TEXAS A&M ENGINEERING EXPERIMENT STATION

NUCLEAR SCIENCE CENTER

September 18, 2013

To Whom It May Concern: 2013-0050

Enclosed please find the Texas A&M Nuclear Science Center 2012 Annual Report. Also enclosed you will find a Texas A&M University memo dated August 29, 2013 that appoints Dr. Radek Skoda as the Director of the NSC. This represents a change in our Level 2 management.

Sincerely,

Jerry Newhouse
Reactor Supervisor
TAMU Nuclear Science Center

A020
NRR

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DWIGHT LOOK COLLEGE OF ENGINEERING

Department of Nuclear Engineering

TEXAS A&M UNIVERSITY

August 29, 2013

MEMORANDUM

TO: M. Katherine Banks
TEES Director
Dean and Vice-Chancellor of Engineering
Approved/Date

THROUGH: Dimitris Lagoudas
TEES Deputy Director
Senior Associate Dean for Research
Approved/Date

THROUGH: Costas Georghiades
TEES Assistant Director
Associate Dean for Research
Approved/Date

FROM: Yassin Hassan
Department Head and Professor
Nuclear Engineering
Signed

SUBJECT: Appointment of Director to Nuclear Science Center (NSC)

I respectfully request your approval to appoint Dr. Radek Skoda as the Director of the Nuclear Science Center. The appointment will be effective September 1, 2013. I thank you in advance for your consideration.

xc: N. K. Anand
R. Skoda
M. Williams

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Texas A&M University System
Texas Engineering Experiment Station

2012 Annual Report

Facility Operating License R-83

Nuclear Science Center
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Prepared By: Ashley Booth, NSC RSO

Reviewed By: W. D. Reece, NSC Director

March 2013

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1. Introduction

The Texas A&M University (TAMU) Nuclear Science Center (NSC) is a multi-disciplinary research and education center supporting basic and applied research in nuclear related fields of science and technology as well as providing educational opportunities for students in these fields as a service to the Texas A&M University System and the state of Texas. The NSC also provides services to commercial ventures requiring radiation or isotope production services.

The NSC reactor is a 1 MW TRIGA research reactor in a large (108,000-gal.) pool. The size of the NSC reactor pool provides great flexibility in the experiments that may be conducted near the reactor. The NSC reactor facility includes two neutron beam ports, a neutron/gamma irradiation cell, a film neutron radiography system, hot cells with manipulator arms, and other supporting facilities. Moreover, NSC has Cs-137 calibrator for use in instrument calibration.

Laboratory facilities include counting laboratories with gas flow proportional detectors and High Purity Germanium detectors, a two-station pneumatics sample transfer system, a fast neutron irradiation system, a delayed neutron detection system and a prompt gamma neutron activation analysis system.

The NSC reactor design allows for easy loading/unloading of various types of samples. The NSC actively produces a variety of radioisotopes for industry, hospitals, and academic users. The NSC provides nationally recognized neutron activation analysis (NAA) services to many research and academic institutions in the United States. The Nuclear Engineering Department on campus is a major user of the NSC reactor. The NSC is also one of the major attractions on campus. Last year, the NSC hosted approximately 1700 visitors including: elementary, middle school, high school and college students as well as faculty members, national laboratory scientists and industrial clients. Through these tours, the NSC taught people with widely varying backgrounds about nuclear science.

With strong support from the University, the NSC is continuously increasing the diversity of its facilities and services. The NSC is continuing to produce the prototype for distance learning modules. Under the Texas Work Force Commission grants, and American Recovery and Reinvestment Act (ARRA) funds, the NSC is successfully providing the operator training program and four undergraduate students received their reactor operator license from the NRC. The NSC is still continuing with the security upgrades and enhancements that were initiated as part of DOE Global Threat Reduction Initiative (GTRI). NSC is continuing to provide technical support for the Y-12 training initiatives.

With the DOE reactor upgrade funding from 2010, the NSC upgraded and replaced the cooling tower and systems as well as purchased a whole body contamination monitor that follows nuclear industry standards.

