



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION IV  
611 RYAN PLAZA DRIVE, SUITE 400  
ARLINGTON, TEXAS 76011-4005

October 15, 2004

Mr. Michael L. Griffin  
Manager of Environmental and  
Regulatory Affairs  
Crow Butte Resources, Inc.  
86 Crow Butte Road  
Post Office Box 169  
Crawford, Nebraska 69339-0169

SUBJECT: NRC INSPECTION REPORT 040-08943/04-001

Dear Mr. Griffin:

On September 16, 2004, the Nuclear Regulatory Commission (NRC) completed an inspection of your in-situ uranium processing facility near Crawford, Nebraska. This inspection consisted of a review of site status, site operations, radiation protection, radioactive waste management, and environmental monitoring. The inspection determined that, overall, you have operated the uranium production facility in a safe and effective manner. The inspection findings were presented to you and other members of your staff at the conclusion of the onsite inspection. The enclosed report presents the results of that inspection.

No violations were identified during the inspection; therefore, no response to this letter is required.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Ms. Judith Walker at (817) 860-8299 or the undersigned at (817) 860-8197.

Sincerely,

***/RA M. C. Maier for/***

Jack E. Whitten, Chief  
Nuclear Materials Licensing Branch

Docket No.: 040-08943  
License No.: SUA-1534

Crow Butte Resources, Inc.

-2-

Enclosure:  
NRC Inspection Report  
040-08943/04-001

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**ENCLOSURE**

U. S. NUCLEAR REGULATORY COMMISSION  
REGION IV

Docket No. 040-08943  
License No. SUA-1534  
Report No. 040-08943/04-001  
Licensee: Crow Butte Resources, Inc.  
Facility: Crow Butte Project  
Location: Crawford, Dawes County, Nebraska  
Dates: September 14-16, 2004  
Inspector: Judith Walker, Health Physicist  
Nuclear Materials Licensing Branch  
Approved By: Jack E. Whitten, Chief  
Nuclear Materials Licensing Branch  
Attachment: Supplemental Information

## **EXECUTIVE SUMMARY**

### **Crow Butte Project NRC Inspection Report 040-08943/04-001**

This inspection included a review of site status, management organization and controls, in-situ leach operations, radiation protection, radioactive waste management, and environmental monitoring. Overall, the licensee was operating the facility in a safe and effective manner.

#### **Management Organization and Controls**

- The inspector determined that the licensee had continued to maintain a staff organization at the site that complied with the license. The inspector noted that the radiation protection staff was staffed with qualified individuals (Section 2).
- The inspector concluded that the licensee had correctly implemented the requirements of the performance-based license (Section 2).

#### **In-Situ Leach Operations**

- Site operations were conducted by the licensee in accordance with applicable license and regulatory requirements (Section 3).
- The inspector observed that site operating parameters were within the respective license limits, and no health or safety hazards were identified (Section 3).
- The inspector determined that the yellowcake dryer maintenance and operations were being performed appropriately by the licensee (Section 3).

#### **Radiation Protection**

- The licensee had implemented a radiation protection program that met requirements established in 10 CFR Part 20 and the license (Section 4).
- Surveys and personnel monitoring were being performed as required by the license and regulations. Bioassay sample results had not exceed the prescribed action levels during the inspection period (Section 4).
- During the interval of time covered by this inspection report, occupational exposures were observed by the inspector to be well below the dose limits specified in 10 CFR Part 20 (Section 4).

#### **Radioactive Waste Management/Environmental Monitoring**

- The inspector noted that the licensee had collected and reported environmental and effluent monitoring results as stipulated in the license. Sample results reviewed by the inspector during the inspection did not exceed applicable NRC regulatory limits (Section 5).

- The inspector determined that the licensee had conducted operations in such a way that doses to the nearest resident were below the NRC's annual limit. The inspector observed no evidence that site operations had any adverse impacts on the environment (Section 5).

## **Report Details**

### **1 Site Status**

Crow Butte Resource's (CBR's) in-situ uranium mine was in full operation during the inspection. The inspector observed in-situ mining operations in progress at Mine Units 5-9 and restoration activities in Mine Units 2-4. The inspector noted that reclamation activities in Mine Unit 1 were completed by the licensee and under review by NRC, and Mine Unit 10 was currently under development.

