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**SAFETY AND SAFEGUARDS EVALUATION REPORT**  
**RENEWAL OF LICENSE SNM-42 FOR**  
**BWX TECHNOLOGIES, INC., IN LYNCHBURG, VA**  
**DOCKET NUMBER 70-27**  
**DECEMBER 2007**

Enclosure 2

[REDACTED]

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## LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	As low as is reasonably achievable
ANSI	American National Standards Institute
ANSI/ANS	ANSI/American Nuclear Society
AOA	Area of Applicability
Bq	Becquerel
BWXT	BWX Technologies, Inc.
CAAS	criticality accident alarm system
CEDE	Committed Effective Dose Equivalent
CFR	Code of Federal Regulations
cm	centimeter
DAC	Derived Air Concentration
DFP	Decommissioning Funding Plan
[REDACTED]	[REDACTED]
dpm	disintegrations per minute
EH&S	Environmental Health & Safety
EPA	Environmental Protection Agency
ERPG	Emergency Response Planning Guideline
FNMC Plan	Fundamental Nuclear Material Control Plan
g	gram
HAZOP	hazard and operability
HEPA	High efficiency particulate air
ICRP	International Commission on Radiation Protection
IDLH	immediately dangerous to life and health
IROFS	Items relied on for safety
ISA	Integrated safety analysis
kg	kilogram
LTC	Lynchburg Technology Center

m	meter
MC&A	Material control and accounting
mc	millicuries
mCi	microcuries
mg	milligrams
mrem	milli-REM
MSDS	Material Safety Data Sheet
mSv	milli-Sievert
NCS	Nuclear criticality safety
NFPA	National Fire Protection Association
NPD	Nuclear Products Division
NRC	Nuclear Regulatory Commission
OSHA	U.S. Occupational Safety and Health Administration
PSP	Physical Security Plan
QA	Quality assurance
RMP	Risk Management Plan
RP	Radiation protection
RWP	Radiation Work Permit
SAR	Safety Analysis Report
SCP	Safeguards Contingency Plan
SER	Safety Evaluation Report
SNM	Special Nuclear Material
SNM-LSS	Special Nuclear Material - Low Strategic Significance
SSC	Structures, systems, and components
TLD	Thermoluminescent dosimeter
USL	upper subcritical limit
UV	ultra-violet



## 1.0 GENERAL INFORMATION

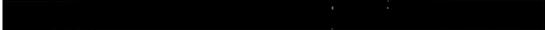
### 1.1 FACILITY AND PROCESS DESCRIPTION

#### 1.1.1 PURPOSE OF REVIEW

The purpose of the U.S. Nuclear Regulatory Commission's (NRC's) review of BWX Technologies, Inc.'s (BWXT) site and process description was to determine whether the license renewal application (the application) met the requirements of 10 CFR 70.22, "Contents of Applications," and 10 CFR 70.65(b)(1), (b)(2), and (b)(3), "Additional Content of Applications." The staff's review was to determine that the renewal application included an overview of the site layout, and a summary description of its manufacturing process.

#### 1.1.2 STAFF REVIEW AND ANALYSIS

In Chapter 1 of the license renewal application and in the associated Environmental Report, BWXT provided a summary description of the site and facility. The description included discussion of site utilities and services. The staff concluded that the description of the site and facility was adequate for the staff's understanding of the site and facility, and was consistent with the ISA Summary.

BWXT's Safety Analysis Reports provided a description of the site processes. The description included the major chemical and mechanical processes to be used at the site, and included identification of raw materials, by-products, wastes and finished products. BWXT uses special nuclear material (SNM) in the production of .

In Section 1.4 of the license renewal application, BWXT specified material possession limits and constraints, including the chemical and physical form of the material, and its quantity limit for the license. The possession limits included raw materials, by-products, wastes, finished materials, and materials on-site for research.

#### 1.1.3 EVALUATION FINDINGS

The staff reviewed the general site description for BWXT according to Section 1.1 of the Standard Review Plan (SRP). BWXT adequately described the site and processes so the staff had an overall understanding of the relationships of the facility features and the function of each feature. BWXT cross-referenced its general description with more detailed descriptions elsewhere in the application. The staff concluded that BWXT complied with the general requirements of 10 CFR 70.22, "Contents of Applications," 10 CFR 70.60, "Applicability," and 10 CFR 70.65(b)(1), (2), and (3), "Additional Content of Applications," as applicable to this section.



## **1.2 INSTITUTIONAL INFORMATION**

### **1.2.1 PURPOSE OF REVIEW**

The purpose of NRC's review of institutional information was to establish whether the application included adequate information identifying BWXT, the its characteristics, and the proposed activity.

### **1.2.2 STAFF REVIEW AND ANALYSIS**

#### **1.2.2.1 Corporate Identity**

The application identified BWXT's full name and address, the site location, the location of incorporation of the company, and the location of the corporate office. The application also described control and ownership of the company, and whether any other company is present or operates on the site to be licensed. BWXT is not owned, controlled, or dominated by an alien, foreign corporation, or foreign government.

#### **1.2.2.2 Financial Qualifications**

In order to make a finding on the financial qualification of BWXT to engage in the proposed activity, the staff reviewed the following documents: (1) McDermott International, Inc., "A Better Horizon, The 2005 Annual Report;" (2) "Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934, for McDermott International, Inc., a Panama-registered company; and (3) and Decommissioning Funding Plan, that is, Chapter 10 of BWXT's license application.

Based on the review of the annual reports pertaining to BWXT's Lynchburg operations, and the Decommissioning Funding Plan (previously approved in License Amendment #113, dated June 30, 2006), the staff found that BWXT demonstrated that it has current and continuing access to financial resources necessary to engage in the proposed activity, in accordance with 10 CFR 70.23(a)(5).

#### **1.2.2.3 Type, Quantity, and Form of Licensed Material**

In accordance with 10 CFR 70.22(a)(2) and (4), BWXT described the types, forms, quantities, and proposed authorized uses of licensed materials to be permitted at this site as follows:





<b>Table 1</b>		
<b>Material Type</b>	<b>Chemical and/or Physical Form</b>	<b>Maximum Quantity<sup>1</sup></b>
Uranium enriched in U-235	[REDACTED]	[REDACTED]
Uranium enriched in U-235	[REDACTED]	[REDACTED]
U-233	[REDACTED]	[REDACTED]
Plutonium	[REDACTED]	[REDACTED]
Plutonium	[REDACTED]	[REDACTED]
Source material	[REDACTED]	[REDACTED]
Am-241	[REDACTED]	[REDACTED]
Np-237	[REDACTED]	[REDACTED]
Any byproduct material	[REDACTED]	[REDACTED]
Byproduct material with Atomic Nos. 1-83	[REDACTED]	[REDACTED]
Fission products & transuranium elements	[REDACTED]	[REDACTED]
Fission products & transuranium elements	[REDACTED]	[REDACTED]
Fission products & transuranium elements	[REDACTED]	[REDACTED]
Fission products & transuranium elements	[REDACTED]	[REDACTED]
In-114m	[REDACTED]	[REDACTED]
Yb-169	[REDACTED]	[REDACTED]
Cf-252	[REDACTED]	[REDACTED]





Table 1		
Material Type	Chemical and/or Physical Form	Maximum Quantity <sup>1</sup>
H-3	[REDACTED]	[REDACTED]
H-3	[REDACTED]	[REDACTED]
H-3	[REDACTED]	[REDACTED]
U-232	[REDACTED]	[REDACTED]
Po-210	[REDACTED]	[REDACTED]
Pu-239 in greater than Class C waste from Parks Township	[REDACTED]	[REDACTED]
Transuranium elements in greater than Class C waste from Parks Township	[REDACTED]	[REDACTED]
<sup>1</sup> maximum form and quantity to be possessed at any one time.		

1.2.2.4 Authorized Uses

BWXT's authorized activities were proposed in Section 1.5 of its license application, as follows:

- BWXT's Nuclear Products Division may fabricate nuclear fuel, nuclear [REDACTED] for the [REDACTED]. [REDACTED] BWXT may also perform recovery/disposal operations of scrap fuel generated by BWXT and other organizations, including [REDACTED].
- BWXT may operate a waste compactor for processing waste generated at the site.
- The fire water system may be utilized by local off-site fire fighting organizations during emergency conditions when fighting fires in the vicinity of the site, except as specified in Chapter 9, Section 9.4.3.
- Byproduct material in the form of sealed sources with activities of up to [REDACTED] may be possessed and used in locations other than the BWXT site for performing instrument calibration, electronic noise analysis, shielding studies, or similar operations.



[REDACTED]

[REDACTED]  
right-of-way with a fence line based on radiation levels not exceeding an exposure dose rate of 500 millirem/year.

- Licensed material may be used in the performance of Research and Development and laboratory analyses [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]
- BWXT may transport and possess licensed material in private carriage to authorized NRC licensees, and licensees licensed by agreement states, pursuant to the regulations in 10 CFR 71 and Title 49 CFR.
- Licensed material may be used in connection with the operation of two laundries that are used for cleaning contaminated and uncontaminated clothing.
- BWXT shall inform the NRC within 30-days of receiving official notification when the state-permitting agency issues violations or modifies the requirements of the state-issued National Pollution Discharge Elimination System (NPDES) permit, or the air quality permit.
- The possession and use of the types, forms, and quantities of material listed in Chapter 1, Section 1.4; I, K, M, R, S, T, U, V, W and X shall be restricted to designated areas at [REDACTED]
- The possession and use of [REDACTED] SNM at the LTC and Waste Treatment Facility shall each total less than [REDACTED], as defined in 10 CFR 70.4.
- Licensed material may be used in the performance of repairs and modifications to radioactive and contaminated [REDACTED] received from other companies, or BWXT divisions.
- BWXT may utilize licensed material in the fabrication of [REDACTED]  
[REDACTED]
- Notwithstanding the requirements in 10 CFR 20.1904 for labeling containers of licensed material, BWXT may post a warning sign at all entrances to the Nuclear Products Division (NPD) Manufacturing Facility stating that any container within the NPD Manufacturing Facility may contain licensed material, or words to that effect. The requirements of 10 CFR 20.1904 shall apply to all other areas at the BWXT site.

[REDACTED]

[REDACTED]

- The limits specified in, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," dated April 1993, shall be used for determining the acceptability of levels of contamination on materials and equipment released for unrestricted use.
- In addition to the financial assurance mechanisms specified in 10 CFR 70.25 for decommissioning funding, BWXT may provide such financial assurance through provisions in contracts and subcontracts with federal government agencies. BWXT is not required, until decommissioning is imminent, to submit decommissioning cost estimates, as required by 10 CFR 70.25(e), [REDACTED]
- BWXT may perform enrichment adjustment operations of authorized material.
- BWXT may receive and perform cleaning operations for the purpose of recovering uranium from UF<sub>6</sub> shipping containers that have been exhausted of UF<sub>6</sub> in gaseous form prior to receipt.
- BWXT may process Uranium/Beryllium materials for the purpose of recovering uranium.
- BWXT may receive and store greater than Class C waste from the BWXT facility located in Leechburg, PA, (Parks Township) as provided for in Items W and X of [Section] 1.4 [of the license application].
- Derived Air Concentration (DAC) and Annual Limit for Intake (ALI) values based on dose coefficients, published in ICRP Publication No. 68, shall be used in lieu of values in 10 CFR 20, Appendix B, in accordance with internal procedures.
- BWXT may perform dissolution of uranium [REDACTED].

#### 1.2.2.5 Special Exemptions or Special Authorizations

BWXT has not received any exemptions or authorizations, "of an unusual nature," that are necessary to be listed in this section. BWXT's exemptions and special authorizations are given in the material license and Chapter 1 of its license application, respectively, and have been reviewed in this evaluation.

#### 1.2.2.6 Security of Classified Information

By letter dated May 31, 2000, [REDACTED]  
[REDACTED]  
[REDACTED] accept responsibility for the NRC's

[REDACTED]

[REDACTED]

interest in protecting classified information at BWXT. By letter dated October 27, 2000, from [REDACTED] approved the following security plans for classified information: (1) "Security Plan for Safeguarding Classified Matter at BWXT, Nuclear Products Division, dated May 21, 2003, and subsequent revisions, and (2) Security Plan for Control of Foreign Nationals [REDACTED], dated March 4, 2003, and subsequent revisions.

### 1.2.3 EVALUATION FINDINGS

The staff reviewed the institutional information for BWXT according to Section 1.2 of the SRP. On the basis of the review, the NRC staff has determined that the applicant has adequately described and documented the corporate structure and financial information, and is in compliance with those parts of 10 CFR 70.22 and 10 CFR 70.65, related to other institutional information. In accordance with 10 CFR 70.22(a)(2) and (4), BWXT adequately described the types, forms, quantities, and proposed authorized uses of licensed materials to be permitted under the license.

BWXT's proposed activities are consistent with the Atomic Energy Act of 1954, as amended. BWXT provided all institutional information necessary to understand the ownership, financial qualifications, location, planned activities, and nuclear materials to be handled in connection with the requested license.

## 1.3 SITE DESCRIPTION

### 1.3.1 PURPOSE OF REVIEW

The purpose of this review was to determine whether the information provided by BWXT adequately described the geographic, demographic, meteorologic, hydrologic, geologic, and seismologic characteristics of the site and surrounding area. The site description is a summary of the information that BWXT used in preparing the Environmental Report, Emergency Plan, and ISA Summary.

### 1.3.2 STAFF REVIEW AND ANALYSIS

BWXT provided site information in the integrated safety analysis (ISA) Summary and the Environmental Report, submitted with the application and the Emergency Plan. The ISA Summary described the facility site, nearby highways, railways, industries, and bodies of water; nearby public facilities, historic and cultural landmarks, and land use; site meteorology, including wind, precipitation, and severe weather; the local surface water and ground water hydrology, including water quality and water use; the regional and local geology and seismology, including geologic and tectonic conditions, seismic history, and seismicity in the area.