NSC has submitted the license amendment request as well as the revised Tech Specs, SAR, and other supporting documents for the renewal process with Nuclear Regulatory Commission (NRC). They are under review and are still pending with the NRC.

This annual report has been prepared to satisfy the reporting requirements of Technical Specification 6.6.1 of the facility operating license R-83 and of the Department of Energy University Reactor Fuel Assistance Program subcontract No. C87-101594 (DE-AC07-76ER02426).

1.1 Nuclear Science Center Staff

The staff at the Nuclear Science Center consists of four major groups: Reactor Operations, Health Physics/Technical Coordination, Reactor Maintenance, and Administrative Services. Personnel directly involved with the operation and maintenance of the reactor are NRC-licensed operators. The NSC is committed to its educational responsibilities and many members of the staff are part or full-time students at Texas A&M University. Appendix A shows the Nuclear Science Center Organization Chart.

The Texas Engineering Experiment Station (TEES) of the Texas A&M University System operates the NSC. The Director of the NSC is responsible to the Deputy Director of the TEES for the administration and the proper and safe operation of the facility. The NSC Radiation Safety Office is responsible for the Director of NSC for matters relating to safety and for maintaining a proper radiation safety program. In addition to the internal structure, the Reactor Safety Board (RSB) advises the Deputy Director of the TEES and the Director of the NSC on issues or policy pertaining to reactor safety. The Texas A&M University Environmental Health and Safety Department (EHSD) provide assistance when it is required for emergencies and for special operations as agreed. The Texas A&M University Police Department provides security support on a daily basis and is a key support group in the event of a security incident. The College Station Fire Department and the College Station Medical Center provides offsite emergency support when it is required as per agreement.

2. Reactor Utilization for 2012

The Nuclear Science Center (NSC) reactor has been in operation since 1961. The reactor is a 1 MW MTR-converted TRIGA reactor. Core IX is the current core configuration and has been in use since September 2006. The NSC reactor is pulse operational and was pulsed up to $1.75 for nuclear engineering laboratories, staff training, and public tours.

The NSC reactor operated for 2010.4 hours in 2012 with a total integrated power of 85 MW-days. There were 602 "Requests for Irradiation" processed at the NSC during the reporting period. The NSC provided services to TAMU departments, other universities, research centers, and secondary schools in and outside the state of Texas. The cumulative total energy output since initial criticality of the LEU fuel is 489.9 MW-days. Table 2 shows the reactor utilization summary in 2012 and Figure 2 shows the annual reactor utilization in MW-hrs of operation.

Table 2: Reactor Utilization Summary in 2012

Days of Reactor Operation	247
Integrated Power (MW-days)	85
Number of Hours at Steady-State	2010.4
Number of Pulses	52
Number of Reactor Irradiations (RFS)	602
Number of Visitors	1882
Unscheduled Shutdowns	17