The licensee continues the yellowcake production in the central processing facility (CPF). The inspector observed uranium-bearing leach solution being pumped from the wellfields to the CPF where ion exchange columns were being used to recover uranium. The end product of the in-situ leach process is normally dried in a dryer maintained under negative pressure. The dried product is then packaged into 55-gallon drums for shipment offsite. In June 2004, the licensee installed a new dryer to replace the dryer that was taken out of service during calendar year (CY) 2003.

### **2 Management Organization and Controls (88005)**

#### **2.1 Inspection Scope**

The licensee's organizational structure was reviewed by the inspector. This review concluded that the licensee had established and maintained an effective organization with specifically defined responsibilities, functions, and controls. The licensee had established and maintained an organization in place that was adequate to ensure compliance with NRC licensing and regulatory requirements.

#### **2.2 Observations and Findings**

##### **a. Organization and Staff**

The organizational structure requirements are outlined in License Condition 9.3 which references the NRC-approved license application. The licensee's staff assignments and reporting responsibilities are outlined in License Condition 9.12 and Section 5 of the license application. At the time of this inspection, 48 individuals were employed by Crow Butte at the site.

On August 8, 2003, CBR's corporate organizational structure and chain of command was revised. The current structure states that the vice president engineering and development currently reports to the senior vice president, operations. The mine manager currently reports to the vice president engineering and development. The manager of environmental and regulatory affairs reports to both the mine manager and senior vice president, operations. The radiation safety officer (RSO) currently reports to the manager of environmental and regulatory affairs.

Overall, the inspector determined the licensee's site organizational structure to be consistent with those in place during previous inspections. The inspector concluded that the licensee had provided an appropriate level of oversight for the current level of plant operations.

b. Performance-Based License Review

The NRC issued CBR a performance-based license (PBL) in March 1998. License Condition 9.4 of the PBL requires, in part, that the licensee may, under certain conditions and without prior NRC approval, make changes in the facility or processes, make changes to procedures, or conduct tests and experiments not presented in the license application. The licensee's implementation of the PBL provisions was reviewed by the inspector to ensure that any changes made by the licensee were under the provisions of License Condition 9.4. Also, that any changes made under the PBL did not negatively impact the licensing basis of the site. Since the previous inspection, the inspector noted that the licensee had conducted five safety and environmental review panel (SERP) reviews addressing the following subject areas:

- Approval of Wellhouse 42 in Mine Unit 9,
- Proposed changes to the renewal application for License No. SUA-1534,
- Initial operation of new yellowcake dryer,
- Approval of Wellhouse 38, and
- Approval of operation of Mine Unit 9 and Wellhouse 44

The inspector reviewed the SERP evaluation reports and determined that the licensee's conclusions were technically and administratively adequate. Also, the inspector concluded that changes made to licensed activities that resulted from the SERP recommendations had not negatively impacted the licensing basis of the site.

2.3 Conclusions

The licensee has continued to maintain a staff organization at the site that complied with the license. The radiation protection group was staffed with qualified individuals. The inspector concluded that the licensee had correctly implemented the requirements of the PBL.

**3 In-Situ Leach Facilities (89001)**

3.1 Inspection Scope

The objective of this portion of the inspection was to verify that the licensee had conducted site activities in accordance with applicable regulations and conditions of the license. Additionally, the scope of this inspection was to ensure that operational controls were adequate to protect the health and safety of workers and members of the public.



### 3.2 Observations and Findings

#### a. Site Tour

Site tours were performed by the inspector to verify that licensed activities were being conducted in accordance with applicable regulations and specific license conditions. The inspector toured site buildings, wellfields, waste storage areas, and processing equipment facilities. The inspector examined fences and gates and noted that they were in good condition. Site fences were also properly posted in accordance with License Condition 9.11. The inspector observed that the facility and related processing equipment appeared to be in good condition and operating properly. No equipment misalignments that could have resulted in loss of uranium bearing materials and potential contamination were identified by the inspector during the inspection. Process flow, level, or pressure parameters were observed within their required ranges. The inspector observed no yellowcake contamination on the floor or in the general area of the central processing plant.

