to be briefed as to its requirements prior to commencing work covered under the plan.

7.0 RECORDS

All records generated as a result of this procedure are maintained in accordance with Y15-101, *Records and Controlled Documents*, and Y15-95-800, *UPF Document Management.*

- Alternate Fall Protection Plan, (UCN-26359)
- Safety Condition Inspections, (UCN-23239)

8.0 REFERENCES

8.1 Source References

- 10 CFR 851, *Worker Safety and Health Program*
- 29 CFR 1926.95, *Criteria for personal protective equipment*
- 29 CFR 1926.104, *Safety Belts, Lifelines, Lanyards*
- 29 CFR 1926.500, Subpart M, *Fall Protection*
- 29 CFR 1926.750, Subpart R, *Steel Erection*
- 29 CFR 1926.760, Subpart R, *Fall Protection*
- Bechtel ES&H Core Process 212, *Fall Protection*
- ANSI Z359 – 2007, *Fall Protection Code*

8.2 Interfacing References

- UPF-CP-222, *Portable Ladders – Control and Use*
- UPF-CP-214, *Barricades and Signs*
- UPF-CP-200, *General Safe Work Practices*
- UPF-CP-205, *Personal Protective Equipment*
- UPF-CP-215, *Floor and Wall Openings/Holes*

- UPF-CP-219, *Suspended Personnel Platforms*
- UPF-CP-224, *Aerial/Scissor Lift Operations*
- Y17-95-64-822, *Site Excavation and Backfill*

9.0 EXHIBITS / APPENDICES / FIGURES

Exhibit A, *Fall Clearance*

Exhibit A
Fall Clearance

Before identifying an anchorage point, determine the potential free-fall and deceleration distance that may be encountered if a fall occurs.

When using a fall arrest system, the overall fall distance calculation needs to account for:

1) the length of the anchorage connector, **plus**
2) the length of the connecting device, **plus**
3) the deceleration distance, (maximum 3.5 feet) **plus**
4) the stretch/movement of the harness and Back D-ring, **plus**
5) the height of the D-ring attached to the back of the worker's harness (or the height of the worker wearing the equipment) **and**
6) a safety factor of 3 feet.

Taking into account all of the variables above, the minimum anchorage height required for a fall arrest system to be effective in preventing contact with a lower level is 18.5 feet.

The diagram below illustrates the method described above.

In addition to fall distance, if the anchorage point is not positioned directly overhead, a swing fall or pendulum effect can occur which could lead to serious injury. When selecting an anchorage point also consider the pendulum effect.