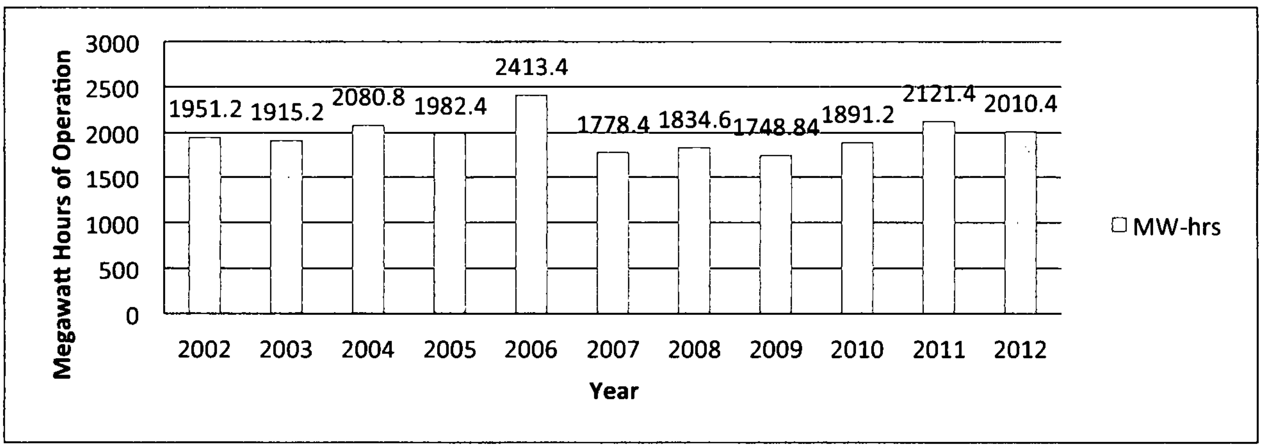

Figure 2. Annual Reactor Utilization in MW-hrs of Operation

2.1 TAMU Academic Support Program

Texas A&M University provides funding for the reactor for such academic activities as nuclear engineering laboratories, neutron activation analysis demonstrations and laboratories, graduate student thesis and dissertation research, and undergraduate research projects. The program has been very successful and is crucial for many graduate students who use the NSC reactor for research and have not received research grants. The wide range of academic users from the university reflects in the NSC's reputation as a multi-disciplinary institution.

2.2 Commercial Activity and External Research

The NSC provides services to a variety of users that provide their own funding. The majority of commercial activities focus on production of radioactive tracers for the Texas petroleum and chemical industries. Another commercial activity uses the converted Thermal Column area to produce micropore filters used in ultra-pure water systems in the semiconductor industry. Outside research grants fund a significant amount of the NSC's research. The NSC is involved with neutron activation analysis and radioassays for a wide variety of samples for outside customers. The NSC has many years of experience producing radioisotopes and has developed several customer-specific methods for radioactive sample production and handling. The production of radioisotopes generally involves handling radioactive material with high activities. The NSC staff takes precautions to minimize the exposures during the transfer of radioactive materials to shipping shields.

3. Facility and Procedure Changes

3.1 Facility Modifications

3.1 Cooling Tower replacement
3.2 Primary Pump replacement
3.3 Primary piping valves addition
3.4 Facility Electrical Panel replacement
3.5 Portal Monitor installation
3.6 Manipulator refurbishment
3.7 Conveyor installation - Repack lab

3.2 Experiment Authorization and Modification Authorization

There were no new Experiment Authorizations (EA) or Modification Authorizations (MA) covered in 2012.

4. Reactor Maintenance and Surveillance

4.1 Scheduled Maintenance

NSC personnel performed regular maintenance on the Fuel Element Temperature Channel, Area Radiation Monitors and the Linear, Log, and Safety Power Channels as required by the Technical Specifications. They also performed all surveillance required by the reactor license. Control rod worth and scram time measurements performed in July 2012 gave the following results. The total rod worth was $14.136. The most reactive control rod was Shim Safety #4 with a worth of $3.648. The shutdown margin was $3.551 and core excess was $5.193. Scram times on all rods were less than 1.2 seconds. In addition, operators performed calorimetric calibration following each maintenance period, and fuel inspections with no abnormalities noted (as required by the Technical Specification). The cold critical reactivity worth, performed for each reactor experiment, shows that the most reactive fixed experiment is the Fast Flux Irradiation Device (-$ 1.141).

4.2 Unscheduled Shutdowns

There were seventeen unscheduled reactor shutdowns during 2012. The cause is detailed below in Table 4-3.

Table 4-2: Unscheduled Shutdowns

1/5/2012	Reactor scrammed due to high level alarm on Safety Power Channel #1. The reactor operator increased power at startup too quickly and regulating rod button stuck causing the alarm.
1/6/2012	Reactor scrammed due to high level alarm on Safety Power Channel #1 during operation.
1/9/2012	Reactor scrammed due to high level alarm on Safety Power Channel #1 during operation.
1/9/2012	Reactor scrammed due to high level alarm on Safety Power Channel #1 during operation. Malfunctioning display caused drawer to read higher than actual power.
1/24/2012	Reactor scrammed due to dropped rod. Low magnet current on Shim Safety Control Rod #1 caused drop during operation.
1/24/2012	Reactor scrammed due to dropped rod. Low magnet current on Shim Safety Control Rod #1 caused drop during operation.
2/6/2012	Reactor scrammed due to high level alarm on Safety Power Channel #1. The reactor operator increased power from 600 kW to 1 MW too quickly causing the alarm.
4/5/2012	Reactor scrammed due to loss of off-site power. Reactor was manually scrammed following brownout.
5/21/2012	Reactor scrammed due to dropped rod. Shim Safety Control Rod #3 disturbed while loading a sample into D3.
6/12/2012	Reactor scrammed due to air compressor malfunction. Manual