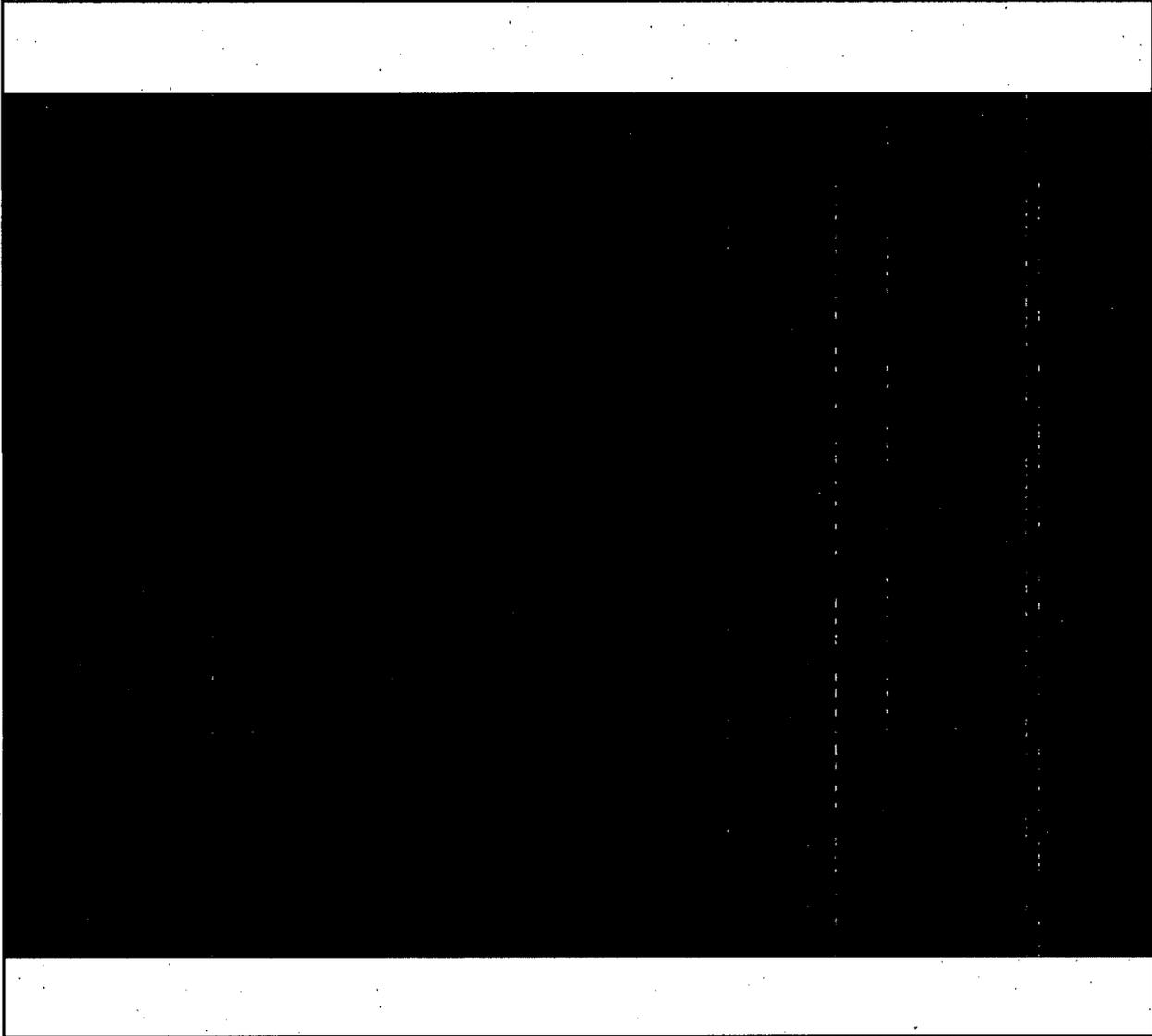
BWXT is located along the James River, about 2 miles east of Lynchburg, Virginia, on a 525-acre site in Campbell County. A topographic site map (Figure 1) shows the location of the BWXT facilities. A more detailed map is provided in Figure 2. Figure 3 gives detail of the LTC facility.

**Figure 1 - Topographic Map of BWXT Site**





**Figure 2 - BWXT Site Layout**



[REDACTED]

**Figure 3 - Lynchburg Technology Center**



The NPD manufacturing building is divided into many [REDACTED], by the differing operations performed. The principal activities of the LTC is research and development.

#### 1.3.2.1 Site Geography

The BWXT site is located on 476 acres [REDACTED]. Ground surface elevations range from approximately 460 feet above sea level at the river, to approximately 700 feet above sea level. [REDACTED]. The nominal elevation of the James River is 458 feet above mean sea level. The highest point in the vicinity of the site is Mt. Athos, to the southeast, which rises to an elevation of 890 feet above mean sea level. The Wastewater Treatment Facility (WTF) was built at an elevation of 488 feet above mean sea level. The main manufacturing facility is 568 feet above mean sea level. There are three primary industrial areas of the site. The NPD facility and LTC facility are located in the central part of the site. The WTF is north of the NPD facility nearer to the river. There are also effluent ponds located around the waste treatment area. In addition, there are two former industrial landfills located to the west of the waste treatment area. The status of these areas has been documented in correspondence between BWXT and the NRC.

[REDACTED]



The primary uses of land adjacent to the site include industrial, agricultural, and unused woodlands. The areas utilized for industrial purposes are to the east and south. To the southeast is the AREVA NP, Inc. site (formerly known as Framatome ANP, Inc.), an NRC licensed facility, which supports commercial nuclear fuel fabrication and [redacted] operations. To the south is the Archer Creek Iron foundry, a facility of the Internet Company. The foundry manufactures [redacted]. To the west, through the north are rolling hills which include woodlands and farmlands. There is one recreational area near the site, located to the northeast, at Joshua Falls, where a small park and area for access to the James River are situated. Residential areas are located directly to the east, south, southwest and west. The closest residence to the facility is approximately 4,500 feet directly east. The nearest potential off-site receptor would be occupational workers at AREVA NP, Inc., approximately 3,000 feet east of the main NPD facility. The closest farming area is approximately 3,000 feet to the northeast. The nearest hospital or school is the Central Virginia Training Center in Lynchburg, which is approximately 2.9 miles west.

1.3.2.2 Population Information

The BWXT site is located in Campbell County, Virginia, near the city of Lynchburg. Campbell County is primarily a rural county. Populations of Campbell County and surrounding counties is presented in Table 2. The company employs approximately 2,400 people. Employment data for the Lynchburg Region is presented in Table 3.

Table 2 Regional Population				
Total Population				
County	2000	1990	1980	1970
Amherst	31,894	28,578	29,122	26,072
Appomattox	13,705	12,298	11,971	9,784
Campbell	51,078	47,572	45,424	43,319
Lynchburg	65,269	66,049	66,743	54,083
<b>Area Total</b>	<b>161,946</b>	<b>154,497</b>	<b>153,260</b>	<b>133,258</b>





<b>Table 3 Lynchburg Employment Statistics</b>	
Lynchburg, VA Metropolitan Statistical Area as of December 2003	
<b>Industry Type</b>	<b>December 2003</b>
Natural Resources & Construction	6,600
Manufacturing	17,800
Trade, Transportation, Utilities	19,300
Information	900
Financial Activities	3,700
Professional & Business	8,800
Education & Health	17,800
Leisure & Hospitality	7,000
Other Services	5,000
Government	13,400
<b>Total (Non-farm)</b>	<b>100,000</b>

1.3.2.3 Meteorology

The climate in Central Virginia is moderate. The average annual temperature is approximately 55°F (13°C). During the summer months, July is historically the month with the highest temperatures. The normal high being 86°F (30°C). Conversely, January is typically the coldest month with normal low temperatures averaging 24°F (-4°C). More detailed data is provided in the Environmental Report associated with the application request. The meteorological data provided was measured at the Lynchburg Municipal Airport. Annual precipitation amounts are expected to average 43 inches. The average rainfall for the month of July is more than 4 inches. Thunderstorms are common but not limited to the summer months. Winds are generally out of the southwest. During the winter months the wind generally shifts from the north. Average wind speeds range from 6 to 9 mph.

1.3.2.4 Hydrology

Surface Water

The James River borders [REDACTED] the BWXT site. It flows generally east-southeast from the Blue Ridge Mountains to the Atlantic Ocean. The river is formed at the point where the Cow-pasture and Jackson rivers merge, northwest of Lynchburg. Based on the data from the U.S. Geological Survey gauging stations, the average annual flow rate of the James River at the site is estimated to be 3,900 cubic feet per second. Water quality of the river is currently classified as a Class II surface water body, not designated for drinking water use. Until late in 2003, BWXT withdrew water from the James River for industrial purposes. In July-August of 2003, BWXT changed the source of their water supply to the Campbell County Utilities Service Authority (CCUSA).



There are no natural ponds or lakes on the site. There are several man-made impoundments used in storm water management or as a part of the waste treatment process (two final effluent ponds, and "Bryant's pond"). Most surface flow is drainage from the facilities during rain events. Three outfalls for surface water run-off exist. Each is a permitted outfall, regulated by the Commonwealth of Virginia Department of Environmental Quality. BWXT's water discharge permit, VPDES Permit number 00367 is issued by the Commonwealth. The permit limits discharges at 6 outfall points. Three of these points actually discharge off-site. The other outfalls are intermediate outfalls that feed into the three off-site discharges.

Flooding of the James River occurs infrequently. There have been 11 significant flood events recorded along the James River since 1771. Each of the events is summarized in Table 4.

<b>Table 4 - Recorded Floods of the James River since 1771 (distance estimated)</b>			
<b>Month-Year</b>	<b>River Elevation</b>	<b>Above Normal</b>	<b>Distance Below Water Treatment Facility</b>
May 1771	489	31	(1)
May 1795	494	36	(6)
September 1870	488	30	0
November 1877	487	29	1
March 1913	483	25	5
March 1936	484	26	4
March 1969	486	28	2
June 1972	485	27	3
June 1982	482	24	6
November 1985	493	35	(5)
January 1996	482	24	6

#### Subsurface Water

Groundwater in the Piedmont Province occurs in crystalline bedrock, consisting of slates, schists, and gneisses, and in the overlying unconsolidated sediment which are of local extent. Reliable well yields for domestic supply are obtained on a wide spread basis from weathered or fractured zones in gneiss and schist. However, yields are generally low to moderate, typically ranging from 1 to 25 gallons per minute, and rarely exceeding 50 to 100 gallons per minute.

Groundwater flows radially from the high elevations located along the southwestern margin of the meander bend to the James River. Because the highest local elevations are to the southwest of NPD, all shallow groundwater in the vicinity of the facility is acted on by a northeasterly horizontal gradient. Slug tests in the shallow zone and bedrock wells were used to estimate the mean hydraulic conductivity for the shallow zone of  $3.7 \times 10^{-4}$  cm per second. On average, the shallow zone is approximately one order of magnitude more conductive than the

bedrock zone, which has mean conductivity of  $4.7 \times 10^{-5}$  cm per second. Until 2003, BWXT withdrew ground water for use as de-ionized and potable water, using several of seven wells on-site. In July-August of 2003, BWXT stopped the use of these wells and began using water supplied by CCUSA.

### 1.3.2.5 Geology

The site is located near the western limit of the Piedmont physiographic province. The bedrock consists of lower Paleozoic metamorphic rocks of the Evington Group, specifically a micaceous schist and phyllite member of the Chandler Formation and a graphite schist member of the Archer Creek Formation. The surficial deposits are principally composed of young Quaternary-age alluvium below the 500-foot elevation contour, and older (Quaternary or Pliocene) terrace gravel at higher elevations. The alluvial deposits, which make up the overburden aquifer, vary from 10 to 35 feet in thickness across the facility. The deposits consist of various mixtures of sand, silt, and clay with increasing amounts of pebbles, cobbles, and boulders at depth.

The soil found at the site has been identified as Cullen-Wilkins. It is generally characterized as deep and moderately deep, well drained, gently sloping to steep soils that have a dominantly clay subsoil, and are found primarily in upland areas. Seismic activity in the Central Virginia region is classified as moderate. The site falls within the western part of the Central Virginia cluster region, which is classified as a Zone 2, moderate region on the Seismic Risk Map of the United States. Since 1774, there have been 18 earthquakes reported as having an intensity of VI or higher. An intensity of VI on the Modified Mercalli Scale is defined as "Felt by all, many frightened and run outdoors, falling plaster and chimneys, damage small." It is comparable to 4.5 on the Richter Scale. Table 5 lists earthquake events of magnitude VI or higher in the Virginia region.

Table 5 - Earthquakes in the Virginia Area			
Date	Maximum Intensity	Area Felt (Sq Miles)	Locality
02/21/1774	VI	58,000	Petersburg
08/27/1833	VI	52,000	Goochland County
04/29/1852	VI	174,500	Grayson County
11/02/1852	VI	32,000	Buckingham County
12/23/1875	VII	50,000	Buckingham County
10/10/1885	VI	25,000	Nelson County
05/03/1897	VII	89,500	Giles County
05/31/1897	VIII	280,000	Gles County
02/05/1898	VI	34,000	Wytheville
02/11/1907	VI	5,600	Arvonnia
04/10/1918	VI	65,000	Luray
09/06/1919	VI	-	Warren County
12/26/1929	VI	1,000	Albemarle County
01/02/1954	VI	0	Bell County, KY/Lee County, VA
04/23/1959	VI	2,050	Giles County
11/20/1969	VI	100,000	Elgood, Wv/Rich Creek, VA
11/11/1975	VI	-	Giles County
09/13/1976	VI	9,000	Carroll County



1.3.3 EVALUATION FINDINGS

The staff reviewed the site description for BWXT according to Section 1.3 of the SRP. BWXT adequately described and summarized general information pertaining to: (1) facility and processes at the site; (2) institutional information including types, forms and quantities of licensed materials and proposed uses; (3) site geography, population information, and meteorology, hydrology, and geology for the site. The reviewer verified that the site description is consistent with the information used as a basis for the environmental report, emergency management plan, and ISA Summary.





## **2.0 ORGANIZATION AND ADMINISTRATION**

### **2.1 PURPOSE OF REVIEW**

The purpose of the review of BWXT's organization and administration was to assure that BWXT's management and staff are qualified by reason of training and experience to use the material for the purpose requested in accordance with 10 CFR 70.22(a)(6) and 70.23(a)(2). This review ensured that BWXT management policies will provide reasonable assurance that the licensee plans, implements, and controls site activities in a manner that ensures the safety of workers, the public, and the environment. The review also ensured that BWXT identified and provided adequate qualification descriptions for key management positions.

### **2.2 STAFF REVIEW AND ANALYSIS**

In Chapter 2 of BWXT's updated license renewal application, BWXT provided a description of the NPD management organization structure, responsibilities, and authorities, including organizational operating units, positions and activities within organizational operating units, position accountability and requirements, and management of organization changes. The basic safety philosophy includes the commitment that license requirements will be literally complied with and that the company is responsible for providing employees with a safe place to work. The supervisor is the company's first line safety representative and is primarily responsible for promoting and enforcing safety standards and proper work methods. Each employee is responsible for obeying safety limits and instructions whether posted, outlined in procedures, or presented in training sessions.

In Section 2.1 of the updated license application, BWXT described organizational responsibilities and authorities, including the lines of communication of key supervisors and managers. Approval authority for selection of personnel was provided in Section 2.4 of the updated license renewal application. The General Manager has the ultimate responsibility for ensuring that operations at the BWXT site are conducted safely. The Manager, Environment, Safety, Health & Safeguards reports directly to the General Manager and has the authority to suspend any activity to ensure safety or compliance.

Section 2.2 of the updated license renewal application described the minimum qualifications and requirements for key supervisors and managers.

Section 2.3 of the updated license renewal application described the function, meeting frequency, membership, quorum requirements, and records and reports of established Safety Committees, including: Change Committee, as low as reasonable achievable (ALARA) Committee, Emergency Preparedness Committee, Safety Review Committee, and Industrial Health and Safety Committee.



### **2.3 EVALUATION FINDINGS**

BWXT described its organization and management policies for providing adequate safety management for the safe operation of the facility. The staff reviewed BWXT's management system, management qualifications, organizational structure, and management controls. These organizational and administrative elements described clear responsibilities and associated resources for the safe operation of the facility. The staff reviewed this information and concludes that BWXT has an acceptable organization, administrative policies, and sufficient competent resources to provide for the safe operation of the facility under both normal and abnormal conditions.





## 3.0 INTEGRATED SAFETY ANALYSIS AND INTEGRATED SAFETY ANALYSIS SUMMARY

### 3.1 PURPOSE OF REVIEW

An ISA identifies potential accident sequences in the facility's operations, designates items relied on for safety (IROFS) to either prevent such accidents or mitigate their consequences to an acceptable level, and describes management measures to provide reasonable assurance of the availability and reliability of IROFS. Applicants for new licenses and persons holding 10 CFR Part 70 licenses on September 18, 2000, must perform an ISA and submit a summary (referred to as an "ISA Summary") to the NRC, for approval. The ISA Summary principally differs from the ISA by focusing on higher risk accident sequences with consequences that could exceed the performance criteria of 10 CFR 70.61. The ISA Summary is a synopsis of the results of the ISA and contains information specified in 10 CFR 70.65(b).