License Condition 10.5 specifies, in part, that the annual throughput for the licensed operation shall not exceed a flow rate of 5,000 gallons per minute (gpm), not including restoration flow. The data reviewed by the inspector indicated that an average production flowrate for CBR was 4,329 gpm. At the time of the site tour, the production injection flowrates were noted to be less than 4,400 gpm as observed by the inspector on the control room computer. License Condition 10.5 further requires that processing plant operations shall not exceed 2-million pounds. The inspector determined that in CY 2003 yellowcake production was below the 2-million pound limit.

License Condition 11.1 requires, in part, that during wellfield operations, injection pressures shall not exceed the integrity test pressure of 100 pounds per square inch gauge (psig) at the injection well heads. Based on information provided by the licensee, the inspector determined that the injection pressures had varied from 40 to 95 psig depending on the wellfield header house elevation, but had not exceeded the 100 psig limit.

License Condition 10.2 requires, in part, that the licensee perform well mechanical integrity tests (MIT's) on each injection and production well before the wells are utilized and that these wells be retested at least once every five years while it is in use. The inspector observed a field technician performing an MIT on a well that was due for the five year interval retest. Standard operating procedure (SOP) P-23 for performing MIT's was reviewed by the inspector. The inspector, by observing the field technician performing an MIT on a well, and reviewing the licensee's test records, concluded that the licensee was conducting MIT's in an acceptable manner and in accordance with license.

b. Evaporation Ponds

License Condition 11.4 requires, in part, that the licensee perform and document pond inspections. The inspector reviewed the licensee's pond inspection records for CY 2003 and to the date of this inspection in CY 2004. The inspector determined that the licensee had adequately inspected the ponds on a daily and weekly basis.

c. Yellowcake Dryer Operations

In June 2003, due to a decision to replace the yellowcake dryer, the licensee discontinued onsite yellowcake dryer operations and began shipping yellowcake slurry offsite for drying and packaging. In June 2004, as planned, the licensee installed a replacement dryer and began dryer operations again onsite.

The licensee dried yellowcake slurry using a vacuum chamber dryer. The yellowcake dryer is required by the NRC to be operated and maintained in accordance with the requirements listed in License Condition 10.8. License Condition 10.8 requires, in part, that the yellowcake dryer be maintained at a negative pressure during system operation. The licensee stated that standard operating procedure (SOP) P-19, "Yellowcake Dryer Operation and Maintenance," had been used by the operations staff when the dryer was operated. The inspector observed the licensee's operators using respiratory equipment and air samplers during yellowcake drying and unloading operations.

d. Management of Spills

License Condition 12.2 requires, in part, that until license termination, the licensee shall maintain documentation on all spills of source or 11e.(2) byproduct materials. Also, the licensee is required to notify the NRC of any spill that may have a radiological impact on the environment. The inspector reviewed records to the date of this inspection for CY 2004, spills to determine if the licensee had reported to the NRC any significant spills. The inspector reviewed the licensee's evaluation of spills to determine if any of the spills that had occurred since the last inspection were reportable under the provisions of 10 CFR 40.60. This spill review conducted by the inspector was necessary to determine if any radiological impact to the environment had occurred. The licensee had evaluated 9 spills to the date of this inspection in CY 2004; however, the licensee's SERP had not reviewed spills that had occurred in the previous year to ascertain whether any trends existed. In summary, the inspector reviewed the licensee's site procedure guidance and spill records and did not identify any mis-classified incidents or spills that had occurred and that had not been correctly reported to the NRC.

3.3 Conclusions

The inspector observed during the site tour that licensed plant process parameters were within established limits, site fences were in good condition, and perimeter postings were appropriate. The licensee had posted radiation areas properly. Yellowcake dryer maintenance and process operations had been performed appropriately. The inspector noted that site activities conducted during the inspection were conducted in accordance with applicable license and regulatory requirements.

## **4 Radiation Protection (83822)**

### **4.1 Inspection Scope**

The scope of this part of the inspection was to determine if the licensee's radiation protection program was in compliance with the requirements established in the license and 10 CFR Part 20 regulations.