	scram initiated to investigate issue.
6/28/2012	Reactor scrammed due to dropped rods. During a return to power, Shim Safety Control Rods #3 and #4 were dropped.
7/17/2012	Reactor scrammed due to loss of power in Shim Safety Control Rod #2 drawer. Investigation found blown fuse in control rod's drawer.
8/13/2012	Reactor scrammed due to scram circuit disconnection. Personnel tracing wires and inadvertently broke connection to circuit initiating a scram.
8/28/2012	Reactor scrammed due to high level alarm on Safety Power Channel #1. Alarm set point was at 120, and a drift in power caused a scram.
11/1/2012	Reactor scrammed due to temporary interruption of off-site power.
12/18/2012	Reactor scrammed due to loss of FAM indication. Connection was inadvertently broken during maintenance.
12/19/2012	Reactor scrammed due to loss of off-site power. A great horned owl landed on the power lines and shorted out a transformer.

4.4 Emergency Plan and Review

The Nuclear Science Center Management and the members of Reactor Safety Board (RSB) reviewed the NSC Security and Emergency Plans.

4.5 Reactor Safety Board

The Reactor Safety Board is responsible for providing an independent review and audit of the safety aspects of the NSC reactor. The Reactor Safety Board met as required in the year 2012.

4.6 Inspections and Audits

The Reactor Safety Board sub- committee performed the required audits and inspections as per the Technical Specifications requirement. The results of the audit were shared with the RSB members. A facility inspection was performed by Nuclear Regulatory Commission in November 2012 for the Health Physics program and no deficiencies were identified.

4.7 NRC Inspection

The NRC conducted an inspection of the NSC in October of 2012. This inspection resulted in zero findings or violations.

5. Health Physics Surveillance

The purpose of Health Physics surveillance is to ensure safe use of radioactive materials in the Nuclear Science Center's research and service activities and to fulfill the regulatory requirements of U.S. Nuclear Regulatory Commission and State agencies. The NSC maintains a Health Physics group as an integral part of the organization. They are responsible for radiological as well as chemical and physical safety concerns. The radiation safety team at the TAMU Environmental Health and Safety Department provides additional support to the NSC Health Physics group upon request.

5.1 Radioactive Shipments

The Health Physics monitoring and technical support that was provided in 2012 assured minimal exposure during sample handling, shipment of radioactive material, and normal reactor operation. The radiation exposures were maintained ALARA. During 2012, about 457 radioactive samples were handled and released to various research facilities including Texas A&M University campus. A total of 427 curies were handled in 2012.

5.2 Personnel Monitoring

Personnel Monitoring was provided on a monthly basis to approximately 60 personnel. All measured doses to personnel were below the limits set forth in 10 CFR 20. Eight individuals received whole body dose greater than 10% of the annual limit in 10 CFR 20. Their deep dose equivalent (DDE) recorded were .56, .66, .7, .78, .86, .86, .95, and 1.3 R for the year. Airborne monitoring during sample handling continued to show no significant airborne activity, therefore, total effective dose equivalent will equal deep dose equivalent for 2012. A total of 9.9 manrem was recorded for the year 2012. When total manrem/curie was determined for 2012, the dose per curie equaled 0.023 (manrem/Ci).

During 2012, about 1733 visitors toured the Nuclear Science Center. Minimal exposures were measured with pocket ion chambers worn by these visitors and the pocket ion chamber readings of their respective tour guides.