10 CFR 70.62(c) requires the licensee to conduct and maintain an ISA of appropriate detail for the complexity of the process that identifies:

- radiological hazards related to possession or processing licensed material;
- chemical hazards of licensed material, and hazardous chemicals produced from licensed material;
- facility hazards that could affect the safety of licensed materials and thus present an increased radiological risk;
- potential accident sequences caused by process deviations or other events internal to the facility and credible external events, including natural phenomena;
- the consequence and the likelihood of occurrence of each potential accident sequence identified pursuant to 10 CFR 70.62(c)(1)(iv), and the methods used to determine the consequences and likelihoods; and
- each IROFS identified pursuant to 10 CFR 70.61(e), the characteristics of its preventive, mitigative, or other safety function, and the assumptions and conditions under which the item is relied on to support compliance with the performance requirements of 10 CFR 70.61.

10 CFR 70.65(b) requires that an ISA Summary be submitted to the NRC, for approval and must contain the following nine requirements:

- a general description of the site, with emphasis on factors that could affect safety;
- a general description of the facility, with emphasis on areas that could affect safety;
- a description of each process in sufficient detail to understand the theory of operation and their hazards, and a general description of the types of accident sequences;
- information that demonstrates compliance with the performance requirements of 10 CFR 70.61, including management measures, criticality alarms, and baseline design criteria, if applicable;

- 
- a description of the ISA team, their qualifications, and methods used in the ISA;
  - a brief list of the IROFS in sufficient detail to understand their functions in relation to the performance requirements;
  - a description of the quantitative standards used to assess consequences from a chemical exposure on-site;
  - a list of sole IROFS; and
  - definitions of unlikely, highly unlikely, and credible as used in the ISA

The NUREG-1520, "Standard Review Plan of a License Application for a Fuel Cycle Facility," (SRP, issued March 2002) (NUREG-1520), was used by the NRC staff, as guidance for the review and evaluation of the health, safety, and environmental aspects of the ISA Summary. The new Subpart H of 10 CFR Part 70 identifies risk-informed performance requirements, and requires licensees to conduct ISA and submit an ISA Summary. Chapter 3, "ISA," and Chapter 11, "Management Measures," of the SRP are the primary chapters that address the staff's review in relation to the performance and other requirements of Subpart H.

### **3.2 STAFF REVIEW AND ANALYSIS**

Chapter 3.0 of the application contains commitments to develop and maintain an ISA for the site. In accordance with 10 CFR 70.62(c)(3)(i), BWXT submitted an ISA Plan for the facility dated March 26, 2001, and a revised ISA Plan dated June 4, 2001, which was approved by NRC in July 10, 2001. In accordance with 10 CFR 70.62(c)(3)(ii), BWXT submitted a site-wide ISA Summary, dated December 16, 2002, supplemented by annual updates. The NRC staff reviewed the ISA Summary and approved it by a letter and license amendment dated June 30, 2006. In the renewal application, BWXT commits to perform an ISA for any new processes at the Facility and to maintain the ISA for the existing processes, following the NRC-approved ISA Plan.

### **3.3 EVALUATION FINDINGS**

As discussed in the Technical Evaluation Report for License Amendment #113, for BWXT's approval of their license reformat request and ISA Summary, dated June 30, 2006, the staff found that the conclusion of that review is current and applicable, and is repeated below for completeness.

The NRC staff found that BWXT performed an ISA, of appropriate level of detail for the complexity of the processes, and identified and evaluated potential hazards and accidents as required by the regulations. The NRC staff reviewed the ISA Summary and other information and found that it provides reasonable assurance that the licensee has established a safety program, maintains process safety information and an ISA, and established management measures that demonstrate that the safety program meets the performance requirements of 10 CFR 70.61. Specifically, the NRC staff found that the ISA results, as documented in the ISA Summary, provide reasonable assurance that the IROFS, management measures, and programmatic commitments will make all "credible" high consequence events to be "highly unlikely" and all "credible" intermediate consequence events to be "unlikely." The NRC staff



concluded that the BWXT's safety program provides reasonable assurance that the IROFS will be available and reliable to perform their intended safety functions when needed in the context of the performance requirements.

The NRC staff also concluded that the licensee's safety program was established and is maintained pursuant to 10 CFR 70.62, is adequate to provide reasonable assurance that the IROFS are available and reliable to perform their intended safety functions when needed, and in the context of the performance requirements of 10 CFR 70.61.



## 4.0 RADIATION PROTECTION

### 4.1 PURPOSE OF REVIEW

The purpose of this review was to determine whether the applicant's Radiation Protection (RP) Program is adequate to protect the radiological health and safety of workers and to comply with the associated regulatory requirements in 10 CFR Parts 19, 20, and 70. Public and environmental protection is discussed in Chapter 9 of this SER.

### 4.2 STAFF REVIEW AND ANALYSIS

#### 4.2.1 RADIATION PROTECTION PROGRAM IMPLEMENTATION

In Chapter 4 of the BWXT's license renewal application, BWXT described the proposed RP program for the proposed facility. The RP program is developed, documented, and will be implemented commensurate with the risk posed by a uranium fuel operation that will meet the requirements of 10 CFR Part 20, Subpart B.

The RP program's organizational structure and the responsibilities of key program personnel are outlined in Section 2.1 of the application. The General Manager will be responsible for the protection of all persons against radiation exposure resulting from facility operations and material, and for compliance with applicable NRC regulations and the facility license. The Manager, Environment, Safety, Health & Safeguards will be responsible for implementing the RP program, and has direct access to the General Manager. The Manager, Environment, Safety, Health & Safeguards and his staff are also be responsible for:

- establishing and maintaining the RP program including the procedures, manuals, and plans associated with the program;
- training in, and monitoring the training effectiveness of, environmental and radiation protection, nuclear criticality safety, occupational safety and health, and emergency planning;
- establishing and maintaining the ALARA program and assuring it is practiced by all personnel;
- the development of procedures to control contamination, exposure of individuals to radiation, and integrity and reliability of radiation detection instruments;
- calibration and quality assurance of all radiological instrumentation, including verification of required Lower Limits of Detection;
- review and assessment of Environmental Health and Safety programs and performance;

- 
- Reviewing and auditing the efficacy of the program in complying with the NRC regulations, other governmental regulations, and applicable Regulatory Guides;
  - Review of regulatory violations and assurance of implementation of corrective actions; and
  - The maintenance of required records and reports to document Radiation Protection Program activities.

BWXT will staff the facility with suitably trained RP personnel. The qualification of radiation safety personnel is described in Section 2.2 of the application, the staff reviewed Section 2.2 and found the training and experience criteria acceptable, since it is consistent with the guidance provided in the American National Standards Institute/American Nuclear Society (ANSI/ANS) Standard 3.1, "Selection, Qualification and Training of Personnel for Nuclear Power Plants" (1993).

BWXT ensured that the RP program will remain independent of the facility's routine operations, and that it maintains its objectivity and is focused only on implementing sound RP principles necessary to achieve ALARA goals. The applicant will review the content and implementation of the RP program at least annually, in accordance with 10 CFR 20.1101. In addition, constraints on atmospheric releases are established to ensure compliance with 10 CFR 20.1101(d). As described above, the applicant will maintain the RP program in accordance with the acceptance criteria in NUREG-1520.

#### 4.2.2 ALARA PROGRAM

The ALARA program will be implemented using written policies and procedures, to ensure occupational radiation exposures are maintained ALARA, and that such exposures are consistent with the requirements of 10 CFR 20.1101.

BWXT stated that the ALARA Committee is responsible for implementing the ALARA program and preparing an ALARA program summary report annually, to review:

- Radiological exposure and effluent release data for trends;
- Audits and inspections;
- Use, maintenance, and surveillance of equipment used for exposure and effluent control; and
- Other issues, as appropriate, that may influence the effectiveness of the radiation protection and ALARA programs.

[REDACTED]

This report will be submitted to its Safety Review Committee for review and recommendations, and, if appropriate, actions that are required to be tracked to completion. The General Manager is the Chairman of the Safety Review Committee.

Areas containing radioactive material will be designated as Contamination Controlled Areas. Access points will be demarcated with changing rooms, step-off pads, and protective clothing available as needed. Personal survey instruments are provided at the exit points.

Goals of the ALARA program include maintaining occupational exposures, as well as environmental releases, as far below regulatory limits as is reasonably achievable. This is accomplished by including ALARA goals in procedures for manufacturing, configuration change, training, and inspections.

BWXT will establish an ALARA Committee, which will meet at least once quarterly. The committee will have at least five members, to include experts in operations, criticality safety, radiological safety, chemical safety, and industrial safety.

Responsibilities of the ALARA Committee include: (1) reviewing the effectiveness of the ALARA program; (2) determining if exposures, releases, and contamination levels are in accordance with the ALARA concept; (3) ensuring that the occupational radiation exposure dose limits of Part 20 are not exceeded under normal operations; and (4) identifying any upward trends in personnel exposures, environmental releases, and facility contamination levels.

BWXT will maintain an ALARA program in accordance with the acceptance criteria as described above.

#### 4.2.3 ORGANIZATION AND PERSONNEL QUALIFICATIONS

The applicant will employ only suitably trained RP personnel at the facility. Information on personnel requirements for most relevant positions in the plant are contained in Section 2.2, i.e. General Manager; Manager, Environment, Safety, Health & Safeguards; Manager, Safety & Licensing; Manager Radiation Protection; Health Physicist; Radiation Control Supervisors; and Radiation Control Technicians.

The Manager, Safety & Licensing is responsible for establishing and implementing the RP program, which includes training personnel in the use of equipment, control of radiation exposure of personnel, continuous determination and evaluation of the radiological status of the facility, and conducting the radiological environmental monitoring program.

The Manager, Radiation Protection is responsible for the protection of workers and the public from radiation; will be skilled in the interpretation of RP data and regulations; will be familiar with the operation of the facility and RP concerns of the site; and will be a resource for radiation safety management decisions.

[REDACTED]

The applicant will organize and staff a RP program in accordance with the acceptance criteria.

#### 4.2.4 WRITTEN PROCEDURES

Activities at the BWXT site involving licensed material are conducted in accordance with written and approved procedures. Personnel are trained to perform all operations in strict compliance with procedures, Radiation Work Permits (RWP), or postings, and not to perform an operation, utilizing licensed material, that is not addressed in a written and approved procedure, RWP, or posting.

The BWXT written procedures include Safety and Operating Procedures, which are generated by each department and submitted to the Safety & Licensing Section for review. These procedures are revised, if appropriate, biennially by the originators. RP postings are displayed in a number of locations to alert personnel of special RP controls, and comply with the minimum requirements specified in 10 CFR 20.1902. In addition the licensee publishes a RP Manual containing generic RP procedures for distribution throughout the facility.

RWP's are issued for non-routine activities involving licensed material, that are not covered by a written and approved procedure, that requires access to high or very high radiation areas, or that have a high potential for exceeding exposure estimates. RWP's shall provide operators with requirements necessary for personnel and environmental protection.

The staff reviewed the administrative requirements of the radiation protection program, which includes radiation protection responsibilities, ALARA commitments, procedures, and the RWP system. The staff finds BWXT's administrative requirements consistent with NRC requirements and with good industry practice and, therefore, acceptable.

#### 4.2.5 TRAINING

An RP training program is designed and implemented to provide training to all personnel and visitors, unless provided with trained escorts, who enter Restricted Areas, commensurate with the radiological hazard to which they may be exposed. The level of training is dependent on work location and involvement in using radioactive materials and sources.

The applicant has incorporated the provisions of 10 CFR 19.12 into the radiation training program, as outlined in Section 4.2 of the BWXT license application. The requirements in 10 CFR 19.12 address required health physics information that BWXT must make available to workers likely to receive exposures greater than 1 mSv (100 mrem) per year.

Individuals requiring unescorted access to Restricted Areas are retrained at least once annually, or as necessary, to address changes in policies, procedures, requirements, and the facility ISA. The effectiveness of the radiation safety training is judged by daily radiation safety inspections of the plant for violations. Supervisors are responsible for ensuring effective and adequate training of personnel to ensure employees understand the safety controls. The

[REDACTED]

Manager, Radiation Protection reviews and updates the content of the formal RP training program. The Manager, Safety & Licensing reviews training for all procedures involving SNM.

The applicant will train its employees in RP in accordance with the acceptance criteria.

#### 4.2.6 VENTILATION AND RESPIRATORY PROTECTION PROGRAMS

The design criteria, including flow velocity at openings, for the ventilation systems, are described in Sections 4.3.1 through 4.3.5. Filters to be used in the systems include high efficiency scrubbers and High-Efficiency Particulate Air (HEPA) filters. Differential pressure across HEPA filters is measured utilizing a pressure drop gage or other static measuring instrument. Filters are replaced when the differential pressure drop exceeds the manufacturers ratings, or the filter fails to function properly.

Air flow rates at ventilation systems servicing primary enclosures will provide minimum face velocities of 100-linear feet per minute. Airflow velocity will be monitored monthly or after significant changes to the system. Insufficient airflow velocity will be reported for corrective action including: filter change, adjustment of dampers to balance airflow, or repairing broken or leaking ducts.

Ventilation is maintained such that air flows from lower contamination areas into higher contamination areas is verified quarterly by smoke tests. Adequacy of containment and ventilation controls is determined by continuous air sampling. If sampling of the ventilation system indicates contamination levels in excess of 25% of the DAC values, the air will be recycled through a HEPA filter.

Respiratory protection will be implemented in accordance with Regulatory Guide 8.15 (1999) to limit exposure to airborne radioactivity. In addition, the Emergency Team and individuals handling readily dispersible radioactive material will receive annual training on respiratory protection. These commitments meet the regulatory criteria for respiratory protection contained in 10 CFR Part 20, Subpart H.

BWXT has established ventilation and respiratory protection programs in accordance with the acceptance criteria, and satisfies the regulatory requirements of Part 20, Subpart H.

#### 4.2.7 RADIATION SURVEY AND MONITORING PROGRAMS

BWXT has a radiation survey and monitoring program. The program involves personal air sampling, removable surface contamination, effluent monitoring, and sealed source monitoring. Procedures for the control of radiation safety of the facility, its operations, and the environment, and to ensure compliance with regulatory requirements are maintained. These procedures are reviewed and updated as necessary, or at least biennially. The program defines actions to be taken when measurements exceed Part 20 occupational dose limits, or the administrative levels established by BWXT, as presented by the table in Section 4.3.1 of the application.

[REDACTED]

Instrument calibrations shall be performed according to approved procedures and shall utilize National Institute of Standards and Technology traceable sources

Personal dosimeters that are sensitive to beta, gamma, and neutron radiation will include Thermal Luminescent Detector (TLD), Film, or optically stimulated luminescent badges. Dosimeters will be required to be worn, by all adults likely to receive greater than 500 mrem in a year. Personnel requiring monitoring per 10 CFR 20.1502(a) are evaluated on a frequency, not greater than quarterly, or as specified by the Radiation Safety Function.

Whole body dose equivalents to workers shall be limited to 1250 mrem per quarter by the worker's supervisor, unless otherwise approved by the Manager, Nuclear Safety. Personal air sampling shall be the primary method of monitoring internal exposures. Work restrictions and diagnostic evaluations will be initiated when air sample results indicate an individual may have received a daily exposure exceeding 16 DAC-hours, or a weekly exposure exceeding 40 DAC-hours. In addition, BWXT will establish action levels for fixed air samples of daily, weekly, monthly, and quarterly average measurements which exceed specified DAC values.