### **4.2 Observations and Findings**

#### **a. Annual Program Review**

License Condition 9.12 specifies, in part, that an annual "as low as is reasonably achievable" (ALARA) audit of the radiation safety program shall be performed in accordance with Regulatory Guide 8.31 and Section 5.3 of the license application. The CY 2003 annual ALARA audit was completed by the licensee and reviewed by the inspector during the inspection. The current ALARA review was found by the inspector to be thorough and comprehensive. During June 2004, the licensee had completed personnel qualifications and required refresher training as specified in Regulatory Guide 8.31.

#### **b. Occupational Exposure Monitoring**

The licensee's dose monitoring program was reviewed by the inspector to ensure that no worker exceeded the occupational dose limits specified in 10 CFR 20.1201. The program consisted of the licensee issuing optically stimulated luminescent (OSL) dosimeters to site workers and the collection of air particulate samples for natural uranium and radon daughters. The licensee had monitored a total of 34 individuals during CY 2003 using OSLs. The licensee's records indicated that the highest external dose for CY 2003 was 238 millirems with an overall employee average of 92 millirems. The inspector reviewed the licensee's dosimetry records and concluded that no individual exceeded the NRC's annual occupational dose limits.

The inspector determined that the licensee had performed air sampling for uranium on a monthly basis. The licensee's average sample results for CY 2003 was less than 2 percent of the derived air concentration value for natural uranium. Air samples were also obtained by the licensee during yellowcake packaging operations. The licensee's analysis of uranium exposure indicated that a significant increase had occurred at the site (39 millirems in CY 2002 to 64 millirems in CY 2003). The licensee's action included the implementation of methods to reduce exposures to uranium, particularly in the yellowcake dryer area.

Radon daughter sampling was conducted monthly by the licensee, unless the action level established by the licensee had been exceeded, then the sampling frequency became weekly. The average concentration noted by the inspector in CY 2003 was 0.208 working levels (WL), or 260 millirems. During CY 2003, the individual with the highest radon daughter exposure was 0.402 WLs or 503 millirems.

To determine the total effective dose equivalent (TEDE) for workers, the licensee used: (1) OSL monitoring for external doses, and (2) radon daughter and natural uranium results from air sampling. In CY 2003, the highest TEDE was determined by the licensee to be 758 millirems, and the average worker TEDE was 371 millirems. These worker doses were determined by the inspector to be well below the NRC's annual TEDE dose limit of 5 rems listed in 10 CFR 20.1201.

c. Bioassays

The urine bioassay program was reviewed by the inspector to determine compliance with License Conditions 9.3 and 9.12. Action levels for Crow Butte Resources were defined using Table 1 of Regulatory Guide 8.22, "Bioassay at Uranium Mills." The inspector determined that the licensee had made evaluations when bioassay results exceeded any action level. Bioassay samples taken by the licensee were analyzed by a vendor laboratory. Sample shipments made by the licensee included blank and spiked samples for quality assurance purposes. The licensee sampled process operators and laboratory personnel on a monthly basis, while personnel involved in dryer operations were sampled on a weekly basis. A review of the licensee's bioassay records for CY 2003 indicated that no worker samples had exceeded the lowest action level of 15 µg/l. Up to the date of this inspection in CY 2004, no sample had exceeded the action level of 15 µg/l.

d. Contamination Control Program Review

The licensee's contamination control program requirements are provided in Table 5.7-18, "Radiological Monitoring Program Summary," of the NRC-approved license renewal application as well as License Conditions 9.8 and 9.12. The licensee's contamination control program included surface contamination surveys, skin and personnel clothing surveys, and equipment release surveys. Table 5.7-18 requires that eating areas, change rooms, and office areas be surveyed by the licensee for alpha contamination on a weekly basis.

The records reviewed by the inspector indicated that the licensee had surveyed the restricted and unrestricted areas using hand-held instruments for detection of total alpha contamination (fixed and removable). Also, in the unrestricted areas, smear tests for removable alpha contamination were performed by the licensee on a monthly frequency. The inspector reviewed the CY 2004 contamination sample results compiled by the licensee up to the date of this inspection and noted results below the licensee's action limits. During this inspection, the inspector observed the licensee's radiation protection technician's conduct contamination surveys in the CPF. The inspector determined that the technicians survey techniques and results were adequate.