NSC employees who were likely to exceed 10% of their total annual dose wore whole body badges (Luxel dosimeter) and extremity badges (TLD dosimeters) that were provided by Landauer, a NVLAP accredited supplier. Landauer also provides the reports of the doses received. Employees who potentially handle more radioactive materials on a regular basis were provided two extremity badges and were changed out on a monthly basis.

5.3 Facility Monitoring

Surveys of the Nuclear Science Center facilities were performed to assess radiological hazards to NSC workers. Radiation levels and sources of radioactive contamination were routinely monitored. All areas accessible to the general public at the NSC were surveyed for radiation and contamination levels monthly by ion chamber readings and evaluation of smear samples. Areas where contamination is expected are access/egress controlled and are evaluated on shorter intervals as needed. Building monitors and Area monitors are located strategically throughout the reactor facility, providing dose equivalent (mrem) on a monthly basis. Table 5-3 summarizes the annual accumulated dose equivalent (mrem) recorded on the area monitors for the year 2012.

Table 5-3: Total Dose Equivalent (mrem) Recorded on Area Monitors

Monitor ID	Location	Accumulated Dose Equivalent (mrem)
BLDG MNTR 1	Upper Research Level Mezzanine	1032
BLDG MNTR 2	Lower Research Level Mezzanine	1910[a]
BLDG MNTR 3	Lower Research Level	1531[a]
AREA	Control Room	70
AREA	Upper Research Level	1186
AREA	Room next to MHA	2769[b]

[a]Radioactive shipments were stored in the LRL area pending transport
[b]Radioactive materials were stored in the temporary locations in MHA.

5.4 Particulate Effluent Monitoring

Radioactive particulates were monitored at the base of the central exhaust stack and summarized on a monthly basis. The annual average release concentration was 5.04×10^{-13} μCi/cc. The total radioactivity released for 2012 was 39 μCi. Table 5-4 summarizes monthly particulate effluent releases during 2012. The most common isotopes noted during particulate effluent releases were Sc-46, Sb-124, and Ir-192.

Table 5-4: Particulate Effluent Releases

Quarter	Month	Concentration from channel 1 (µCi/cc)	Dilution Concentration (µCi/cc)	Exhaust Volume (cc)	Additional releases (µCi)	Total activity released (Ci)
I	January	1.72E-13	8.60E-16	9.96E+12		1.71E-06
	February	1.31E-13	6.53E-16	8.99E+12		1.17E-06
	March	<BG	<BG	9.96E+12		<BG
	Average:	**1.51E-13**	**7.57E-16**	**9.64E+12**		**9.63E-07**
			Total:	**2.89E+13**		**2.89E-06**
II	April	4.94E-13	2.47E-15	9.64E+12		4.76E-06
	May	<BG	<BG	9.96E+12		<BG
	June	2.17E-13	1.08E-15	9.64E+12		2.09E-06
	Average:	**3.55E-13**	**1.78E-15**	**9.74E+12**		**3.42E-06**
			Total:	**2.92E+13**		**6.85E-06**
III	July	7.92E-13	3.96E-15	9.96E+12		7.89E-06
	August	<BG	<BG	9.96E+12		<BG
	September	9.67E-13	4.84E-15	9.64E+12		9.32E-06
	Average:	**8.80E-13**	**4.40E-15**	**9.85E+12**		**8.61E-06**
			Total:	**2.96E+13**		**1.72E-05**
IV	October	6.17E-13	3.08E-15	9.96E+12		6.14E-6
	November	6.28E-13	3.14E-15	9.64E+12		6.06E-06
	December	<BG	<BG	9.96E+12		<BG
	Average:	**5.02E-13**	**2.51E-15**	**9.85E+12**		**6.10E-06**
			Total:	**2.96E+13**		**1.22E-05**
Annual Summary	**Average:**	**5.02E-13**	**2.51E-15**	**9.77E+12**		**4.77E-06**
			Total:	**1.17E+14**		**3.91E-05**

notes:

1. Concentration released from the stack: Concentration sampled from Ch 1 multiplied by volume of air going through the stack
2. Diluted Concentration equal to: Average Release Concentration multiplied by 0.005 (Technical Specification 3.5.2, dilution value for release concentration at exclusion boundary)
3. Exhaust Volume equal to: (# days/month)*(24hrs/day)*(60min/hr)*(7875 cfm)/ 3.53E-5cc)
4. Additional Release equal to: (Individual releases calculated from facility air monitoring data)
5. Total Release equal to: (Average Release Concentration)*(Exhaust Volume)*10^-6+(Additional Releases)

5.5 Gaseous Effluent Monitoring

Argon-41 is the major gaseous effluent produced and released at the Nuclear Science Center. This effluent is monitored at the central exhaust stack. Total Argon-41 released during 2012 was approximately 6.05 Ci with an annual average release concentration of 5.40×10^{-8} μCi/cc. Table 5-5 summarizes monthly gaseous effluent (Ar-41) releases during 2012.

Table 5-5: Gaseous Effluent (Ar-41) Releases

Quarter	Month	Concentration from channel 3 (μCi)	Dilution Concentration (μCi)	Exhaust Volume (cc)	Additional releases (μCi)	Total activity released (Ci)
I	January	6.63E-10	3.31E-12	9.96E+12		6.60E-03
	February	2.59E-10	1.29E-12	8.99E+12		2.33E-03
	March	<BG	<BG	9.96E+12		<BG
	Average:	**4.61E-10**	**2.30E-12**	**9.64E+12**		**4.47E-03**
			Total:	**2.89E+13**		**8.93E-03**
II	April	4.57E-10	2.28E-12	9.64E+12		4.40E-03
	May	3.66E-10	1.83E-12	9.96E+12		3.64E-03
	June	<BG	<BG	9.64E+12	5.66E+04	5.66E-02
	Average:	**4.11E-10**	**2.06E-12**	**9.74E+12**	**5.66E+04**	**2.15E-02**
			Total:	**2.92E+13**	**5.66E+04**	**6.46E-02**
III	July	2.82E-10	1.41E-12	9.96E+12		2.81E-03
	August	2.15E-10	1.07E-12	9.96E+12	1.07E+05	1.09E-01
	September	9.46E-10	4.73E-12	9.64E+12		9.12E-03
	Average:	**4.81E-10**	**2.41E-12**	**9.85E+12**	**1.07E+05**	**4.04E-02**
			Total:	**2.96E+13**	**1.07E+05**	**1.21E-01**
IV	October	5.79E-09	2.89E-11	9.96E+12		5.76E-02
	November	3.49E-10	1.75E-12	9.64E+12		3.37E-03
	December	6.10E-10	3.05E-12	9.96E+12		6.07E-03
	Average:	**2.25E-09**	**1.12E-11**	**9.85E+12**		**2.24E-02**
			Total:	**2.96E+13**		**6.71E-02**
Annual Summary	**Average:**	**9.00E-10**	**4.50E-12**	**9.77E+12**	**8.18E+04**	**2.22E-02**
				1.17E+14	**8.18E+04**	**2.62E-01**

notes:

1. Concentration released from the stack: Concentration sampled from Ch 3 multiplied by volume of air going through the stack
2. Diluted Concentration equal to: Average Release Concentration multiplied by 0.005 (Technical Specification 3.5.2, dilution value for release concentration at exclusion boundary)
3. Exhaust Volume equal to: (# days/month)*(24hrs/day)*(60min/hr)*(7875 cfm)/ 3.53E-5cc)
4. Additional Release equal to: (Individual releases calculated from facility air monitoring data)
5. Total Release equal to: (Average Release Concentration)*(Exhaust Volume)*10^-6+(Additional Releases)