BWXT will perform air sampling consistent with the guidance provided in Regulatory Guide 8.25 (1992). Diagnostic evaluations based on air samples will be augmented by bioassay measurements, which conform to guidance provided in Regulatory Guide 8.9 (1993). Bioassay is performed for all employees who spend 25% or more of their time, on a quarterly basis, in areas where air sampling is in excess of 10% of the DAC value.

All areas where exposure to airborne radioactive material is a risk are monitored using air sampling. Whenever fixed air samples exceed the action limits specified in Section 4.3.3.1, an investigation is initiated to identify and correct the elevated airborne concentration. Air samplers used to monitor individual Committee Effective Dose Equivalents (CEDEs). The samplers are changed out after each working shift unless conditions warrant a modified schedule. Bioassay measurements are used to supplement and/or test the fixed samples.

Surface contamination surveys are made on a regular scheduled frequency in production areas of the facility, or areas where [REDACTED] radioactive material is handled as described in Section 4.3.5. For new processes, or when processing a new type of material, surveys shall be performed each shift during the first 30 days of operation. Contamination Controlled Areas will be surveyed weekly or biweekly as specified in procedures. Monitoring will include measurements of removable surface contamination, with extent and frequency based on the potential for contamination in each area, and operational experience.

BWXT defined a radiological controlled area as an area in which readily dispersible radioactive material is handled. The action levels for removable surface contamination are 83.3 Bq/100 cm<sup>2</sup> (5000 dpm/100 cm<sup>2</sup>) alpha, beta+gamma. If an action level is exceeded, access shall be restricted and decontamination shall begin during the next working shift. Personnel must undergo decontamination if the direct contamination reading (fixed plus removable) on either of their hands or shoes exceeds background. Items, such as tools or equipment, are monitored for contamination, which must be below specified limits, prior to removal from a controlled area.

[REDACTED]

BWXT's corrective action process is described in Section 11.6. Investigations using the division-wide corrective action system will be conducted for the following:

- audit and assessment findings
- unusual incidents
- failed or degraded IROFS

Incident investigations are performed under management direction, to fully understand an upset condition, determine the root causes, and implement corrective actions to prevent recurrence.

Sealed sources containing more than 100 microcuries of beta and/or gamma emitting material or more than 10 microcuries of alpha emitting material, will be tested for leakage and/or contamination at least once every six months. Sources with 0.005 microcuries or more of contamination will be immediately withdrawn from use for decontamination and repair. Stored sources shall be leak-tested prior to any use in, or transfer from, the licensed activity unless tested within the previous six months. Records of leak-test results shall be maintained for review by the NRC staff.

BWXT has an access control program that ensures: (a) signs, labels, and other access controls are properly posted and operative; (b) restricted areas are established to prevent the spread of contamination and are identified with appropriate signs; and (c) there are intermediate areas where personnel are required to monitor their hands and shoes or perform a whole body frisk, as appropriate, before entering an uncontrolled area. BWXT has established action levels of 3.3 Bq/100cm<sup>2</sup> (200 dpm/100cm<sup>2</sup>) alpha and 33.3 Bq/100cm<sup>2</sup> (2000dpm/100cm<sup>2</sup>) beta+gamma contamination (corrected for background) at points of egress from Radiological Controlled Areas.

BWXT has established radiation survey and monitoring programs in accordance with the acceptance criteria.

#### 4.2.8 ADDITIONAL PROGRAM REQUIREMENTS

BWXT established a program to maintain records of the RP program, radiation survey results, and results of corrective action program referrals, RWPs, and planned special exposures. The facility identifies, preserves, controls and destroys records in accordance with the guidelines, procedure, and practices set forth in Sections 4.5 and 11.7 of the application.

The applicant will report, to the NRC, any event that results in an occupational exposure to radiation exceeding the dose limits in Part 20, within the time specified in 10 CFR 20.2202 and 10 CFR 70.74. A detailed listing of reports required by the NRC regulations will be maintained and followed. The applicant will prepare and submit, to NRC, an annual report of the results of individual monitoring, as required by 10 CFR 20.2206(b).

[REDACTED]

Exposure to individuals which exceed action levels shall be investigated. Corrective action shall be reported to the appropriate manager, according to approved procedures. BWXT will refer to the facility's corrective action program any radiation incidents that results in an occupational exposure that exceeds the dose limits in Part 20, Appendix B, or is required to be reported to the NRC, pursuant to 10 CFR 70.74, and to reporting, to NRC. BWXT will report both the corrective actions taken (or planned) to protect against a recurrence, and the proposed schedule to achieve compliance with 10 CFR 20.

#### **4.3 EVALUATION FINDINGS**

BWXT established and will maintain an acceptable RP program that includes:

- an effective documented program to ensure that occupational radiological exposures are ALARA;
- an organization with adequate qualification requirements for the RP personnel;
- approved written RP procedures and RWPs for RP activities;
- RP training for all personnel who have access to restricted areas;
- a program to control airborne concentrations of radioactive material with engineering controls and respiratory protection;
- a radiation survey and monitoring program that includes requirements for controlling radiological contamination within the facility and monitoring of external and internal radiation exposures; and
- other programs to maintain records, report to the NRC, in accordance with Parts 20 and 70, and corrective actions for upsets at the facility.

BWXT's RP program meets the requirements of Parts 19, 20, and 70. Conformance to the license application will ensure safe operation.

#### **4.4 REFERENCES**

U.S. Nuclear Regulatory Commission (NRC), Regulatory Guide 8.25, "Air Sampling in the Workplace," 1992.

U.S. Nuclear Regulatory Commission (NRC), Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program," 1993.

U.S. Nuclear Regulatory Commission (NRC), Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection," 1999.

U.S. Nuclear Regulatory Commission (NRC), NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," 2002.

## 5.0 NUCLEAR CRITICALITY SAFETY

### 5.1 PURPOSE OF REVIEW

The purpose of this review was to determine whether BWXT's nuclear criticality safety (NCS) program is adequate to support safe operation of the facility, as required by 10 CFR Part 70.

The NCS programmatic review determined that: (1) BWXT provided for the appropriate management of the NCS program; (2) identified, and committed to, the responsibilities and authorities of individuals for developing and implementing the NCS program; (3) the facility management measures described in 10 CFR 70.62 have been committed to, and will support implementing and maintaining the NCS program; and (4) an adequate NCS program is described, which included identifying and committing to the NCS methods and NCS technical practices used to ensure the safe operation of the facility, as required by Part 70.

### 5.2 STAFF REVIEW AND ANALYSIS

BWXT submitted an amendment request, dated December 1, 2002, to reformat SNM License No. 42 to accommodate the requirements of the revised 10 CFR Part 70, which requires licensees to complete an ISA. As part of the reformatted license, a new Chapter 3, on ISA's, was created from the existing license application, Sections 15.1--15.3. Additionally, Chapters 4 and 14 were combined into a proposed Chapter 5, "Nuclear Criticality Safety," which included a description of administrative and technical procedures, design approach, and computer codes. Also Chapter 11, "Management Measures," combined the existing Chapters 2.5--2.10 with additional information to demonstrate compliance with the management measures and facility change process requirements in the revised 10 CFR Part 70. By letter dated June 30, 2006, the NRC approved BWXT's December 1, 2002, amendment request. The basis for approving BWXT's license reformat amendment request is contained in the SER, also dated June 30, 2006. The amendment also updated the chapter and section numbers in Safety Condition S-17 based on the reformatted license which changed Chapter 4 to Chapter 5. Safety Condition S-17 was issued on August 27, 2004, as part of NRC's approval of BWXT's license amendment request to increase the k-effective limits for the [REDACTED].

The staff reviewed the application, dated June 30, 2004, and the information BWXT provided by letters dated January 9 and October 24, 2006. The application included a description of BWXT's Organization and Administration in Chapter 2, ISA and ISA Summary in Chapter 3, NCS program in Chapter 5, and Management Measures in Chapter 11.

#### 5.2.1 MANAGEMENT OF THE NCS PROGRAM

BWXT NCS program objectives included preventing an inadvertent nuclear criticality; protecting against the occurrence of an identified accident sequence in the ISA Summary; complying with the NCS performance requirements of 10 CFR 70.61; establishing and maintaining NCS safety parameters, procedures, IROFS, safety limits and operating limits for IROFS; and conducting

[REDACTED]

NCS evaluations to assure that under normal and credible abnormal conditions, all nuclear processes will remain subcritical and maintain an approved margin of subcriticality for safety. BWXT also committed to provide training in emergency procedures, in response to an inadvertent nuclear criticality, and to comply with the NCS baseline criteria requirements in 10 CFR 70.64(a), the NCS ISA Summary requirements in 10 CFR 70.65(b), and the change process requirements in 10 CFR 70.72.

BWXT's approach to NCS is based on the double contingency principle, which states that process designs shall incorporate sufficient factors of safety to require at least two, unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible. NCS for systems that cannot feasibly use double contingency protection is assured through defense-in-depth. Defense-in-depth uses two or more reliable barriers or controls to prevent unwanted changes in any one process condition that might adversely affect system safety. The control of two parameters is preferred over multiple controls on a single parameter. The licensee's NCS function establishes limits and controls for all activities involving SNM. Administrative limits and controls are conveyed via postings in the operating area, operating procedures, or both methods. Engineered limits and controls are provided in operating and maintenance procedures as necessary. Before a modification or addition to the facility, process or equipment used for handling, processing, or storing SNM is made, the change is evaluated and approved following an approved procedure. All changes are reviewed by the Change Review Board, which is a safety committee that reviews and approves changes or additions to processes or equipment that involve the use of licensed material, and could affect its safety or the safety of personnel.

The staff reviewed BWXT's description of its management of the NCS program and found that it is acceptable because the licensee committed to develop, implement, and maintain an NCS program to meet the regulatory requirements of 10 CFR Part 70 and established NCS safety parameters and procedures are established. Additionally, the staff found that the licensee's commitments regarding its management of the NCS program, as described above, adequately address the acceptance criteria in NUREG-1520, Section 5.4.3.1.

## 5.2.2 ORGANIZATION AND ADMINISTRATION

The BWXT site is comprised of the NPD Manufacturing Facilities, the LTC, the Waste Treatment Facility and Uranium Storage Facilities. The responsibility and authority for the NCS program has been delegated to the NCS Manager. The NCS Manager reports to the Nuclear Safety and Licensing Manager. The Nuclear Safety and Licensing Manager reports to the Environment, Safety, Health and Safeguards Manager. The Environment, Safety, Health and Safeguards Manager reports to the General Manager. The General Manager has ultimate responsibility for ensuring that operations at the BWXT site are conducted safely and in compliance with applicable regulations and license conditions.

[REDACTED]

The NCS Manager has responsibility for the administration of the NCS program, including the posting of limits and controls, issuance of NCS procedures, the technical content of NCS training, and inspection and surveillance of SNM handling and processing. The NCS Manager is also responsible for maintaining properly verified and validated NCS calculational and evaluation capabilities and ensuring independent quality assurance (QA) checks for all NCS evaluations and calculations. NCS engineers are responsible for conducting NCS evaluations, calculations, quarterly audits and weekly inspections. NCS engineers also perform QA checks as directed by the NCS Manager. Both the NCS Manager and the NCS engineers have the authority to suspend activities if their professional judgement deems the activities unsafe or contrary to the license or regulatory requirements.

The NCS Manager is required to have a bachelor's degree in a physical science or engineering field, and at least two years of experience as an NCS engineer at BWXT, or at least three years of experience as an NCS engineer at another facility. NCS engineers are required to have a bachelor's degree in a physical science or the engineering field. In addition, NCS engineers must have one year of experience performing evaluations under the direct supervision of a qualified NCS engineer, two years of experience performing NCS evaluations at SNM handling facilities, or two years of experience performing [REDACTED] physics calculations, with one year of experience performing NCS evaluations at [REDACTED] facilities. NCS engineers may also have a Master of Science degree in physics or nuclear engineering and at least six months of experience performing NCS evaluations at BWXT under the supervision of a qualified NCS engineer.

The staff reviewed the licensee's description of its NCS organizational structure and found that it is acceptable because the NCS organization is independent from the production staff, NCS evaluations are performed by qualified reviewers with an independent review to assure quality, and the NCS organization is consistent with the requirements in ANSI/ANS-8.19-2005, "Administrative Practices for Nuclear Criticality Safety." Additionally, the staff found that the licensee's commitments regarding its organization and administration, as described above, adequately addressed the acceptance criteria in NUREG-1520, Section 5.4.3.2.

### 5.2.3 NCS MANAGEMENT MEASURES

BWXT maintains NCS management measures (training, procedures, audits and assessments) to assure that all IROFS are available and reliable to perform their intended functions when needed. Before being granted unescorted access to Restricted Areas, licensee personnel are given annual general NCS training, which includes training on the importance of immediately evacuating in the event that there is a criticality accident. The licensee also provides annual specialized training for personnel that handle [REDACTED] material. The effectiveness of training is evaluated by written and/or oral tests, the number of violations found during nuclear safety inspections, and assessment by supervisors of personnel.

[REDACTED]

BWXT personnel are trained to perform all operations in strict compliance with procedures, Radiation Work Permits (RWPs), or postings. BWXT personnel are trained not to perform an operation involving SNM that is not in a written and approved procedure, RWP, or posting. All activities are conducted in accordance with safety procedures that are approved by the Nuclear Safety and Licensing Manager. Procedures that implement IROFS are reviewed and approved by the appropriate safety discipline. Those operating procedures are supplemented by an NCS manual, radiation protection manual, postings, RWPs, and radiation protection procedures. The NCS manual is a compilation of NCS procedures that have generic applicability. Safety and operating procedures are reviewed and/or revised every five years.

Audits and inspections are performed to determine that site operations are conducted in compliance with regulatory requirements, license conditions, written procedures, and postings. NCS engineers perform weekly NCS inspections of selected site operations involving SNM to verify that activities are being conducted within NCS limits. NCS audits of selected plant activities are conducted quarterly by an NCS Engineer, and the entire site is audited semiannually.

The staff reviewed the BWXT's description of its NCS management measures and found that they are acceptable because the licensee committed to provide training to personnel, to conduct activities involving SNM with written and approved procedures, to conduct weekly NCS walkdowns, to conduct quarterly NCS audits, and to maintain records relative to radiological health and safety and training. Additionally, the staff found that the licensee's commitments regarding management measures, as described above, adequately address the acceptance criteria in NUREG-1520, Section 5.4.3.3.

## 5.2.4 METHODOLOGIES AND TECHNICAL PRACTICES

### 5.2.4.1 Computer Codes

BWXT submitted a revision to License Application Section 5.2.1, "Computer Codes," describing the licensee's use of computer codes for NCS determinations. The application, Section 5.2.1 states that the codes must be well benchmarked and verified, and are run on controlled software and hardware. The calculations must be performed and reviewed by qualified NCS personnel, and must verify that calculations lie within the code's validated area of applicability (AOA). BWXT stated that the validation is performed using the guidance in ANSI/ANS-8.1-1998, "Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors." The contents of the validation report are described in the license application. If modifications to the computer code system are required, the licensee will assess the changes to determine whether the code needs to be re-verified. The licensee will re-verify the computer codes, at a minimum, whenever the code is installed, and at least once annually.

The licensee then described the calculational methodology to be used, including determination of the calculational margin and an Upper Subcritical Limit. The preferred methodology is the non-parametric method, with equations presented, although the 95/95 lower tolerance limit or

[REDACTED]

lower tolerance band may be employed if the assumptions of these methods (primarily the assumption of normality) are met. The use of positive bias (i.e., when the calculated value of  $k_{eff}$  is greater than the experimental value) is prohibited, whether the licensee uses the nonparametric method, a method that uses trends (e.g., the lower tolerance band), or a method that uses average  $k_{eff}$  values (e.g., the lower tolerance limit). [REDACTED]

[REDACTED]

In addition, the description of the validation methodology (especially the non-parametric method) is consistent with ANSI/ANS-8.1-1998 and the guidance in NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Calculational Methodology." The staff determined that the equations presented will ensure that there is adequate allowance for uncertainty in the methodology, the benchmark data, and the calculated value of  $k_{eff}$  to ensure subcriticality and will prevent the taking of any credit for positive bias.