License Condition 9.12 requires, in part, that employees must monitor themselves with an alpha survey instrument prior to exiting the restricted area. Also, if the results of monitoring exceed the action level, employees must decontaminate themselves to less than the action level. The licensee must also perform unannounced quarterly spot checks of employees exiting the controlled areas.

The licensee's records of these spot checks of employees exiting the controlled areas were reviewed for CY 2004 up to the date of this inspection and were found adequate. The inspector confirmed that survey meters had been properly calibrated, daily checked for operability, and were fully functional at the time of this inspection. Monitoring records reviewed by the inspector indicated that no individual had left the site with contamination above the licensee's action level.

In accordance with License Condition 9.8, the release of equipment or packages from the restricted area must be in accordance with the NRC guidance document entitled, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials." The inspector reviewed records of surveys conducted by the licensee up to the date of this inspection in CY 2004. The licensee's records indicated that no items had been released from the site with contamination in excess of the fixed surface and removable contamination limits specified in the NRC guidance document.

The inspector reviewed the licensee's methods for releasing shipments that contained radioactive material (e.g., dry yellowcake in drums, wet yellowcake in slurry, and 11e.(2) byproduct waste). Shipping records and manifest reviewed by the inspector indicated that the licensee had conducted contamination surveys on each container before it was released from the controlled area and transported from the facility. Since the previous inspection, the licensee had shipped three dry yellowcake shipments contained in drums, 29 wet yellowcake slurry shipment transported in tanker trucks, and four 11e.(2) byproduct shipments.

The licensee, based on records reviewed by the inspector, had ensured external radiation contamination on each container was not in excess of Department of Transportation (DOT) limits specified in 49 CFR 173.428. The DOT's external radiation contamination limit for loose beta-gamma contamination on each container is 22 disintegrations per minute per square centimeter squared (dpm/cm<sup>2</sup>). The inspector reviewed container release survey records since the last inspection and determined that the licensee was meeting DOT's established contamination limit. The inspector concluded that the licensee had released radioactive material shipments in accordance with applicable license conditions, NRC regulations, and DOT requirements.

e. NRC Radiation Surveys

During the site tour, the inspector observed the licensee measuring ambient gamma exposure rates using an microRoentgen ( $\mu$ R) meter. Areas surveyed during the site tour by the licensee included the CPF, the reverse osmosis building, yellowcake drum storage area, and wellfield houses. Except for the areas previously identified in the CPF, no other radiation areas, as defined by 10 CFR 20.1003, were identified by the licensee or the inspector.

f. Instrument Calibrations

License Condition 9.12 requires, in part, that all radiation, environmental monitoring, sampling, and detection equipment be calibrated after repair and as recommended by the manufacturer or at least annually. The inspector reviewed calibration records for radiation detection instruments used up to the date of this inspection in CY 2004. The records indicated that the licensee had maintained calibrated equipment available for use. Records also indicated that all instruments were routinely calibrated against known standards and were checked daily for proper operation. During the site tour, the inspector observed that each radiation detection instrument in use had been calibrated and daily operational checks had been conducted.

4.3 Conclusions

The inspector concluded that the licensee had implemented a radiation protection program that met the requirements established in 10 CFR Part 20 and the license. Surveys and personnel monitoring activities conducted by the licensee were being performed as required. Bioassay sample results had not exceeded the prescribed action levels. Occupational exposures were well below the 10 CFR Part 20 limits.

**5 Environmental Monitoring (88045)  
Radioactive Waste Management (88035)**

5.1 Inspection Scope

The environmental and groundwater monitoring programs were reviewed by the inspector to assess the effectiveness of the licensee's programs and to evaluate the impact, if any, of site activities on the local environment.