5.6 Liquid Effluent Monitoring

Radioactive Liquid effluents are maintained in collection tanks before release from the confines of the Nuclear Science Center. Sample activity concentrations and isotope identifications were determined before each release. The concentration values for each isotope were compared with the effluent concentrations in water (10 CFR 20) and were determined to be in compliance. In September 2008, a new sewer system was tied into the Texas A&M waste treatment plant for release of liquid waste and NSC started releasing liquid waste through the sewer system effective September 2008. Sample activity concentrations were then compared with Sewer line concentrations (10 CFR 20) and were determined to be in compliance. There were 50 releases in 2012, totaling 7.61×10^5 gallons including dilution. The total radioactivity released was 8.41 mCi with an annual average concentration of 2.92×10^{-6} µCi/cc. The annual dose to the public calculated from liquid effluents is about 2.07 mrem. Summary of the release data are presented in the following Table 5-6. Radioactivity concentrations for each isotope found were below the Effluent Concentration limits specified in 10 CFR 20, Appendix B. The radionuclides identified in the waste stream were Sc-46, Cr-51, Mn-54, Ir-192, Co-58, Co-60, Zn-65, Sb-122, Sb-124, and Cs-137.

Table 5-6: Liquid Effluent Releases

Quarter	Month	Number of Releases	Volume Released (cc)	Total Radioactivity (Ci)	Average Concentration (µCi/cc)
	January	2	1.43E+08	3.85E-04	2.69E-06
	February	4	2.02E+08	8.95E-04	4.43E-06
	March	4	2.73E+08	2.06E-03	7.55E-06
I	**Total**	**10**	**6.18E+08**	**3.34E-03**	**5.40E-06**
	April	8	4.81E+08	1.27E-03	2.64E-06
	May	2	1.18E+08	3.25E-04	2.76E-06
	June	8	4.54E+08	9.25E-04	2.04E-06
II	**Total**	**18**	**1.05E+09**	**2.52E-03**	**2.40E-06**
	July	6	3.51E+08	1.21E-03	5.52E-06
	August	7	4.05E+08	5.89E-04	1.45E-06
	September	5	2.42E+08	5.49E-04	2.27E-06
III	**Total**	**18**	**9.99E+08**	**2.26E-03**	**2.26E-06**
	October	3	1.57E-08	2.59E-04	1.65E-06
	November	1	5.25E+07	3.95E-05	6.83E-07
	December	0			
IV	**Total**	**4**	**2.10E+08**	**2.95E-04**	**1.41E-06**
Annual Summary	**Total**	**50**	**2.88E+09**	**8.41E-03**	**2.92E-06**

6. Environmental Monitoring

In conjunction with representatives from the Texas Department of State Health Services (TDSHS) Radiation Control, a quarterly environmental survey is conducted to insure compliance with federal regulations. This program consists of TLD monitors located at various locations on the NSC site and two background monitors; one located at 3.84 miles NW of facility and the other at 0.25 miles SE of facility.

6.1 Environmental Samples

Since the implementation of discharging liquid waste to the sewer, TDSHS no longer requires the collection of a quarterly sediment sample. A letter from TDSHS to this effect is on file.

6.2 Site Boundary Dose Rate

The environmental survey program measures the integrated radiation exposures at the exclusion area boundaries. These measurements are made for periods of approximately 92 days using TLDs. Monthly measurements of direct gamma exposure rate in μR/h are also made at each of the TLD locations. The dosimeters were provided and processed by Texas Department of State Health Services, Environmental Monitoring, Division of Regulatory Services, Austin, Texas.

The total TLD dose is multiplied by the occupancy factor (1/16) to determine the deep dose. To determine the dose to the public outside the site area from air effluents, the EPA approved code COMPLY was used. The annual dose calculated using COMPLY was 0.2 mrem/yr. This is added to the deep dose to determine the total dose to the general public and the maximum dose noted was 1.7 mrem. Table 6-2 summarizes the site boundary dose rates.