The staff reviewed the BWXT's description of its use of computer codes for NCS determinations and found that it is acceptable because the programmatic commitments, the validation methodology, and the AOA were adequate. Additionally, the staff found that the licensee's commitments regarding its use of computer codes for NCS determinations, as described above, adequately address the acceptance criteria in NUREG-1520, Section 5.4.3.4.1(6) and 5.4.3.4.1(7)(a)-(j). Based on the above, the staff has reasonable assurance that criticality calculations performed, in accordance with the license application will ensure that nuclear processes are subcritical under normal and credible abnormal conditions.

#### 5.2.4.2 Technical Practices

The description of the design criteria used by the licensee to ensure NCS includes a description of the means of NCS control, methods of NCS control, and acceptability of NCS control. The four means of NCS control in order of preference are: (1) passive engineered control, (2) active engineered control, (3) enhanced administrative control and (4) simple administrative control. The licensee identifies twelve methods of NCS control (approximate order of preference): (1) favorable geometry, (2) spacing, (3) volume, (4) fixed neutron absorber, (5) piece count, (6) mass, (7) moderation, (8) concentration, (9) material specification, (10) uranium enrichment, (11) soluble neutron absorber, and (12) reflection. Each method of NCS control is associated with a means of NCS control and if there is more than one means possible for a given method, the highest order means of NCS control available and feasible will be used.

When based on a calculated  $k_{eff}$ , each method has a set of limits that are: (1) the failure limit; (2) the safety limit; (3) the limiting condition of operation; and (4) the routine operating limit. The design objective is to select the highest order method and means feasible and then to assure that the controls selected are acceptable. The four requirements for control acceptability are: (1) being functionally available; (2) remaining functionally available; (3) having malfunction detection and corrective systems; and (4) being documented.

[REDACTED]

BWXT applied nuclear safety factors to single isolated [REDACTED] containing [REDACTED] material. The safety factors reduce the critical dimension, critical volume, critical mass, and critical concentration to assure [REDACTED] is subcritical. Present and future equipment are dimensionally designed such that a criticality cannot be achieved under any foreseeable conditions. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] The accident condition  $k_{eff}$  is based on optimum moderation unless moderating materials such as polyethylene, water, and paper are restricted or carefully controlled. The licensee has committed to use Raschig rings in accordance with ANSI/ANS-8.5-1996, "Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material," with two exceptions. The licensee does not perform the chemical or mechanical tests described in paragraphs 4.4 and 4.5 of the standard. As an alternative, the BWXT inspects and samples the rings in the application environment, whenever the standard requires either of these tests. The licensee analyzes glass samples for boron content every twelve months. These alternative methods are acceptable, because, based upon twenty years of experience, BWXT has found no tendency that the glass would dissolve or leach at a rate greater than what will be discovered and corrected at the inspection and sampling intervals.

The licensee has requested that safety condition S-17 not be brought forward into the renewed license, stating that it has been incorporated into Chapter 5 of the license application. The staff's review has shown that the license application includes the  $k_{eff}$  limits for the [REDACTED] as described in the license condition and that the license application does not allow these increased limits to apply to [REDACTED] designs subsequent to [REDACTED]. However, the license application does not include the definition of "systems involving [REDACTED]." Therefore, the safety condition shall be modified so that only the definition of "systems involving [REDACTED]" remains.

The staff reviewed the licensee's description of its technical practices and found that they are acceptable because the licensee committed to the double contingency principle and the licensee defines the acceptability of controlled parameters used to define the NCS basis. Additionally, the staff found that the licensee's commitments regarding its NCS technical practices, as described above, adequately address the acceptance criteria in NUREG-1520, Section 5.4.3.4.2.

#### 5.2.4.3 Requirements in 10 CFR 70.24

The licensee maintains a criticality accident alarm system (CAAS) consistent with the requirements of 10 CFR 70.24. The licensee places criticality detectors in accordance with the criteria described in ANSI/ANS-8.3-1997, "Criticality Accident Alarm System," as modified by Regulatory Guide 3.71, "Nuclear Criticality Safety Standards for Fuels and Material Facilities," Revision 1. Calibration of the criticality monitoring system (Chapter 4 of the license application)

[REDACTED]

is conducted at least once annually using a gamma source traceable to the National Institute of Standards and Technology. Calibration is also performed after the system is repaired, if the repair affects the calibration. Records of the calibration are kept for at least three years. When the CAAS is out of service, in storm-watch mode, or being tested or repaired, compensatory measures that are specified in facility procedures, are put into place to ensure area evacuation in the event of a criticality.

The staff reviewed BWXT's commitments regarding its CAAS and found that they are acceptable because BWXT maintains a CAAS that is capable of energizing a clearly audible alarm signal if an accidental criticality occurs, and BWXT maintains emergency procedures for each area in which SNM is handled, used or stored to ensure prompt personnel evacuation upon sounding the alarm. Additionally, the staff found that BWXT's commitments regarding its CAAS, as described above, adequately address the acceptance criteria in NUREG-1520, Section 5.4.3.4.3.

### 5.3 EVALUATION FINDINGS

The staff reviewed the NCS program for BWXT and has reasonable assurance that: (1) the licensee will have in place a staff of managers, supervisors, engineers, process operators, and other support personnel who are qualified to develop, implement, and maintain the NCS program in accordance with the facility organization and administration and management measures; (2) BWXT conduct of operations will be based on NCS methodologies and NCS technical practices, which will ensure that the [REDACTED] material will be possessed, stored, and used safely and according to the requirements in 10 CFR Part 70; (3) BWXT will develop, implement, and maintain a CAAS in accordance with the requirements in 10 CFR 70.24, and the site emergency management program; (4) BWXT will have, in place, a NCS program, in accordance with the subcriticality of operations and margin of subcriticality for safety requirements in 10 CFR 70.61(d), and baseline design criteria requirements in 10 CFR 70.64(a).

It is recommended that safety condition S-11 be added to read as follows:

S-11 "Systems involving [REDACTED]" shall be deemed to include only workstations containing one or more machined and assembled [REDACTED] by themselves or in conjunction with other [REDACTED] that are not [REDACTED]. This shall apply to [REDACTED] areas only.

Based on the NRC review, the staff concluded that the licensee's NCS program met the requirements of 10 CFR Part 70, and provides reasonable assurance for the protection of public health and safety, including workers and the environment.

[REDACTED]

## 6.0 CHEMICAL PROCESS SAFETY

### 6.1 PURPOSE OF REVIEW

The purpose of the chemical process safety review was to determine that the BWXT designed a facility that will adequately protect workers, the public, and the environment against chemical hazards of licensed material and hazardous chemicals produced from licensed material. The licensee must also protect against facility conditions or operator actions that can affect the safety of licensed materials and thus present an increased radiological risk.

### 6.2 STAFF REVIEW AND ANALYSIS

The NRC's objective is to ensure safe operations that involves licensed radioactive material and hazardous chemicals produced from licensed material, as defined in 10 CFR 70.4. The NRC recognizes that hazardous chemicals are also regulated by other Federal and State agencies. At the Federal level, the Occupational Safety and Health Administration (OSHA) has issued 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals Standard," and the Environmental Protection Agency has published 40 CFR Part 68, "Risk Management Plan (RMP)."

The NRC staff reviewed the October 24, 2006, License Application for Renewal; the June 30, 2004, License Application for Renewal; Chapter 6 of the December 01, 2005, License Reformat; Chapter 3 of the December 22, 2005, Revisions to Chapters 3 and 11; Chapter 11 of the July 11, 2005, Revisions to Chapters 1, 2, 4, 10, and 11; the June 12, 2006, Emergency Plan; and relevant ISA Summary chapters. In addition, the NRC review team visited the BWXT site on August 21-23, 2006 and toured several production areas, including, machining areas; uranium recovery; [REDACTED]. Chemical substances used in the facility include: [REDACTED]

[REDACTED]: The team also toured the waste treatment facility. Chemical storage at the waste treatment facility includes a lime silo as well as acids used for pH adjustment. No chlorine is stored at the waste treatment facility – UV light is used to disinfect the wastewater.

The NRC staff toured the [REDACTED] chemical [REDACTED] areas. Isopropyl alcohol and other solvents are stored in 55-gallon drum quantities in the flammable [REDACTED]. These chemicals are dispensed from the drums into cans for use in the production areas. [REDACTED], acetylene and other gases are stored in cylinders [REDACTED]. In addition, [REDACTED] gas is stored in a nearby area [REDACTED]. In another storage building, hydrofluoric acid is stored in 55-gal drums [REDACTED]. Nitric acid is stored in [REDACTED]. The NRC staff also discussed the safety evaluation review process for new materials, Material Safety Data Sheets (MSDS), employee training, the existence of written procedures for safe work practices and the respiratory protection program, and the requirements of safety-related audits with BWXT staff.

[REDACTED]

10 CFR 70.62(a) requires BWXT to establish a safety program that will adequately protect workers, public health and safety, and the environment from the chemical hazards of licensed material. The Industrial Health & Safety manager is responsible for the industrial health and safety programs, which include the protection of plant personnel, equipment and material from chemical hazards. BWXT's Industrial Health & Safety staff is responsible for: establishing the programs for chemical exposure monitoring; hazardous materials, emergency response, fire protection, respiratory protection (for non-radioactive hazards); and personal protective equipment, recordkeeping, general safety audits; OSHA compliance, accident investigation; and work-place environmental monitoring. BWXT stated that the chemical safety program is designed to minimize the potential for chemical releases or hazards and to implement administrative systems to prevent chemical process upsets.

Employees are trained in general safety, including hazard communication. Employees also receive area-specific training and annual general safety refresher training. Chapter 11 of the application commits to establishing training programs, to include instruction in fire protection, chemicals, and hazardous materials.

Under OSHA's hazard communication standard, employers must maintain MSDS for any hazardous chemicals stored or used. BWXT maintains copies of the MSDS in various locations on the shop floors and in central locations.

BWXT has also implemented procedures for site-wide safe work procedures, including, *respiratory protection, confined space entry, and lockout/tagout of equipment.*

10 CFR 70.62(b) requires a licensee to maintain process safety information to enable the performance and maintenance of an ISA. Chapter 3 of the application describes the process safety information used in performing an ISA analysis. Process safety information includes hazard information for the materials being used or produced in the reviewed process, process technology information, process equipment information, and discipline-specific safety analyses. Chapter 3 also requires that the ISA Summaries be maintained as current, through the implementation of the change management process.

10 CFR 70.62(c)(2) requires that an ISA be performed by a team with expertise in engineering and process operations. As stated in Chapter 3 of the application, the ISA is performed by a team consisting of personnel experienced and knowledgeable in nuclear criticality safety, radiation safety, fire protection, and chemical process safety; a cognizant engineer with experience and knowledge specific for the process; and an experienced operator. At least one member of the team is required to be knowledgeable in the ISA methodology being used.

10 CFR 70.65 requires a licensee to conduct an ISA to identify facility and external hazards, and their potential for initiating accident sequences, their likelihood and consequences, and the IROFS. Chapter 3 of the application identifies the methodologies that may be used by BWXT when conducting a process hazards analysis for a chemical operation as: checklist analysis; what-if analysis; a combination of what-if/checklist analysis; Hazard and Operability Analysis;

[REDACTED]

failure modes and effects analysis; fault tree analysis; and event tree analysis. The process hazards analysis team leader selects a methodology based on the characteristics of the process being reviewed. Each ISA Summary identifies the methodology that was selected as well as describing the basis for the selection. The ISA Summary identifies the chemical accident scenarios leading to intermediate or high consequences. The ISA Summary also includes an evaluation of chemical interactions possible in the process, presented as a chemical interaction matrix, or as a chemical compatibility matrix.

10 CFR 70.65(b)(7) requires that the ISA Summary include a description of the proposed quantitative standards, used to assess the consequences to an individual, from acute chemical exposure to licensed material, or chemicals produced from licensed materials which are on-site, or expected to be on-site. Table 3.2.4.3 of the application, describes the definitions of high and intermediate chemical accident consequences consistent with the regulatory definition in 10 CFR 70.61(b)(4) and (c)(4). Table 3.2.4.3 also identifies quantitative standards that correspond to these definitions. High consequence events, in terms of chemical exposure, include exposure of workers to concentrations above the Emergency Response Planning Guideline [REDACTED] concentrations above the immediately dangerous to life and health; serious burns; and explosive energy release. High consequence events also include exposure of members of the public to concentration above the [REDACTED]. Intermediate consequence events, in terms of chemical exposure, include exposure of workers to concentrations above equal to [REDACTED] serious burns; and explosive energy release. Intermediate consequence events also include exposure to members of the public to concentration above the [REDACTED].

10 CFR 70.61 requires that IROFS be applied to the extent needed to reduce the likelihood of occurrence of each high consequence or credible event, so that the event is highly unlikely or consequences are less severe; and, or, to the extent needed to reduce the likelihood of occurrence of each intermediate consequence or credible event, so that the event is unlikely or the consequences are less severe.

The ISA Summary chapters describe the chemical hazards identified, and whether any chemical accident scenarios evaluated by BWXT exceeded high or intermediate consequences. Determination of the consequences was based on the performance requirements of 10 CFR 70.61.

10 CFR 70.62(d) requires that management measures be established to ensure compliance with the performance requirements of 10 CFR 70.61. Chapter 11 of the application describes the corrective action program, which includes requirements for incident investigations. Incident investigations are performed for unusual incidents, at the direction of management, in order that an upset condition can be fully understood, root causes determined, and corrective actions implemented to prevent recurrence. Chapter 11 also states that corrective actions to address findings from an incident are tracked through the corrective action and commitment tracking system. Activities at the facility are to be conducted in accordance with written and approved procedures. Chemical hazards are reviewed as part of the change management process. Chapter 11 of the applications also describes BWXT's commitments to audits of the chemical safety program.

[REDACTED]

For hazardous chemicals, 10 CFR 70.22(i)(3)(xiii) requires that the Emergency Plan certify that the licensee has met its responsibilities under Emergency Planning and Community Right to Know Act of 1986, Title III. BWXT's Emergency Plan, Revision 18, states that the facility prepares and submits the annual Tier II Hazardous Chemical Inventory (required under Section 312 of EPCRA) and the annual Toxic Chemical Release Inventory (required under Section 313 of EPCRA). BWXT also participates in the Campbell County, VA, Local Emergency Planning Committee.

### **6.3 EVALUATION FINDINGS**

Based on the review of the application, the NRC staff concluded that BWXT described and assessed chemical accident consequences and effects that could result from the handling, storage, or processing of licensed materials. BWXT prepared a hazard analysis that identifies and evaluates those chemical process hazards and potential accidents, and established safety controls providing reasonable assurance of safe facility operation. To ensure that the performance requirements in 10 CFR Part 70 are met, BWXT stated that controls are available and able to perform their safety-related functions when needed.

The staff concluded that BWXT's plan for managing chemical process safety meets the requirements of Part 70 and provides reasonable assurance that the public health and safety and environment will be protected.



## 7.0 FIRE SAFETY

### 7.1 PURPOSE OF REVIEW

The purpose of this review was to determine with reasonable assurance that the applicant designed a facility that provides adequate protection against fires and explosions that could affect the safety of licensed materials and thus present an increased radiological risk. The review also established that the application considered radiological consequences of fires and instituted suitable safety controls to protect workers, the public, and the environment.