5.2 Observations and Findings

a. Environmental Monitoring

License Condition 11.3 requires, in part, that the licensee establish and conduct an effluent and environmental monitoring program in accordance with a letter submitted to the NRC dated March 18, 1999. License Condition 12.1 requires, in part, that the effluent and environmental monitoring results be reported to the NRC in accordance with the provisions of 10 CFR 40.65. The inspector reviewed the licensee's semi-annual effluent and environmental reports dated August 7, 2003, for the first half of CY 2002, report dated February 10, 2004, for the second half of CY 2003 and report dated August 18, 2004, for the first half of CY 2004. The inspector noted that the licensee had submitted semi-annual reports to the NRC in a timely manner and the licensee had provided all relevant data.

b. Environmental Air Sampling

During CY 2003 and to the date of this inspection in CY 2004, the licensee had performed environmental sampling for air particulates, radon, surface water, sediment, well water, and ambient radiation monitoring. The licensee had utilized seven environmental air sampling stations including one background (control) and the three nearest resident stations. Air particulate sampling had been performed at all stations when the yellowcake dryer was in operation. The filters from each of the environmental air sampling sites were then composited by the licensee on a quarterly basis and analyzed for natural uranium, radium-226, and lead-210 concentrations. All air particulate sample results for CYs 2003 and to the date of this inspection in CY 2004 were observed by the inspector to be less than 8.0 percent of the applicable limits specified in 10 CFR Part 20, Appendix B, effluent concentrations limits (ECL).

Radon-222 was monitored by the licensee at the seven sample stations with track-etch canisters exchanged on a semi-annual basis. The highest radon sample results reported by the licensee's environmental dosimetry vendor, was at fenceline monitoring station AM-8 during the second half of CY 2003. This sample result was recorded by the vendor as 37 percent of the applicable ECL (with daughters removed).

c. Environmental Exposure Rates

Environmental thermoluminescent dosimeters (ETLDs) were also located at the seven sample stations for monitoring ambient gamma exposures. The records reviewed by the inspector indicated that the licensee had exchanged the ETLDs on a quarterly basis.

During CY 2002, the highest annual exposure measured by the licensee was at fenceline monitoring Station 8. The licensee recorded this exposure as 11.0 millirems during CY 2003, with the background contribution subtracted.

d. Public Dose Assessment

The inspector evaluated the potential public dose to ensure that the licensee's site operations did not result in a total effective dose to individual members of the public in excess of 100 millirems per year, the annual limit specified in 10 CFR 20.1301. The public dose assessment evaluation provided by the licensee included environmental monitoring data from CY 2003 and monitoring data from the background station and three nearest resident stations. Based on the highest dose measured for CY 2003, the dose to the public was determined by the inspector to be well below the NRC's annual limit.

5.3 Conclusions

The inspector determined that the licensee had collected and reported environmental and effluent samples required by the license. Dose estimates to the nearest resident were determined by the inspector to be below the NRC's annual limits. There was no evidence presented by the licensee that site operations had an adverse impact on the environment.

**6 Exit Meeting Summary**

The inspector presented the inspection results to representatives of the licensee at the conclusion of the inspection on September 16, 2004. The licensee's representatives acknowledged the findings as presented. The licensee did not identify any documents or processes reviewed by the inspector as proprietary information.



## ATTACHMENT

### **SUPPLEMENTAL INFORMATION**

#### PARTIAL LIST OF PERSONS CONTACTED

##### Licensee

M. Griffin, Manager of Environmental/Regulatory Affairs  
R. Grantham, Radiation Safety Officer  
C. Miller, Plant Superintendent  
J. Stokey, Mine Manager

##### Nebraska Department of Environmental Quality

D. Carlson, Underground Injection Control Program

#### ITEMS OPENED, CLOSED AND DISCUSSED

##### Opened

None

##### Closed

None

##### Discussed

None

#### LIST OF ACRONYMS USED

ALARA	as low as is reasonably achievable
CFR	Code of Federal Regulations
CPF	central processing facility
CY	calendar year
DOT	Department of Transportation
dpm/cm <sup>2</sup>	disintegrations per minute per square centimeter squared
ECL	effluent concentrations limit
ETLD	environmental thermoluminescent dosimeter
gpm	gallons per minute
MIT	well mechanical integrity tests
OSL	optically stimulated luminescent
PBL	performance-based license
PDR	Public Document Room
psig	pounds per square inch gauge
RSO	radiation safety officer
SERP	safety and environmental review panel
SOP	standard operating procedure
TEDE	total effective dose equivalent
WL	working level