Table 6-2: Site Boundary Dose Rates 2012

Site #	Location	Quarterly Exposure rates (mrem/91 days)				TLD Dose (mrem)	Deep Dose (mrem)	Internal Dose (mrem)	Total Dose (mrem)
2	300ft W of reactor building	0.0	1.1	5.0	10.5	16.6	1.0	0.2	1.2
3	250ft WSW of reactor building	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
4	200ft NW of reactor building	0.0	6.5	9.9	3.8	20.2	1.3	0.2	1.5
5	225ft NE of reactor building	0.0	2.2	4.1	5.7	12.0	0.8	0.2	1.0
10	190ft SE of reactor building	0.0	0.0	0.0	1.0	1.0	0.1	0.2	0.3
11	300ft NE of reactor building	0.0	0.0	0.0	1.9	1.9	0.1	0.2	0.3
*14	3mi NW of facility	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
18	375ft NE of reactor building	0.0	3.3	3.3	2.9	9.5	0.6	0.2	0.8
19	320ft NE of reactor building	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
20	E Wall of accelerator building	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
21	W Wall of accelerator building	0.0	0.0	0.0	1.0	1.0	0.1	0.2	0.3
22	S Wall of accelerator building	9.2	0.0	0.0	0.0	9.2	0.6	0.2	0.8
*23	0.25mi SE of facility	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
24	N wall of accelerator bldg, NW	8.1	16.3	0.0	0.0	24.4	1.5	0.2	1.7
25	N wall of accelerator bldg, E	0.0	14.1	0.0	0.0	14.1	0.9	0.2	1.1
26	W Fence of hyperbaric lab, 10ft from SW corner	x	x	5.8	0.0	5.8	0.4	0.2	0.6
27	E fence of hyperbaric lab, 10ft S of entrance	x	x	5.8	0.0	5.8	0.4	0.2	0.6
28	S fence of hyperbaric lab, 10ft E of personnel gate	x	x	6.6	0.0	6.6	0.4	0.2	0.6
29	325ft SW from reactor building, SW corner	x	x	0.0	0.0	0.0	0.0	0.2	0.2

* 14 and 23 are background TLD's

7. Radioactive Waste Shipments

In 2012, there were no radioactive waste shipments from this facility for disposal.

APPENDIX A

Nuclear Science Center Organizational Chart
Updated (2012)

Dr. Warren Reece
Director

- **Associate Director**
- Dr. Radek Skoda, Asst. Director
- Dr. Hsu, Res. Scientist

Greg Stansy, Manager of Operations
- Jerry Newhouse, Reactor Supervisor
- Jared Porter, Sr. SRO
- Jesse Johns, Sr. SRO
- James Tompkins, Sr. SRO
  - Esteban Botello, Sr. SRO/ HP Tech
  - Mathew Deck, Sr. SRO/ HP Tech
  - Russle M, RO/ HP Tech
  - Becky Jones, Student Tech I
  - Carly Cantwell, Student Tech I
  - Cameron M, Student Tech I
  - Michael Winter, Student Tech I
  - Nick Mowers, Student Tech I

Ashley Booth, Radiation Safety Officer
- Scott Miller, Health Physics Supervisor
- Robert Pack, Technician II

Master Instrument Maker
- Viktor Vlassov, Instrument maker I

Joe Snook, Machine Shop Foreman
- Jim Reynolds, Machinist I
- Nick Walker, Student Worker
- Shane Swientek, Student Worker

Debra Arrington, Administrative Coordinator
- Halli Falke, Business Coordinator
- Shandy Root, Office Associate
- Anna Bufflaoe, Student Worker

Appendix B

Reactor Safety Board Membership (2012)

Chairman/Licensee:

Dr. Emile Schweikert, Professor
Chemistry Department

Members:

Dr. John Ford, Associate Professor
Nuclear Engineering Department

Dr. Marvin Adams, Associate Professor
Nuclear Engineering Department

Dr. Bill Charlton, Associate Professor
Nuclear Engineering Department

Dr. William Dennis James, Research Chemist
Chemistry Department

Dr. John Hardy, Professor
Physics Department

Dr. Teruki Kamon, Professor
Physics Department

Dr. Sean McDeavitt, Assistant Professor
Nuclear Engineering Department

Dr. Karen Vierow, Associate Professor
Nuclear Engineering Department

Ex-Officio Members:

Dr. Warren Reece, Director
Nuclear Science Center

Mrs. Ashley Booth, NSC RSO
Nuclear Science Center

Vacant, Associate Director
Nuclear Science Center

Dr. Yassin Hassan, Professor and Head
Nuclear Engineering Department

Dr. Latha Vasudevan, RSO
Environmental Health and Safety Department