### 7.2 STAFF REVIEW AND ANALYSIS

#### 7.2.1 FIRE SAFETY MANAGEMENT MEASURES

The application documented how BWXT administers and ensures fire safety at the licensed facility. The application reflects a commitment to ensure that the IROFS, as identified in the ISA Summary, are available and reliable, and the facility maintains fire safety awareness among employees, controls transient ignition sources and combustibles, and maintains a readiness to extinguish or limit the consequences of fire.

The application identified the Manager, Industrial Health and Safety as the administrator of the licensee's fire safety program. This manager is a senior-level manager, who has the authority and staff to ensure that fire safety receives appropriate priority. Oversight of the program shall be provided by the Safety Review Committee and the Industrial Health and Safety Committee. NRC's August 2006 site review determined that day-to-day fire safety is supervised by an individual with sufficient practical fire safety experience in nuclear facilities.

The applicant utilized National Fire Protection Association (NFPA), "Standard for Fire Protection for Facilities Handling Radioactive Materials," NFPA 801 (2003c), which specifies the following fire safety management measures, including: fire prevention; inspection, testing, and maintenance of fire protection systems; emergency response organization qualifications, drills, and training; and pre-fire plans. The staff recognizes NFPA 801 (2003c) as an acceptable standard for fire safety management measures.

Specific fire protection programs will be implemented for:

- control of flammable liquids, pyrophoric materials, combustible metals and combustible gases,
- control of transient combustibles,
- periodic audits,
- housekeeping, storage, and use of ordinary combustibles, and
- Control and permitting of ignition sources.

[REDACTED]

In response to an NRC's request for additional information regarding hot work permits, BWXT responded (2006a) that ignition Source Work (Hot work) is controlled through compliance with the IH&S health and Safety Manual procedure on Ignition Source permits as referenced to NFPA 51-B (2003a). The procedure establishes areas where ignition source permits are required, and where exempt areas have been established due to routine welding in those areas. The Ignition Source Work procedure also provides guidelines for performing ignition source work.

All changes to the facility, or processes that could affect fire safety or the IROFS are reviewed and approved according to the facility change control process. NFPA 801 (2003c) will be referenced during engineering reviews as guidance for design of new facilities containing processes involving licensed material.

Fire prevention is accomplished by maintaining the facility such that accumulation of combustibles is minimized, strictly controlling the use of ignition sources and other potential fire sources, and designing and controlling processes such that the possibility of a fire is minimized.

The inspection, testing, and maintenance of fire related IROFS are established during the ISA. The ISA Summary identifies inspection testing and maintenance as it applies to specific IROFS. The maintenance and inspection procedures are based on the requirements of the NFPA standards.

The licensee maintains a Pre-Fire Plan, which provides specific guidance to the site Emergency Team in responding to fires in all areas where radioactive material is stored or processed. The Pre-Fire Plan includes drawings that identify the information necessary for fire fighting in those areas. During the August 2006 site visit, the NRC staff reviewed BWXT's Pre-Fire Plans for the [REDACTED] Area and the [REDACTED]. The NRC determined that the Pre-Fire Plans complied with most of the [REDACTED] suggested in NFPA 801 (2003c) with the exception of emergency lighting which is captured in other drawings.

The staff concluded that the application met the guidance provided in NUREG-1520 (2002) for fire safety management measures and is, therefore, acceptable.

## 7.2.2 FIRE HAZARDS ANALYSIS

Information that would normally be contained in the FHA, in accordance with NFPA 801 (2003c) and NUREG-1520 (2002), was captured in the Safety Analysis Reports (SAR) for various process areas, contained in BWXT's ISA Summary. During the August 2006 onsite review, the NRC staff reviewed scenarios associated with SAR 15.35, "[REDACTED] Process Operations, SAR 15.10," "3" [REDACTED] in Uranium Recovery, and 15.5 [REDACTED] Process in Uranium Recovery." Based on their review, the NRC staff determined that most of the fire hazard analysis steps, recommended in Appendix B of NFPA 801 (2003c), were present in the SAR documents, but not in the detail recommended by the standard. Also, the design of the main portion of the facility is such that no fire separation is provided between most [REDACTED] and [REDACTED].

[REDACTED]

boundaries of areas analyzed in the SARs may not be fire area boundaries. However, the SAR descriptions contained fuel loading, fire scenarios, methods of consequence analysis, potential consequences, and a description of mitigative controls in accordance with the guidance in NUREG-1520 (2002).

The staff concluded that the application met the guidance provided in NUREG-1520 (2002) for Fire Hazards Analysis and is, therefore, acceptable.

### 7.2.3 FACILITY DESIGN

Building construction, fire area determination, electrical installation, life safety, ventilation, drainage, and lightning protection are all facility design features that affect fire safety. The application documents the fire safety considerations used in the general design of the facilities containing licensed material, or facilities that impose an exposure threat to radiological facilities. Features listed by the BWXT include:

- noncombustible and fire resistant building materials,
- fire barrier separations,
- ventilation controls and fire dampers,
- explosive gas detection systems,
- fire detection systems,
- fire suppression systems,
- electrical Installations, and
- exit considerations.

Moderation control areas are provided with portable fire extinguishers for use on Class A, B, C, and D fires. Wheeled CO<sub>2</sub> extinguishers are located outside of the evacuation doors of the individual controlled areas for extended use during firefighting operations.

Drainage from fixed and manual fire suppression is contained onsite by collection of all storm-water/waste water at Bryant's pond located at the waste treatment facility (2006a).

[REDACTED]

[REDACTED]. The SAR documents have descriptions of the pathways. Evacuation route signs are visible within the areas (2006a).

[REDACTED]

[REDACTED] BWXT stated that [REDACTED], was assumed in the fire analysis provided in 15.2.2 of the ISA Summary. In addition, the roof has a Class A fire rating as defined in NFPA 256 (2003b). Therefore, a fire on the roof would not be expected to spread with such rapidity or intensity that structural members would be threatened (2006a).

BWXT states that design and construction of new facilities will: (1) comply with the baseline design criteria specified in 10 CFR 70.64(a); (2) comply with the defense-in-depth requirements of 10 CFR 70.64(b); and (3) be consistent with the guidance provided in NFPA 801 (2003a). The staff reviewed the adequacy of the fire safety design of new facilities and found it to be acceptable.

The staff concludes that the license application meets the guidance provided in NUREG-1520 (2002) for Facility Design and is, therefore, acceptable.

#### 7.2.4 PROCESS FIRE SAFETY

Process fire safety, specific to fire/explosion hazards associated with individual processes, is discussed in the individual SAR documents for a given area. Fire loading calculations for controlled areas are captured in ISA documents associated with each SAR, and approximate inventory quantities for chemical hazards are provided in the chemical section of each SAR document (2006a).

The ISA Summary, as revised in January 2006, includes several detailed sections describing the results of fire analyses, [REDACTED]

The staff concluded that the application met the guidance provided in NUREG-1520 (2002) for Process Fire Safety and is, therefore, acceptable.

#### 7.2.5 FIRE PROTECTION AND EMERGENCY RESPONSE

Fire protection systems at the site include the installation of wet pipe sprinkler systems, dry pipe sprinkler systems, a pre-action sprinkler system, dry chemical extinguishing systems, and a gaseous agent extinguishing system (2006a). Of these systems, only the wet pipe system protecting the [REDACTED] is an IROFS. Sprinkler system design utilizes NFPA 13 (2006b), Ordinary Hazard Class, Group 2 criteria, except for the flammable liquids storage [REDACTED] where an extra hazard classification is used (September 7, 2006).

[REDACTED]

The site also has [REDACTED] detection system, designed to monitor for preset values of concentration for [REDACTED] based on the [REDACTED] [REDACTED] alarm notifications, which perform process/system shutdown functions and area evacuations, are established from nationally recognized standards and manufacturer's data. The alarm set points for the interior of enclosures are typically [REDACTED] of the lower explosive limit (LEL) value of an [REDACTED]. The alarm set points for the exterior of enclosures are typically [REDACTED] of the LEL value of an individual gas. These set points satisfy the guidance provided in NFPA 801 (2003c)

All emergency team members are trained as State of Virginia Level 1 or level 2 firefighters which exceeds the training required by OSHA or NFPA 600 (2005) fire brigade standards. Equipment available for fire fighting is commensurate with OSHA and NFPA 600 (2005) fire brigade standards related to industrial fire brigades that perform advanced interior and exterior structural fire fighting, including portable fire extinguishers, hose and hose accessories, portable lighting equipment, forcible entry tools, ladders, salvage/overhaul equipment, personal protective equipment, and self contained breathing apparatus (2006a).

Employees are trained how to use of fire extinguishers at least once per year. Emergency personnel are trained on specific radiation and nuclear criticality safety issues at least once a year. General fire fighter training is given four times a year with live fire scenarios (2006a).

Available hoses allow sufficient lays such that all areas of the site are accessible for manual fire suppression. Fire hydrants are accessible to emergency vehicle, and allow for sufficient hose lay to access points of different areas of the site. Through the use of varying sized hoses [REDACTED] and water capacities, sufficient volumes of water can be delivered to emergency personnel so that they can perform fire fighting duties commensurate with the advanced interior and exterior structural fire fighting duties defined in NFPA 600 (2006a).

The staff concluded that the application met the guidance provided in NUREG-1520 (2002) for Fire Protection and Emergency Response and is, therefore, acceptable.

### **7.3 EVALUATION FINDINGS**

The staff reviewed BWXT's application with regard to fire safety management measures, fire hazards analysis, facility fire protection, process fire safety, and fire safety and emergency response. BWXT's submittals provided sufficient information, in accordance with requirements of 10 CFR 70.22, and 70.65, regarding potential fire hazards, consequences, and required controls for the proposed processes. The NRC staff determined that BWXT demonstrated compliance with the performance requirements of 10 CFR 70.61 for fire protection, related to postulated accident scenarios. The design proposed by the applicant also satisfies the requirements of 10 CFR 70.64(a), Baseline Design Criterion (3) "Fire Protection," as well as 10 CFR 70.64 (b), defense in depth.



#### 7.4 REFERENCES

(2006a) BWX Technologies, letter to Director, Office of Nuclear Materials Safety and Safeguards from Leah R. Morell, BWXT "Response to Request for Additional Information on License Renewal Application for Fire Safety and Environmental Protection," September 7, 2006.

(2006b) National Fire Protection Association, NFPA-13, "Standard for Installation of Sprinkler Systems - 2007 Edition," August 17, 2006.

(2003a) National Fire Protection Association, NFPA-51B, "Standard for Fire Prevention During Welding, Cutting, and Other Hot Work - 2003 Edition," August 7, 2003.

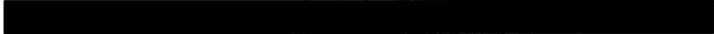
(2003b) National Fire Protection Association, NFPA-256, "Standard Methods of Fire Tests of Roof Coverings - 2003 Edition," August 7, 2003

(2005) National Fire Protection Association, NFPA-600, "Standard on Industrial Fire Brigades - 2005 Edition," February 7, 2006

(2003c) National Fire Protection Association, NFPA-801, "Standard for Fire Protection for Facilities Handling Radioactive Materials - 2003 Edition," February 6, 2003

(2001) U.S. Nuclear Regulatory Commission, NUREG-1513, "Integrated Safety Analysis Guidance Document," 2001.

(2002) U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," March 2002.



## **8.0 EMERGENCY MANAGEMENT**

BWXT's Emergency Plan is a living document, updated annually. This plan is not part of the NRC's license renewal review. Safety Condition S-2 gives the date of the current Emergency Plan. Safety Condition S-2 is carried forward, unchanged, in the renewed license.

## 9.0 ENVIRONMENTAL PROTECTION

### 9.1 PURPOSE OF REVIEW

The purpose of this review was to determine whether BWXT's proposed environmental protection measures are adequate to protect the environment, and the health and safety of the public, as required by 10 CFR Parts 20, 30, 40, 51, and 70. The NRC staff evaluated the effects that BWXT's license renewal would have on the environment, in accordance with the SRP (NUREG-1520). In addition, the staff determined that BWXT submitted an environmental report that is adequate to prepare an Environmental Assessment and Finding of No Significant Impact.

### 9.2 STAFF REVIEW AND ANALYSIS

#### 9.2.1 ENVIRONMENTAL REPORT

The staff reviewed and evaluated the BWXT Environmental Report for Renewal of License SNM-42, Rev. 1, dated 2004, (transmitted by BWXT letter dated February 25, 2005), the BWXT response to NRC's Request for Additional Information, dated 2005, and NRC's Supplemental Environmental Assessment for Renewal of Special Nuclear Materials License SNM-42, dated June 1995, and additional references given in NRC's Environmental Assessment for this renewal.

#### 9.2.2 RADIATION SAFETY

See this Safety and Safeguards Evaluation Report, Section 4.0, "Radiation Protection," for the staff's review and conclusion for BWXT's radiation protection program.

#### 9.2.3 EFFLUENT AND ENVIRONMENTAL MONITORING

The NRC staff reviewed Chapter 9, "Environmental Protection," of the application. It describes the site's Environmental Protection Program, which assures that exposure of the public and the environment to hazardous materials used in facility operations is kept ALARA. The Environmental Protection Program includes liquid effluent monitoring; air monitoring; soil, sediment and vegetation sampling; water monitoring; direct radiation monitoring; and property and equipment release monitoring.

##### 9.2.3.1 Liquid Effluent Monitoring

Liquid effluent from the Waste Treatment Facility will be continuously sampled, using a composite sampler. Releases of liquid effluent from the Waste Treatment Facility are sampled and analyzed to assure compliance with the liquid effluent limits of 10 CFR Part 20, prior to discharge into the James River. Once a day, a sample will be collected from the composite sampler and will be analyzed for gross alpha and gross beta/gamma activity. A monthly

[REDACTED]

composite of these daily samples will be analyzed for uranium isotopes as well as gross beta/gamma activity. If the concentration in the effluent exceeds the established daily and monthly action levels, an investigation will be performed. Corrective action will be taken if the investigation indicates that the monthly action level may be exceeded on an annual average basis. In addition, if the monthly action level for gross beta/gamma activity is exceeded, a beta/gamma isotopic analysis will be performed.

#### 9.2.3.2 Air Effluent Monitoring

The gaseous exhaust streams containing significant levels of radioactive material will be treated with an absolute filter or with a high efficiency scrubber. [REDACTED] will have two stages of HEPA filters. Operations used to handle [REDACTED] will have two stages of HEPA filters unless: the exhaust goes to the 50 meter stack through one stage of HEPA filtration and the material in open containers is 80 mCi or less for [REDACTED] or 3300 mCi or less for [REDACTED], or the exhaust goes to the Radiochemistry Laboratory or Analytical chemistry stack through a scrubber and the amount of material in open containers is 5 uCi or less for [REDACTED] or 200 uCi or less for [REDACTED]. Performance of the final HEPA filters, used for the [REDACTED] facility will be verified by cold [REDACTED] testing the filters, either annually or after a filter is changed, whichever comes first.

All gaseous effluent release points with releases that are greater than 10% of the concentrations listed in 10 CFR 20, Appendix B, Table II, will be continuously sampled. An impinger will be used to sample the release point when soluble gasses are likely. The samples will be analyzed every working day, unless the release point is continuously monitored. Action levels have been set for the various monitored stacks. If the action levels are exceeded, an investigation is required. If the investigation indicates that average annual action level or the annual release limit may be exceeded, Regulatory Guide 4.20 will be used to determine compliance with the NRC requirements on air emissions. If the results of this indicate that the release may exceed the requirements, appropriate corrective action will be taken.

#### 9.2.3.3 Environmental Monitoring

Surface water samples will be collected quarterly, upstream and downstream of the effluent discharge point on the James River and analyzed for alpha and beta activity. If the set action levels are exceeded, isotopic content of the sample will be analyzed and investigative and corrective actions will be taken as appropriate. [REDACTED] is sampled monthly and the [REDACTED] is monitored to assure [REDACTED] integrity. Annual direct radiation surveys are made of the water channel passing through the [REDACTED] and the east end of the canal. TLDs or equivalent are used to continuously monitor direct radiation of the LTC area boundary.

[REDACTED] located [REDACTED], Bryant's Pond, the final effluent ponds, the LTC liquid waste tanks, and [REDACTED] of the plant near the James River will be sampled annually to measure the alpha and beta activity. If the established action levels for groundwater are exceeded, the samples will be analyzed for isotopic content and appropriate investigative and corrective actions will be taken. If it is determined that licensed activities have resulted in the action levels being exceeded, a report will be submitted to the NRC, Region II Office.

[REDACTED]

Air samples will be collected continuously at the site boundaries, located approximately at the four compass points. These samples will be counted weekly and the results will be compared to action levels. If the action levels are exceeded, appropriate investigative and corrective action will be taken.

Soil, sediment, and vegetation samples will be taken semi-annually and analyzed for uranium and gross beta/gamma activity. The data will be analyzed to identify any trends in the concentrations. If radioactivity concentrations exceed specified action levels, appropriate investigative and corrective actions will be taken. Action levels are specified for gross alpha and gross beta/gamma activity in these samples. If the action levels are exceeded, then an investigation will be performed and corrective action will be taken as needed. TLDs or an equivalent method are used to monitor direct radiation at the LTC area boundary.

Material and equipment removed from an area where readily dispersible radioactive material is handled or processed is monitored for contamination in accordance with, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material", dated April 1993.

### **9.3 EVALUATION FINDINGS**

BWXT has developed a program to implement adequate environmental protection measures during operation, which include: (1) effluent controls to maintain public doses ALARA as part of the radiation protection program, and (2) effluent and environmental monitoring. The NRC staff concluded that BWXT's program, as described in its application, is adequate to protect the environment and the health and safety of the public, and complies with regulatory requirements in Parts 20, 51, and 70.

The NRC staff consulted with the Commonwealth of Virginia prior to issuing an Environmental Assessment (EA), dated March 31, 2006, for this licensing action, as required by 10 CFR 51.20. The EA and Finding Of No Significant Impact was published in the Federal Register (71 FR 16348, March 31, 2006). The NRC staff concluded that the proposed renewal of license SNM-42, involving the continued operations at the BWXT site in Lynchburg, Virginia, will not result in a significant impact to the human environment. The NRC staff also concluded that the proposed action will not adversely affect federally listed species or federally designated critical habitat because no federally listed species are known to inhabit the project area. The staff also finds that no historic properties will be affected by the proposed action. The facility is already built, and no changes to the operations are associated with the license renewal. Airborne and liquid effluents are below regulatory limits for nonradiological and radiological contaminants. The radiological doses associated with the exposure to these effluents for the maximally exposed individual is less than 1 percent of NRC's 1.0 mSv [100 mrem] annual limit in 10 CFR 20.1301. No environmental impact statement is required.



## **10.0 DECOMMISSIONING**

### **10.1 PURPOSE OF THE REVIEW**

The purpose of this review was to determine that funds will be available to decommission the site safely and in accordance with 10 CFR 70.25.

### **10.2 STAFF REVIEW AND ANALYSIS**

BWXT submitted a DFP for the site in a letter dated May 15, 2000. The NRC approved the cost estimate and the method for assuring funds for decommissioning in a letter dated December 15, 2000, and requested that BWXT to submit signed and executed documents for the method of assuring funds. BWXT provided the signed and executed documents with a letter dated January 15, 2001.

BWXT has committed to update the cost estimate every three years, as required by 10 CFR 70.25(e). The most recent update to the cost estimate was completed in March 2006 and is on file at the site.

### **10.3 EVALUATION FINDINGS**

The NRC staff evaluated BWXT's DFP in accordance with NUREG-1757 as documented in a letter dated December 15, 2000. The staff reviewed Chapter 10 of the application, which contains the decommissioning funding plan, a description of the financial assurance and a cost estimate for decommissioning activities. On the basis of these reviews and BWXT's compliance with the updating requirements, the NRC staff determined that BWXT's financial assurance for decommissioning continues to provide sufficient funding to ensure decommissioning and decontamination of the site and, therefore, provides reasonable assurance of protection for workers, the public, and the environment.

## 11.0 MANAGEMENT MEASURES

### 11.1 PURPOSE OF REVIEW

The purpose of this review was to verify that BWXT provided conclusive information to ensure that the management measures applied to IROFS, as documented in the ISA Summary, provide assurance that the IROFS will be available and reliable, consistent with the performance requirements of 10 CFR 70.61. The review also determined whether the measures are applied to the IROFS in a graded approach commensurate with the IROFS' importance to safety. The acceptance criteria for the review are contained in Section 11.4.3 of NUREG-1520 (NRC, 2002).

Management measures are functions that BWXT performs, generally on a continuing basis, which are applied to safety significant controls, which include IROFS, to ensure compliance with established performance requirements that the IROFS are available and reliable. Management measures shall be implemented to assure compliance with performance requirements, and the degree to which they will be applied will be a function of the item's importance to meeting performance requirements as evaluated in the ISA. This chapter addresses each of the management measures included in the 10 CFR Part 70 definition of management measures, including: (a) configuration management; (b) maintenance; (c) training and qualifications; (d) procedures; (e) audits and assessments; (f) incident investigations; (g) records management; and (h) other QA elements.

### 11.2 STAFF REVIEW AND ANALYSIS

In each process area of the ISA Summary, BWXT provided tables that include identification of IROFS credited in the analyses. For brevity, BWXT included only the specific, unique maintenance applied to each specific control listed in those tables. Also, the ISA Summary briefly lists some of the management measures applied to most IROFS, while Chapter 11 of the reformatted license contains a more complete discussion of the management measures applied to IROFS to ensure they are available and reliable. The following is a list of the eight key elements of management measures discussed by BWXT:

- configuration management
- maintenance
- training and qualification
- procedures
- audits and assessments
- corrective action program
- records management
- other quality assurance elements/quality system

[REDACTED]

The staff reviewed the configuration management function for BWXT according to Chapter 11 of the SRP and finds it to be acceptable. The staff reviewed the organizational structure, procedures, responsibilities to implement configuration management, the design requirements and bases, document and change control responsibilities and procedures, and assessments, and finds them to be acceptable.

BWXT has committed to the maintenance of the IROFS. The licensee's maintenance commitments contain the basic elements to maintain availability and reliability. The staff concluded that the licensee's maintenance functions meet the requirements of 10 CFR Part 70, and provide reasonable assurance that the health and safety of the worker and public are maintained.

Based on its review of the license application regarding training and qualification, the staff concluded that the training and qualification program will result in maintaining qualified and competent personnel to design, construct, startup, operate, maintain, modify and decommission the facility safety.

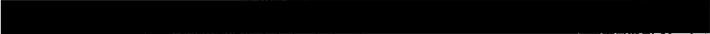
The staff reviewed the licensee's procedures that are part of the management measures. The staff found that the licensee described a suitably detailed process for development, approval, and implementation of the IROFS.

Based on its review of the ISA Summary and the application, and the onsite review of procedures for audits and assessments, the NRC staff found that BWXT adequately described its process for audits and assessments.

BWXT has committed in its license application to perform incident investigations in its corrective action program, by establishing an organization responsible for doing investigations and determining root causes and generic implications of events, and recommending and tracking the implementation of corrective actions. BWXT has also committed to maintenance of records related to corrective actions. The staff finds these areas to be acceptable.

The staff reviewed BWXT's Records Management Program against the SRP's acceptance criteria and concluded that the system will be effective in collecting, verifying, protecting, and storing information about the facility; that it will provide records storage areas with capability to protect the information for the required durations; and that it provides reasonable assurance that any deficiencies in the records management system will be detected and corrected in a timely manner.

As described in BWXT's license application, it has established and documented a commitment to a quality system based on the International Organization for Standardization (ISO 9001) quality management system, that incorporates all the other QA elements necessary for maintenance of the IROFS, and for the design, construction, and operations of the facility. The staff's review concluded that this is acceptable.



### 11.3 EVALUATION FINDINGS

As discussed in the Technical Evaluation Report for the License Amendment #113, for BWXT's approval of their license reformat request and ISA Summary, dated June 30, 2006, the staff found that the conclusion of that review is current and applicable and is repeated below for completeness.

The staff finds that the management measures, as applied to specific IROFS, are acceptable for providing reasonable assurance that the IROFS will be available and reliable to perform their safety functions. The NRC staff reviewed the above information and found that the licensee's description of the management measures applied to the IROFS are acceptable to meet the requirements of 10 CFR 70.65(b)(4).

The staff concluded that the BWXT's quality system, as described in the application, provides reasonable assurance that authorized activities will be carried out in compliance with the license requirements, and deviations from requirements will be promptly identified and corrected.

## 12.0 MATERIAL CONTROL AND ACCOUNTING

### 12.1 PURPOSE OF REVIEW

The purpose of this review was to ensure there would be no adverse impact on the public health and safety or common defense and security as a result of BWXT's license renewal.

### 12.2 STAFF REVIEW AND ANALYSIS

#### 12.2.1 FUNDAMENTAL NUCLEAR MATERIAL CONTROL (FNMC) PLAN

Currently, BWXT maintains an approved Fundamental Nuclear Material Control (FNMC) Plan. This FNMC Plan pertains to both low-enriched uranium and high-enriched uranium Material Control & Accounting (MC&A) activities at the facility. The last revision of the BWXT FNMC Plan was submitted to the NRC in March 2005, and was approved in July 2005, as reflected in Safeguards License Condition SG-5.1. The staff determined that the currently approved FNMC Plan contains appropriate and necessary commitments to meet applicable MC&A requirements in 10 CFR 74.51, "Formula Quantities of Strategic Special Nuclear Material." The staff also determined that the five chapters of the current FNMC Plan are consistent with the regulatory guidelines of NUREG-1280, Rev. 1, "Standard Format and Content Acceptance Criteria for the MC&A Reform Amendment."

#### 12.2.2 MATERIALS LICENSE - SAFEGUARDS CONDITIONS

The staff reviewed BWXT's MC&A safeguards conditions contained in Sections 1.0, 2.0, 3.0, 4.0, and 5.0 of its Special Nuclear Materials License 42 (SNM-42). The purpose of this review was to ensure that the safeguards conditions relevant to the facility's MC&A programs are compatible and consistent with the approved FNMC Plan and regulatory requirements in the applicable 10 CFR Parts 74.51-59. The review resulted in the following determinations:

A number of safeguards conditions, which either expired or were no longer applicable to the programs, was deleted from the current license. Specifically, the deletion includes the following conditions: SG-1.1, SG-2.1, SG-3.1, SG-4.11 through 4.24, SG-4.26 through 4.32, SG-5.2, and SG-5.5 through 5.7. In particular, Condition SG-5.5 was deleted because it conflicts with 10 CFR 74.15. Condition SG-5.2 was no longer needed since the low-enriched uranium FNMC Plan was previously consolidated into the currently approved FNMC Plan.

For clarification and consistency purposes, all other MC&A safeguards conditions are rewritten and renumbered as follows:

#### Section 1.0 - Abrupt Loss Detection

- There is no condition in this section. The necessary information and commitments are contained in the FNMC, Plan identified in Condition SG-5.1.

[REDACTED]

- Safeguards Condition SG-1.1 was deleted because the reference to Chapter 1 of the FNMC Plan is listed in SG-5.1.

#### Section 2.0 - Item Monitoring

- There is no condition in this section. The necessary information and commitments are contained in the FNMC Plan identified in Condition SG-5.1.

Safeguards Condition SG-2.1 is deleted for editorial reasons.

#### Section 3.0 - Alarm Resolution

There is no condition in this section. The necessary information and commitments are contained in the Plan identified in Condition SG-5.1.

Safeguards Condition SG-3.1 was deleted because the original condition was incorporated into the FNMC Plan.

#### Section 4.0 - Quality Assurance

SG-4.1 Notwithstanding the requirements of 10 CFR 74.59(d)(1) to establish and maintain a system of measurements sufficient to substantiate [REDACTED] content of all SSNM received, inventoried, shipped, or discarded, the licensee:

- (a) shall follow Section 4.7.1.3 of the FNMC Plan identified in Safeguards Condition SG-5.1 with respect to mechanical treatment of receipts of certified [REDACTED] for the purpose of storage consolidation, without measurement for physical inventory purposes. That is, following mechanical treatment, the original receipt value shall be retained for accounting purposes until the material undergoes chemical processing;
- (b) need not measure the total [REDACTED] content of those materials measured by nondestructive assay for [REDACTED], if the calculated [REDACTED] content is based on the measured isotope content divided by a previously established and traceable isotopic abundance (as a weight fraction) measurement at the area of generation;
- (c) shall, without measurement, process and/or store [REDACTED] [REDACTED] which are received with intact [REDACTED] provided (i) they were manufactured by a DOE contractor, (ii) the [REDACTED] remains intact prior to processing, and (iii) the previous [REDACTED] values determined by the manufacturer are assigned to these items;

[REDACTED]

[REDACTED]

(d) shall follow Section 4.7.1.3 of the FNMC Plan identified in Safeguards Condition SG-5.1 for the measurement of [REDACTED] content of government-required retainer samples received, provided an unresolved statistically significant shipper-receiver difference does not exist on the [REDACTED]; and

(e) shall follow Section 4.3.1.7 of the FNMC Plan identified in Safeguards Condition SG-5.1 for the measurement of [REDACTED] sections in the form of pieces [REDACTED].

SG-4.2 To satisfy the requirements of 10 CFR 74.59(h)(1)(ii) that limits of error be calculated for each shipment, for [REDACTED], the licensee shall follow Section 4.7.2 of the FNMC Plan identified in Safeguards Condition SG-5.1.

SG-4.3 Notwithstanding the requirements of 10 CFR 74.59(e)(3) to generate current data on the performance of measurement processes, to measure standards and replicates for bulk volume systems, to perform replicate sampling and replicate analysis for environmental releases, to perform replicate isotopic analysis, to generate bulk and random errors for process materials, and to generate separate random errors for sampling and analysis on all sampling systems, the licensee shall follow Section 4.4 of the Plan identified in Safeguards Condition SG-5.1.

SG-4.4 Notwithstanding the requirements of 10 CFR 74.59(e)(6) concerning bias corrections, the licensee shall follow Section 4.4.2.4 of the Plan identified in Safeguards Condition SG-5.1.

SG-4.5 The use of disposable pipettes is limited to those applications listed in Section 4.4.2.2.3 of the Plan identified in Safeguards Condition SG-5.1.

SG-4.6 Any in-process measurements performed for the sole purpose of process monitoring and not for accountability shall not be required to meet 10 CFR 74.59(e) requirements.

SG-4.7 Notwithstanding the requirements of 10 CFR 74.59(e)(5) to statistically evaluate all program data and information, the licensee shall exclude secondary weights from the standard error of inventory difference (SEID) calculation and bias corrections.

SG-4.8 Notwithstanding the requirements of 10 CFR 74.59(e)(8) to establish and maintain a statistical control system designed to monitor the quality of each type of program measurement, the licensee shall:

[REDACTED]

(a) follow Section 4.4.2.3 of the FNMC Plan identified in Safeguards Condition SG-5.1 in lieu of maintaining control charts for control standard measurements associated with scales and balances and nondestructive assay measurement systems; and

(b) follow Section 4.4.2.11 of the FNMC Plan identified in Safeguards Condition SG-5.1 in lieu of controlling within-lot sampling errors of [REDACTED] at the 0.05 and 0.001 levels of significance.

- SG-4.9 Notwithstanding the requirements of 10 CFR 74.59(e)(3) and (8) to determine and control random and systematic errors, the licensee shall exclude the measured discard path for airborne environmental releases from the measurement control program and the standard error of inventory difference (SEID) calculation.
- SG-4.10 Notwithstanding the requirement of 10 CFR 74.59(e)(3)(i) to measure control standards for all measurement systems for the purpose of determining bias, and notwithstanding the requirement of 10 CFR 74.59(e)(8) to maintain a statistical control system to monitor such control standard measurements, the licensee need not measure nor monitor control standards for point calibrated, bias-free systems. To be regarded as bias-free, a measurement system shall be calibrated by one or more measurements of a representative standard each time process unknowns are measured, and the measurement value assigned to a given unknown shall be based on that calibration.
- SG-4.11 Notwithstanding the commitment, in Section 4.7.1.2 of the FNMC Plan identified in Safeguards Condition SG-5.1, to perform receipt verification measurements and distribute DOE/NRC Form 741 within 30 days of receiving shipments of strategic special nuclear material, the licensee shall have 30 additional days from the date of the material receipt to fulfill the above stated commitment relative to the shipment [REDACTED] identified in the September 6, 2002, request letter. This condition shall automatically expire on completion of the last shipment of the subject [REDACTED].
- SG-4.12 Notwithstanding the commitments in Section 4.7.1.2 of the FNMC Plan identified in Safeguards Condition SG-5.1 to follow NUREG/BR-0006, "Instructions for Completing Nuclear Material Transaction Reports," for performing and reporting receipt measurements, the licensee shall: (a) within 10 days acknowledge, receipt of the shipment in accordance with NUREG/BR-0006, using the shipper's values, and (b) within 75 days after receipt of each shipment, report receiver's values, if necessary, in accordance with NUREG/BR-0006. The condition only applies to the [REDACTED] identified in the licensee's letters dated September 28 and November 10, 2004, and shall automatically expire on the completion of the final shipment of the subject [REDACTED]. Upon completion of the final shipment, BWXT shall notify the NRC with a written request to amend SNM-42 to delete this Safeguards Condition.

[REDACTED]

Section 5.0 - FNMC Plan and Special Regulatory Issues

- SG-5.1 To achieve the performance objectives of 10 CFR 74.51(a) and maintain the system capabilities of 10 CFR 74.51(b) with respect to all activities involving special nuclear material, the licensee shall follow the General Discussion and Chapters 1.0 through 4.0 (all pages dated March 29, 2006) of its "Fundamental Nuclear Materials Control Plan - Special Nuclear Materials License 42." Any revisions to this FNMC Plan shall be made in accordance with, and pursuant to, either 10 CFR 70.32(c) or 10 CFR 70.34.
- SG-5.2 In lieu of the requirements of 10 CFR 74.59(h)(1)(ii) to review and evaluate shipper-receiver differences [REDACTED] basis for receipts of off-site generated scrap, the licensee shall follow Sections 4.7.1.12, 4.7.2.10, 4.7.2.11, and 4.7.2.12 of the FNMC Plan identified in Safeguards Condition SG-5.1. For this material, the recovered quantities and associated uncertainties for a campaign shall be evaluated in accordance with the requirements of 10 CFR 74.59(h)(1)(ii) relative to all shipments, in a [REDACTED] and on a cumulative basis for like material.
- SG-5.3 Notwithstanding the requirement of 10 CFR 74.59(h)(2)(ii) to recover any scrap measured with a standard deviation greater than [REDACTED] percent within six months from the end of the inventory period in which it was generated, the licensee shall retain no more than [REDACTED] scrap with a standard deviation greater than five percent until processes can be developed to eliminate the generation of this scrap or an approved process for the conversion of this scrap to a better measured form is in place.
- SG-5.4 Operations involving special nuclear material which are not described in the FNMC Plan, identified in Safeguards Condition SG-5.1, shall not be initiated until an appropriate safeguards plan has been approved by the Nuclear Regulatory Commission.
- SG-5.5 The restriction of 10 CFR 74.51(d)(2) is hereby lifted, and based on performance acceptable to the NRC, the licensee is authorized to conduct physical inventories in accordance with the requirements of 10 CFR 74.59(f)(1). The licensee need not calculate the standard error of inventory difference for a given plant if the inventory difference for that plant is [REDACTED]
- SG-5.6 Notwithstanding the SNM possession limits allowed by Conditions 6, 7 and 8 of this license, and notwithstanding the material control and accounting (MC&A) requirements that would normally apply to the authorized possession and use of such SNM quantities, [REDACTED] is exempted from the MC&A requirements of 10 CFR Parts 70 and 74 except for those identified below. This exemption is conditional upon compliance with the licensee's

[REDACTED]

commitments, as given in the General Discussion Section of the FNMC Plan identified in Safeguards Condition SG-5.1, to: (1) maintain the total possessed [REDACTED] SNM quantity [REDACTED], and (2) maintain [REDACTED] that encloses the BWXT Nuclear Products Division facility. Those MC&A regulatory requirements of 10 CFR Parts 70 and 74 that apply to [REDACTED] are as follows:

10 CFR 70.51(b)(1) through (3); 10 CFR 74.6; 10 CFR 74.11; 10 CFR 74.13(a); 10 CFR 74.15; 10 CFR 74.17(c); 10 CFR 74.19; 10 CFR 74.59(b)(1) and (2); 10 CFR 74.59(c); 10 CFR 74.59(d)(2); 10 CFR 74.59(e)(3), (4) and (8); 10 CFR 74.59(f); and 10 CFR 74.59(h)(1)(i), and 10 CFR 74.59(h)(3) and (5).

Conditions SG-5.8 and 5.9 were rewritten and renumbered as SG-5.5 and 5.6 respectively. The former condition deals with certain insignificant bias corrections to the inventory differences which is consistent with the guidelines in Section 4.5 of NUREG-1280. The latter condition deals with clarifications for material [REDACTED] and additions of regulatory requirements [REDACTED] with regard to recordkeeping, the human error program, and custodial responsibility.

Editorial changes were made to Safeguards Conditions SG-4.1(a), (c), and (d), SG-4.2, SG-4.7, SG-4.9, SG-4.10, and SG-5.3 to ensure that the applicability of the condition was clear by changing the word, "may" or "must" to "shall" as appropriate. In addition, BWXT requested, and the NRC approved an editorial wording change to Safeguards Condition SG-5.3 that changed the words, "may retain up to [REDACTED]," to read, "shall retain no more than [REDACTED] [REDACTED] This revision does not change the technical basis for the condition.

### 12.3 EVALUATION FINDINGS

Based on the above, the staff determined that the MC&A portion in the application for a license renewal is acceptable and is in accordance with the requirements in 10 CFR 70.73 and 10 CFR 74, Subpart E. The staff found that the facility's MC&A programs, as delineated in its approved FNMC Plan and related safeguards conditions, are consistent with the regulatory requirements in Subpart E of 10 CFR Part 74 and the guidelines given in NUREG-1280, and continue to provide an effective MC&A program at BWXT. As a result, the staff determined that BWXT meets the requirements in the area of MC&A to operate the facility, under Part 74. Approval of the MC&A portion of the license renewal application is recommended. The staff also recommended that all the MC&A Safeguards Conditions, in Sections 1.0 through 5.0 of the Materials License SNM-42, be issued as discussed above to reflect the current status of BWXT's overall MC&A programs.

[REDACTED]

## 13.0 PHYSICAL PROTECTION AND PHYSICAL SECURITY

### 13.1 PURPOSE OF REVIEW

BWXT has diverse production and storage situations, requiring it to maintain numerous security plans. The staff reviewed four of the six security plans. The four plans reviewed were: the Physical Security Plan (PSP), dated April 29, 2004, submitted as Revision 4 on October 13, 2004, the Training and Qualification Plan (T&QP), dated April 29, 2004, submitted as Revision 11 on October 13, 2004, the Safeguards [REDACTED] Plan (S[P]), dated April 29, 2004, submitted as Revision 2 on October 13, 2004, and the Physical Protection Plan for Special Nuclear Material [REDACTED] for BWXT [REDACTED] dated December 18, 1998.

The remaining two BWXT security plans, physical security plan for protection of special nuclear material of low strategic significance (SNM-LSS) known as the "Low Strategic Special Nuclear Material Security" and the [REDACTED] protection plan, known as "[REDACTED]" will not be in effect when the license is renewed because the plans have been withdrawn (see following paragraph).

### 13.2 STAFF REVIEW AND ANALYSIS

In a letter dated June 30, 2004, BWXT requested renewal of existing license SNM-42, which expired September 30, 2005. BWXT requested that certain applicable license conditions, noted in the June 30, 2004, letter, be carried forward into the renewed license.

By letter dated March 1, 2006 BWXT requested the deletion of the security plan, "Low Strategic Special Nuclear Material Security," as referenced in current safeguards condition SG-6.5 and "Security Plan B," dated July 21, 1986, and revised August 27 and 28, 1986, as referenced in current Safeguards Condition SG-6.6. BWXT resubmitted the application, in its entirety, by letter dated October 24, 2006.

In its renewal request, the licensee advised that, because of the small amount of material at the site, categorized as Category III, no plan such as the current, Low Strategic Special Nuclear Material Security Plan, was required. The licensee committed to the requirements specified [REDACTED]

BWXT has also requested that [REDACTED] be withdrawn. The licensee requested, and the staff recommended that the wording in SG-6.4 and SG-6.5 be changed to the following:

[REDACTED]

Safeguards Condition SG-6.4 is recommended to read:

SG-6.4 "The licensee shall implement and maintain a procedure for areas where a plan submittal to the NRC is not required [REDACTED] in accordance with 10 CFR 73.67, and shall limit the possession of SNM for those areas below that of a Moderate Strategic Significance and [REDACTED]. In addition, quantities of [REDACTED] SNM shall be limited to the amount specified in Safeguards Condition SG-5.6. In the event the licensee plans to exceed these quantities, an appropriate security plan shall be submitted to the NRC in accordance with 10 CFR 73.67(c)."

Safeguards Condition SG-6.5 is recommended to read:

SG-6.5 "Notwithstanding the requirements of 10 CFR 73.40 and 10 CFR 73.50 for the protection of formula quantities of SNM with radiation dose rates greater than specified in 10 CFR 73.6(b), the licensee shall implement an NRC-approved security plan for the protection of [REDACTED] prior to receipt of those [REDACTED]. The SNM protected by this security plan shall be limited to the equivalent of [REDACTED]. The SNM protected by this security plan shall have at least [REDACTED]."

Safeguards Condition 6.7 was also edited to add the word "physicians or" to the list of persons allowed to conduct required medical examinations required by 10 CFR Part 73. The license condition was never intended to preclude the use of licensed physicians that is currently required by 10 CFR Part 73.

A Category 1 Order was issued to BWXT on August 21, 2002. A full security plan review was done at that time and BWXT's security plans were found to be acceptable. The minor changes made to this plan, since the Category 1 Order review, does not constitute a reduction in security. The attachment to that Order contained [REDACTED] required of the licensee, which are in effect at this time, and will remain in effect after the license is renewed.

The PSP, the T&QP and the S[P] were reviewed by the staff in 2004 and were approved as a complete revision of BWXT's old plan as it incorporated the requirements in 10 CFR Part 73 and the [REDACTED] that were part of the Order noted above.

**13.3 EVALUATION FINDINGS**

The staff concluded that the BWXT license renewal request has been submitted in accordance with 10 CFR 70.21 and 10 CFR 70.22. The information contained in the application, statements or reports filed with the Commission under the license have been incorporated by reference, and are clear and specific and in the proper format. The staff reviewed BWXT's license application against the requirements of 10 CFR Part 73 and its license, and find them to be acceptable.

[REDACTED]

[REDACTED]

## 14.0 PHYSICAL SECURITY FOR THE TRANSPORTATION OF SPECIAL NUCLEAR MATERIAL OF LOW STRATEGIC SIGNIFICANCE

The staff reviewed BWXT's letter dated March 1, 2006, requesting the withdrawal of the security plans addressing the transportation of Special Nuclear Material of Low Strategic Significance (SNM-LSS) and to amend the associated Safeguards Condition SG-6.5, located in the expired license. BWXT's proposed replacement, now SG-6.4, states that "in the event the licensee plans to exceed these [REDACTED] quantities, an appropriate security plan shall be submitted in accordance with 10 CFR 73.67(c) sufficiently prior to implementation for NRC review and approval."

The staff notes that although the licensee is not required to have a security plan for transporting SNM-LSS quantities less than 10 kg, the licensee is required to implement a physical protection system capable of achieving the performance objectives specified in CFR73.67(a) when transporting any quantity of SNM-LSS.

The staff reviewed the proposed changes and concluded that the changes meet all applicable requirements.



## 15.0 ENVIRONMENTAL REVIEW

On June 30, 2004, BWXT requested that the NRC approve its license renewal application. BWXT's request for the proposed change was previously noticed in the *Federal Register* on March 6, 2006 (71 FR 11231), with a notice of license amendment request and opportunity to request a hearing.

The staff prepared the EA in support of the proposed action. In that EA, the NRC staff concluded that the proposed renewal, for a 20-year period, of Materials License SNM-42 involving the continued operations at the BWXT site in Lynchburg, VA, will not result in a significant impact to the environment. The NRC staff concluded that the proposed action will not adversely affect federally listed species or federally designated critical habitat because no federally listed species are known to inhabit in the project area. The NRC staff found that no historic properties will be affected by the proposed action. The site is already built, and no changes to the operations are associated with the action. The proposed action can be viewed as a continuation of impacts and can be evaluated based on the previous impacts from past operations.

Airborne effluents released through stacks and liquid effluents released in the James River are below regulatory limits for nonradiological and radiological contaminants. The radiological dose associated with the exposure to these effluents, for the maximally exposed individual is less than 1 percent of the NRC's 1.0 mSv [100 mrem] annual limit pursuant to 10 CFR 20.1301. Occupational doses are also well below regulatory limits.

The environmental impacts of the proposed action have been evaluated in accordance with the requirements presented in 10 CFR Part 51. The NRC staff determined that the renewal of license SNM-42, allowing continued operations at the BWXT site for a 20-year period will not have a significant impact on the human environment. On the basis of the EA, the NRC has concluded that there are no significant environmental impacts from the proposed action and determined not to prepare an environmental impact statement. The EA and a Finding of No Significant Impact was published in the *Federal Register* on March 31, 2006 (71FR16348).



## 16.0 CONCLUSION

Based on the reviews documented in this Safety and Safeguards Evaluation of BWXT's License Renewal Application, the staff concluded that there is reasonable assurance that the activities to be authorized by the issuance of a renewed license for BWXT will not constitute an undue risk to the health and safety of the public. Furthermore, the staff determined that the renewal application meets the requirements of 10 CFR 70.33.

The staff discussed this conclusion with the NRC's Region II Office and they have no objection to the issuance of this renewed license.

The staff recommends that the license for BWXT be renewed for a 20-year term in accordance with the statements, representations, and conditions in the license renewal application dated October 24, 2006, subject to the identified license conditions detailed in this Safety and Safeguards Evaluation Report.



## 17.0 PRINCIPAL CONTRIBUTORS

The individuals and organizations listed below are the principal contributors to the preparation of this Safety Evaluation Report.

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